

BIDDING DOCUMENT
for
THE PROCUREMENT OF

The laying & jointing of PE 100(HDPE)Pipes of Thuli Madhau Samudayik Lift WSP

National Competitive Bidding (NCB)

IFB No: CONS/NCB/RCH/08/081/82

Contract Identification No. : CONS/NCB/RCH/08/081/82

Water Supply And Sanitation Division No. 4, Ramechhap

Issued on: 12-12-2024 00:00

Abbreviations

BD ...	Bidding Document
BDF ...	Bidding Forms
BDS ...	Bid Data Sheet
BOQ ...	Bill of Quantities
COF ...	Contract Forms
DP ...	Development Partners
DoLIDAR ...	Department of Local Infrastructure Development and Agricultural Roads
ELI ...	Eligibility
EQC ...	Evaluation and Qualification Criteria
EXP ...	Experience
FIN ...	Financial
GCC ...	General Conditions of Contract
GoN ...	Government of Nepal
ICC ...	International Chamber of Commerce
IFB ...	Invitation for Bids
ITB ...	Instructions to Bidders
JV ...	Joint Venture
LIT ...	Litigation
NCB ...	National Competitive Bidding
PAN ...	Permanent Account Number
PPA ...	Public Procurement Act
PPMO ...	Public Procurement Monitoring Office
PPR ...	Public Procurement Regulations
PL ...	Profit & Loss
SBD ...	Standard Bidding Document
SCC ...	Special Conditions of Contract
TS ...	Technical Specifications
VAT ...	Value Added Tax
WRQ ...	Works Requirements

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Invitation for Bids

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Water Supply And Sanitation Division No. 4, Ramechhap

Invitation for Bids No.: CONS/NCB/RCH/08/081/82

Date of publication: 12-12-2024 00:00

1. Water Supply And Sanitation Division No. 4, Ramechhap invites sealed bids or electronic bids from Nepalese eligible bidders for the construction of The laying & jointing of PE 100(HDPE)Pipes of Thuli Madhau Samudayik Lift WSP under National Competitive Bidding procedures.
The estimated amount for the works is Rs. (in NRs) 3124904.72 (Exclusive of VAT and Contingencies)
2. Eligible Bidders may obtain further information and inspect the bidding document at the office of Water Supply And Sanitation Division No. 4, Ramechhap, Manthali, Ramechhap, Manathali, Ramechhap, Bagmati Province, Nepal or may visit PPMO website www.bolpatra.gov.np/egp.
3. Bidder who chooses to submit their bid electronically may purchase the hard copy of the bidding documents as mentioned above or may download the bidding documents for e-submission from PPMO's Web Site www.bolpatra.gov.np/egp. Bidders, submitting their bid electronically, should deposit the cost(as specified above) of bidding document in the Project's Rajaswa (revenue) account as specified below and the scanned copy (pdf format) of the Bank deposit voucher shall be uploaded by the bidder at the time of electronic submission of the bids. Information to deposit the cost of bidding document in Bank:

Name of the Bank:	Rastriya Banijya Bank Ltd.
Name of Office:	Water Supply And Sanitation Division No. 4, Ramechhap
Office Code no:	3370524013
Office Account no:	1680100202030000
Rajaswa (revenue) Shirshak no.:	14229
4. Pre-bid meeting shall be held at Water Supply And Sanitation Division No. 4, Ramechhap
Manthali, Ramechhap
Manathali, Ramechhap
Bagmati Province
Nepal at 02-01-2025 14:00 hours.
5. Sealed or electronic bids must be submitted to the office Water Supply And Sanitation Division No. 4, Ramechhap, Manthali, Ramechhap, Manathali, Ramechhap, Bagmati Province, Nepal by hand/courier or through PPMO website www.bolpatra.gov.np/egp on or before 12-01-2025 12:00. Bids received after this deadline will be rejected.
6. The bids will be opened in the presence of Bidders' representatives who choose to attend at 12-01-2025 14:00 at the office of Water Supply And Sanitation Division No. 4, Ramechhap
Manthali, Ramechhap
Manathali, Ramechhap
Bagmati Province
Nepal. Bids must be valid for a period of 90 days after bid opening and must be accompanied by a bid security or scanned copy of the bid security in .pdf format in case of e-bid, amounting to a minimum of NRs. 90000.0, which shall be valid for 30 days beyond the validity period of the bid.
7. If the last date of purchasing and /or submission falls on a government holiday, then the next working day shall be considered as the last date. In such case the validity period of the bid security shall remain the same as specified for the original last date of bid submission.

Part - I Bidding Procedures

Section I – Instruction to Bidders

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SECTION– I: Instructions to Bidders

A. General	
1. Scope of Bid	<p>1.1 In connection with the Invitation for Bids indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section V (Works Requirements). The name, identification, and number of Contracts of the National Competitive Bidding (NCB) are provided in the BDS.</p> <p>1.2 Throughout this Bidding Document:</p> <ul style="list-style-type: none"> (a) the term “in writing” means communicated in written form and delivered against receipt; (b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and (c) “day” means calendar day.
2. Source of Funds	<p>2.1 GoN Funded: In accordance with its annual program and budget, approved by the GoN, the implementing agency indicated in the BDS plans to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued.</p> <p style="text-align: center;">Or</p> <p>Public Entities' own Resource Funded: In accordance with its annual program and budget, approved by the public entity, the implementing agency indicated in the BDS plans to apply a portion of the allocated budget to eligible payments under the contract(s) for which this Bidding Document is issued.</p> <p style="text-align: center;">Or</p> <p>DP Funded: The GoN has applied for or received financing (hereinafter called “funds”) from the Development Partner (hereinafter called “the DP”) indicated in the BDS toward the cost of the project named in the BDS. The GoN intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.</p> <p>2.2 DP Funded: Payment by the DP will be made only at the request of the GoN and upon approval by the DP in accordance with the terms and conditions of the financing agreement between the GoN and the DP (hereinafter called the “Loan/Grant Agreement”), and will be subject in all respects to the terms and conditions of that Loan/Grant Agreement. No party other than the GoN shall derive any rights from the Loan Agreement or have any claim to the funds.</p>
3. Fraud and Corruption	<p>3.1 Procuring Entities as well as bidders, suppliers and contractors and their sub-contractors under GoN/DP-financed contracts, shall adhere to the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this;</p> <ul style="list-style-type: none"> (a) the Employer adopts, for the purposes of this provision, the terms as defined below: <ul style="list-style-type: none"> (i) “corrupt practice” means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party; (ii) “fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an

	<p>obligation;</p> <p>(iii) “coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;</p> <p>(iv) “collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.</p> <p>v) “obstructive practice” means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an investigation; (b) making false statements to investigators in order to materially impede an investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (e) materially impeding GoN/DP’s contractual rights of audit or access to information; and</p> <p>vi) “integrity violation” is any act which violates Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of GoN/DP sanctions, retaliation against whistleblowers or witnesses, and other violations of Anticorruption Policy, including failure to adhere to the highest ethical standard.</p> <p>(b) the Employer will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the contract;</p> <p>(c) DP will cancel the portion of the financing allocated to a contract if it determines at any time that representative(s) of the GoN or of a beneficiary of DP-financing engaged in corrupt, fraudulent, collusive, or coercive practices or other integrity violations during the procurement or the execution of that contract, without the GoN having taken timely and appropriate action satisfactory to DP to remedy the situation.</p> <p>(d) DP will impose remedial actions on a firm or an individual, at any time, in accordance with DP’s Anticorruption Policy and related Guidelines (as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate in DP-financed, -administered, or -supported activities or to benefit from an DP-financed, -administered, or -supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and</p> <p>(e) The Contractor shall permit the GoN/DP to inspect the Contractor’s accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the GoN/DP, if so required by the GoN/DP.</p>
	<p>3.2 The Bidder shall not carry out or cause to carry out the following acts with an intention to influence the implementation of the procurement process or the procurement agreement :</p>

	<p>(a) give or propose improper inducement directly or indirectly,</p> <p>(b) distortion or misrepresentation of facts,</p> <p>(c) engaging in corrupt or fraudulent practice or involving in such act,</p> <p>(d) interference in participation of other competing bidders,</p> <p>(e) coercion or threatening directly or indirectly to cause harm to the person or the property of any person to be involved in the procurement proceedings,</p> <p>(f) collusive practice among bidders before or after submission of bids for distribution of works among bidders or fixing artificial/uncompetitive bid price with an intention to deprive the Employer the benefit of open competitive bid price,</p> <p>(g) contacting the Employer with an intention to influence the Employer with regards to the bids or interference of any kind in examination and evaluation of the bids during the period from the time of opening of the bids until the notification of award of contract.</p> <p>3.3 PPMO, on the recommendation of the Procuring Entity may blacklist a Bidder for a period of one (1) to three (3) years for its conduct including on the following grounds and seriousness of the act committed by the bidder:</p> <p>(a) if convicted by a court of law in a criminal offence which disqualifies the Bidder from participating in the contract,</p> <p>(b) if it is established that the contract agreement signed by the Bidder was based on false or misrepresentation of Bidder’s qualification information,</p> <p>(c) if it at any time determines that the firm has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for, or in executing, a GoN/DP-financed contract.</p> <p>(d) if the successful bidder fails to sign the contract.</p> <p>3.4 A bidder declared blacklisted and ineligible by the GoN, Public Procurement Monitoring Office (PPMO) and/or the DP in case of DP funded project, shall be ineligible to bid for a contract during the period of time determined by the GoN, PPMO and/or the DP.</p> <p>3.5 In case of a natural person or firm/institution/company which is already declared blacklisted and ineligible by the GoN, any other new or existing firm/institution/company owned partially or fully by such Natural person or Owner or Board of director of blacklisted firm/institution/company; shall not be eligible bidder.</p> <p>3.6 Furthermore, Bidders shall be aware of the provisions of GCC (GCC 28.3 and 72.3(j).</p>
<p>4. Eligible Bidders</p>	<p>4.1 A Bidder may be a natural person, private entity, or government - owned entity—subject to ITB 4.5—or any combination of them in the form of a Joint Venture (JV) under an existing agreement, or with the intent to constitute a legally-enforceable joint venture. In the case of a JV:</p> <p>(a) all partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms. Maximum number of JV shall be as specified in the BDS. The eligibility criteria requirement of the parties to the JV shall be as specified in Section III Evaluation and Eligibility Criteria, and</p> <p>(b) the JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during Contract execution.</p> <p>4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of any country</p>

	<p>or eligible countries mentioned in the BDS. A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed sub Contractors or suppliers for any part of the Contract including related services.</p>
	<p>4.3 A Bidder shall not have a conflict of interest. A Bidder found to have a conflict of interest shall be disqualified. if any of, including but not limited to, the following apply:</p> <ul style="list-style-type: none"> (a) they have controlling partners in common; or (b) they receive or have received any direct or indirect subsidy from any of them; or (c) they have the same legal representative for purposes of this bid; or (d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or improperly influence on the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or (e) a Bidder participates in more than one bid in this bidding process either individually or as a partner in a joint venture. This will result in the disqualification of all Bids in which it is involved. However, subject to any finding of a conflict of interest in terms of ITB 4.3 (a)-(d) above, this does not limit the participation of the same subcontractor in more than one bid; or (f) a Bidder or any of its affiliated entity, participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or (g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer as Engineer for the Contract.
	<p>4.4 A firm that is under a declaration of ineligibility by the GoN/DP in accordance with ITB 3, at the date of the deadline for bid submission or thereafter, shall be disqualified. A firm shall not be eligible to participate in any procurement activities under an DP-financed, -administered, or -supported project while under temporary suspension or debarment by DP pursuant to the DP's Anticorruption Policy (see ITB 3), whether such debarment was directly imposed by the DP, or enforced by other DPs pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a temporary suspended or debarred firm will be rejected.</p>
	<p>4.5 Enterprises owned by Government shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the GoN.</p>
	<p>4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.</p>

	<p>4.7 Firms shall be excluded in any of the cases, if</p> <ul style="list-style-type: none"> (a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Nepal prohibits any import of goods or Contracting of works or services from that country or any payments to persons or entities in that country. (b) DP Funded: as a matter of law or official regulation, Nepal prohibits commercial relations with that country, provided that the DP is satisfied that such exclusion does not preclude effective competition for the supply of goods or related services required; (c) DP Funded: a firm has been determined to be ineligible by the DP in relation to their guidelines or appropriate provisions on preventing and combating fraud and corruption in projects financed by them. <p>4.8 Maximum number of bidding process that a Bidder, and all parties constituting the Bidder can participate shall be as specified in BDS. The bidders shall be considered ineligible if number of participation in bidding process exceeds the number as specified.</p>
<p>5. Eligible Materials, Equipment and Services</p>	<p>5.1 The materials, equipment and services to be supplied under the Contract shall have their origin in any source countries as defined in ITB 4.2 above and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer’s request, Bidders may be required to provide evidence of the origin of materials, equipment and services.</p> <p>5.2 For purposes of ITB 5.1 above, “origin” means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.</p>
<p>B. Contents of Bidding Documents</p>	
<p>6. Sections of Bidding Document</p>	<p>6.1 The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.</p> <p>PART I Bidding Procedures</p> <ul style="list-style-type: none"> Section I Instructions to Bidders (ITB) Section II Bid Data Sheet (BDS) Section III Evaluation and Eligibility Criteria (EEC) Section IV Bidding Forms (BDF) <p>PART II Requirements</p> <ul style="list-style-type: none"> Section V Works Requirements (WRQ) Section VI Bill of Quantities (BOQ) <p>PART III Conditions of Contract and Contract Forms</p> <ul style="list-style-type: none"> Section VII General Conditions of Contract (GCC) Section VIII Special Conditions of Contract (SCC) Section IX Contract Forms (COF)

	6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.
	6.3 The Employer is not responsible for the completeness of the Bidding Document and their Addenda, if they were not obtained directly from the source stated by the Employer in the Invitation for Bids.
	6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document and to furnish with its bid all information and documentation as is required by the Bidding Documents. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.
7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting	7.1 A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer’s address indicated in the BDS or raise any question or curiosity during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received within the period as mentioned in ITB 7.5. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 17.2
	7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a Contract for construction of the Works. The costs of visiting the Site shall be at the Bidder’s own expense.
	7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
	7.4 The Bidder’s designated representative is invited to attend a pre-bid meeting, if provided for in the BDS . The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage. 7.5 The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer as mentioned in BDS .
	7.5 The Bidder is requested, to submit any questions in writing, to reach the Employer as mentioned in BDS .
	7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
	7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
8. Amendment of Bidding Document	8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing agenda.

	8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.
	8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 19.2
C. Preparation of Bids	
9. Cost of Bidding	9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
10. Language of Bid	10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS . Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS , in which case, for purposes of interpretation of the Bid, such translation shall govern.
11. Documents Comprising the Bid	<p>11.1 The Bid shall comprise the following:</p> <ul style="list-style-type: none"> (a) Letter of Bid; (b) completed Bill of Quantities (BoQ), in accordance with ITB 12 and ITB 13, or as stipulated in the BDS; (c) Bid Security, in accordance with ITB 16; (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 17.2; (e) documentary evidence of establishing the Bidder's eligibility; (f) Bids submitted by a Joint Venture shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement. The Joint Venture agreement, or letter of intent to enter into a Joint Venture including a draft agreement shall indicate at least the parts of the Works to be executed by the respective partners; and (h) any other required documents, which is not against the provision of Procurement Act/Regulation/Directives and Standard Bidding Document issued by PPMO as specified in the BDS. <p>11.2 The Bidder is solely responsible for the authenticity of the submitted documents.</p>
12. Letter of Bid and Schedules	12.1 The Letter of Bid, Schedules, and all documents listed under ITB 11, shall be prepared using the relevant forms in Section IV (Bidding Forms) and in Section VI (Bill of Quantities). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.
13. Bid Prices and Discounts	<p>13.1 The prices and discounts quoted by the Bidder in the Letter of Bid and in the Schedules shall conform to the requirements specified below.</p> <p>13.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section VI (Bill of Quantities).</p>

	<p>In case of Unit Rate Contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.</p> <p>13.3 The price to be quoted in the Letter of Bid shall be the total price of the Bid, excluding any discounts offered. Absence of the total price in the Letter of Bid or the Bid Price in the Bill of Quantities shall result in rejection of the Bid.</p> <p>13.4 The Bidder shall quote any discounts and the methodology for their application in the Letter of Bid, in accordance with ITB 12.1.</p> <p>13.5 If so indicated in ITB 1.1, bids are invited for individual Contracts or for any combination of Contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 13.4, provided the bids for all Contracts are submitted and opened at the same time.</p> <p>13.6 Unless otherwise provided in the BDS and the Conditions of Contract, the prices quoted by the Bidder shall be fixed. If the prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Table of Adjustment Data in Section IV (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.</p> <p>13.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 30 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total bid price submitted by the Bidder.</p>
14. Currency of Bid and Payment	14.1 The currency of the bid and payment shall be in Nepalese Rupees.
15. Period of Validity of Bids	<p>15.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.</p> <p>15.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 16, it shall also be extended 30 days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its bid and to include any additional conditions against the provisions specified in Bid Documents.</p>
16. Bid Security	16.1 The Bidder shall furnish as part of its bid, in original form, a bid security as specified in the BDS . In case of e-submission of bid, the Bidder shall upload scanned copy of Bid security letter at the time of electronic submission of the bid. The Bidder accepts that the scanned copy of the Bid security shall, for all purposes, be equal to the original. The details of original Bid Security and the scanned copy submitted with e-bid should be the same otherwise the bid shall be non-responsive.

	<p>16.2 The bid security shall be, at the Bidder’s option, in any of the following forms:</p> <ul style="list-style-type: none"> (a) an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law or; (b) a cash deposit voucher in the Employer's Account as specified in BDS. <p>In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included in Section IV (Bidding Forms) or in another Form acceptable to the employer. The form must include the complete name of the Bidder. The bid security shall be valid for minimum thirty (30) days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 15.2.</p> <p>16.3 Any bid not accompanied by an enforceable and substantially compliant bid security shall be rejected by the Employer as nonresponsive. In case of e- Submission, if the scanned copy of an acceptable Bid Security letter is not uploaded with the electronic Bid then Bid shall be rejected.</p> <p>16.4 The bid security of unsuccessful Bidders shall be returned within three days, once the successful bidder has furnished the required performance security and signed the Contract Agreement pursuant to ITB 34.1 and 35.1.</p> <p>16.5 The bid security shall be forfeited if:</p> <ul style="list-style-type: none"> (a) a Bidder requests for withdrawal or modification of its bid, except as provided in ITB 15.2: <ul style="list-style-type: none"> (i) during the period of bid validity specified by the Bidder on the Bid, in case of electronic submission; (ii) from the period twenty-four hours prior to bid submission deadline up to the period of bid validity specified by the Bidder on the Letter of Bid, in case of hard copy submission. (b) a Bidder changes the prices or substance of the bid while providing information pursuant to clause ITB 24.1; (c) a Bidder involves in fraud and corruption pursuant to clause 3.1; (d) the successful Bidder fails to: <ul style="list-style-type: none"> (i) furnish a performance security in accordance with ITB 34.1; or (ii) sign the Contract in accordance with ITB 35.1 (iii) accept the correction of arithmetical errors pursuant to clause 28.1; <p>16.6 The Bid Security of a JV shall be in the name of the JV that submits the bid. If the JV has not been legally constituted at the time of bidding, the Bid Security shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.</p>
<p>17. Format and Signing of Bid</p>	<p>17.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it ORIGINAL”. In addition, the Bidder shall submit copies of the bid in the number specified in the BDS, and clearly mark each of them “COPY.” In the event of any discrepancy between the original and the copies, the original shall prevail. In case of e-submission of bid, the Bidder shall submit his bid electronically in PDF or web forms files as specified in ITB Clause 18.1(b),</p> <p>17.2 The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be</p>

	<p>typed or printed below the signature. All pages of the bid, except for an amended printed literature, shall be signed or initialed by the person signing the bid.</p> <p>17.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.</p>
D. Submission and Opening of Bids	
18. Sealing and Marking of Bids	<p>18.1 Unless otherwise specified in BDS, Bidders shall submit their bids by electronic or by mail/by hand/by courier. Procedures for submission, sealing and marking are as follows:</p> <p>(a) Bidders submitting bids by mail, by hand or by courier</p> <p>i. Bidders shall enclose the original and each copy of the Bid. These envelopes containing the original and the copies shall then be enclosed in one single envelope.</p> <p>ii. The inner and outer envelopes shall:</p> <p>(aa) bear the name and address of the Bidder;</p> <p>(bb) be addressed to the Employer as provided in BDS19.1;</p> <p>(cc) bear the specific identification of this bidding process indicated in BDS 1.1; and</p> <p>(dd) bear a warning not to open before the time and date for bid opening.</p> <p>iii. If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.</p> <p>(b) Bidders submitting Bids electronically shall follow the electronic bid submission procedure specified in BDS.</p>
19. Deadline for Submission of Bids	<p>19.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS. In case of e-submission, the standard time for e-submission is Nepalese Standard Time as set out in the server. The e-procurement system will accept the e-submission of bid from the date of publishing of notice and will automatically not allow the e-submission of bid after the deadline for submission of bid.</p> <p>19.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.</p>
20. Late Bids	<p>20.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 19. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.</p>
21. Withdrawal, and Modification of Bids	<p>21.1 A Bidder may withdraw, or modify its bid after it has been submitted either in hard copy or by e-submission. Procedures for withdrawal or modification of submitted bids are as follows:</p> <p>(i) Bids submitted in hard Copy</p> <p>a) Bidders may withdraw or modify its bids by sending a written notice in a sealed envelope, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 17.2 before 24 hours prior to the last deadline of submission of bid. The corresponding modification of the bid must accompany the respective written notice. All notices must be:</p> <p>(aa) prepared and submitted in accordance with ITB 17 and ITB 18, and in</p>

	<p>addition, the respective envelopes shall be clearly marked “WITHDRAWAL”, “MODIFICATION;” and</p> <p>(bb) received by the Employer twenty four hour hours prior to the deadline prescribed for submission of bids, in accordance with ITB 19.</p> <p>ii) E-submitted bids.</p> <p>a) Bidder may submit modification or withdrawal prior to the deadline prescribed for submission of bids through e-GP system by using the forms and instructions provided by the system.</p>
	<p>21.2. Bids requested to be withdrawn in accordance with ITB 21.1 shall not be opened. In case of hard copy submission, the Bid will be returned unopened to the Bidders.</p>
	<p>21.3 Except in case of any modification or correction in bid document made by procuring entity, Bidder may submit request for withdrawal or modification only one time.</p>
	<p>21.4 In case of hard copy bid, no bid may be withdrawn if the bid has already been modified; except in case of any modification or correction in bid document by procuring entity.</p>
	<p>21.5 Request for withdrawal or modification must be made through the same medium of submission. Request for withdrawal or modifications through different medium shall not be considered.</p>
	<p>21.6 The following provisions apply for withdrawal or modification of the Bids:</p> <p>(i) In case of bids submitted in hard copy no bid shall be withdrawn or modified in the interval between 24 hours prior to the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.</p> <p>(ii) In case of e-submitted bids no bids shall be withdrawn or modified in the interval between deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.</p>
	<p>21.7 Once a Bid is withdrawn, bidder will not be able to submit another bid for the same bid.</p>
<p>22. Bid Opening</p>	<p>22.1 The Employer shall open the bids in public at the address, date and time specified in the BDS in the presence of Bidders` designated representatives who choose to attend.</p>
	<p>22.2 The Employer shall download the e-submitted bid files. The e-procurement system allows the Employer to download the e-submitted bid files (report) only after bid opening date and time after login simultaneously by two members of the Bid opening committee.</p>
	<p>22.3 Electronically submitted bid shall be opened at first in the same time and date as specified above. Electronic Bids shall be opened one by one and read out. The e-submitted bids must be readable through open standards interfaces. Unreadable and or partially submitted bid files shall be considered incomplete.</p>
	<p>22.4 Thereafter, envelopes marked “WITHDRAWAL” shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be Permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening. Next, envelopes marked “MODIFICATION” shall be opened and read out with the corresponding bid. No bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read</p>

	<p>out at bid opening. Only envelopes that are opened and read out at bid opening shall be considered further.</p> <p>22.5 All other envelopes shall be opened one at a time, reading out: the name of the Bidder; the Bid Price(s), including any discounts and alternative bids and indicating whether there is a modification; the presence of a bid security and any other details as the Employer may consider appropriate. Only discounts and alternative offers read out at bid opening shall be considered for evaluation. No bid shall be rejected at bid opening except for late bids, in accordance with ITB 20.1.</p> <p>22.6 The Employer shall prepare a record of the bid opening that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, or modification; the Bid Price, per Contract if applicable, including any discounts and alternative offers; and the presence or absence of a bid security. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.</p>
E. Evaluation and Comparison of Bids	
23. Confidentiality	<p>23.1 Information relating to the examination, evaluation, comparison, and recommendation of Contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.</p> <p>23.2 Any attempt by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.</p> <p>23.3 Notwithstanding ITB 23.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.</p>
24. Clarification of Bids	<p>24.1 To assist in the examination, evaluation, and comparison of the bids, the Employer may, at its discretion, ask any Bidder for a clarification of its bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the prices or substance of the bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids, in accordance with ITB 28. In case of e-submission of bid, upon notification from the employer, the bidder shall also submit the original of documents comprising the bid as per ITB 11.1 for verification of submitted documents for acceptance of the e-submitted bid.</p> <p>24.2 If a Bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.</p>
25. Deviations, Reservations, and Omissions	<p>25.1 During the evaluation of bids, the following definitions apply:</p> <p>(a) "Deviation" is a departure from the requirements specified in the Bidding Document;</p> <p>(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and</p> <p>(c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.</p>
26. Determination of Responsiveness	<p>26.1 The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.</p> <p>26.2 A substantially responsive bid is one that meets the requirements of the Bidding</p>

	<p>Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,</p> <p>(a) if accepted, would:</p> <p>(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract;</p> <p>or</p> <p>(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or</p> <p>(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.</p> <p>26.3 If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.</p> <p>26.4 In case of e-submission bids, the Employer evaluates the bid on the basis of the information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 24.1, the bid shall not be considered for further evaluation.</p> <p>26.5 In Case, a corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded from the evaluation, if public entity receives instruction from Government of Nepal.</p>
<p>27. Nonconformities, Errors, and Omissions</p>	<p>27.1 Provided that a bid is substantially responsive, the Employer may waive any non-conformities in the bid that do not constitute a material deviation, reservation, or omission.</p> <p>27.2 Provided that a bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of the bid. Failure of the Bidder to comply with the request may result in the rejection of its bid.</p> <p>27.3 Provided that a bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the methods indicated in Section III (Evaluation and Eligibility Criteria).</p> <p>27.4 If the monetary value of such non-conformities is found to be more than fifteen percent of the Bid Price of the bidder on account of minor discrepancies pursuant to ITB 27.3, such bid shall be considered non responsive and shall not be involved in evaluation.</p>
<p>28. Correction of Arithmetical Errors</p>	<p>28.1 Provided that the bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis:</p> <p>(a) only for unit price Contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail</p>

	<p>and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;</p> <p>(b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and</p> <p>(c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Bid will be corrected.</p> <p>(d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) ,(b) and (c) above.</p> <p>28.2 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be disqualified and its bid security shall be forfeited.</p>
<p>29. Evaluation of Bids</p>	<p>29.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.</p> <p>29.2 To evaluate a bid, the Employer shall consider the following:</p> <ul style="list-style-type: none"> (a) the bid price, excluding Value Added Tax , Provisional Sums, and the provision, if any, for contingencies in the Summary Bill of Quantities, for Unit Rate Contracts, or Schedule of Prices for lump sum Contracts, but including Day work items, where priced competitively; (b) price adjustment for correction of arithmetic errors in accordance with ITB 28.1; (c) price adjustment due to discounts offered in accordance with ITB 13.4; (d) adjustment for nonconformities in accordance with ITB 27.3; (e) application of all the evaluation factors indicated in Section III (Evaluation and Eligibility Criteria); <p>29.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.</p> <p>29.4 If this Bidding Document allows Bidders to quote separate prices for different Lots (Contracts), and to award multiple Contracts to a single Bidder as specified in BDS, the methodology to determine the lowest evaluated price of the Contract combinations, including any discounts offered in the Letter of Bid, is specified in Section III (Evaluation and Eligibility Criteria).</p> <p>29.5 if the bid for an Unit Rate Contract, which results in the lowest Evaluated Bid Price is seriously unbalanced or front loaded or extremely low in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analysis, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder as mentioned in BDS to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract or may consider the bid as non-responsive.</p> <p>29.6 In case of e-submission bids, the Employer evaluates the bid on the basis of the</p>

	<p>information in the electronically submitted bid files. If the Bidder cannot substantiate or provide evidence to establish the information provided in e-submitted bid through documents/ clarifications as per ITB Clause 24.1, the bid shall not be considered for further evaluation.</p> <p>29.7 In Case, a corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded from the evaluation, if public entity receives instruction from Government of Nepal.</p>
30. Comparison of Bids	30.1 The Employer shall compare all substantially responsive bids in accordance with ITB 29.2 to determine the lowest evaluated bid.
31. Employer's Right to Accept Any Bid, and to Reject Any or All Bids	31.1 The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to Contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.
F. Award of Contract	
32. Award Criteria	32.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.
33. Letter of Intent to Award the Contract/Notification of Award	33.1 The Employer shall notify the concerned Bidder whose bid has been selected in accordance with ITB 32.1 within seven days of the selection of the bid, in writing that the Employer has intention to accept its bid and the information regarding the name, address and amount of selected bidder shall be given to all other bidders who submitted the bid.
	33.2 If no bidder submits an application pursuant to ITB 36 within a period of seven days of the notice provided under ITB 33.1, the Employer shall, accept the bid selected in accordance with ITB 32.1 and Letter of Acceptance shall be communicated to the selected bidder prior to the expiration of period of Bid validity, to furnish the performance security and sign the contract within fifteen days.
34. Performance Security	<p>34.1 Within Fifteen (15) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security as under mentioned from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in accordance with the conditions of Contract using Sample Form for the Performance Security included in Section IX (Contract Forms), or another form acceptable to the Employer.</p> <p>i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price.</p> <p>ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows:</p> <p>Performance Security Amount = $[(0.85 \times \text{Cost Estimate} - \text{Bid Price}) \times 0.5] + 5\%$ of Bid Price. The Bid Price and Cost Estimate shall be inclusive of Value Added Tax.</p>
	34.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of

	<p>the award and forfeiture of the bid security. In that event the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily. The process shall be repeated according to ITB 33.</p>
<p>35. Signing of Contract</p>	<p>35.1 The Employer and the successful Bidder shall sign the Contract Agreement within the period as stated ITB 34.1.</p> <p>35.2 At the same time, the Employer shall affix a public notice on the result of the award on its notice board and make arrangement for causing such notice to be affixed on the notice board also of the District Coordination Committee, District Administration Office, Provincial Treasury and Controller Office and District Treasury and Controller Office. The Employer may make arrangements to post the notice into its website, if it has; and if it does not have, into the website of the Public Procurement Monitoring Office, identifying the bid and lot numbers and the following information: (i) the result of evaluation of bid; (ii) date of publication of notice inviting bids; (iii) name of newspaper; (iv) reference number of notice; (v) item of procurement; (vi) name and address of bidder making contract and (vii) contract price.</p> <p>35.3 Within thirty (30) days from the date of issuance of notification pursuant to ITB 33.1 unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, requests for debriefing.</p> <p>35.4 If the bidder whose bid is accepted fails to sign the contract as stated ITB 35.1, the Public Procurement Monitoring Office shall blacklist the bidder on recommendation of the Public Entity.</p>
<p>36. Complaint and Review</p>	<p>36.1 If a Bidder is dissatisfied with the Procurement proceedings or the decision made by the Employer in the intention to award the Contract, it may file an application to the Chief of the Public Entity within Seven (7) days of providing the notice under ITB 33.1 by the Public Entity, for review of the proceedings stating the factual and legal grounds.</p> <p>36.2 Late application filed after the deadline pursuant to ITB 36.1 shall not be processed.</p> <p>36.3 The chief of Public Entity shall, within five (5) days after receiving the application, give its decision with reasons, in writing pursuant to ITB 36.1:</p> <ul style="list-style-type: none"> (a) whether to suspend the procurement proceeding and indicate the procedure to be adopted for further proceedings; or (b) to reject the application. <p>The decision of the chief of Public Entity shall be final.</p>

SECTION-II
Bid Data Sheet

A. General

ITB 1.1	The number of the Invitation for Bids is : CONS/NCB/RCH/08/081/82
ITB 1.1	The Employer is : Water Supply And Sanitation Division No. 4, Ramechhap
ITB 1.1	The number and identification of lots (contracts) comprising this bidding process is: : NA
ITB 2.1	The name of the Project is : The laying & jointing of PE 100(HDPE)Pipes of Thuli Madhau Samudayik Lift WSP The implementing agency is : NA
ITB 4.1(a)	Maximum number of partner in a joint venture shall be : 3
ITB 4.2	Eligible countries : Nepal
ITB 4.8	Maximum number of bidding process that a Bidder, and all parties constituting the Bidder can participate shall be :5

B. Bidding Document

ITB 7.1	For clarification purposes only, the Employer's address is: Attention: Ajay Yadav Address: Manthali, Ramechhap Ramechhap Bagmati Province Manathali Telephone: 9860305942 Facsimile number: Electronic mail address: pr3wssd4@gmail.com
ITB 7.4	A pre bid meeting shall be held. Pre-Bid meeting will take place at the following date, time and place: Date and Time:02-01-2025 14:00 Address :Water Supply And Sanitation Division No. 4, Ramechhap Manthali, Ramechhap Manathali, Ramechhap Bagmati Province Nepal
ITB 7.4	A site visit shall not be organized by the Employer.
ITB 7.5	Time for request: Requests for clarification should be received by the Employer no later than 10 days prior to the deadline for submission of bids.

C. Preparation of Bids

ITB 10.1	The language of the bid is: English / Nepali
ITB 11.1 (b)	In accordance with ITB 12 and ITB 14, the following schedules shall be submitted with the bid, including the priced Bill of Quantities for Unit Rate Contracts and Schedule of Prices for lump sum contracts: NA

ITB 11.1 (i)	The Bidder shall submit with its bid the following additional documents:	
	SL No	Document Name
	1	NA
ITB 13.6	The prices quoted by the Bidder shall not be subject to adjustment during the performance of the Contract.	
ITB 15.1	The bid validity period shall be Ninety (90) days.	
ITB 16.1	The Bidder shall furnish a bid security, from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law with a minimum of 90000.00 NPR, which shall be valid for 30 days beyond the validity period of the bid.	
ITB 16.2(b)	Bank Name:	Rastriya Banijya Bank Ltd.
	Bank Address:	Manthali, Ramechhap
	Account Name:	KHA-2-3: DHARAUTI A/C (PRA.LE.NI.KA
	Account Number:	1680100202030000
ITB 17.1	In addition to the original of the bid, the number of copy/ies is/are: NA	
ITB 17.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall indicate:</p> <p>(a) The name and description of the documentation required to demonstrate the authority of the signatory to sign the Bid such as a Power of Attorney; and</p> <p>(b) In the case of Bids submitted by an existing or intended JV, an undertaking signed by all parties</p> <p style="padding-left: 40px;">(i) stating that all parties shall be jointly and severally liable, and</p> <p style="padding-left: 40px;">(ii) nominating a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.</p>	
D. Submission and Opening of Bids		
ITB 18.1	Bidders shall have the option of submitting their bids by electronic only.	

<p>ITB 18.1 (b)</p>	<p>Electronic bid submission procedure: (a) Bidders submitting Bids electronically shall follow the electronic bid submission procedures specified in this clause.</p> <ol style="list-style-type: none"> i. Bidders who choose to submit their bids electronically, can view/download the bidding documents from "published bids" section of e-GP system https://bolpatra.gov.np/egp. ii. For the purpose of e-Submission, the bidder shall, at first, register in e-GP system and maintain their organization profile data and documents required during bid response preparation. The details of e-GP registration and profile management procedure are specified in Article No 9 and 10 respectively of e-GP Directives issued by PPMO, which can be downloaded from Download section of e-GP system. iii. In order to submit the bid, interested bidders shall deposit the cost of bidding document in the bank and account specified in Invitation for Bid (IFB). The scanned copy (in PDF format) of the bank deposit voucher shall also be submitted along with the bid. iv. The bidders shall prepare their bids using data and documents maintained in bidder's profile, instruction provided by e-GP system and forms/format provided in the bidding document. v. Bidders may submit bids as a single entity or as a joint venture (JV). Bidder submitting bid in JV shall have to upload joint venture agreement along with partner(s) Bolpatra ID provided during bidder's registration. vi. Bidders (all partners in case of JV) shall update their profile data and documents required during preparation and submission of their bids. vii. In case of bid submission in JV, the consent of the partners shall be obtained through the confirmation link sent to the registered email address and the partners shall have to acknowledge their confirmation. viii. Bidders shall submit the required documents as specified in Section I-Instruction to Bidders, Section II-Bid Data Sheet and Section III-Evaluation and Eligibility Criteria of the bidding document. The format of the documents shall be in PDF and/or web form as provisioned in the e-GP system. ix. After providing all the details and documents, the e-GP system will generate bid response documents for the bidder. Bidders shall download, verify and confirm the bid response documents prior to bid submission. x. For verifying the authentic user, the system will send one time password (OTP) in the registered e-mail address of the bidder. System will validate the OTP and then only allow bidders to submit their bid. xi. Electronically submitted bids can be modified and/or withdrawn through the system within the bid submission deadline. xii. The bidder/bid shall meet the following requirements and conditions for e-submission of bids; <ol style="list-style-type: none"> aa) The e-submitted bids must be readable through PDF reader. bb) The bidders are fully responsible for using the e-GP system as per specified procedures and in no case the employer shall be held liable for bidder's inability to use the system. ac) When a bidder submits electronic bid through the e-GP System, it is assumed that the bidder has prepared the bid by studying and examining the complete set of the bidding document and e-GP instruction including the provision stipulated in e-GP Directives.
<p>ITB 19.1</p>	<p>For bid submission purposes only, the Employer's address is :</p> <p>Attention : Anil Prasad Kesari</p> <p>Address : Water Supply And Sanitation Division No. 4, Ramechhap Manthali, Ramechhap Manathali, Ramechhap Bagmati Province Nepal</p> <p>The deadline for bid submission is : 12-01-2025 12:00</p>
<p>ITB 22.1</p>	<p>The bid opening shall take place at :</p> <p>Address : Water Supply And Sanitation Division No. 4, Ramechhap Manthali, Ramechhap Manathali, Ramechhap Bagmati Province Nepal</p> <p>Date : 12-01-2025 14:00</p>
<h3>E. Evaluation and Comparison of Bids</h3>	
<p>ITB 29.4</p>	<p>Bidders are not permitted to quote separate prices for lots (Contracts), and a single Bidder will be awarded multiple lots (Contracts) based on provision of Paragraph 1.1, Multiple Contracts Section III (Evaluation and Qualification Criteria).</p>
<p>ITB 29.5</p>	<p>The amount of the performance security be increased by 8 percent of the quoted bid price.</p>

SECTION - III

Evaluation and Eligibility Criteria

This Section contains all the criteria that the Employer shall use to evaluate bids and eligible Bidders. GoN/DP requires bidders to be qualified by meeting predefined eligibility criteria. In accordance with ITB 29, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section IV (Bidding Forms).

1 Evaluation

In addition to the criteria listed in ITB 29.2 (a) - (e) the following criteria shall apply:

2 Eligibility

2.1 Conflict of Interest

No conflicts of interest in accordance with ITB Sub-Clause 4.3.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : existing or intended JV must meet requirement

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Letter of Bid

2.2 Government/DP Eligibility

Not having been declared ineligible by government/DP, as described in ITB Sub-Clause 4.4.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : must meet requirement

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Letter of Bid

2.3 Government-owned Entity

Bidder required to meet conditions of ITB Sub-Clause 4.5.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : existing or intended JV must meet requirement

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Forms ELI - 1, ELI - 2, with attachments

2.4 UN Eligibility

Not having been declared ineligible based on a United Nations resolution or Employer's country law, as described in ITB Sub-Clause 4.7.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : existing or intended JV must meet requirement

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Letter of Bid

2.5 Bidder's Participation in Bidding Process

Bidder's Participation in not more than five (5) bidding process since 2078-12-03 i.e. March 17, 2022 as described in ITB Sub-Clause 4.8.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : existing or intended JV must meet requirement

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : ELI-3

2.6 Other Eligibility: Firm Registration Certificate

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : not applicable

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Document attachment

2.7 Other Eligibility: Business Registration Certificate (License)

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : not applicable

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Document attachment

2.8 Other Eligibility: VAT and PAN Registration certificate

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : not applicable

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Document attachment

2.9 Other Eligibility: Tax Clearance certificate

Tax clearances certificate for the F/Y ..2080/2081 or Tax return submission evidence or evidence of tax time extension for.

Single Entity : must meet requirement

Joint Venture :

All Partners Combined : not applicable

Each Partner : must meet requirement

One Partner : not applicable

Documents:

Submission Requirements : Document attachment

2.10 other Documents

Power of Attorney, Self Declaration Letter

Following contracts shall not be counted for this purpose

- a) The contracts which were invited or accepted before 2078-12-03 B.S or March 17, 2022 A.D
- b) The contracts which have been invited after 2078-12-03 B.S i.e March 17, 2022 A.D and accepted but the work acceptance report has been approved according to Rule 117 of PPR.
- c) The contracts that are running under all types of foreign assistance

SECTION-IV

Bidding Forms

This Section contains the forms which are to be completed by the Bidder and submitted as part of its Bid.

Letter of Bid

The Bidder must accomplish the Letter of Bid in its letterhead clearly showing the Bidder's complete name and address.

Date:

Name of the contract:

Invitation for Bid No.:

To:

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) Clause 8;
- (b) We offer to execute in conformity with the Bidding Documents the following Works:
- (c) The total price of our Bid, excluding any discounts offered in item (d) below is: [Insert one of the options below as appropriate] or when left blank is the Bid Price indicated in the Bill of Quantities

Option 1, in case of single contract: Total price is: [insert the total price of the Bid in words and figures];

Or

Option 2, in case of multiple lots (contracts): (i) Total price of each lot (contracts): [insert the total price of each lot in words and figures]; (ii) Total price of subject contract [say Lot1] and Lot2 [another contract] [insert the total price in words and figures]; (iii) Total price of subject contract [say Lot1] and Lot3 [another contract] [insert the total price in words and figures]; Total price of subject contract [say Lot1], Lot2 [another contract], Lot3 [another contract],[insert the total price in words and figures];

- (d) The discounts offered and the methodology for their application for subject contract [single contract] are:..... [For Bidding Documents not provisioning multiple contracts]

Add following if Bidding Document provisions applicability of multiple contracts

The discounts offered and the methodology for their application for subject contract [say Lot1] and Lot2 [another contract] are:.....

The discounts offered and the methodology for their application for subject contract [say Lot1] and Lot3 [another contract] are:.....

The discounts offered and the methodology for their application for subject contract [say Lot1], Lot2 [another contract] and Lot3 [another contract],....., are:.....

[Note:

1. Formulate possible combinations depending upon the number of lots under Bidding Process and modify accordingly Paragraph (c) and (d)]

(e) Our bid shall be valid for a period of*[insert validity period as specified in ITB 15.1]* days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;

(g) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries or any countries [insert the nationality of the Bidder, including that of all parties that comprise the Bidder if the Bidder is a consortium or association, and the nationality of each Subcontractor and Supplier];

(h) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;

(i) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.3;

(j) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council;

(k) We are not a government owned entity/We are a government owned entity but meet the requirements of ITB 4.5;¹

(l) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(m) We declare that, we have not been black listed as per ITB 3.4 and no conflict of interest in the proposed procurement proceedings and we have not been punished for an offense relating to the concerned profession or business.

- (n) We declare that we have not running contracts more than five (5)¹ in accordance with ITB 4.8.
- (o) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive; and
- (p) If awarded the contract, the person named below shall act as Contractor's Representative:
- (q) We agree to permit the Employer/DP or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Employer.

Name:

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ Note: Following contracts shall not be counted for this purpose

- a) The contracts which were invited or accepted before 2078-12-03 B.S or March 17, 2022 A.D
- b) The contracts which have been invited after 2078-12-03 B.S i.e March 17, 2022 A.D and accepted but the work acceptance report has been approved according to Rule 117 of PPR.
- c) The contracts that are running under all types of foreign assistance

1 Use one of the two options as appropriate.

Table of Price Adjustment Data²

[To be used if Price Adjustment is applicable as per GCC 53.1]

Code	Index Description	Source of Index*	Base Value and Date	Employer's Proposed Weighting Range (coefficient)	Bidder's Proposed Weighting (coefficient)**
1	2	3	4	5	6
	Non - adjustable (A)			0.15	0.15
	Labor (b)				
	Materials (c)				
	Equipment usage (d)				
		Total			1.00

*Normally following source of index shall apply. Public Entity shall choose applicable Index for each item.

(a) Labor: "National Salary and Wage Rate Index" - "Construction Labor" of Nepal Rastra Bank
or
rate fixed by District Rate Fixation Committee

(b) Material: "National Wholesale Price Index" - Construction Materials" of Nepal Rastra Bank

(c) Equipment usage:

"National Wholesale Price Index" - "Machinery and Equipment" of Nepal Rastra Bank
or

"Fuel" Price fixed by Nepal Oil Corporation.

** Bidders proposed weightings should be within the range specified by the Employer in column - 5

² Non-compliance of the data (stipulated by the bidder in this table) with requirements described here shall not be grounds for bid rejection and such non-compliance will be subject to clarification and rectification prior to contract award.

Table of Price Adjustment Data³

[To be used if Price Adjustment is applicable as per GCC 53.6]

Code	Construction Material*	Unit	Base Price (NRs/Unit) (Ex-factory)	(Ex-	Source (Factory)**
1	2	3	4		5

* Major construction materials to be specified by Employer in column - 2.

** Base Price and source normally to be specified by Employer (or alternatively informed to be proposed by bidder) in column 4 and 5.

Note:

The base prices of the construction materials shall be taken as of 30 days before the deadline for submission of the Bid as quoted by the Bidder and verified by the Employer. For the purpose of calculation of price adjustment, the Ex-factory price of the same source shall be taken into consideration.

³ Non-compliance of the data (stipulated by the bidder in this table) with requirements described here shall not be grounds for bid rejection and such non-compliance will be subject to clarification and rectification prior to contract award.

Bid Security

Bank Guarantee

Bank's Name, and Address of Issuing Branch or Office

(On letterhead paper of the Bank)

Beneficiary: **name and address of Employer**

Date:

Bid Security No.:

We have been informed that **[insert name of the Bidder]** (hereinafter called "the Bidder") intends to submit its bid (hereinafter called "the Bid") to you for the execution of **name of Contract** under Invitation for Bids No. ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee. At the request of the Bidder, we..... **name of Bank** hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of **amount in figures** (. **amount in words**) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

- (a) has withdrawn or modifies its Bid:
- (i) during the period of bid validity specified by the Bidder on the Letter Bid, in case of electronic submission
- (ii) from the period twenty-four hours prior to bid submission deadline up to the period of bid validity specified by the Bidder on the Letter of Bid, in case of hard copy submission; or
- (b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
- (c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB.
- (d) is involved in fraud and corruption in accordance with the ITB

This guarantee will remain in force up to and including the date **number** days after the deadline for submission of Bids as such deadline is stated in the instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not later than the above date.

This Bank guarantee shall not be withdrawn or released merely upon return of the original guarantee by the Bidder unless notified by you for the release of the guarantee.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 758.

... Bank's seal and authorized signature(s) ...

Note:

The bid security of has been counter guaranteed by the Bank on (Applicable for Bid Security of Foreign Banks).

Bidder's Information Format

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

Others

Bidder's Information

Form ELI - 1: Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of JV, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents.	
<ol style="list-style-type: none">1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.2. Authorization to represent the firm or JV named in above, in accordance with ITB 17.2.3. In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1.4. In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.	

Form ELI - 2: JV Information Sheet

Each member of a JV must fill in this form

JV / Specialist Subcontractor Information	
Bidder's legal name	
JV Partner's or Subcontractor's legal name	
JV Partner's or Subcontractor's country of constitution	
JV Partner's or Subcontractor's year of constitution	
JV Partner's or Subcontractor's legal address in country of constitution	
JV Partner's or Subcontractor's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents.	
<ol style="list-style-type: none"> 1. articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2. 2. Authorization to represent the firm named above, in accordance with ITB .2. 3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5. 	

Form ELI - 3: Bidder's Running Contracts****

Each member of a JV must fill in this form

Bidder's Running Contracts					
Name of office	Contract Identification no.	Source of Fund*	Date of issuance of Letter of Acceptance	Status of contract**	Date of Issuance of Taking Over Certificate***

* Mention GON funded or DP funded or Other PE (Insert name) funded

** Mention "Yet to sign" if contract is not signed, "Running" if contract has been signed and contract is running and "Substantially completed" if taking over certificate has been issued.

*** Insert date of issuance of taking over certificate if the awarded contract has been substantially completed and taking over certificate has been issued.

****Note: Following contracts shall not be counted for this purpose

- a) The contracts which were invited or accepted before 2078-12-03 B.S or March 17, 2022 A.D
- b) The contracts which have been invited after 2078-12-03 B.S i.e March 17, 2022 A.D and accepted but the work acceptance report has been approved according to Rule 117 of PPR.
- c) The contracts that are running under all types of foreign assistance

Price Adjustment : Table A - Local Currency

SI No.	Index Description	Source of Index	Base Value	Base Date	Employer's Proposed Weighting coefficient Range from	Employer's Proposed Weighting coefficient Range to	Bidder's Proposed Weight
						Total	1

Part - II

REQUIREMENTS

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STANDARD SPECIFICATIONS

1.0 ITEMS OF GENERAL APPLICATION

1.1 SCOPE

These Technical Specifications cover principles, responsibilities, and requirements for items that will be applicable to all civil, electrical, mechanical, and building works pertinent to the Contract.

They shall be read in conjunction with the Conditions of Contract, the Bills of Quantities (BOQ) and the Drawings.

The specifications provided in the Specification cover the Works under the Contract. If the Contractor requires additional specifications for more explicit description of the Works or to supplement the existing specifications, or any other specifications to complete the Works, the Contractor shall submit such additional or supplementary specifications for the approval by the Engineer. All costs incurred for the additional specifications under the clause are deemed to be included in other unit rates quoted in the Bill of Quantities.

1.1.1 Scope of Contract

Details of scope of Contract are as described in the Supplementary Specifications.

1.1.2 Scope of Works

Project Specific Details

The activities to be undertaken by the Contractor within these Contracts include the following:

- a. To supply all materials and equipment required for construction of the Works, except items supplied by the Employer. The Contractor's supply items may include manufacture, collection, transportation and delivery to Site. The Contractor will be responsible for ensuring that all procedures are adequately covered and that the materials fully conform to the Contract requirements. These responsibilities will include all necessary charges or dues related to insurance, freight, taxes (including customs and excise duties, surcharges etc.) and all testing and inspections for quality control.
- b. To provide all necessary staff (including civil engineers, administrators, Site supervision personnel) and workmen (including all necessary specialists, operators, tradesmen, artisans etc. in addition to semi-skilled and unskilled workers) necessary for execution of the Works through to completion. Where appropriate, the contractor shall provide all suitable facilities and accommodation for the staff and workmen and he shall make provision for all costs related to such provisions and for medical, re-location, taxes or other expenses.
- c. To provide all equipment, machinery, tools etc. and related spares, maintenance and consumables necessary for implementation of the Works.
- d. To provide all site offices, stores, workshops and facilities necessary for use by the Employer, Engineer and support staff and for the Contractor himself and his support staff
- e. To undertake all operations necessary to complete the Works. These operations shall include: excavation, provision, haulage and installation of suitable bedding and backfill material and disposal of surplus excavated material; distribution, laying and jointing of pipes; installation of all special pipe work, valves etc. and construction of all related concrete or other activities together with all testing and disinfection of completed Works.
- f. To prepare documentary records of the Works in the form of "as-built" drawings, schedules etc.
- g. All the above activities shall be performed in a professional way and with good engineering and/or constructional practice. Upon completion of the Works the scheme shall be fully operational with minimum disruption or inconvenience to interested parties, including land owners, and there shall be no outstanding matters requiring attention

1.1.3 Definitions

a) **General**

Acceptable/Approved (Approval) - Acceptable to/approved (approval) by the Engineer in writing.

Agreed - Agreed in writing.

As detailed - As detailed on the drawings.

Authorized/ordered/rejected - Authorized/ordered/rejected by the Engineer in writing.

Designated - Shown on the drawings or otherwise specified by the Engineer or, in relation to an item scheduled in the Bill of Quantities, description of an item.

Indicated - Indicated in or reasonably to be inferred from the contract, or indicated in writing by the Engineer.

Instructed/directed/permitted -Instructed/directed/ permitted by the Engineer.

Satisfactory - Capable of fulfilling or having fulfilled the intended function.

Service - Any pipeline, cable, duct etc. for conveying or transmitting any fluid, power or other matter.

Submitted - Submitted to the Engineer.

Working easement – Area required by the Contractor for execution of the Works, including permanent right of way obtained or land purchased by the Employer plus any temporary way-leaves arranged by the Contractor.

Working strip - The working easement on the pipeline route.

b) Tolerances

Deviation - The difference between the actual (i.e., measured) size or position and the specified size or position.

Permissible deviation - The specified limit(s) of deviation.

Tolerance - The range between the limits within which a size or position must lie.

c) Measurement and Payment

Bill/schedule - The bill/schedule of quantities.

Billed/scheduled rate - The unit rate or price entered in the bill/schedule at which the Contractor undertakes to execute the particular work or to provide the required material, article or service, or to do any or all of these things, as set out in the item concerned.

Billed/scheduled - Listed in the bill/schedule of quantities.

1.2 FACILITIES FOR ENGINEER

1.2.1 Engineering Laboratory

The Laboratory shall be at vicinity of the project site and provided to the dimensions herein after given and as directed by the Engineer to the full satisfaction of the Engineer. On completion of the project, the facilities and contents, equipment and furniture will become the property of the Contractor.

The laboratory building shall contain the following rooms and with net areas approximately as follows:

1. Laboratory	12 m ²
2. Office	9 m ²
3. Toilet with commode, washbasin, mirror, towels holder, etc.	4 m ²
4. Storage room	9 m ²

The Contractor shall provide sufficient water supply as well as power at all times for all lighting, other electrical appliances and apparatus. All power shall be 220 volts 50 cycles except as

otherwise specified or directed by the Engineer or may be required for equipment contained in the laboratory or supplied by the Contractor. Room(s) shall have preferably concrete floors or to the satisfaction of Engineer with acceptable finish.

1.2.1.1 Furniture for Engineering Laboratory

Following Furniture shall be supplied by the Contractor for the Laboratory: Worktables and

Shelves shall be provided as directed by the Engineer.

- 5 wooden chairs
- 2 wooden tables, 70x140cm
- 1 steel almirah (large) locking type

1.2.1.2 Laboratory Equipment and Testing

- i. All equipment/ apparatus necessary for the regular testing of material and workmanship shall be provided by the Contractor in the field for the purposes of conducting the test of the works. The Contractor shall provide field laboratory testing apparatus required for tests such as moisture content. Sieve analysis, liquid limit, plastic limit, penetration permeability density, compaction, compression strength etc. Any off site tests needed to be conducted outside the Contractor's laboratory has to be approved by the Engineer.
- ii. The Contractor shall also be responsible for proper maintenance, lighting, power, water supply, and all consumables required for testing for the duration of the contract. Laboratory equipment shall be maintained and be in good working all the time.
- iii. The laboratory shall be adequately staffed and equipped by the Contractor so that there shall never occur any interruption to construction activities resulting from the need to carry out tests required under the contract. All samples and records shall be preserved as per the instruction of the Engineer.
- iv. The Contractor shall make all arrangements for sampling, transportation, and preparations for regular site laboratory testing as well as off- site testing by the Engineer.

1.2.2 Delay in Provision of Engineers Facilities

In the event the Contractor does not provide, or complete to the satisfaction of the Engineer, the required facilities outlined in the Clause 1.2.1 and 1.2.2 herein within the specified time limit of two weeks after award of the Contract then the Engineer may arrange to rent alternate equivalent facilities. This requirement will be related to the Contractor's own schedule and level of activity. The Contractor will be responsible for the cost of providing such temporary facilities as the engineer may deem necessary in this period. Furthermore the Contractors first monthly Payment Certificate may be submitted only after written acceptance by the Engineer of the facilities.

1.2.3 Cost for Engineer Facilities

The cost of the facilities for the Engineer as mentioned in the clause 1.2 shall be covered under Contractor's overhead cost. The cost should compensate for furnishing all material, equipment, tools and incidental necessary to complete and maintain the facilities including all furniture, potable water, electricity, sanitary installations, expendables and providing support staff etc.

The following items shall also be provided by the Contractor at his own expenses until expiration of the Contract.

- a) Building and accommodation for the Contractor's own and his workmen use.
- b) Supply of water for Works and for drinking purposes by means of storage tanks and available at all times.
- c) Supply of electricity at all times including standby generators to make the electricity available at all times.
- d) Maintenance and replacement parts for repairs of the laboratory.
- e) Unskilled labour at least (Six) for materials testing and field surveys.

All the laboratory equipment including all other additional purchase for laboratory provided by the Contractor will remain the property of the Contractor.

1.3 ACCESS TO AND POSSESSION OF SITE

1.3.1 The Site

The Site is: That land purchased or for which a right of way has been acquired by the Employer.

Final Possession of the Site, or Parts thereof, for the purpose of carrying out the execution of the Works to be given by the Employer shall be subject to any restrictions mentioned in the Contract.

The Contractor shall himself obtain temporary way leaves on whatever additional lands or working easements are required by him to carry out the Works.

1.3.2 Temporary Way leaves, Access Costs

The Contractor shall be responsible for obtaining temporary way leaves.

The cost of obtaining way leaves, including crop compensation, for temporary working areas, additional working easement and for any additional areas, required by the Contractor in connection with the Works as well as for the access to all of these shall be borne by the Contractor himself. The Contractor shall arrange for the serving of any Statutory Notices as per Clause 1.6 in connection with any temporary working area and shall give to the occupier of each such area seven days' notice of his intention to enter and shall ensure that his methods of working cause the minimum of disturbance to the land and to its owners and occupiers.

The Contractor shall at all times provide proper facilities for access and inspection of the Works by the Engineer, his assistants, inspectors, agents and representatives of public agencies having jurisdiction.

The extent of each temporary working area and the period of time for its occupation shall be such as the Engineer considers necessary having regard to the Contractor's reasonable requirements which shall be submitted together with the Work Program to the Engineer.

The Contractor shall reinstate any temporary working areas to the condition prevailing prior to his initial entry as soon as possible after the work in those areas has been completed so as to keep the period of occupation to a minimum. The Contractor shall in any event restore the areas to a tidy and workmanlike condition. Boundary walls, fences, and other structures that have been damaged, removed, or otherwise interfered with by the Contractor shall be restored to a condition at least equivalent to their original condition.

1.3.3 Access to Adjoining Property

If the Contractor's work will cause unavoidable interference with access to adjoining property, the Contractor shall first give 7 days' notice to the occupier of such property and shall provide temporary means of access for vehicles, animals, and pedestrians.

Convenient access to driveways, houses, and buildings adjoining the work shall be maintained and temporary approaches to intersecting streets and alleys shall be provided and kept in good condition by the Contractor.

As soon as a section of surfacing, pavement, or a structure has been completed, it shall be opened for use by traffic at the request of the Engineer.

The Contractor shall not prevent the free access to public water valves, water hydrants, or utility valves.

1.3.4 Permanent Right-of-Way

The Employer will make all statutory arrangements necessary for obtaining the final possession of the Site and the permanent right-of-way in the shortest possible time.

1.3.5 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.3). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

1.4 PROVISION AND MAINTENANCE OF SITE INSTALLATIONS

1.4.1 Camp for Contractor's Staff

The Contractor shall provide adequate housing with all necessary amenities and facilities for his staff and labour. The type of housing, such as accommodation containers, pre-fabricated or in-situ buildings or even rental is entirely up to him. Also the choice of one central camp or of various sub-camps is up to him as this depends greatly on the approved work program

During the whole period of existence, from setting up through operation to final removal upon completion of the Works, the Contractor shall be fully responsible for constantly carrying out all measures necessary for safeguarding the natural environment affected by his camp or camps.

He shall cause the least possible interference with existing amenities, whether man-made or natural. No trees shall be felled except as authorized by the Engineer

Latrine and ablution facilities and first-aid services shall be provided in sufficient type and numbers to the satisfaction of the Engineer and shall be maintained in a clean and sanitary condition at all times.

On completion of the Works or as soon as the facilities provided by the Contractor are no longer required, the Contractor shall remove such facilities and clear away all surface indications of their presence. Each camp area shall be reinstated to the satisfaction of the Engineer.

1.4.2 Contractor's Offices, Stores and Services

The Contractor shall provide, erect, construct, maintain and subsequently remove proper offices, stores, workshops, laboratories, storage and parking areas for his own use. Such facilities shall be sufficiently sized and equipped to enable him to manage his operations and those of his Subcontractors in a professional manner and to enable him to carry out all his obligations under the Contract.

Sheds for storage of materials that may deteriorate or corrode if exposed to the weather shall be weatherproof, adequately ventilated and provided with raised floors.

Within his offices a meeting room shall be available for site meetings with the Engineer and the Employer.

These Contractor's facilities shall be subject to the same stipulations regarding sitting, interference with amenities and environmental protection as the Contractor's camp.

1.4.3 Contractor's Construction Equipment

When working in built-up areas, the Contractor shall provide and use suitable and effective silencing devices for pneumatic tools and other Equipment that would otherwise cause a noise level exceeding 85 dB (A) during excavation and other work. Alternatively, he shall, by means of barriers, effectively isolate the source of any such noise in order to comply with above requirement.

1.4.4 Water Supply

The Contractor shall make his own arrangements for the supply of all water for his camp, office and other temporary buildings as well as for the execution of the Works.

When using other sources of water, such as stone spouts, etc. the Contractor shall have due regard to and coordinate with other users.

Water for drinking purposes shall be of drinking water quality.

1.4.5 Sanitation

The Contractor shall maintain the Site and all working areas in a hygienic condition. In all matters of health and sanitation he shall comply with the requirements of the local Medical Officer of Health or other competent authority.

1.4.6 Sewage and Waste Disposal

The Contractor shall make provision for the discharge or disposal from his camp, offices and the Works of all water as well as of all liquid and solid waste products however arising. The methods of disposal shall be to the satisfaction of the Engineer and of any authority or person having an interest in any land or watercourse over or in which water and waste products may be so discharged.

1.4.7 Pollution

The Contractor shall take all reasonable measures to minimize any dust nuisance, pollution of streams and inconvenience to or interference with the public (or others) as a result of the execution of the Works.

1.4.8 Energy Supply

The Contractor shall install, operate, maintain and subsequently remove temporary supplies of electricity for power, heating, cooling, lighting and ventilation of all camps, offices, stores, laboratories and other temporary buildings used by the Contractor in addition to all electricity requirements in connection with the construction, testing and Defects Correction of the Works.

The Contractor shall ensure that all proposed electrical installations comply with the requirements of the Nepal Electricity Authority and shall be responsible for and shall bear all costs associated with obtaining the written approval of that authority for such installations and their operations.

Prior to placing orders for transformers, conductors, cables and associated equipment, the Contractor shall ensure by enquiry with the Nepal Electricity Authority that his proposed equipment is suitable for use with the existing or proposed medium/high tension electricity supply lines.

1.4.9 Supply of Fuel, Lubricants, etc.

The Contractor shall be responsible for arranging and ensuring that adequate supplies of petrol, diesel oil, motor oil, kerosene, lubricants and other petroleum products are available at all times to meet his requirements for the purpose of or in connection with the Contract; the Contractor's particular attention is drawn to this requirements as from time to time shortages and interruptions in the supply of fuel oils, etc., may occur.

Firewood may be obtained on the open market. Under no circumstances shall the Contractor cut down trees for firewood.

With regard to the transportation, storage, and handling of all his fuel requirements, including all electrical connections, he must strictly comply with all relevant safety codes and regulations.

Particular care is to be taken to avoid pollution due to spillage of fuel and oils, they shall be stored within a bonded area, all equipment drive by diesel or petrol engines shall be installed on a drip tray, waste oils shall be disposed of in a proper manner.

1.4.10 Temporary Telephone Connections

The Contractor shall arrange at his own cost for temporary telephone connections to his offices and other installations.

He shall be responsible for all installations, connection and disconnection charges for his and his Representative's offices.

1.4.11 First Aid

The Contractor shall make his own arrangements for treatment of casualties on the Site in such first-aid units as may be thought necessary. The Contractor shall be responsible for the construction of such first-aid units and their management and operation and the removal by ambulance of injured or sick employees to nearby hospitals. The first-aid service shall cover the Contractor's own personnel as well as that of the Employer, the Engineer and all Subcontractors.

1.4.12 Fire Protection

No naked fire shall be used by the Contractor on or about the Site otherwise than in the open air without the permission in writing of the Engineer. If in the Engineer's opinion the use of naked fire may cause a fire hazard, the Contractor shall at no extra cost to the Employer take such additional precautions and provide such additional fire fighting equipment as the Engineer considers necessary.

The term "naked fire" shall be deemed to include electric arcs and oxyacetylene or other flames used in welding or cutting metals.

Compliance with the requirements of the Engineer shall not relieve the Contractor of any of his obligations under the Contract.

1.4.13 Contractor's Canteen

The Contractor shall provide adequate eating facilities for his employees and workmen.

1.4.14 Testing Facilities, Laboratory

The Contractor shall provide a laboratory equipped and furnished with all testing facilities required to perform all mandatory tests stipulated in the various specific clauses of these Technical Specifications.

1.4.15 Site Safety

The Contractor shall at all times in the conduct of his work and that of his Subcontractors adhere to the established rules and regulations concerning all safety matters at Site such as the recommendations contained in the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc., or other internationally recognized recommendations to the extent that such provisions do not conflict with the applicable laws. This is especially important wherever it is necessary to enable the free passage of the public through the Site.

The Contractor's Safety Officer shall have the qualification and the authority to issue instructions to the Contractor's personnel regarding protection measures to prevent accidents.

During construction the Contractor shall erect, maintain and subsequently remove sufficient barricades, guards, lighting, sheeting, shoring, temporary sidewalks and bridges, danger signals as well as temporary covering of potential accident areas.

If and where required the Contractor shall erect and maintain suitable and approved temporary fencing, to BS 1722 Part 1 Type PLC 180A or better, to enclose such areas of construction and areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under the Contract. Where temporary fencing has to be erected alongside a public road, footpath, etc., it shall be of the type required by and shall be erected to the satisfaction of the authority concerned.

All open excavations along pipelines shall be protected sufficiently to keep out livestock, and ensure the safety of workmen and members of the public and be in accordance with the directives of the police and the other local regulations.

The Contractor shall be responsible for ensuring that all persons working in the vicinity of power lines are aware of the relatively large distance that high voltage electricity can "short" to earth when cranes or other large masses of steel are in the vicinity of power lines.

Where work is to be carried out in the proximity of buildings, bridges, tanks or other structures, the Contractor shall take all necessary precautions, including shoring and strutting, where necessary, to ensure the safety of the structures that are at risk.

The Contractor shall be responsible for all damages or injury which may be caused on any property by trespass by the Contractor's or his Subcontractor's employees in the course of their employment, whether the said trespass was committed with or without the consent or knowledge of the Contractor.

1.4.16 Protection of Overhead and Underground Services

The Contractor will be held responsible for any damage to known services (i.e. overhead services that are visible within the Site and underground services shown on the drawings) and he shall take all necessary measures to protect them. All work or protective measures shall be subject to approval of the Engineer. In the event of a service being damaged he shall inform the Engineer and the authority concerned, the Contractor shall not repair any such service unless instructed to do so.

Where no underground services are shown on the drawings or scheduled but the possibility of their presence can reasonably be inferred, the Contractor shall, in collaboration with the Engineer, ascertain whether any such services exist within the relevant section of the Site. The Contractor shall complete such an investigation well in advance of the start of construction work in the said section and he shall submit a report in good time to enable the Engineer to make whatever arrangements are necessary for the protection, removal or diversion of the services before any construction activities commences.

As soon as any underground service not shown on the drawings is discovered, it shall be deemed to be a known service and the Contractor will be held responsible for any subsequent damage to it. If such a service is damaged during the course of its discovery, the cost of making good such damage will be met by the Employer unless he establishes that the Contractor did not exercise reasonable diligence and that the damage was avoidable.

Where the authority concerned elects to carry out on its own account any alterations or protective measures, the Contractor shall co-operate with and allow such authority reasonable access and sufficient space and time to carry out the required work.

1.4.17 Signboards

Signboards shall be placed at specified locations giving, in English and Nepali, information about the project and Employer, and the names of the Engineer and Contractor in a form and size to be agreed upon by the Employer and the Engineer. They shall be of durable construction capable of withstanding the effects of the climate until the end of the Defects Liability Period.

The Contractor shall keep the signboards in good repair for the duration of the contract and shall remove them on completion of the Contract.

Besides these signboards the Contractor shall not, except with the written authority of the Engineer, exhibit or permit to be exhibited on the Site any other form of advertisement.

1.4.18 Site Roads, Loading and Turning Areas

The Contractor shall provide and maintain such access to the various sections of the Works as he requires for the proper execution of the work. Existing roads and bridges shall be upgraded for the construction transport purposes and site roads, loading and turning areas shall be so arranged as to minimize inconvenience to adjoining landowners or occupants and to the general public. The site roads shall be of gravel or equivalent material providing a hard surface for vehicles. Temporary roads, loading and turning areas shall be removed when they are no longer required and the location reinstated to the satisfaction of the Engineer, and damage to existing roads or bridges shall be repaired and reinstated to the satisfaction of the Engineer.

1.4.19 Site Drainage

The Contractor shall keep each Section of the Works well drained until the Engineer certifies that it is substantially complete and shall ensure that, so far as is practicable, all work is carried out in the dry. Site areas shall be kept well drained and free from standing water except where this is impracticable having regard to methods of Temporary Works properly adopted by the Contractor.

The Contractor shall provide, operate and maintain in sufficient quantity such pumping equipment, well points, pipes and other equipment as may be necessary to minimize damage, inconvenience and interference and shall construct, operate and maintain all temporary cofferdams, sumps, ditches, drains and other temporary works as may be necessary to remove water from the Site while construction is in progress. Such Temporary Works and construction equipment shall not be removed without the approval of the Engineer.

Notwithstanding any approval by the Engineer of the Contractor's arrangements for the removal of water, the Contractor shall be responsible for the sufficiency thereof and for keeping the Works safe at all times and for making good at his own expense any damage to the Works.

The Contractor shall be responsible to keep the Site clear of water at whatever pump rate is found necessary.

The Contractor's site drainage facilities shall not cause pollution in any local watercourses, he shall be responsible for any legal action resulting from pollution events.

1.4.20 Cleaning-up of Site

Before application is made for the Employer to accept any substantially completed Section of the Works, all items shall be complete, ready to operate and in a clean condition. All trash, debris, unused building materials and temporary facilities shall have been removed from the Site. Tools and construction equipment not needed during the subsequent Defects Liability Period for repair and adjustment shall not remain on the Site. The temporary walkways, parking areas and roadways shall be completely swept and broomed.

1.4.21 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.4). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

1.5 PROVISION OF TEMPORARY FACILITIES

1.5.1 Temporary Diversions of Utilities

If in the opinion of the Contractor it is necessary to make temporary diversions of services in connection with the Works, the Contractor shall arrange with the relevant authority for the construction of diversions.

The Contractor may at his own cost and subject to the approval of the authority concerned, make such temporary diversions as may facilitate the carrying out of the Works. These temporary diversions shall be reinstated to the full satisfaction of the Engineer and the relevant authority on completion of the Works.

1.5.2 Detours and Traffic Control

The Contractor shall program his work in such a way that, wherever the temporary closure of street sections to public thoroughfare cannot be avoided, the duration of traffic diversion can be kept as short as possible. No streets shall be closed and no detours shall be introduced and no traffic diverted until the Contractor's proposals have been approved by the Engineer and the appropriate Government authorities, such as the Roads Department.

Where work is to be carried out in public roads, the Contractor shall give notice to the Engineer sufficiently in advance of the date on which he wishes to commence such work.

The Contractor shall be responsible for obtaining the permission of the Engineer, Road Department and the Police for activities he intends to carry out in public roads. Two copies of the Contractor's proposals to the relevant authorities shall be submitted to the Engineer. One copy of all obtained approvals shall be submitted to the Engineer.

The Contractor's attention is drawn to the fact that processing of the documentation required by the local authorities prior to the cutting of existing public roads takes approximately 30 days. During the Monsoon period (June to August) no road cuttings are normally allowed.

Detours shall be selected in such a way that the inconvenience to the affected traffic as well as to the inhabitants of the affected areas is kept to a minimum.

The Contractor shall furnish, install and maintain at all times during the execution of the Works all necessary traffic signs, barricades, lights, signals and other traffic control devices, including flagging and other means of guiding traffic through the work zone. Traffic control shall be managed in accordance with prevailing rules and regulations, and with the approval and to the satisfaction of the Engineer.

All devices mentioned above shall be in conformity with the requirements of the Roads Department. All traffic signs and control devices to be furnished and installed by the Contractor shall be approved by the Engineer for their location, position, visibility, adequacy and manner of use under specific job conditions.

All traffic control devices necessary for the initial stage of construction shall be properly placed and operational before any construction is allowed to start. When work of a progressive nature is involved, the necessary signs shall be moved concurrently where they are needed.

If the Engineer determines that proper provisions for safe traffic control are not being provided or maintained, he may restrict construction operations affected by such defective signs or devices until such provisions are established or maintained, or may altogether order suspension of the Work until a proper traffic control is achieved. In case of serious or wilful disregard by the Contractor of the safety of the public or his employees, the Engineer may take necessary steps to rectify the situation and deduct the cost thereof from monies due or becoming due to the Contractor. The Contractor shall be responsible for all resulting delays.

The Contractor shall designate or otherwise employ personnel to furnish continuous surveillance of the traffic control operations. The designated personnel shall be available day and night to respond to calls involving damage due to vandalism or traffic accidents.

At sections where traffic is in operation and when ordered by the Engineer, the movements of the Contractor's equipment from one place of work to another shall be subject to traffic control. During rush hours movement of larger vehicles, such as trucks, cranes, dumpers, etc. through main thoroughfare are not permitted by the police. Spillage resulting from hauling operations along or across the road way shall be removed immediately at the Contractor's expense.

1.5.3 Provision of Temporary Services

When the execution of the Works requires the temporary disconnection of existing public utilities, the Contractor shall provide the affected users with temporary services in at least the same standard as the original services.

For water supply he may install temporary lines or arrange for regular supply by tankers.

When forced to disconnect existing sewers the Contractor shall install temporary pipes of adequate size to carry off sewage from any private sewer facilities cut off by construction work. Connections to temporary pipes shall be made immediately by the Contractor upon cutting off the existing facility. No sewage shall be allowed to flow from any severed facility upon the ground surface or into the trench excavation. Pipes used in temporary sewers may be plastic or approved flexible material.

When the Contractor is forced to disconnect power or telephone connections the relevant authority shall provide temporary connections at the Contractors expense.

Upon completion of work the Contractor shall replace all severed connections, with the assistance of the concerned authority where necessary, and restore to operating order the existing facilities.

No valve or other controls in public service facilities shall be operated by the Contractor without approval of the Engineer and the relevant authorities. All users affected by such operation shall be notified by the Contractor at least one hour before the operation and advised of the probable time when service will be restored.

1.5.3 Protection of Adjoining Property

1.5.3.1 Land

The Contractor shall control the movement of his crews and equipment on the working easement including access routes approved by the Engineer so as to minimize damage to crops and property and shall endeavour to avoid marring the lands. Ruts and scars shall be obliterated and damage to land shall be corrected and the land shall be restored as closely as possible to its original conditions before final taking-over of the Works.

The Contractor shall be responsible directly to the tenant / land owner for any excessive or avoidable damage to crops or lands resulting from his operations whether on lands adjacent to right-of-way or on approved access road and deductions will be made from payment due to the Contractor to cover the amount of such excessive or avoidable damage if adequate compensation is not paid by the Contractor, in the opinion of the Engineer.

1.5.3.2 Buildings and other Structures

The Contractor shall be responsible and take all measures in order to protect adjoining property including buildings and other structures. Prior to the commencement of the activities, the Contractor shall assess the probability and extent of unavoidable damages, if any, to the building and properties and submit his assessment to the Engineer. The Engineer may make his own opinion and if required may order arrangements for protection or repair of such likely unavoidable damage in which event the Contractor shall complete the activities.

The measurement for payment of the repair of the damages to the building, if ordered, shall be made at actual quantities of activities carried out. All costs related to the assessment, protection etc. are deemed to be included in the unit rates of other items, and shall not be paid separately.

1.5.4 Reinstatement upon Completion

Temporary facilities shall be provided by the Contractor, only for as long as required after which he shall dismantle and remove the same from their place of use as speedily as possible. Re-usable components shall be safely stored by the Contractor in his yard.

The place of use shall be cleared and reinstated immediately to at least the condition existing before the temporary facilities were provided, and to the satisfaction of the Engineer.

1.5.5 Provision of Vehicle Facility

Provision for a four-wheel drive jeep of at least 1999 model has been made for the use of Engineer (for construction supervision purpose) during the project period. The vehicle is to be made available on per day basis as and when instructed. Separate payment shall be made to the Contractor for providing this facility as per the rate quoted in the BOQ.

1.5.6 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.5). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

1.6 COORDINATION WITH OTHER AUTHORITIES

1.6.1 Statutory Services

As far as possible the Contractor shall acquaint himself with the actual location of all existing public utilities such as sewers, water mains, drains, cables for electricity, telephone lines, lighting poles, masts, etc., before commencing any activities likely to affect the existing utilities. The Contractor shall with the assistance of the Employer obtain such information directly from the responsible authorities as early as possible.

1.6.2 Notices, Permits

Well in advance of the programmed start of any work which may affect traffic or any existing utilities the Contractor shall give advance notice to the respective authority indicating the type, the exact location, the programmed starting time and the expected duration of the activities and shall provide whatever particulars may be required by the authorities to issue any required permits and make all necessary arrangements. The Employer will provide whatever assistance possible to the Contractor to facilitate the permit procedure, which, however, will remain the sole responsibility of the Contractor.

1.6.3 Witnessing and Post-Construction Clearances

It is expected that the issue of these permits will be tied to the requirement that the work may only be carried out in the presence of authorized inspectors from the authorities concerned. Their job will be to witness and assess any damage or interference with their respective utility. Should such disturbances occur it will be at their discretion to authorize either the Contractor to correct them or to arrange for specialized repairs through their own personnel.

The Contractor shall be fully responsible for all costs whatever resulting from avoidable damages of or interference with other utilities.

As proof that the activities in question have been completed to the satisfaction of the authorities concerned the Contractor shall submit to the Engineer upon request official post-construction clearances issued by the respective authorities.

1.6.4 Measurement and Payment

No payment will be made for these activities as they are deemed to be included in the rates other items.

1.7 SUBMISSIONS BY THE CONTRACTOR

1.7.1 Pre-Construction Surveys and Setting Out

The Contractor shall agree and record with the Engineer, prior to his first entry thereon, the surface topography and ground conditions along the transmission and distribution mains as per Drawings of Tender Document to the extent considered necessary by either the Engineer or the Contractor. The agreed record is to include photographs and spot levels as necessary and written descriptions of the site conditions.

Prior to the start of any construction activities, the Contractor should layout the right - of - way, work areas, clearing, and pavement cuts to insure a proper recognition and protection of the adjacent properties.

Access roads, detours, bypasses, and protective fences or barricades also should be laid out and constructed as required in advance of drainage construction.

All lay-outs must be approved by the Engineer before any demolition, rehabilitation or construction begins.

Upon commencement of the Works the Contractor shall carry out all additional survey activities necessary for setting out the Works.

The Contractor shall establish all setting out necessary for the performance of the Work to the approval of the Engineer including levels of the original ground surface at the Site and final

surveys of the completed Works for the final measurement. Levels shall close within 25 mm times the square root of the length of the circuit in km.

Ground levels shall be taken jointly by the Contractor and the Engineer both prior to commencing and after completion of earthworks. The result of the survey shall be recorded in the manner agreed between the Engineer and the Contractor and be signed by both as being a correct record.

Where cross sections are ordered these shall be at 25 m intervals or at such other spacing as may be ordered by the Engineer. The location of the first cross section shall be approved by the Engineer and each cross section shall extend a minimum distance of 10 m beyond the limits of the Works.

From the centre line and grades established, the Contractor shall furnish and place all additional stakes, templates and bench marks necessary for marking and maintaining points, lines and sections for layout of the Works. The Contractor shall give 2 working days' notice in writing whenever he will require the assistance of the Engineer for laying out any portion of the Work.

The Contractor's methods of recording survey data shall be subject to approval and field books and tabulated data shall be well maintained and made available for inspection and checking by the Engineer when ordered.

Instruments and equipment for surveys shall be subject to rigorous inspection by both the Contractor and the Engineer and any item found to be defective, in the opinion of the Engineer, shall be promptly replaced, repaired or adjusted as directed. All surveying shall be done under the direct supervision of a qualified surveyor or engineer who, as an employee of the Contractor, shall be subject to the approval of the Engineer at all times during the progress of the work.

1.7.2 Detailed Design of Temporary Works

The Contractor shall submit for approval full particulars, including drawings of any of the site installations and Temporary Works. If required the Contractor shall also submit calculations of the stresses, strains and deflections which will arise in False-work or other Temporary Works and these calculations shall be accompanied by detailed Working Drawings to show the Contractor's proposals. Approval by the Engineer of the Contractor's proposals, calculations, or drawings shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

1.7.3 Working Drawings

The Drawings prepared by the Engineer, are called Engineer's Drawings and listed in an Appendix to the Specification. They may be modified or added to as provided by the following clauses.

The proposals shown on the Engineer's Drawings are based on information available prior to preparation of the Tender Documents. All levels indicated or proposed are based on survey prepared by the Engineer but may need to be revised subject to the results of survey and site investigation carried out by the Contractor. Nevertheless, the Contractor shall follow such proposals in preparing his own proposals consistent with his own experience.

Working Drawings shall be submitted by the Contractor to the Engineer. Working Drawings shall include, but not be restricted to, pipeline profiles, reinforcement detail drawings and bending schedules, shop drawings for structural steel and miscellaneous metal work, working drawings for mechanical plant, architectural items and electrical work and drawings for other work for which the Engineer's approval is required.

It shall be the Contractor's own responsibility to prepare such Working Drawings as he may require for the proper setting out and construction of all structures and facilities. Work shall not commence on an individual structure or facilities until the relevant Working Drawings have been approved by the Engineer.

Within 28 days of the date of the Letter of Acceptance, the Contractor shall submit to the Engineer a Drawings Submittal Schedule for the Working Drawings listing the anticipated dates upon which they will be submitted for approval by the Engineer. The submission dates shall be spaced at reasonable intervals to allow at least 14 days for the Engineer to duly check and to either approve them or to request changes or modifications, as the case may be.

All dimensions shall be in metric units and each drawing shall be properly identified by a drawing head and a numbering code in the form prescribed by the Engineer upon commencement of the Works. ISO or DIN standard size sheets shall be used.

Drawings shall not be smaller than 210 x 297 mm (DIN A4) or larger than 841 x 1189 mm (DIN A0) but preferably in 420 x 297 mm (DIN A3) size.

Prior to submittal, the Contractor shall also check the drawings prepared by his Subcontractors for accuracy and completeness, especially that the relation to adjoining work is accurately shown.

The Contractor shall submit 3 (three) copies of all drawings for approval.

Any changes or modifications to the Working Drawings that the Engineer considers necessary shall be made by the Contractor promptly and the drawings resubmitted for approval.

Approval of Working Drawings will be given by the Engineer in the form of a stamp "RELEASED FOR CONSTRUCTION" together with the date and the authorized signature. Only those Working Drawings carrying the signed and dated stamp shall be used for execution.

Copies of all such approved Working Drawings together with one unreduced transparency shall be supplied to the Engineer by the Contractor immediately after approval. The cost of preparing and providing all Working Drawings shall be included in the Contract Rates.

Should it be found at any time after approval has been given by the Engineer to a Working Drawing submitted by the Contractor that the said Working Drawing does not comply with the terms and conditions of the Contract or that the details do not agree with the Working Drawings previously approved, such alterations and additions as may be deemed necessary by the Engineer shall be made therein by the Contractor and the work carried out accordingly without entitling the Contractor to extra payment on account thereof, except where such alternations and additions are to be made in direct consequence of written order by the Engineer to vary the Works.

No examination by the Engineer of any document submitted by the Contractor or of the Contractor's Working Drawings, nor the approval expressed by the Engineer in regard thereto, either with or without modification, shall absolve the Contractor from any liability imposed upon him by any provision of the Contract. Notwithstanding the Engineer's approval of the Working Drawings the Contractor shall be responsible for any dimensional or other errors.

1.7.4 As-Built Drawings

Such approved Working Drawings as have been selected by the Engineer shall be correctly modified for inclusion in the As-Built Drawings incorporating such variations to the Works as have been ordered and executed. Such drawings shall show the actual arrangement of all structures and items of equipment installed under the Contract. The Contractor shall submit 1 (one) reproducible copy and 3 (three) prints of all As-Built Drawings clearly named as such to the Engineer for approval before applying for the Taking-Over Certificate for the respective Section of the Works. After approval of the As Built Drawing the Contractor shall supply an electronic copy of the drawing.

During the course of the Works, the Contractor shall maintain a fully detailed record of all changes from the approval to facilitate easy and accurate preparation of the As-Built Drawing.

Irrespective of the other contractual prerequisites no Section of the Works will be considered substantially completed until the respective As-Built Drawings have been approved by the Engineer.

1.7.5 Construction Programme and Progress of Works

1.7.5.1 Construction Programme

In amplification of the requirements of Clause 14 of the Conditions of Contract, the programme shall be in the form of a Critical Path Method (CPM) Diagram showing, sequences, dependencies, durations and dates for execution of all major items following the sub-divisions in the Bills of Quantities for the execution of the Works within the periods stated in the Contract. It shall be supported by:

- Data of the construction methods
- Equipment Utilization Schedule
- Manpower Utilization Schedule
- Subcontracting Schedule
- Mobilization/Demobilization Schedule

The CPM diagram incorporating the above mentioned schedules shall be prepared using Microsoft Project, or similar approved project management software, and shall be presented in hard copy and electronic form to the Engineer.

In carrying out the Works due attention shall be paid to all measures which can reasonably be taken in order to diminish the inconvenience which the work may cause to services and access to property.

1.7.5.2 Updating, Monitoring and Reporting Progress

The Contractor shall monitor the progress of the Works including information provided by his Sub-contractors and suppliers, as necessary, for purpose of network planning, scheduling and updating and shall confirm the actual progress on each current activity shown on applicable CPM networks. The CPM networks shall form part of the Monthly Progress Report and shall indicate changes of schedule, if any in network activity duration and start/finish imposed dates. It shall also be provided in electronic form.

The Contractor shall prepare written explanatory notes on the particular activities which are overrunning or going to overrun against the Master Schedule. If any such overrunning work is on the critical path, the Contractor shall state what corrective actions will be taken by him to bring it back on the schedule.

1.7.5.3 Detailed Fortnightly Programme

The contractor shall submit at the end of each working week a detailed bar chart programme for the next fortnight. The programme shall identify where further drawings or instructions are to be issued by the Engineer to avoid disruption to the progress of the Works.

1.7.5.4 Progress Reports

The Contractor shall furnish the Engineer with 5 copies of Progress Reports at regular monthly intervals in a form determined by the Engineer, containing the following information:

- (a) Physical progress for the report month and estimated progress for the next month;
- (b) CPM networks and explanatory notices as described in 1.7.5.2;
- (c) Updated S-curves for physical progress at different sections of the works;
- (d) Any report which may be specifically requested by the Employer and/or the Engineer.

These monthly progress reports shall be submitted not later than 7 days after the end of the report month.

1.7.6 Operation and Maintenance Manual

The contractor is not required to produce an operation and maintenance manual, however he shall provide details of all the plant he supplies and give details of recommended maintenance intervals and procedures.

1.7.7 Record / Progress Photographs

The Contractor shall arrange each month for 24 Nos. of photographs (Digital) to be taken by a professional photographer as Record Photographs and shall provide the software copy and 3 colour prints each on glossy paper uncounted and of a size not less than 210 mm x 297 mm (A4) in transparent plastic pockets contained in hard cover album. Each print shall contain upon its back the date and description of the view taken. The Contractor shall ensure that no use is made of any negative or print without permission from the Employer.

1.7.8 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.7). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

1.8 QUALITY CONTROL

1.8.1 Quality Control Plan and Procedures

The Contractor shall be responsible for establishing and maintaining procedures for quality control that will ensure that all aspects of the Works comply with the requirements of the Contract.

As soon as reasonably practicable prior to the commencement of Works the Contractor shall submit for approval a Quality Control Plan and Quality Assurance Plan giving detailed proposals for control of quality of all aspects of work on the Site and at suppliers' workshops.

The Quality Control Plan shall include the following:

- (a) A list of the Contractor's staff engaged in quality control
- (b) A list of any outside testing agencies employed by the Contractor for work in connection with quality control
- (c) Where a testing laboratory is to be established on Site under the Contract, a list of major items of equipment and a layout of the laboratory, together details of the tests which will be carried out there
- (d) A list of manufactured items and materials, obtained by the Contractor for the Works, which require inspection at the suppliers' premises, and the proposed procedures for ensuring quality control
- (e) a list of materials and operations to be inspected by the Contractor at the various stages of construction work on Site, together with inspection procedures, test types and frequencies
- (f) Sample of proposed quality control records, testing and reporting forms.

Unless the Engineer permits otherwise, the approved Quality Control Plan shall be followed throughout the construction of the Works. Any approval by the Engineer of the Contractor's plan and procedures shall not relieve the Contractor of his obligation to ensure that the Works comply with the requirements of the Contract.

The Contractor shall appoint a suitably qualified member of his staff to be responsible for all aspects of quality control and to maintain effective liaison with the Engineer.

1.8.2 Sampling and Testing

The Contractor shall provide for the approval of the Engineer, samples of all construction materials and manufactured items required for the Permanent Works. All samples rejected by the Engineer shall be removed from Site. All approved samples shall be stored by the Contractor in a sample room, at a location approved by the Engineer, for the duration of the Contract, and any materials or manufactured items subsequently delivered to Site for incorporation in the Permanent Works shall be of a quality at least equal to the approved sample. The approved samples may only be disposed of with the Engineers approval.

Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer. Samples for testing will generally be

selected by the Engineer from materials to be utilized in the project and all tests will be under the supervision of, and as directed by, and at such points as may be convenient to the Engineer.

Material requiring testing shall be furnished in sufficient time before intended use so as to allow for testing. No materials represented by tests may be used prior to receipt of written approval of said materials.

The Contractor shall give the Engineer at least 14 days' notice in writing of the date on which any of the materials will be ready for testing or inspection at the suppliers' premises or at a laboratory approved by the Engineer and unless the Engineer shall attend at the appointed place and time the test may proceed in his absence. The Contractor shall in any case submit to the Engineer within 7 (seven) days after every test such number of certified copies of the test readings as the Engineer may require.

Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineer's powers under the Contract.

The provisions of this Clause shall also apply to materials supplied under any nominated subcontract.

After all construction at each Section is completed and before applying for taking-over, the Contractor shall perform field tests as called for in the Specifications. The Contractor shall demonstrate to the Engineer the proper operation of the facilities and the satisfactory performance of the individual components. Any improper operation of the system or any improper, or faulty construction shall be repaired or corrected to the satisfaction of the Engineer. The Contractor shall make such changes, adjustments or replacement of equipment as may be required to make the same comply with the Specifications, or replace any defective parts or materials.

In addition to any special provision made herein as to sampling and testing materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the Works may be called for at any time by the Engineer and these shall be furnished without delay by the Contractor at his own cost. Approved samples will be retained. The Engineer will be at liberty to reject all materials and workmanship that are not equal or better in quality and character than such approved samples.

The tests required for quality control shall include but not be limited to:

- (a) Tests conducted at the premises of the Contractor, Subcontractor, manufacturer or supplier which are normally or customarily carried out at such premises for the items or materials being supplied for the Works
- (b) tests which are normally or customarily conducted on the items or materials being supplied for the Works by the Contractor, Subcontractor, supplier or manufacturer but which have to be conducted at an approved laboratory because the necessary testing facilities are not available on the premises of the Contractor, Sub-Contractor, supplier and manufacturer
- (c) Tests on locally obtained materials or items either on the Site or at an approved laboratory for the purpose of obtaining the approval of the Engineer to the classification, use and compliance with the Specifications of such items or materials
- (d) Routine quality control tests conducted by the Contractor to ensure compliance with the Specifications
- (e) Regular testing of concrete and other materials as specified in the relevant Chapters of the Technical Specifications
- (f) Standard shop and Site acceptance tests, including trial assemblies, of Plant.

1.8.3 Inspection and Acceptance

The Engineer will not inspect any item of fabricated or finished work until such time as the Contractor shall have forwarded to the Engineer the approved Working Drawings covering the items to be inspected, together with four copies of the respective orders.

Manufactured items and materials delivered to the Site shall be inspected by the Contractor on arrival. Any defects shall be notified to the Engineer. Minor defects to surface finishes and the

like in manufactured items shall be made good in an approved manner to the satisfaction of the Engineer. Items with more serious defects shall be returned to the suppliers for correction or replacement as appropriate.

Any construction material requires Third Party Inspection, as per Employer's prerogative, the Contractor has to give uninterrupted access to the site, either at the source of material or at the construction site, to the Independent Third Party Inspector appointed by the Employer. The cost of third party inspection shall be borne by the Employer.

1.8.4 Materials/Plant Certificates

Where certificates are required by the Specifications or relevant Reference Standard, the original and one copy of each such certificate shall be provided by the Contractor.

Certificates shall be clearly identified by serial or reference number and shall include information required by the relevant Reference Standard or Specification clause.

The timing for submittal of certificates shall be as follows:

- (a) manufacturer's and supplier's test certificates shall be submitted as soon as the tests have been completed and in any case not less than 7 calendar days prior to the time that the materials represented by such certificates are needed for incorporation into the Permanent Works
- (b) Certificates of tests carried out during the construction or on completion of parts of the Permanent Works shall be submitted within 7 days of the completion of the test.

No materials, articles or items of fabricated or finished work to be supplied by the Contractor or Subcontractors which have been inspected and tested by the Engineer or the inspecting Engineer shall be dispatched unless a Passing Certificate has been requested by the Contractor from the Engineer and subsequently been issued by the Engineer to the effect that the same are approved. Neither the Contractor nor Sub-Contractors shall make use of any materials or articles ordered by them for the purpose of fabrication until a Passing Certificate covering the said materials and articles shall have been issued by the Engineer or inspecting Engineer.

1.8.5 Site Records

Daily records of on-site testing and inspection shall be kept on forms of approved format. Test results shall be certified by the responsible member of the Contractor's staff. All test certificates and inspection records (including any from suppliers or other outside testing agencies) shall be clearly identified with the appropriate part of the Works to which they refer, and they shall be submitted to the Engineer together with the respective Passing Certificate.

Once each month, or at such other intervals as the Engineer may require, the Contractor shall submit in an approved form a summary of all quality control inspections and tests performed at Site and elsewhere in the intervening period.

Test results shall be summarized in tabular form or graphically or both in a way that best illustrates the trends, specific results and specification requirements. Where the tests show that the specified requirements were not achieved, the report shall describe the action that was taken.

Each report shall also contain a forecast of quality control work likely to be carried out during the period to be covered by the succeeding report.

The Contractor shall keep detailed and up-to-date inventories in an approved form of goods and materials already approved by the Engineer for which Passing Certificates have been issued as well as of all other goods and materials subject to quality control which are on order, delivered, found faulty, lost during the work or found to be surplus to requirements. The Engineer shall have access to these records at all times.

1.8.6 Daily Log Book

The Contractor shall keep a Daily Log Book at each location where major construction activities are taking place. This Daily Log Book shall be in a form approved by the Engineer and shall contain, but not be limited to, the following major items of information:

- (a) Name of Contractor and Package No.
- (b) Date
- (c) Weather conditions (max. /min., temperature, hours and intensity of rainfall)
- (d) Work carried out during the day per Section (description, quantities)
- (e) Major equipment used per section (on contractual work, on extra work ordered, approximate operating time on either)
- (f) Strength of labour force per Section (on contractual work, on extra work ordered, hours worked on either)
- (g) Delays (cause, effects such as idle time etc.)
- (h) Unusual events (earthquakes, floods, fires, storms, accidents, etc.)
- (l) visitors at Site.

Each daily log shall be signed by the responsible Site Manager of the Contractor and "noted" by the Engineer.

1.8.7 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.8). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

1.9 STANDARDS, CODES AND ABBREVIATIONS

1.9.1 Reference Standards and Codes

The Works shall be carried out in accordance with the relevant quality standards, test procedures or codes of practice, collectively referred to as Reference Standards, listed in the relevant parts of the Specifications. The applicable issue of any Reference Standard shall, unless otherwise stated in the Specification, be the issue current at the date two months preceding the date for submission of the tenders for the contract. The Contractor shall familiarize himself fully with the requirements of such standards. If no standard is indicated then the relevant ISO Standard or, in the absence of such standard, the relevant German, British, American, Nepalese or Indian Standards shall apply, or others, if so approved.

The Contractor may propose, at no extra cost to the Employer, the use of any alternative relevant authoritative internationally recognized Reference Standard, which shall be no less exacting, in the opinion of the Engineer, than the corresponding standard quoted in the Specification. The Contractor shall demonstrate to the Engineer that the alternative standard is suitable and equivalent to the specified standard, as well as provide proof of previous successful use. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. The Engineer shall decide whether or not the use of such alternative will be allowed as a Reference Standard.

The Contractor shall obtain and keep on Site at least one copy of each approved Reference Standard and each Reference Standard referred to in the Specifications, and will make these accessible to the Engineer at any time upon request.

The Contractor shall obtain the Reference Standards from the addresses given below:

NS	Nepalese Standardization Office, Balaju, Kathmandu, Nepal
ISO	International Organization for STANDARDIZATION, Rue de Varembe, Geneva, Switzerland
DIN	Deutsche Industrie Norm (German Industry Standard) from Deutsche Normenausschuss, Beuth-Vertrieb, P.O. Box 1045, W-1000, Berlin 30, and Federal Republic of Germany
BSI	British Standards Institution, 389 Chiswick High Road, London W4 4BR, England

AASHTO	American Association of State Highway and Transportation Officials, Suite 341 National Press Building, Washington, D.C. 2004, U.S.A.
ASTM	American Society for Testing and Materials, 2501 Race St., Philadelphia, PA 19103, U.S.A.
AWS	American Welding Society, Inc., 2501 N.W. 7th St., Miami, FL 33125, U.S.A.
AWWA	American Water Works Association, 6666 West Quincy Ave. Denver, Colorado 80235, U.S.A.
IS	Indian Standards, Manak Bhawan - 9, Bahadur Shah Jafar Marg, New Delhi, 11002

1.9.2 Metric Units

S.I. units of measurement shall be used throughout the Contract. All information and data originating in another system shall be transferred by the Contractor into the S.I. system.

1.9.3 Measurement and Payment

Unless otherwise provided in the Contract, no separate measurements and/or payment shall be made for all materials and works required under this clause (Clause 1.9). All cost in connection with the work specified herein shall be considered to be included with other related items of works in the Bill of Quantities.

2.0 CIVIL ENGINEERING WORKS, BUILDING CONSTRUCTION ACTIVITIES

2.1 SITE CLEARANCE

2.1.1 Scope

This specification covers the removal of vegetation, boulders of size up to 0.2 m³, surface obstructions, and the demolition and removal of structures including their basements (if any) not directly associated with or incidental to any excavation.

2.1.2 Interpretations

2.1.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and be read in conjunction with this specification:

- a) 1 General
- b) 2.2 Earthworks, as applicable.

2.1.2.2 Application

This specification contains stipulations that are generally and particularly applicable to site clearance.

2.1.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Cleared surface - The natural surface of the ground after clearing of surface vegetation has been completed.

Designated area - An area the position of which in relation to the work to be carried out is shown on the drawing or is described in the specification and is therefore known to the Contractor at the time of tendering.

Finished level - The level of the finished earthworks as shown on the drawings or stated in the project specification.

Grubbing - The operation of digging out the roots of vegetation.

Original ground level - The level of the surface of an area before the commencement of clearing.

2.1.3 Material

Material obtained from clearing and grubbing and from the demolition of structures shall be disposed of in borrow pits or other suitable places indicated by the Engineer and shall be covered with soil or gravel. Where no such place is indicated by the Engineer, the Contractor shall make his own arrangements for the provision of a suitable place.

The Contractor shall not clear the Site of or damage any living tree having a girth more than 0.5 m (measured 1 m above the ground level) situated on the parts of the Site not subsequently to be occupied by the Works without the written permission of the Engineer. All trunks and branches of cleared trees shall be stripped of secondary branches, sawn into transportable lengths and stacked at designated areas. Such timber shall not be used by the contractor for any purpose, and shall remain the property of the Employer.

Fencing wire shall be neatly wound into rolls or coils and all such wire, together with all fence posts and other re-usable material from walls, etc., shall be stacked at designated areas.

2.1.4 Construction Equipment

The Contractor shall provide saws for cutting of trees and branches as ordered, and plant that is suitable for grubbing roots and for digging out and removing other obstructions on the Site.

2.1.5 Construction and Workmanship

2.1.5.1 Areas to be Cleared and Grubbed

Prior to the start of any work, the Contractor should lay-out the right-of-way, working areas, clearing, and pavement cuts to insure a proper recognition and protection of the adjacent properties.

All lay-out work must be approved by the Engineer before any demolition, rehabilitation or construction begins.

The Contractor shall clear the parts of the Site subsequently to be occupied by the Works and shall maintain them clear of vegetation. Areas cleared shall include but not be limited to, portions of the Site where excavations are to be carried out and embankments and structures constructed, however, the Contractor shall not commence clearing and grubbing until the Engineer has designated, in writing and in detail, the exact areas to be cleared or grubbed and the time at which the work is to be started.

The Contractor shall ensure that the general shape, profile, and levels of the area are not materially altered during clearing and grubbing operations.

In order to avoid re-clearing or to control dust or erosion the Contractor may have to clear and grub at the latest practicable stage of construction.

2.1.5.2 Cutting of Trees

The Contractor shall take the necessary precautions to prevent injury to persons and animals and damage to structures and other private and public property. Where necessary, trees shall be cut in sections from the top downwards.

No tree shall be cut down until the Engineer has given written authorization for such work to commence.

If possible, trees shall be felled in such a manner as to allow removal of the root together with the trunk.

Individual trees indicated and marked by the Engineer as trees to be preserved shall be left standing and uninjured. An amount of NRs 5,000/- shall be deducted from monies due to the

Contractor as a penalty in respect of every such tree that is damaged or removed unnecessarily or without the authorization of the Engineer.

2.1.5.3 Clearing

Clearing shall consist of:

- a) The removal of all trees and bushes (complete with roots), other vegetation, rubbish, fences, and all other material that may interfere with the construction of the Works
- b) The disposal of all material resulting from the clearing
- c) The removal of all rocks and boulders of size up to 0.2 m³ that are lying on the surface to be cleared or exposed during the clearing operation.
- d) Where fences have to be taken down, the sorting, coiling, and stacking of the material, and
- e) The removal and stacking of other re-usable materials.

The moving of a certain amount of soil or gravel may be inherent in or unavoidable during the process of clearing. No extra payment will be made for the removal of such soil or gravel.

2.1.5.4 Grubbing

All stumps and roots larger than 75 mm in diameter shall be removed to a depth of at least 600 mm below the finished level and at least 100 mm below original ground level. Where a road bed or other area has to be compacted, all stumps and roots included matted roots shall be removed to a depth of at least 200 mm below the cleared surface. The removal of stumps and roots shall be done in such a manner that the topsoil is least disturbed.

Cavities resulting from grubbing shall be backfilled with approved material and compacted to a density at least equal to that of the surrounding ground.

2.1.5.5 Re-clearing of Vegetation

If during the contract period vegetation should again grow on any portion of the Site, or other areas that have been cleared in accordance with this specification, the Engineer may, if he considers it necessary, order that such area(s) be re-cleared.

Such re-clearing shall include the removal and disposal of grass, shrubs, and other vegetation, as in the first clearing operation.

2.1.5.6 Demolition of Structures

Before moving equipment onto the Site and commencing operations the Contractor shall establish to the Engineer's satisfaction that the method of demolition proposed by the Contractor is such that he can keep any nuisance arising from dust, noise, and vibration to an acceptable level and ensure the safety of structures adjacent to those to be demolished.

The materials obtained from demolition shall become the property of the Contractor and shall be destroyed or removed from the Site.

Demolition of reinforced concrete structures shall be carried out using approved methods and in accordance with any safety regulations of the local municipality or relevant thereto. The Contractor should note that a Building Permit may be required for demolition work.

Except as noted below, debris arising from demolition shall be removed from the Site promptly and disposed of in a place and in a manner acceptable to the local municipality.

Underground structures shall be broken out to a depth of 1 meter below original ground level. Sumps, pits, chambers and the like shall be properly cleaned out and filled with clean demolition hard-core, excluding any wood, plastic, sheet metal, loose reinforcement steel and the like.

The top surface of hard-core material shall be blinded with clean sand to a minimum thickness of 200 mm.

Where directed by the Engineer, a reinforced concrete raft shall be cast over sumps, pits, etc. after filling.

The area shall be spread with approved fill material and graded to original levels, or such other levels as the Engineer may direct.

Demolition of walls, tanks, plates inside building to be rehabilitated will be performed with the required care, without damaging the stability of the structure.

Where required or directed by the Engineer, the existing structure will be temporary reinforced to assure the stability. The Contractor will submit for the Engineer's approval the methods applied for demolishing and the proposed temporary safety measures. The Engineer's approval shall not relieve the Contractor of any of his responsibilities under the Contract.

2.1.6 Measurement and Payment

The items scheduled for clearance and demolition will be classified according to the nature of the materials involved and the methods of their disposal.

Only those areas designated to be cleared in terms of Clause 2.1.5.1 will be measured for payment. The area of surfaced roads, structures, and paved areas falling within such designated areas will be deducted from such measurements.

Demolition of structures, buildings etc., shall be measured as a sum for demolition of the identified structure.

2.2 EARTHWORKS

2.2.1 Scope

This specification covers earthworks carried out with light or heavy equipment or by hand, for general excavations, terracing, landscaping etc. It covers the requirements for site works, excavations for foundations for buildings, bridges and general structures and reinstatement of surfaces.

2.2.2 Interpretations

2.2.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1 General
- b) 2.1 Site Clearance
- c) 3.1 Pipe Trenches, as applicable

2.2.2.2 Application

This specification contains Clauses that are generally applicable to earthworks. Interpretations, additions, and variations of this specification (if any) are set out in the Particular Technical Specification.

2.2.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Backfill - Approved material placed in an excavation after specified operations have been performed.

Borrow - Material obtained from various sources such as borrow pits.

Borrow pit - An excavation made for the purpose of procurement of material.

Bulk Excavation – An excavation made from original ground level to reduced site or platform level.

Catch water drain - An open drain and/or berm intended to intercept water and to lead it to suitable discharge points.

Excavation - An excavation, to accommodate a structure or pipeline, made below the original ground level or reduced site/platform level as appropriate.

Over break - Excavation carried out in excess of the designated profile.

Pass - In regard to compaction, a movement of an approved compacting machine from one end of the layer being compacted to the other end.

Specified density - The ratio of field density to laboratory-determined modified AASHTO maximum density.

Spoil - Unsuitable or excess material removed to waste.

Stockpile - A pile of material that has been selected, loaded, transported and unloaded in a heap outside the confines of a borrow pit or of an excavation that forms part of the Works.

Suitable material - That material which is acceptable in accordance with the Contract for use in the Works and which is capable of being compacted, in the manner specified, to form a stable fill having side slopes as indicated on the Drawings.

Top Soil - The top layer of soil containing organic components that can support vegetation

Unsuitable material shall mean other than suitable material and shall include:

- a) Material from swamps, marshes or bogs;
- b) Organic and perishable material;
- c) Material susceptible to spontaneous combustion;
- d) Clay of liquid limit exceeding 80 and/or plasticity index exceeding 55.

2.2.3 Materials

2.2.3.1 Classification for Excavation Purposes

The Engineer will decide on the classification of the materials, which will be based on inspections and criteria given below.

The excavation of material will be classified as follows:

- a) Normal excavation. Material that can be efficiently (i.e. in a manner that can reasonably be expected of an experienced contractor, having regard to the production achieved) removed or loaded, with normal mechanical means.
- b) Rock excavation. Rock is defined as all materials which, in the opinion of the Engineer, require blasting, or the use of metal wedges and sledgehammers, or the use of compressed air drilling for its removal, and which cannot be extracted by ripping with a tractor of at least 110 kW with a single rear mounted heavy duty ripper.

2.2.3.2 Classification for Placing Purposes (Filling)

- a) Material for embankments, terraces, etc. Such materials shall, generally, have a CBR of at least 3% (compacted at OMC), a PI not exceeding 18, and a maximum dimension of 300 mm, unless otherwise specified in the Technical Specifications.
- b) Material for backfill or fill against structures. Material placed as backfill or as fill within 500 mm of structures shall comply with requirements specified under a) above except that it shall not contain more than 10% rock or hard fragments retained on a sieve of nominal aperture size 50 mm.
- c) Stone used for rock fill, gabions and stone pitching shall be hard, tough, sound, and clean and derived from a source approved by the Engineer.

2.2.3.3 Selection

Topsoil, if required for later use on the Site, as well as any other material excavated that is suitable for backfilling or for filling against the finished structures, shall be selected and

stockpiled in the vicinity of the structures. Topsoil shall be stockpiled in a manner to prevent its deterioration. The topsoil for such purpose shall be free from any foreign materials.

The use of top soil shall be restricted to surface layers in positions not subject to loading pavements or structures.

No excavated suitable material other than surplus to requirements of the Contract shall be removed from the Site except on the direction or with the permission of the Engineer. Should the Contractor be permitted to remove suitable material from the Site to suit his operational procedure, then he shall make good at his own expense any consequent deficit of filling arising there from.

If any suitable material excavated from within the Site is, with the permission of the Engineer, taken by the Contractor for purposes other than the forming of embankments and other areas of fill, sufficient suitable filling material to occupy after full compaction, a volume corresponding to that which the excavated material occupied shall, unless otherwise directed by the Engineer, be provided by the Contractor from his own resources.

Suitable material surplus to the total requirements of the Works and all unsuitable material shall, unless the Engineer permits otherwise, be run to spoil in tips provided by the Contractor. Where the excavation reveals a combination of suitable and unsuitable materials the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the suitable materials are excavated separately for use in the Works without contamination by the unsuitable materials.

Any material that is below the finished level of an excavation and that the Engineer considers to be unsuitable, shall be excavated and disposed of as directed. The resultant space shall be refilled with backfill and compacted as specified.

2.2.3.4 Explosives and Blasting

The Contractor shall store explosives in a licensed store or magazine provided with a separate compartment for detonators. Explosives shall be handled only by currently licensed shot firers. The Contractor shall ensure that there is no unauthorised issue or improper use of explosives brought on the Site.

Explosives shall be used in the quantities and manner recommended by the manufacturers. The written permission of the Engineer shall be obtained for each and every location or series of locations where the Contractor wishes to use more than 10 kg of explosives in one blast. Such permission shall not in any way relieve the Contractor of his liabilities under Clause 22 of the Conditions of Contract.

When blasting is carried out, the Contractor shall ensure, by adherence to proper safety distances and by the use of heavy blasting mats where necessary to prevent the dispersal of material that no damage is caused to persons or property on or off Site. Special care shall be taken when blasting to ensure that individual explosions are reduced to such a size as to preclude damage to any buildings or structures. Blasting will not be permitted within 400 metres of any building or structure.

2.2.4 Construction Equipment

Equipment shall be suitable for obtaining the end result required under the conditions applicable to the Site.

Compaction equipment used for applying the dynamic load, controlling the moisture content, and grading or mixing, shall be capable of achieving the compaction specified with the material available.

Any vehicle or item of equipment provided by the Contractor for the transport of materials shall conform to the requirements of the applicable road traffic ordinance if the vehicle or equipment is required to operate on any public road, street, or area that has been surfaced.

Where any of the Contractor's operations or the movement of any of the Contractor's vehicles or equipment has caused damage to the surface of any area normally open to the public, the Contractor shall repair such surface as a matter of urgency, and at his own expense.

The Contractor shall provide and use, where applicable, equipment that is suitable for the detection and location of underground service pipes and cables.

Construction traffic shall not use the surface of the bottom of mass excavations unless the excavation is in rock or the Contractor maintains the level of the bottom surface at least 30 cm from formation level. Any damage to the formation arising from such use of the surface shall be made good by the Contractor at his own expense, with material having the same characteristics as the material which has been damaged.

2.2.5 Construction and Workmanship

2.2.5.1 Precautions

2.2.5.1.1 Safety and Safeguarding

Every excavation that is accessible to the public shall be adequately protected by barriers or fences, provided with lighting at night and watched to ensure that barricades and lights are effective at all times. Reference shall be made to clause 1.4.15 of this specification.

The Contractor shall suitably safeguard excavations if the depth of an excavation or the nature of the material excavated renders the sides of the excavation liable to movement that might endanger the Works or the workmen engaged on the excavation.

This safeguarding may consist of supports by timber or sheeting adequately strutted and braced, or, if approved by the Engineer, by a reduction of the slope of the excavated face or faces so that any danger to the Works or the said workmen is eliminated.

The Contractor shall make good any fall of earth or rock due to insufficient safeguarding at his own expense, as directed and by approved means.

Without relieving the Contractor in any way of his responsibility, the Engineer may order additional lateral support for, or the sloping or reduction of the slope of, the sides of any excavation. During the progress of each excavation, the Contractor shall report to the Engineer the presence of bedding planes inclined towards the excavation, seepage water and any other feature that may affect the stability of the excavation, as soon as the presence of such feature or features is known. All timbering and sheeting shall be removed from the excavation at the completion of the work, unless the written permission of the Engineer allowing any portion to remain is obtained.

Should blasting be necessary, the Contractor shall obtain the permission from the Engineer and the local authority well in advance and in writing and shall take every precaution to protect the Works and persons, animals and property in the vicinity of the Site. The Contractor will be held responsible for any injury or damage caused by any blasting operations and shall, at his own expense, make good such damage. A copy of the blasting permit(s) issued to the Contractor to cover the purchase, storage, and handling of explosives, shall be handed over to the Engineer.

When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound and stable as the nature of the material permits. The Contractor shall make good at his own expense any additional excavation necessitated by the shattering of rock in excess of a 150mm over break allowance.

2.2.5.1.2 Existing Services

The Engineer's Drawings as well as the Contractor's working drawings show positions of existing underground services based on the best information available.

The Contractor shall, before commencing work in any particular area, verify the position of all underground services and all other obstacles and existing construction on the Site.

The Contractor shall have equipment required for the detection and location of underground services available on the Site and in an operable condition for as long as is necessary to detect and locate such services and, if so ordered, he shall excavate by hand to expose such services in areas and in a manner and at a time agreed upon with the Engineer.

The Contractor shall advise the Engineer at least 7 days in advance of the actual date on which he proposes to excavate near any service. He shall not use mechanical equipment to excavate within 3 m of the assumed position of any service and shall, if necessary, expose the service by means of hand excavation carried out under proper supervision. When so ordered, the Contractor shall backfill such observation trenches with approved material to the compaction density ordered.

Once a service is exposed the Contractor shall take all measures necessary for the support and protection of the service.

Where a service is damaged because of the Contractor's negligence, he shall inform the Engineer and the authority concerned make good such damage or bear the cost of the repairs, as applicable.

2.2.5.1.3 Storm water and Groundwater

The Contractor's responsibility will include the provision of adequate protection against erosion and flooding by storm water, flow from springs, and seepage, and to include provision for repair, at his expense, of any damage to the Works that may arise as a result of the inadequacy of the protection provided by him.

The Contractor shall provide and maintain and operate dewatering or other pumping equipment, and shall construct such drains, sumps and catch waters as may be necessary to remove water from the excavations or to prevent its entrance thereto.

2.2.5.1.4 Nuisance

Wherever dust from the activities, haul roads, borrow pits or road deviations becomes a nuisance to the public the Contractor shall, when so ordered by the Engineer, apply sufficient water or take other measures to lay the dust, oil shall not be used.

All excavated material shall be so deposited as not to interfere with or endanger the Works, other property or traffic. The Engineer may order the Contractor to remove, at his expense, any material that the Engineer considers liable to endanger or to interfere with the Works, private property, traffic or pedestrians, and to place such material at some other approved location.

2.2.5.1.5 Roads

The Contractor shall reinstate and maintain the surfaces of all roadways through which trenches or other excavations have been made. Should any subsidence occur at the location of such trench or excavation, the Contractor shall immediately restore the road surface to its correct level. Where immediate restoration is impracticable, the Contractor shall provide protection as specified. The Contractor shall follow the requirements of the Department of Roads.

2.2.5.1.6 Traffic Control

Where work affects the operation or safety of public road traffic, the Contractor shall, comply with the requirements of the Clause 1.5.2 of the Specification.

2.2.5.2 Methods and Procedures

2.2.5.2.1 Site Preparation

Before carrying out any work at any location, the location shall be inspected where necessary together with the Engineer.

The Contractor shall request in writing such inspections where in his opinion the situation shown in the Drawings has changed and/or is different from actual conditions.

After clearing, the location shall be surveyed in conjunction with the Engineer's representative to establish original ground levels, and these agreed ground levels shall form the basis for the calculation of quantities of any subsequent excavation and filling.

Should work commence in the absence of this joint survey, the Engineer's statement shall be final.

Prior to the start of excavation proper, if and as scheduled, all areas in which excavation is to take place or that are to be covered by banks, structures etc., shall be cleared as specified or directed by the Engineer.

Where so ordered, the Contractor shall remove and conserve the topsoil for later use in a manner approved by the Engineer. The Contractor will not be required to remove topsoil from any area in which the average depth of topsoil is less than 150 mm.

The Contractor is responsible for the transfer of line and grade from control points established by the Engineer. The preservation of stakes or other line and grade references provided by the Engineer is the responsibility of the Contractor.

The Contractor's method for setting the line and grade for the activities shall be approved by the Engineer.

2.2.5.2.2 Excavation

Excavation shall be carried out to the depth indicated or to such greater depth as may be required by the Engineer to ensure a satisfactory foundation.

Except where otherwise specified, shown on the Drawings, ordered or dictated by the requirements for safeguarding, excavation shall be so carried out and so trimmed to the outline of the concrete work shown on the Drawings that the excavated surfaces will act as forms for the concrete works. Such surfaces as well as the bottom of excavations shall be cleaned by hand, air or other effective means to remove all loose, soft or otherwise unsuitable material and as required by the Engineer.

Should the Contractor excavate to dimensions in excess of those stipulated or permitted, he shall fill in the excess at his own expense in the manner specified or approved by the Engineer. Excavated surfaces that will remain permanently exposed shall be finished off in a neat and workmanlike manner and shall be graded to provide adequate drainage.

When the Contractor is required by the Engineer to open up borrow pits, he shall maintain them so that they do not become a danger to persons and livestock. On completion of borrowing, the sides of the pits, if not filled with unused material, shall be graded 1V:2H, or as the Engineer may direct. The Contractor shall not spoil, stockpile or waste any material without approval. He shall dispose of surplus and unsuitable material in areas designated by him and approved by the Engineer. Spoil heaps shall be flattened to present a neat level or graded surface with no danger of erosion.

The Contractor shall not sell any materials arising from excavations, demolitions and the like carried out on the Site unless permission is obtained from the Engineer.

2.2.5.2.2.1 Excavation of Foundation Pits & Trenches

Excavations shall be taken out to the least dimensions required to accommodate the several parts of the Works and shall provide any working space necessary for their excavation.

Excavations shall be carried out in such lengths, widths and depth at one time and in the sequence as approved by the Engineer and in such manner as to avoid any damage to the ground and adjacent property.

Excavations shall be timbered, sheeted and piled or otherwise supported to the extent necessary to support the surrounding ground and to ensure the safety of the Works and adjacent structures. Alternatively where specifically permitted they may be suitably battered.

Unless otherwise required by the Contract no timber or other supports shall be left in excavations without consent of the Engineer.

All proposed measures for the shoring and supporting of excavations or trenches shall be to the approval of the Engineer. Calculations showing the adequacy of any temporary works shall when required be submitted to the Engineer for approval.

2.2.5.2.2.2 Excavations to be Kept Free of Water

The Contractor shall provide and maintain and operate dewatering or other pumping equipment, and shall construct such drains, sumps and catch waters as may be necessary to remove water from the excavations or to prevent its entrance thereto. Water in the excavations shall be dealt with in such manner as will prevent the surfaces on or against which foundations or other work will be constructed from any deterioration of their natural condition, or from such condition as improved by work executed under the Contract.

The arrangement made for dewatering the ground, diverting water or removing water entering the excavations shall be to the satisfaction of the Engineer. Arrangements for removing water shall ensure that the dewatering of excavations can continue during the placing of concrete or execution of any other activities which could be adversely affected by water in or entering excavations. (The Contractor shall ensure that disposal of water does not create a nuisance or cause damage).

Precautions shall be taken especially when ground dewatering equipment is used, to ensure that the lowering of the ground water table in the vicinity of excavations or the removal of fine particles of soil from the ground surrounding the excavations causes no damage to sources of water supply, the adjoining Works or property, or the ground consolidated previously by others. The Contractor shall take all necessary precautions to ensure the stability of any of the Works against floating or displacement during construction due to high sub-soil water level, flood or other causes.

The method of disposal of drainage water from dewatering operations shall be to the approval of the Engineer and the Employer. Drainage water shall be caught where necessary in holding lagoons which shall be constructed by the Contractor for the purpose or piped to approved disposal points as directed. The Contractor shall obtain all necessary approvals and No Objection Certificates for his disposal method.

Crossings of existing road corridors in disposal systems for drainage water from dewatering systems shall be laid as permanent structures to an acceptable standard of construction. Depth of cover to drainage pipes shall not be less than 1.5 metres. Pipes shall be PVC or reinforced concrete with appropriate joints. Pipes shall be laid, bedded and backfilled to the approval of the Engineer.

Applications for approval for disposal of drainage water shall be made to the Engineer and Employer in the form of Method Statements giving the following information:

- Routes, diameters, depths and materials of proposed pipelines.
- Design of proposed holding lagoons.
- Proposed daily average, and maximum pumping/discharge rates.
- Effect on any existing disposal systems proposed to be used.
- Any other information required by the Engineer or Employer.

2.2.5.2.2.3 Foundation Levels and Preparation of Foundations

Formation levels shall be at the levels shown in the Drawings or at such other levels as may be directed.

The Contractor shall make good with suitable material or concrete as may be directed:

- Any excavation greater than the net volume required for the Works.
- Any additional excavation at or below the bottom of foundations to remove material which has become unsuitable.

When approaching foundation levels in excavations in material other than rock, the final trimming to these levels, whether for actual foundations or for any blinding concrete required by

the Contract shall not take place until placing of the blinding concrete or of concrete in the foundation is about to commence.

In the event of the Contractor requiring to trim the foundations in advance of readiness to place concrete, the trimmed foundations shall be protected against the ingress of moisture or the evaporation of soil moisture.

In the case where blinding concrete is required by the Contract no trimming of side faces of excavations shall be carried out for 24 hours after the placing thereof.

Where foundations are in rock, as the excavations approach finished level, the Contractor may be directed to continue excavating without the use of explosives or with limited use thereof by shallow holes and light charges. The final trimming of the foundations shall be executed without explosives by approved hand tools.

Immediately before placing concrete against rock surface, all loose and soft material shall be removed from surface by the use of stiff brooms, hammers, picks and air/water jets. Before the placing of concrete all water shall be removed from depressions and the Contractor shall take all measures necessary to keep all rock faces, against which concrete is to be deposited, dry and properly drained.

2.2.5.2.2.4 Protection of Slopes during Contract Period

The Contractor shall be responsible for the protection of slopes formed during the initial earthmoving stage, from subsequent erosion or damage throughout the period of the Contract, caused either by natural means or as a result of subsequent construction operations, or by construction traffic.

The form of protection to be used shall be to the approval of the Engineer. During or after the initial earthmoving the Contractor shall submit his proposals for the protection of the formed slopes. No subsequent construction activity will be permitted until the approved form of slope protection has been carried out.

2.2.5.2.3 Placing and Compaction

Where approved material from excavations is insufficient to form designated embankments, terraces etc., the Contractor shall, unless otherwise ordered, obtain the additional material, as directed, from borrow pits at locations approved by the Engineer.

Fill in embankments terraces etc.

The material of each embankment shall be deposited in layers of thickness, before compaction, not exceeding 300 mm. The material shall be spread to form a layer that is of approximately uniform thickness, and graded over the whole area of the embankment. Each layer shall be compacted at OMC to a density of at least 90 % of modified AASHTO maximum density in the case of cohesive soil or 98 % in the case of non-cohesive soil, unless indicated otherwise on the Drawings. Should the material be too wet, owing to rain or any other cause, it shall be harrowed and allow to dry out to the correct moisture content before compaction is undertaken. The Contractor shall ensure that storm water will at all times be discharged uniformly over the full area of each embankment or through specially prepared and protected drainage ditches to prevent scouring of the slopes. Where it is necessary to use clay or clayey material in embankments, such material shall be placed not less than 1 m and not more than 5 m below the finished surface.

Backfilling

Where backfilling or filling around or against structures has been authorized by the Engineer, such filling shall be placed, and shall be compacted approximately simultaneously on both sides of the structure to minimize unequal loading. All excavations shall be carefully refilled with approved material in layers of thickness not exceeding 200 mm. Each layer shall be compacted, using power rammers or vibrating plate compactors, to a density equal or better than that of the adjoining undisturbed material. Each layer shall be completed before the next is added. Except with the consent of the Engineer, filling shall not be deposited in water.

Timber sheeting and other excavation supports shall be carefully removed as the filling proceeds except where they are required by the Contract, or directed by the Engineer to be left in position, but removal of such supports will not relieve the Contractor of his responsibilities for the stability of the Works.

No filling shall take place around any structure until the Engineer's approval to backfill has been obtained and no backfilling shall take place around sumps, tanks or any other water retaining structures until the structure has been tested and a certificate of compliance with the specified test issued.

2.2.5.2.4 Finishing, Landscaping

On completion of earthworks to the finished level, the whole surface shall be graded, shaped and compacted to final grades and levels. The surface shall be lightly watered as the Engineer may direct.

If ordered by the Engineer, topsoil shall be placed on level and slightly graded areas and shall be lightly compacted by tamping, and trimmed neatly to required lines, grades and levels. The final thickness of topsoil after compaction shall be at least 300 mm.

If ordered by the Engineer, grass or other vegetation shall be planted after top soiling has been completed. Such planted areas shall be neatly trimmed and well watered, and the Contractor shall ensure that planted areas are not permitted to dry out. Any grass or vegetation planted that fails to grow shall be replaced by the Contractor, at his expense.

All land drains, like irrigation channels, culverts, etc. which have been severed during excavation work shall be carefully reinstated by the Contractor at his cost in either similar or approved equivalent material or construction.

Particular attention shall be paid to the support of reinstated drains in filled ground.

2.2.6 Tolérance in Positions, Dimensions, Labels, etc.

The work shall be finished to and within the limits (permissible deviation = PD) given below:

a) Excavations

- (i) position on plan, i.e. PD in plan of any point measured from nearest grid line: ± 35 mm
- (ii) Dimensions on plan, i.e. PD from the designed dimensions: -10 to +50 mm
- (iii) Foundation level, i.e. PD in level of surface of excavation trimmed to receive blinding concrete: ± 50 mm
- (iv) Level (other than foundation level), i.e. PD from designed levels with reference to nearest transferred bench-mark: ± 15 mm

b) Embankments, terraces, etc.

- (i) Position of top edge, i.e. PD from designated position of any point, measured from nearest grid line: ± 300 mm
- (ii) Alignment of top edge, i.e. PD from a line joining any two points 30 m apart on top edge of embankment: ± 100 mm
- (iii) Finished levels, i.e. PD from designated levels with reference to nearest transferred bench-mark: ± 50 mm
- (iv) slopes of top surfaces, i.e. PD from rate of fall: $\pm 5\%$ i.e. if fall 10% tolerance 9.5 to 10.5%

c) Moisture Content and Density

- (i) OMC in field during compaction: +1% and -2%
- (ii) Specified density: + (no top limit) and -0

2.2.7 Testing and Acceptance

To determine founding conditions or for other purposes, the Engineer may require the Contractor to drill, auger or excavate holes in advance of the start of construction. When so

requested by the Engineer, the Contractor shall provide labour, tools, machinery and equipment for sinking such exploratory holes and for refilling them. Such operations will be paid as day work.

The Contractor shall carry out sufficient tests to satisfy himself about the consistency of material placed in embankments and as backfill.

The Engineer may carry out check tests as he deems necessary, at any depth or at any layer. Where these tests reveal that the material used does not comply with the applicable requirements of the specification, or that the compaction specified has not been attained, the Contractor shall rectify the work to the satisfaction of the Engineer.

2.2.8 Measurement and Payment

Rates for bulk excavation shall cover the cost of excavating, forming embankments, terraces, shoring and supporting excavations, protection of structures, provision for existing services, dealing with storm and ground water, protection of slopes, and the cost of disposal of any surplus and unsuitable material to a tip identified by the Contractor and approved by the Engineer.

Rates for excavation shall cover the cost of excavating and re-use of the excavated or imported material in backfilling, forming embankments, terraces, shoring and supporting excavations, protection of structures, provision for existing services, dealing with storm and ground water, protection of slopes, the cost of disposal of any surplus and unsuitable material, and the import of any suitable material required for backfill.

Rates for filling shall cover the cost of the provision of suitable material, placing in layers, and compacting as specified.

Rates for landscaping shall include trimming the earthworks to final grades and levels, disposal of surplus materials, planting and seeding, reinstatement of land drains.

The rate for excavation in rock shall be extra over to normal excavation. Excavations which are required to be backfilled will be measured as if taken out with vertical sides regardless of whether they have been taken out with sloping sides. They will be measured from the net plan of the finished concrete footing, foundation, building or concrete structure except that, in the case of conical-bottomed tanks or other such structures, the volume will be measured from the finished outline of the concrete as shown on the drawings.

Fill is measured as the volume between ground levels before and after the filling and the rate will include forming embankments, terraces, etc.

Landscaping is measured as the area over which finishing is required, it shall exclude areas covered by structures, roads and pavements.

2.3 CONCRETE

2.3.1 Scope

This specification covers the requirements for plain and reinforced concrete, either cast-in-situ or precast, for civil engineering and building construction applicable to this project.

2.3.2 Interpretations

2.3.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and be read in conjunction with this specification:

- a) 1 General
- b) 2.2 Earthworks, as applicable

2.3.2.2 Application

This specification contains clauses that are generally applicable to concrete and structural precast concrete work.

2.3.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

a) General

Adverse weather. Cold weather, or weather in which the ambient temperature is above 45° C, or the relative humidity is low, or the wind velocity is high, or weather in which any combination of the latter three conditions occurs, and which tends to impair the quality of fresh or hardened concrete or otherwise causes concrete to have abnormal properties.

Approved laboratory - A laboratory suitably equipped and staffed for purposes of concrete testing and as such approved by the Engineer.

Cold weather - Weather conditions in which the ambient temperature is 5° C or less.

Concrete cover - The thickness of concrete between the face of the concrete and the outside of reinforcing steel nearest this face as cast.

Cool weather - Weather conditions in which the ambient temperature is higher than 5° C but not higher than 15° C.

Fixture - An item such as a bolt, anchorage, bearing, or the like that is cast or grouted into concrete.

Formwork - Temporary work that is required to support and shape the concrete for a structure.

Hot weather - Weather conditions in which the ambient temperature is higher than 25° C.

Normal weather - Weather conditions in which the ambient temperature is higher than 15° C and less than 25° C.

b) Quality

Consistency - The extent, as measured by the slump test, to which fresh concrete resists flow or deformation.

Designed Mix – A mix specified by its required performance in terms of strength.

Grade of concrete - An identification number for the concrete, the number being numerically equal to the characteristic compressive strength at 28 days expressed in MPa.

Prescribed mix - Concrete for which the Engineer has prescribed the mix proportions.

Ready-mixed concrete - Concrete complying with the relevant requirements of the specification and delivered to the Site in a plastic state.

Sample (of concrete) - The minimum volume of uncompact freshly mixed concrete required for a designated test as specified in BS 1881.

Target slump - The average value for the slump of concrete aimed at ensuring compliance with the slump required in terms of the specification.

Workability - The property of fresh concrete that determines the ease with which it can be placed and compacted without segregation of the constituent materials.

c) Strength

Specified strength - The required concrete strength (or the strength corresponding to the required concrete grade) stated on the Drawings or in the Technical Specification, and which in

all cases represents the strength below which not more than 5 % of valid 28 days test results obtained on cubes of concrete of the same grade can be expected to fall.

Designed Mix - A design mix is designated by its specified strength followed by the size of aggregate used in its manufacture.

Target strength - An average value of the strength of concrete that is higher than the characteristic strength and is aimed at to ensure that the characteristic strength is attained. (Note: If the standard deviation can be determined, the value of the target strength is at least equal to the specified strength plus 1.64 times the standard deviation of valid 28 days test results.)

Valid test result - The average result obtained from the testing of two test cubes of concrete as defined in BS 5328 Part 4.

d) Exposure conditions

Mild conditions - Conditions under which the concrete is protected from the weather and is exposed only to air.

Moderate conditions – Conditions under which the concrete is sheltered from severe rain and is not subject to freezing when wet, or buried in non-aggressive soil, or continuously under fresh water.

Severe conditions – Conditions under which the concrete is exposed or subject to any of the following: driving rain, alternate wetting and drying out, freezing when wet, fresh condensation of water, aggressive soil, salt-laden air.

Very severe conditions – Conditions under which the concrete is exposed to any of the following: water containing sulphates or chlorides, highly corrosive fumes.

e) Joints

The location of joints is controlled by design requirements and construction limitations. Joints shown on the Engineer's Drawings are "designated construction joints" and are required for design requirements and cover "movement joints", "contraction joints" and "expansion joints". The Engineer may, at the request of the Contractor, give his consent to further joints before the casting of concrete to suit the Contractor's method of construction. These shall be defined as "construction joints". In the event that the placing of concrete has to be halted due to equipment failure, inclement weather, movement of shutters or some other event, which are not the Employer's risk, which requires the halting of concreting, and "unforeseen construction joint" shall be formed. Where they are to the Employer's risk they shall be defined as "unforeseen designated joints"

2.3.2.4 Abbreviations

For the purpose of this specification, the abbreviation for reinforced cement concrete shall be RCC and the abbreviation for plain cement concrete shall be PCC.

2.3.3 Materials

2.3.3.1 Approval of Materials

The Contractor shall supply in good time to the Engineer for his approval, samples of the aggregates and, if so ordered, of the water, that he proposes to use for the concrete and shall furnish evidence that the water and aggregates comply with the requirements of the Contract. Evidence shall be in the form of a statement from an approved laboratory of the results of tests, or an authoritative report or record of previous experience.

2.3.3.2 Cement

Unless otherwise specified the cement used in the Works shall be Ordinary Portland Cement (OPC) complying with NS, ISO, or BS standards. The Contractor shall require the manufacturer to provide a certificate for each consignment of cement received at the Site. The Contractor

shall maintain a record available for inspection by the Engineer of the locations of concrete from each consignment.

Within eight weeks of the award of the Contract a report on proposed cement sources shall be submitted to the Engineer. The report shall propose primary and secondary sources of supply and shall give each manufacturer's full analysis of chemical composition and physical properties determined in accordance with NS 49-2041.

The report on cement sources shall be submitted at least four weeks in advance of the commencement of work on trial concrete mixes.

The Contractor shall supply samples of cement, when requested by the Engineer both from any store on Site and the place of manufacture for his approval.

The Contractor shall conduct preliminary and works tests as required by the Engineer to determine fineness, compressive strength (mortar cube) at 3 days and 28 days, initial and final setting time and soundness of the cement, as described in NS 49-2041.

Separate storage facilities shall be provided on the Site for each type of cement used. Cement shall be fresh when delivered to Site and the consignments shall be used in the order of their delivery. The Contractor shall mark the date of delivery on each consignment and each consignment shall be stored separately in such manner as to be easily accessible and identifiable. No cement in bags or other container shall be used unless these and the manufacturer's seals are intact at the time of mixing. If the cement is delivered in bags it shall be stored under cover and on elevated floors that provide proper protection against moisture and other factors that may promote deterioration. Bulk cement may be used providing it is stored in approved weather-proof silos or similar containers provided that the cement drawn for use is measured by mass and not by volume. The Contractor shall not use cement which has hardened into lumps.

2.3.3.3 Water

The water used for making and curing concrete, grout and mortar shall comply with NS 223-2047 and shall be from a source approved by the Engineer. Water shall be clean and free from injurious amounts of acids, alkalis, organic matter and other substances that may impair strength, durability or appearance of the concrete. At the time of use shall be free from polluting matter in any quantity which:

- (a) Affects the initial setting time of the cement by more than 30 minutes or reduces the compressive strength of test cubes by more than 20% when tested in accordance with NS;
- (b) Prevents the achievement of the specified test cube strengths at 28 days for the appropriate class of concrete;
- (c) Produces discolouration or efflorescence on the surface of the hardened concrete.

The water shall be free from hydrocarbons and from suspended organic matter. Inorganic matter in solution shall not exceed 500 mg/l by weight and in suspension shall not exceed 50 mg/l by weight. The water which the Contractor proposes shall be tested by the Contractor to the approval of the Engineer before use in the Permanent Works.

Regular tests of the water shall be made by the Contractor during construction of the Works as instructed by the Engineer. The water shall be sampled at the point of discharge into the mix. The Contractor shall supply two copies of each test result to the Engineer.

2.3.3.4 Aggregates

All aggregates shall comply with the requirements of NS 305-2050 & NS 403-2054 Specification for aggregates from natural sources for concrete and the additional requirements of this Specification. The Contractor shall undertake all necessary testing to demonstrate compliance with NS 305-2050.

Fine aggregate shall consist of natural sand. The Engineer will permit the addition of suitable crushed rock fine aggregate, as necessary, to the sand where in his opinion it is impracticable to obtain the specified grading of the combined aggregates otherwise than by such addition.

Coarse aggregate shall comply with the requirements of NS 305-2050 & NS 403-2054 for single sized aggregates to the nominal maximum size specified for the appropriate class of concrete and shall be made up of the following grading:

- (a) 40 mm single sized
- (b) 20 mm single sized
- (c) 10 mm single sized.

Immediately after commencement of the Works, the Contractor shall supply samples of proposed aggregates and also carry out preliminary testing on proposed aggregates for compliance with the Specification. The results of such tests shall be to the satisfaction of the Engineer before the Engineer will give approval to the source of aggregates proposed by the Contractor. Alternatively, and subject to the approval of the Engineer, the Contractor may submit certified results of tests on the aggregate carried out by an independent laboratory for the Engineer's approval of the source of aggregate.

During the performance of the Contract, the Contractor shall supply samples of aggregates when required by the Engineer for testing (the samples shall be taken in accordance with NS 298-2050. Testing of all aggregates in accordance with NS 305-2050 for compliance with all specified requirements shall be performed by the Contractor for each source of aggregate at each grading.

Any rejected aggregate shall be promptly removed from Site.

2.3.3.5 Admixtures

Admixtures shall not be used in any concrete without prior approval of the Engineer. Admixtures may require tests to be made before they are used. To facilitate approval, the Contractor shall provide the following information:

- a) The trade name of the admixture, its source, and the manufacturer's recommended method of use
- b) Typical dosage rates and possible detrimental effects of under-dosage and over-dosage
- c) Whether compounds (such as those containing chloride in any form as an active ingredient) likely to cause corrosion of the reinforcing steel or deterioration of the concrete are present, and, if so, the chloride content (expressed as chloride ions or as anhydrous chloride) by mass of admixture
- d) The average expected air content of freshly mixed concrete containing an admixture which causes air to be entrained when used at the manufacturer's recommended rate of dosage.

If the use of air-entraining agent is permitted by the Engineer, test measurements shall be carried out on Site by the Contractor, as and when required by the Engineer, to determine

- a) The percentage of air entrained in the concrete, and
- b) The density of concrete.

The Contractor shall provide equipment to permit measurement of entrained air at such frequencies as are required by the Engineer.

2.3.3.6 Reinforcement

Unless otherwise stated reinforcement shall be Type 2 deformed bars; Type R (mild steel plain bars) may also be scheduled. All reinforcement shall comply with NS 191-2046.

Fabric reinforcement shall comply with BS 4483.

The contractor shall supply the Engineer with certificates from the manufacturer issued in accordance with relevant NS, for all the required tests including the rebind test in respect of each consignment delivered to Site.

The reinforcement at the time of incorporation in the Permanent Works shall be clean and free from damage, oil or grease, loose mill scale and loose rust. Bars which have become bent shall not be straightened or regent for incorporation in the Works without the approval of the Engineer.

Steel reinforcement shall be stored clear of the ground and supported to prevent distortion. The Contractor shall supply samples of reinforcement from the stocks on Site when required by the Engineer.

2.3.3.7 Storage Capacity

The storage capacity provided and the amount of material stored (whether cement, aggregates, steel, or water) shall be sufficient to ensure that no interruption to the progress of the work is occasioned by lack of materials.

2.3.3.8 Deteriorated Material

Material that has deteriorated, or that has been contaminated or otherwise damaged, shall not be used in the concrete. Such material shall be removed from the Site without delay.

2.3.3.9 Water stops

The Contractor shall supply and fix water stops in all joints in members which are to be water-retaining and where shown on the Drawings.

Water stops built into joints shall be made of PVC, rubber or similar approved material. They shall be obtained from manufactures approved by the Engineer and shall be stored, fixed and jointed in accordance with the manufacture's instruction. They shall be fabricated into the longest practicable units complete with angles and junctions at the manufacture's works and shall be made continuous throughout the structure below highest water level and where shown on the Drawings. The number of joints in the water stop made on Site shall be kept to a minimum.

Where water stop joints are vulcanized or welded on Site, jointing shall be performed strictly in accordance with the supplier's instructions and recommendations. The tensile strength of the spliced water stop at a factory-made splice shall be at least 90% of the water stop's tensile strength, when tested according to BS 903, or equivalent standard, with the spliced joint in the middle portion of the dumb-bell test specimen and the tensile force applied normally to the direction of the splice. The tensile strength of a water stop spliced at the Site shall be 80% of the original strength of the water stop.

The edge bulb section shall be circular for water stops installed within concrete sections; trapezoidal for water stops installed at the base of slabs.

The Contractor shall supply the manufacturer's test certificates for each consignment of water stops delivered to Site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

2.3.3.10 Joint Filler

Unless otherwise specified, joint filler shall be of expanded polystyrene, resin or bituminous bonded cork, or similar. The filler shall be obtained from a manufacturer approved by the Engineer and shall be stored and fixed in accordance with the manufacturer's instructions. The Contractor shall supply the manufacturer's certificate for each consignment of joint filler delivered to Site and shall, in addition, supply to the Engineer sufficient of each consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

2.3.3.11 Joint Sealant

Unless otherwise shown on the drawings or ordered by the Engineer, an elastomeric two part polysulphide or polyurethane sealer shall be used. Such joint sealers and the requisite priming materials shall be obtained only from manufacturers that have been approved by the Engineer. They shall be stored in accordance with the manufacturer's instructions and recommendations. Polysulphide sealers shall comply with BS 4254.

The Contractor shall supply the manufacturer's test certificate for each consignment of each type of joint sealer delivered to Site and shall, in addition, supply to the Engineer sufficient of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure, if ordered.

2.3.3.12 Waterproof Membrane

The waterproof membrane shall be combination of heavy polythene film and a thick self-adhesive rubber/bitumen compound of 1.5 mm thickness or alternatively a 1.5 mm butyl rubber membrane or cement based silicon typed waterproofing compound. A compatible solar protection material shall be used at the exposed perimeter of the membrane. Such waterproof membranes, solar protection material and the requisite priming materials shall be obtained only from manufacturers which have been approved by the Engineer. They shall be stored in accordance with the manufacturer's instructions and recommendations.

The Contractor shall supply the manufacturer's test certificate for each consignment of waterproof membrane materials.

2.3.3.13 Concrete Curing Compound

Concrete curing compound for structures shall be a liquid resin or wax resin base membrane curing compound of a proprietary brand and shall contain a fugitive dye.

Test certificates, prepared by an approved testing laboratory, shall be supplied by the Contractor to show that the performance of the curing compound complies with the curing efficiency.

2.3.3.14 Premixed Grout

The grout used to secure holding down bolts or to fill under structural steelwork shall be premixed and with properties applicable to the application. All premixed grout shall be kept in conditions recommended by the manufacturer and shall not be used after the expiry date.

2.3.3.15 Bituminous Paint

Bituminous paint shall comply with BS 3416, Type II for materials in contact with raw or treated water and Type I for all other cases.

2.3.4 Construction Equipment

2.3.4.1 General

All Construction Equipment shall be maintained in good working order at all times during concrete work.

2.3.4.2 Batching Equipment

The Contractor shall proportion the ingredients of each batch of concrete by weight. The measuring equipment should give an accuracy of $\pm 3\%$ for each ingredient. The water shall be added to the aggregates and cement in a mechanical batch mixer. The device for measuring the water shall show accurately the weight required with a given moisture content of the aggregate and shall be so designed that the water supply will be automatically stopped when the correct quantity has been discharged into the mix.

The storage of aggregates shall be segregated to prevent contamination of the aggregates.

In the case of automatic equipment, the weighing scales shall be so interlocked that a new batch of materials cannot be delivered until the weighing hoppers have been completely emptied of the previous batch and the scales are in balance. Where discharge of materials from the hoppers is manually controlled, a method of signalling shall be employed to ensure that ingredients are not omitted, or are not added more than once, when a batch of concrete is being made up.

Admixtures shall be used in liquid or powder form and shall be measured by volume or weight in the case of liquids and by weight only if in powder form and shall be dispensed through equipment capable of measurement within the tolerance specified. Tanks or drums containing liquid admixtures shall be clearly labelled for identification purposes and stored in such a way as to avoid damage from contamination. Agitation shall be provided for liquid admixtures which are not in stable solutions.

2.3.4.3 Mixing Equipment

The type and capacity of mixing machines shall be such that the rate of output of concrete is suitable for the rate of concreting. Each machine shall be capable of producing a uniform distribution of the ingredients throughout the batch and shall comply with the specification to which the manufacturer claims it has been manufactured. Worn or bent blades and paddles shall be replaced. The inner surfaces of the mixer shall be clean and free from hardened concrete. The mixers used shall be specially suited to the production of low slump concrete.

2.3.4.4 Vibrators

Vibrators shall be capable of fully compacting each layer of concrete. At least one standby vibrator shall be available at all times during concreting for every three vibrators necessary to maintain the rate of placing.

Vibrating equipment used for the production of precast elements, whether in the form of a vibrating table, an external vibrator attached to the mould, or an immersion vibrator, shall have the frequency that is suitable for the compaction of low slump concrete.

2.3.4.5 Formwork

Formwork shall be so designed and constructed that the concrete can be properly placed and compacted and that, subject to the tolerances specified, the required shapes, finishes, positions, levels, and dimensions shown on the drawings are maintained. The formwork and joints shall be capable of resisting the dead load, including the pressure exerted by the wet concrete, wind forces, and all other superimposed loads and forces. If not otherwise directed, forms shall be made of timber where practicable.

The types of ties used and their position shall be such that the required finish is achieved and will not be marred by subsequent corrosion of the ties.

Unless otherwise shown or directed, formwork shall be such that exterior corners of finished concrete are provided with 25-mm chamfers and re-entrant corners without fillets.

2.3.4.6 Casting Beds and Moulds

All casting beds for precast concrete shall be properly aligned and levelled. Adequate weather protection shall be provided should this be necessary to achieve the standards specified below.

2.3.4.7 Construction Equipment for Handling, Lifting and Stacking

The Contractor shall provide adequate equipment for handling, lifting, and stacking precast units that they do not become discoloured and are protected from permanent damage due to stresses induced during handling or stacking or due to the use of slings, chains, and hooks.

2.3.5 Construction and Workmanship

2.3.5.1 Reinforcement

Reinforcing bars shall be bent to the shapes and dimensions shown on the drawings and bending schedules. All bars shall be bent cold around an appropriate former. Bending shall be done slowly, a steady, even pressure being used without jerk or impact.

Steel shall, at the time of the placing of the concrete, be free from loose or powdery rust, scale, oil, or other coatings that may reduce the bond between steel and surrounding concrete, affect the durability of the concrete, or initiate corrosion of the reinforcement. If any substance other

than water is used for lubricating the formwork, every precaution shall be taken to avoid contamination of the reinforcing steel by such substance.

Reinforcing steel shall be positioned as shown on the drawings or as directed and maintained in those positions within the tolerances specified. It shall be secured against displacement by tying at intersections with annealed wire of nominal diameter 1.25 or 1.6 mm, or by the use of acceptable clips or, if permitted by the Engineer, by welding. Reinforcing bars shall be supported and aligned in their correct position by means of hangers, chairs, spacers or saddles of approved design.

Unless otherwise shown on the drawing or directed by the Engineer, the minimum cover of concrete over reinforcing bars, measured from the outside of the most outer bar or stirrup, shall be 25 mm for mild exposure conditions, 35 mm for moderate exposure conditions, and 50 mm for severe exposure conditions or the diameter of the bar to which the cover is measured, whichever is greater. Cover shall be maintained by the use of plastic spacers

The Contractor shall ensure that reinforcement including stirrups, links, and tying wire does not encroach into the specified cover. Splices or joints in reinforcing bars shall be made only as and where shown on the drawings or as otherwise approved.

If left exposed for future bonding of extensions to the Works, reinforcing steel shall be protected from corrosion as directed. For precast units, reinforcement shall, where practicable, be performed into rigid cages. For this purpose, spot welding of bars shall be carried out only by skilled and experienced welders.

2.3.5.2 Formwork

Formwork will be classified in accordance with the surface conditions required on the finished concrete, as shown on the drawings or as directed. Such finishes will be as follows:

- a) Class F1 Rough: No treatment of the surface of the concrete will be required after the striking of the formwork. The finish of the concrete need not be more accurate than Degree of Accuracy III as defined in terms of clause 2.3.6.
- b) Class F2 Smooth: Imperfections such as small fins, bulges, irregularities, surface honeycombing, and slight surface discolouration's shall be made good and repaired by approved methods. The finish of the concrete shall be accurate to Degree of Accuracy II.
- c) Class F3 Special. Special finishes shall be as indicated on the drawings.

Forms shall be erected with joints tight enough to prevent leakage of cement mortar.

Surfaces of forms (regardless of the material of which they are made) that are to be in contact with fresh (wet) concrete shall be treated with a coat of non-staining mineral oil or other approved material, or, in the case of timber forms, by thorough wetting of the surfaces with water, so as to ensure easy release and prevent adhesion of the formwork during stripping.

Before re-use, all formwork shall be reconditioned, and all form surfaces that are to be in contact with the concrete shall be thoroughly cleaned.

Where necessary for the proper placing of the concrete, temporary openings for cleaning, inspection, or placing and compaction purposes shall be provided and, subsequently, so closed as to provide the finish specified and to conform to the applicable tolerances specified.

Formwork shall not be removed before the concrete has attained sufficient strength to support its own weight and any loads that may be imposed on it. The Engineer's approval shall be obtained before formwork is removed. As a guide, the formwork shall remain in place, after placing of the concrete, as follows:

a) Concrete cast with OPC or SRPC, in hot or normal weather

- (I) Beam sides, walls, and unloaded columns 1 day
- (ii) Slabs with props left underneath 4 days
- (iii) Beam soffits with props left under 7 days
- (iv) Slab props, including cantilevers 10 days
- (v) Beam props, including cantilevers 14 days

b) Concrete cast with OPC or SRPC, in cold weather

- (i) Beam sides, walls, and unloaded columns 1.5 days
- (ii) Slabs with props left underneath 7 days
- (iii) Beam soffits with props left under 12 days
- (iv) Slab props, including cantilevers 17 days
- (v) Beam props, including cantilevers 21 days

In cool weather, stripping times shall be determined by interpolation between the periods specified for normal and cold weather.

Formwork shall be removed carefully so that shock and damage to the concrete are avoided.

Notwithstanding the provisions above, the Contractor shall be responsible for making good any damage to the concrete arising from the removal of formwork and its supports.

2.3.5.3 Holes, Chases and Fixing Blocks

No holes or chases, other than those shown on the drawings or approved by the Engineer, shall be cut or otherwise formed in the concrete. The manner of attaching fixtures to be embedded in the concrete shall be subject to approval by the Engineer.

Boxes for forming holes shall be constructed so as to be easily removable without damaging the concrete during removal. They shall be properly vented to permit the escape of entrapped air and shall be capable of being sealed, subsequently, to prevent the loss of grout.

2.3.5.4 Pipes and Conduits

No pipes or conduits, other than those shown on the drawings or approved by the Engineer, shall be permanently embedded in the concrete.

2.3.5.5 Concrete

2.3.5.5.1 Quality

Concrete shall comply with the requirements for strength concrete or for prescribed mix concrete, as applicable. For precast concrete, the mix shall be of grade M20 unless another grade is shown on the drawings.

The Contractor shall determine to the approval of the Engineer the actual proportions of ingredients for each class of concrete to be used in the Permanent Works.

The concrete shall meet the requirements given in the following table

Requirements of Classes of Concrete

Class	Cement content (kg/m ³)		Maximum W/C ratio	Workability	Cube crushing strengths (N/mm ²)		
	Minimum	Maximum			Target	Minimum of 4	Minimum
35A/40	325	400	0.55	Medium	46.5	38.0	32.0
35A/20	325	400	0.55	High	46.5	38.0	32.0
30/40	245	400	0.65	Medium	41.5	33.0	27.0
30/20	275	440	0.65	High	41.5	33.0	27.0
30/10	315	460	0.65	High	41.5	33.0	27.0
20/20	220	440	0.65	Medium	31.5	23.0	17.0
10/20	220	-	0.70		16.0	12.0	8.0

Notes: 1 Water cement ratio is the ratio of free water to cement in the mix based on aggregates being in a saturated surface dry condition.

- 2. The specified characteristic compressive strengths for the minimum individual test result and the mean of four consecutive test results are derived from Clause 3.16.2 and Table 1 of BS 5328 : Part 4 : 1990.
- 3. High workability: slump 65 to 135mm

Medium workability: slump 50 to 100mm

Unless otherwise specified or agreed by the Engineer for concrete Grade 30 and above the proportions of coarse and fine aggregates shall be selected to achieve one of the grading curves defined in the following table within an allowable tolerance of generally 5%. A change from a maximum positive tolerance to a maximum negative tolerance in consecutive sieve sizes shall be avoided.

Combined Aggregate Gradings

Sieve size (mm)	40 mm maximum aggregate size grading curves			
	1	2	3	4
50	100	100	100	100
37.50	95	97	99	100
20	50	59	67	75
10	36	44	52	60
5	24	32	40	47
2.36	18	25	31	38
1.18	12	18	24	30
0.60	7	12	17	23
0.30	3	7	11	15
0.15	0	0	2	5
Sieve size (mm)	20 mm maximum aggregate size grading curves			
	1	2	3	4
37.5	100	100	100	100
20	95	97	99	100
10	45	55	65	75
5	30	35	42	48
2.36	23	28	35	42
1.18	16	21	28	34
0.60	9	14	21	27
0.30	2	3	5	12
0.15	0	0	0	1.5

The Contractor shall submit details of the source of all material and the proposed quantities of each ingredient per cubic metre of fully compacted concrete. The Contractor shall then make trial mixes for each class of concrete using the same type of Constructional Equipment and the same materials as are proposed for the Permanent Works. The Contractor shall give 24 hours' notice of such trials to enable the Engineer's Representative to attend. For each trial mix, three separate batches of concrete shall be made by the Contractor and will be tested at 28 days all in accordance with NS 511-2060. Such trial mixes shall not be the first batch through the equipment in any one sequence of concrete production.

The Contractor shall not commence concreting in the Permanent Works until details of trial mixes and test results for each class of concrete have been submitted to, and approved by, the Engineer.

A trial mix design will be approved by the Engineer with respect to strength if the average compressive strength of the nine cubes so tested is more than the target mean strength appropriate to the class as given in Table above.

The Contractor shall not alter the approved mix proportions nor the approved source of supply of any of the ingredients without having previously obtained the approval of the Engineer.

During production the Engineer may require trial mixes to be made before a substantial change is made in the materials or in the proportions of the materials to be used.

2.3.5.5.2 Batching

a) Weight Batching

In normal circumstances weight batching shall be used. The mass of cement supplied in a standard sack shall not be less than 50 kg. All cement taken from bulk storage containers and from partly used sacks shall be batched by mass with additional 2 % of mass required.

Mixing water for each batch shall be measured. The amount of water measured shall be adjusted to allow for the moisture content of the aggregates.

The mass of the aggregate of each size shall be determined and a correction made for the moisture content of the aggregates. (See 2.3.5.1).

b) Volume Batching

In special circumstances, and at the sole discretion of the Engineer, proportioning of materials by volume may be approved. If batching is by volume, the fine and the coarse aggregates shall be measured separately in suitable measuring boxes of known volume and of such capacity that the quantities of aggregates for each batch are suitable for direct transfer into the mixer. Bulking tests on the fine aggregate shall be conducted regularly and the results used for adjustment of the batch volume of the fine aggregate to give the true volume required.

Volume-batching of cement will in no case be accepted. The Contractor may, however, so proportion the mix that each batch shall use a whole bag or bags of cement, the weight of which is known precisely. All gauge boxes shall be accurate and strongly constructed and due allowance shall be made for bulking of the aggregates in assessing the correct volume to be used. The aggregates and the cement shall be thoroughly mixed in a clean mechanical mixer for a period of time agreed with the Engineer and the water added on the basis of the approved mix.

2.3.5.5.3 Mixing

The following requirements shall apply to the mixing of concrete at the construction location:

- a) Mixing of materials for concrete shall be conducted by an experienced operator.
- b) The sequence of charging the mixing equipment shall have been approved before mixing commences and, unless otherwise directed, the approved sequence shall be maintained.
- c) The total volume of material per batch shall not exceed the rated capacity of the mixer.
- d) Before any concrete is mixed, the inner surfaces of the mixer shall be cleaned and all hardened concrete shall be removed. A slurry of cement, sand, and water containing cement and sand in a ratio of 1:2 and in sufficient quantity to cover the entire inside surface of the mixer shall be produced in the clean mixer and discharged immediately before the charging of the mixer with materials at the commencement of each concrete production run.
- e) The period of mixing shall be measured from the time when all the materials are in the drum or pan to the commencement of discharge. Subject to the provisions of (f) below, the mixing period for each batch of 1.5 m³ or less shall be at least 1.5 min and 1 min for drum-type and pan-type mixers respectively, and shall be increased by 20 sec and 15 sec respectively for each additional cubic metre or part thereof. During this period, the drum or pan shall be rotated at the speed recommended by the manufacturer of the mixer. The maximum continuous mixing times at the recommended mixing speed shall not exceed 10 min and 6 min per batch for drum-type and pan-type mixers respectively.
- f) Discharge shall be so carried out that there is no segregation of the materials in the mix. The mixer shall be emptied completely before it is recharged. If the mixer has been out of use for longer than 30 min, it shall be thoroughly cleaned out, particular attention being paid to the removal of any built-up of materials in the drum, in the loader, and around the blades or paddles.

The Engineer will advise whether the production of concrete at a central concrete production facility other than on the construction location is permitted and whether the test results obtained by such a production facility as part of its quality control system are acceptable.

2.3.5.5.4 Transportation

Mixed concrete shall be discharged from the mixer and transported to its final position in such a manner that segregation, loss of ingredients, and adulteration are prevented and that the mix is of the required workability at the point and time of placing.

2.3.5.5.5 Placing

The Contractor shall give the Engineer 3 days notice of his intention to place concrete. The concrete shall be placed within 1 hrs of the time of its discharge from the mixer. Concrete shall not be retempered by the addition of water or any other material. The forms to be filled shall be clean internally. All excavations and other surfaces of an absorbent nature that are to come into contact with the concrete shall be dampened with water. There shall be no free water on the surfaces against which concrete is to be placed.

Wherever possible, the concrete shall be deposited vertically into its final position to avoid segregation and displacement of reinforcement and other items that are to be embedded.

Deposited concrete shall not be so worked (whether by means of vibrators or otherwise) as to cause it to flow laterally in such a way that segregation occurs. Where possible, the concrete shall be brought up in horizontal layers of compacted thickness not exceeding 450 mm and heaping shall be avoided.

Where a chute is used to convey the concrete, its slope shall be such as will not cause segregation, and a suitable spout or baffles shall be provided for the discharge of the concrete.

Concrete shall not be allowed to fall freely through a height of more than 2 m, unless otherwise approved.

Placing of concrete under water will be permitted only under exceptional circumstances when it is, in the opinion of the Engineer, not practicable to dewater before placing. No concrete shall be placed in flowing water. When the placing of concrete under water is permitted, it shall be placed by means of a tremie. During placing, the lower end of the tremie shall be continuously immersed in the concrete being deposited. To maintain the desired properties of the concrete the quantity of cement in the concrete mix shall be increased by 20%. Full details of the method proposed and of the adjusted concrete mix proportions shall be submitted to the Engineer for his approval before placing commences. During and after concreting under water, pumping or dewatering operations in the immediate vicinity shall be suspended.

Waterstops shall be carefully maintained in the position shown on the drawings and properly protected from damage and the harmful effects of light and heat during all stages of construction. The stop-boards on each side of the waterstop shall be accurately wrought to match the profile of the waterstop. The concrete shall be carefully compacted under and around the waterstop so as to leave no cavities.

Joint filler material of the thickness specified shall be cut to shape and fixed to fill the whole space between the concrete faces of the joint which is not otherwise filled by waterstop and joint sealer. Abutting pieces shall be placed in close contact and the joints covered on each side to prevent the passage of cement grout.

Recesses at movement joints on both faces of the concrete work except on the underside of continuously supported work and on faces backfilled with earth shall be accurately formed to the lines and dimensions shown on the drawings. The Contractor shall prepare the surfaces of the recesses and shall supply a joint sealer and fill or caulk the recess completely with it, all in accordance with the manufacturer's instructions.

The placing of concrete by pumping in any section of the Works shall be subject to the approval of the Engineer. The Contractor shall furnish the Engineer with full details regarding the mix proportions of concrete that he intends to place by pumping.

The Contractor shall not place concrete in the Permanent Works:

- (a) During heavy rains or dust storms.
- (b) When the air temperature is more than 43° C.
- (c) When the air temperature is less than 2° C.
- (d) If the temperature of the concrete on discharge from the mixer is less than 4° C or more than 32° C.
- (e) When the air temperature exceeds 25° C without taking precautions and demonstrating to the approval of the Engineer that the maximum internal temperature of the concrete within

24 hours after casting in place is unlikely to be more than 30° C in excess of the ambient temperature or more than 60° C.

- (f) Without the Engineer's approval if the temperature of the shutters or reinforcement exceeds 30° C.

To keep within these limits the Contractor may, among other means, spray aggregates with water, and use chilled mixing water, or add ice direct to the mixer provided that no ice is present in the mix when discharged from the mixer.

When concreting in hot weather all material used shall be kept in the shade. Water tanks, mixers and chutes should be shaded, but where this is not possible they shall be painted white and kept white.

2.3.5.5.6 Compaction

The Contractor shall regard the compaction of the concrete as work of fundamental importance and shall produce a watertight concrete of maximum density compatible with the approved mix. Compaction shall be assisted by the use of mechanical vibrators of the immersion type, but shall not involve the vibration of reinforcement or shutters except that vibration of shutters may be allowed, with the approval of the Engineer. Vibrators shall be inserted at least to the full depth of the newly deposited concrete and then slowly withdrawn to prevent the formation of voids. The procedure shall be continuous with points of insertion 150 to 225 mm apart. The number and type of vibrators available for use during each period of concreting shall be to the approval of the Engineer, which will not be given if sufficient stand-by vibrators in good working order are not readily available. If concreting is in the dark, ample lighting shall be provided at the mixing stations and at every place where concrete is being deposited.

Compaction shall be carried out by mechanical vibration.

Over-vibration resulting in segregation, surface laitance, or leakage, or any combination of these, shall not be permitted. The rate of concrete placing shall be commensurate with the available compaction equipment and only skilled operators shall be permitted to undertake compaction by vibration.

Concrete for precast elements shall be so placed in moulds and vibrated that concrete surfaces are smooth and even and all arises are true and clean.

Where precast units having architectural finishes are required, the Contractor shall ensure that duplicate samples are submitted to and approved by the Engineer with regard to both colour and quality before full scale production is commenced. One sample will be retained by the Engineer and the other shall be retained by the Contractor at the place of manufacture. The Contractor shall not commence manufacture until acceptable samples have been lodged.

2.3.5.5.7 Designated and Construction Joints

Concreting shall be carried out continuously up to the locations where joints are shown on the Contractor's working drawings or up to approved or directed locations. The method adopted for forming such joints and unforeseen joints shall be one of the following:

General Preparation

- a) Joints when concrete is less than 24 hrs old. The surface of the concrete shall be water jetted to expose the aggregate.
- b) Joints when concrete is more than 24 hrs but not more than 3 days old. The surface of the concrete shall be sandblasted or chipped with a light hammer to expose the aggregate.
- c) Joints when concrete is more than 3 days old. The procedure specified in (b) above shall be followed.

Preparation before placing concrete

- a) Joints when concrete is less than 24 hrs old. The surface of the concrete shall be swept clean and immediately before placing the concrete wetted but without pools of water.
- b) Joints when concrete is more than 24 hrs but not more than 3 days old. The surface of the concrete shall be swept clean, and thoroughly wetted but without pools of water.

- c) Joints when concrete is more than 3 days old. The procedure specified in (b) above shall be followed, except that the old surface shall be kept continuously wet for at least 24 hrs before the new concrete is placed.

2.3.5.5.8 Curing and Protection

The Contractor shall, until it has thoroughly hardened and for not less than 7 days, protect the concrete from the harmful effects of frosts, wind, sun, high or low temperature, variation or reversal of temperature gradient, premature loading, deflection or impact, and aggressive groundwater. The protruding steel shall be kept cool.

Unless otherwise approved by the Engineer, exposed concrete surfaces shall be kept continuously moist for not less than 7 days after casting in the case of Portland and sulphate resisting cement concretes. Immediately upon exposure, surfaces shall be covered with a thick layer of hessian or sand or other material as may be approved by the Engineer, which shall be in continuous contact with the concrete and kept wet to the satisfaction of the Engineer; the Contractor shall make special provision to the satisfaction of the Engineer for the supervision of wetting concrete which incorporates other authorised types of cement.

If curing membranes are proposed by the Contractor and approved by the Engineer, they shall be applied in conformity with the manufacturer's instructions. They shall be applied to unshuttered surfaces within one hour of concrete deposition and shall incorporate aluminum or other approved reflecting agent. Surfaces with applied curing membrane shall be shaded from the sun, unless otherwise approved.

Curing membranes shall not be applied to construction joints.

Concrete curing compound for structures shall be a liquid resin or wax resin base membrane curing compound of a proprietary brand and shall contain a fugitive dye.

Test certificates, prepared by an approved testing laboratory, shall be supplied by the Contractor to show that the compound complies with the curing efficiency.

2.3.5.5.9 Concrete Surfaces

Surfaces of concrete not finished against forms or ground surfaces shall be finished to the following classes.

Type U1 - This finish is for surfaces where a superior finish is not required. It is also the first stage for finishes U2 and U3. The finishing operations shall consist of grading, tamping and screeding the concrete to produce a uniform, plain or ridged surface.

Type U2 - This is a smooth matt finish such as may be achieved by a wood trowel, as required, inter alia, to receive mastic pavings, block or tile pavings bedded in mastic or screeds. Smoothing shall be done only after the concrete has hardened sufficiently, and may be by hand or machine. Care shall be taken that the concrete is worked no more than is necessary to produce a uniform surface free from marks.

Type U3 - This is a smooth steel-trowelled finish for surfaces of concrete pavings, tops of walls, copings and other members exposed to weathering or water, surfaces to receive thin flexible sheet, tile pavings bedded in adhesive, and seatings for bearing plates and the like where the metal is in direct contact with the concrete. Trowelling shall not commence until the moisture film has disappeared and the concrete hardened sufficiently to prevent excess laitance from being worked to the surface. The surfaces shall be trowelled by hand or machine under firm pressure and left free from trowel marks.

2.3.5.5.10 Watertight Concrete

Each section of the Works that is required, to hold or exclude water shall be watertight, and special care, particularly at construction joints, shall be taken by the Contractor to ensure watertightness. Should any such section of the Works fail to pass the tests for watertightness as required in terms of the Technical Specification or as ordered, or show any sign of water

leakage or penetration after being taken into use, it shall be deemed defective and shall be demolished and replaced with proper one.

2.3.5.5.11 Concrete in Wet Ground

The Contractor is to provide a dewatering system which ensures when concrete is placed there is not surface water and the ground provides suitable working condition.

2.3.5.5.12 Grouting

Where it is required to grout holding-down bolts, or to place grout under column bases or bedplates for equipment, the Contractor shall first prepare the relevant concrete surfaces by scabbling and cleaning them. The grout shall consist of an approved premixed grout mixture of cement, sand, water, and admixture, and shall be so rammed into each HD-bolt pocket or under each base or bedplate (as applicable) that all voids and pockets are completely filled around the bolt or between the top of the concrete and the underside of the metalwork, and, in the case of a base or a bedplate, that the grout projects beyond the base or bedplate. After the void has been completely filled, the edges of the mortar grout shall be trimmed at an angle of 45° outward from the bottom edges of each base or bedplate and the trimmed edge wood-floated to a neat finish.

2.3.5.5.13 Concrete Pumping

Where approved by the Engineer, the Contractor may use a suitable concrete pump for transporting the concrete from the batching equipment or transport vehicle to the point where it is to be deposited, in which case the specified mix proportions shall be adjusted and agreed with the Engineer at the time of submission of the relevant method statement. The concrete shall be fed directly from the batching equipment or transport vehicle into the hopper of the pump. Once concreting has commenced the rate of the flow and mixing must be such as to ensure continuous movement of the concrete in the pipework, which shall have as few bends as possible. Frequent slump tests (e.g. in accordance with BS 1881) shall be carried out at the delivery end to ensure the consistency and workability at the point of placing. All equipment must be thoroughly cleaned at the end of each operation.

2.3.5.5.14 Defects

The concrete shall be homogeneous and free from honeycombing, interstices, and planes of weakness. If, after removal of the forms, the concrete shows any defect, the Contractor shall immediately report such defect to the Engineer, and he shall not carry out any patching or remedial work until authorized to do so by the Engineer.

After thorough inspection and investigation of the quality and strength of the defective work and after due consideration of the possible consequences of such defect, the Engineer will either specify the extent and method of repair or order the demolition and reconstruction of the whole of the defective work to the extent that he considers necessary.

The cost of all such investigation, repair, and remedial work and of any demolition and reconstruction of defective work shall be borne by the Contractor and all repair, remedial, and reconstruction work shall be executed to the satisfaction of the Engineer.

Finished concrete shall have a neat, smooth, even, and uniform finish free from any honeycombing. If the finish of any formed or floated concrete surface is, to the opinion of the Engineer, unsatisfactory and does not conform to that specified, the Contractor will be required, at his own expense, to rub down such surface while it is still green, or, alternatively, to grind it down with Carborundum or other suitable material when it has hardened or to take other approved measures to give the specified finish.

For precast elements, moulds shall be removed without any shock or vibration that might damage the concrete or have any other detrimental effect on the units and on their surfaces.

2.3.5.5.15 Handling and Erection of Precast Units

The Contractor shall ensure that lugs, slots, holes, etc., provided for handling units and moving them from the point of manufacture to the place where they are erected, are adequate and are

so arranged that excessive stresses do not occur in any unit during handling, movement, or erection. Without the Contractor's responsibility being limited in any respect, the position of lifting and supporting points, the method of lifting, and the type of equipment and transport used shall be subject to approval by the Engineer.

The Contractor shall place indelible identity, location, and orientation marks on each unit, as and where necessary.

Packing pieces shall be such that they do not discolour or otherwise permanently damage the units.

Precast units shall be so stacked that the accumulation of trapped water and dirt is prevented, that, in the case of small units, deformation is minimized during the curing process, and that large units have complete freedom of movement during the curing process.

The method of assembly and erection agreed to with the Engineer shall be adhered to on the Site. Immediately after the unit is in position and before the lifting equipment is removed temporary supports or temporary connections between units shall be provided as necessary. The final structural connections shall be completed as soon as is practicable.

2.3.5.5.16 Joint Sealers

(a) General

The Contractor shall construct recesses at all joints and on both faces of the concrete work except on the underside of ground slabs. The recesses shall be accurately formed to the lines and dimensions shown on the Drawings or as agreed with the Engineer.

The Contractor shall prepare the surfaces of the recess, prime if necessary and shall apply a joint sealer and fill or caulk the recess completely with it.

Joint sealing shall not be commenced without the approval of the Engineer. In reservoir joints the sealer shall be applied after the construction of the reservoir roof.

Sealants shall be installed in strict accordance with the manufacturer's instructions. De-bonding strip shall be used in conjunction with the sealers as indicated on the Drawings. The de-bonding strip shall be compatible with the joint sealer and shall be resistant to attack from the primer used to bond the sealer to the concrete.

Polysulphide and polyurethane sealers shall not abut bituminous sealers. Surfaces to receive polysulphide and polyurethane sealers shall be kept free from bituminous paints.

All sealers shall be appropriate for the prevailing climatic conditions.

2.3.5.5.17 Concrete for Benching

Concrete for benching in manholes and similar structures shall consist of Grade C20/10 concrete unless otherwise specified. It shall be placed with low workability to the approximate shape required, and, while still green, shall be finished with not less than an average of 20 mm of cement screed to a steel trowelled finish and to the contours indicated on the drawings.

2.3.5.5.18 Records

The Contractor shall maintain written records that provide the following information:

- a) The date on which each section was concreted
- b) the position of the section within the Works
- c) the time taken to place the concrete
- d) the daily weather conditions
- e) the nature of samples taken and the dates they were taken
- f) the curing history
- g) the date of removal of formwork
- h) the grade of concrete

A written record of the concrete works shall be made each day by the Contractor and kept available for inspection by the Engineer. The diary shall contain notes and records of:

- (a) The names of the Contractor's engineers who are responsible for the different phases of the concrete work, and also the names of their assistants.
- (b) The temperatures of air, water, cement, aggregates and concrete, together with the air humidity and type of weather.
- (c) Deliveries to the Site of concrete materials (quantity, brand of cement, etc).
- (d) Inspections carried out, tests performed, etc and their results.
- (e) Times of commencement and completion of different parts of the concrete works, and times of erection and striking of forms.
- (f) Quantity of cement, fine and coarse aggregate and admixture used for each section of work, and the number and kind of test samples taken on these ingredients and water.

2.3.5.5.19 Reservoir Roof Finish

Reservoir roof finish shall comprise:

- (i) Waterproof Membrane heavy duty polythene film and self adhesive rubber/bitumen compound.
- (ii) Heat Insulation. Sand layer overlaid with thick layer of crushed rock or gravel.

(i) Waterproof Membrane

The membrane shall be laid on a clean, dry concrete surface, free from dust, primed if necessary, in accordance with the manufacturer's instructions with at least 75 mm lap at each joint.

All materials shall be carefully protected from damage, deterioration before, during and after installation. Part or all of the heat insulation layer shall be laid as soon as possible after the completion of laying of waterproof membrane and approval by the Engineer. A solar protective material shall be installed in all locations where the membrane is not permanently covered by the heat insulation layer.

(ii) Heat Insulation

The roof membrane of the reservoir shall be covered with a 50 mm layer of sand of the same type as used for making concrete and subsequently overlaid with a 100 mm thick layer of crushed rock or gravel of 20 mm nominal size.

The Contractor shall ensure that the roof membrane is not damaged when the heat insulation is being placed. During the placing operation, the roof slab shall not be subjected to a superimposed load exceeding 150 kg over and above the weight of the granular material. The material shall be spread in even layers and not stock piled in heaps on the roof for spreading at a later date.

2.3.6 Tolerances

2.3.6.1 General

Permissible deviations (PD) appropriate to the degree of accuracy will be applied to linear dimensions, position, plumb (verticality), level, squareness, and bow.

Where precast units are to fit on or between cast-in-situ concrete units, the tolerances applicable to the cast-in-situ concrete shall be compatible with the tolerances applicable to the precast units.

The Degree of Accuracy may be one of the following:

- a) Degree of Accuracy III for use where a high degree of accuracy is unnecessary, eg mass foundations, Finish classes F1 and U1.
- b) Degree of Accuracy II for what is normally considered "good work" Finishes F2 and U2.

- c) Degree of Accuracy I where the use of special, as opposed to normal, methods or materials (or both) is warranted, e.g. prefabricated units or where such are to fit in. Finishes classes F3 and U3.

Deviations will be measured as set out below:

- a) Any deviation from flatness of a plane surface will be measured as the maximum deviation of the surface from any straight line of length 3 m joining two points on the surface, determined by means of a straight-edge the ends of which are supported on identical blocks of suitable thickness placed over each of the points.
- b) Any abrupt change in a continuous surface, including a local depression or peak in a floor or wall and any abrupt change caused by a joint in formwork will be measured as specified in (a) above.
- c) Out-of-squareness of a corner or an opening or an element such as a column will be measured by taking the longer of two adjacent sides as the base line, and determining any departure from the perpendicular of the side at either end of the base line.

2.3.6.2 Permissible Deviations

If no Degree of Accuracy is specified in the Technical Specification, Degree of Accuracy II shall apply.

The Permissible Deviations are:

a) for the Degree of Accuracy III:

(i) reinforcement	
spacing between two adjacent bars	± 25 mm
location of ends of bars	± 40 mm
cover to reinforcement	- 0,+ 20 mm
(ii) foundations	
position in plan from grid or centre line	± 50 mm
linear dimension in plan cast against excav.	± 60 mm
linear dimension in plan cast against formw.	± 30 mm
level of underside of concrete	- 40,+ 20 mm
surface level	- 30, +15 mm
(iii) elements above foundation	
position in plan from grid or centre line	± 25 mm
linear dimensions	± 30 mm
cross-section dimension	- 10,+ 20 mm
level of any element or component	- 20,+ 10 mm
plumb, per metre of height	5 mm
plumb, maximum of any point, at any height	70 mm
out-of-squareness, for short sides <0.5 m	± 10 mm
out-of-squareness, for short sides < 2.0 m	± 20 mm
out-of-squareness, for short sides < 4.0 m	± 25 mm
flatness of or abrupt changes in exp. surface	10 mm
flatness of surface to be plastered	15 mm
abrupt changes in surfaces to be plastered	10 mm
cover to reinforcement	0 mm
location in plan or elev. of HD-bolts	± 5 mm
constituents in the concrete mix	± 5 %

b) for the Degree of Accuracy II:

(i) reinforcement	
spacing between two adjacent bars	± 20 mm
location of ends of bars	± 30 mm
cover to reinforcement	- 0,+ 15 mm
(ii) foundations	
position in plan from grid or centre line	± 35 mm

linear dimension in plan cast against excav.	± 40 mm
linear dimension in plan cast against formw.	± 20 mm
level of underside of concrete	- 30,+ 15 mm
surface level	- 20,+ 10 mm

(iii) elements above foundation	
position in plan from grid or centre line	± 15 mm
linear dimensions	± 20 mm
cross-section dimension	- 5, + 10 mm
level of any element or component	- 15, + 5 mm
plumb, per metre of height	4 mm
plumb, maximum of any point, at any height	50 mm
out-of-squareness, for short sides <0.5 m	± 5 mm
out-of-squareness, for short sides <2.0 m	± 15 mm
out-of-squareness, for short sides <4.0 m	± 20 mm
flatness of or abrupt changes in exp. surface	5 mm
flatness of surface to be plastered	10 mm
abrupt changes in surfaces to be plastered	5 mm
cover to reinforcement	0 mm
location in plan or elev. of HD-bolts	± 3 mm
constituents in the concrete mix	± 5 %

c) for the Degree of Accuracy I:

(i) reinforcement	
spacing between two adjacent bars	± 15 mm
location of ends of bars	± 20 mm
cover to reinforcement	- 0,+ 10 mm

(ii) foundations	
position in plan from grid or centre line	± 20 mm
linear dimension in plan cast against excav.	± 20 mm
linear dimension in plan cast against formw.	± 10 mm
level of underside of concrete	- 20,+ 10 mm
surface level	- 10, + 5 mm

(iii) elements above foundation	
position in plan from grid or centre line	± 5 mm
linear dimensions	± 10 mm
cross-section dimension	± 5 mm
level of any element or component	- 10,+ 0 mm
plumb, per metre of height	2 mm
plumb, maximum of any point, at any height	30 mm
out-of-squareness, for short sides <0.5 m	± 3 mm
out-of-squareness, for short sides <2.0 m	± 10 mm
out-of-squareness, for short sides <4.0 m	± 15 mm
flatness of or abrupt changes in exp. surface	30 mm
flatness of surface to be plastered	5 mm
abrupt changes in surfaces to be plastered	3 mm
cover to reinforcement	0 mm
location in plan or elev. of HD-bolts	± 1.5 mm
constituents in the concrete mix	± 5 %

- d) for precast beams the deviation from the intended line measured on a part of or on the overall length of the beam shall not exceed 3 mm for the length of up to 3 m, and for each additional metre in length a deviation of 1 mm will be allowed up to a maximum of 10 mm. In addition, the rate of deviation from the intended line shall not exceed 1:300.

2.3.7 Tests and Acceptance

2.3.7.1 Facilities and Frequencies of Sampling

For the purposes of taking samples and carrying out tests, the Engineer shall have free access to the Works, and the Contractor shall provide all equipment required for the sampling (e.g.

cones, moulds) as specified and render any assistance necessary. If so required, the Contractor shall provide storage and protection for such samples on the Site.

While concrete of a particular grade is being placed under the same conditions, sets of samples (each sample being sufficient for 3 cubes) shall be taken.

The sets of samples shall be taken as close as is practicable to the start of placing and at appropriate intervals thereafter, or from one particular batch and then from subsequent batches chosen at appropriate intervals.

At least one set of samples shall be taken from each day's casting and from at least every 90 m³ of concrete of each grade placed.

Only one sample shall be drawn from any one batch of concrete, and, except where otherwise ordered, no sample shall be taken of any grade until at least 3 batches of such grade have been mixed and discharged.

2.3.7.2 Testing

All testing shall be carried out in accordance with the relevant applicable standards or as directed by the Engineer.

The Contractor shall ensure that Site testing is carried out by a competent technician or by a person deemed by the Engineer to be sufficiently experienced.

The Contractor shall ensure that laboratory testing is carried out by a recognized testing institution or an approved laboratory or a firm approved by the Engineer.

Where early-strength testing is desired by the Contractor (eg for determination of the seven day strength), plans for such testing and interpretation of results shall be as agreed between the Contractor and the Engineer. As a general guide the seven day strength may be considered to be the 28 days strength divided by 1.4.

2.3.7.3 Acceptance Criteria for Designed Mix concrete

Of the three cubes made from each sample of fresh concrete in accordance with relevant NS or BS 1881, one will be crushed at 7 days and the other two at 28 days. The average of the two 28-days strengths will be taken as the test result. Compliance with the specified strength requirements shall always be judged on the 28-days' test results.

Concrete shall be considered to have failed to comply with the Specification:

- (a) if a test result is less than the minimum specified for that class of concrete, in which case the concrete which it represents shall be broken out and disposed of away from the Site by the Contractor unless at his sole discretion the Engineer approves otherwise.
- (b) if the average of four consecutive test results for that class of concrete shall have failed to exceed the minimum mean of 4 in which case no further concrete of that class shall be placed in the Permanent Works until the Contractor shall have discovered the cause of such failure and rectified it to the satisfaction of the Engineer.

If a mix fails to achieve the requirements for fresh concrete the batch shall be rejected and no further concrete of that class shall be placed in the Permanent Works until the cause of failure has been rectified.

If, after evaluation of the test results an examination of the concrete in the structure is indicated, one or more of the procedures in the sequence given below may be adopted at the discretion of the Engineer to determine the acceptability or otherwise of concrete in particular sections of the structure:

- a) An assessment of the stress level in the structure concerned in relation to the test result obtained
- b) non-destructive testing, subject to similar concrete of proved acceptable quality being available in comparable members in the same construction as a reference (impact

- hammers and ultrasonic testing are two examples of such test techniques that may be used, provided the apparatus has been previously calibrated)
- c) the testing of drilled cores in accordance with relevant applicable standards under terms and conditions agreed upon between the Engineer and the Contractor.

Where load tests are, in the opinion of the Engineer, unsuitable or impractical, and if an examination described above does not show the concrete strength to be acceptable, or if a portion of the structure fails to pass the test, the Contractor shall, on the instructions and directions of the Engineer, either replace or strengthen by approved means: each section of the structure that failed or contains concrete that failed, as relevant; and any section, irrespective of strength, the functional purpose of which is affected by the a failed section or failed concrete.

The Contractor shall bear the cost of any replacement or strengthening referred to above as well as any other remedial measures that may be ordered to restore the durability of the concrete to that achievable by concrete of the strength required in terms of the specification.

2.3.7.4 Individual Load Tests on Precast Units

If so directed by the Engineer, the unit to be tested shall be supported at its designed points of support and loaded for 5 min with a load equal to the sum of the characteristic dead load plus 1.25 times the characteristic imposed load, and the deflection shall then be recorded. The maximum deflection measured after application of the load shall be checked for compliance with the applicable requirements of the relevant applicable standards.

The recovery shall be measured 5 min after the removal of the applied load and the load shall then be re-imposed. The percentage recovery after the second loading shall be at least equal to that determined after the first loading and at least 90 % of the deflection recorded during the second loading. At no time during the test shall there be, in the opinion of the Engineer and in the light of a reasonable interpretation of the relevant data, any sign of weakness or faulty construction in the unit under test.

If destructive tests for beam units are ordered, the unit to be tested shall be supported at its design points of support, and loaded to its ultimate design load. The unit shall not fail within 15 min after the application of the test load. A deflection exceeding 1/40 of the span shall be regarded as failure of the unit.

For units not amenable to the tests described above, details of the testing arrangements shall be agreed between the Engineer and the Contractor before such units are cast.

2.3.7.5 Acceptance Criteria for Reservoirs Tanks etc.

Cleaning Reservoirs, Tanks etc

On completion, all water retaining structures shall be carefully cleaned by sweeping and brushing with stiff brooms, first with the minimum use of water and subsequently with water hosing, to the approval of the Engineer. The water shall be run off, bailed or pumped out after cleaning and any sediment removed to the satisfaction of the Engineer.

Testing of Water Retaining Structures

All water retaining structures with dividing walls and, each individual tank shall be tested separately. In the case of underground or semi-underground structures, the testing shall take place before any perimeter drains or filter membrane or backfilling are placed against the walls and no such placing of material against the walls shall take place until the Engineer has given his approval after the completion of satisfactory testing.

The testing shall not be undertaken until the structure to be tested has been completed structurally (including roof, if any) and has been passed by the Engineer in writing as satisfactory in all respects other than watertightness, especially in regard to the final finish of the work; no filling shall take place earlier than 28 days after the casting of the final sections of the structure which will be stressed by the filling of the structure.

The structure shall be filled with clean water to the design top water level (any overflow pipes or other openings in walls etc being temporarily but efficiently closed by means approved by the

Engineer). The rate of filling shall be reasonably constant and shall not exceed 2.5 m of the depth in 24 hours. A higher rate may be used with approval from the Engineer. After filling, the structure shall be allowed to stand full (being topped up as necessary) for at least 72 hours, for absorption of water by the concrete to take place, at the end of which period the level shall be accurately noted. The structure shall then be accepted as watertight if after a further 72 hours:

- (i) No leaks or damp patches on the backs of walls are discernible during the period of the test (if the backs of walls are wetted by rainfall or any other cause the test must be delayed until they are dry for at least 72 hours). In case of individual parts of a structure being tested independently, the division walls also must be watertight.
- (ii) The floor under-drainage system of the structure (if any) remains dry, or the flow in it before the test is not increased as a result of filling the structure with water.
- (iii) There is no discernible change in the level of the water in the structure during the period of the test. For the purposes of this clause, the limit of discernability will be taken as 3 mm.

The roof of concrete reservoirs and tanks shall be tested for watertightness after the application of the waterproof membrane by lagooning the roof slabs to a minimum depth of 50 mm for a period of 72 hours. The roof slab shall be regarded as satisfactory if no leaks or damp patches appear on the soffit.

Should the part of the structure under test fail the above tests in any respect, the contractor shall immediately take such steps as may be necessary to ascertain the nature and positions of any defects or leakages, shall empty the structure, and remedy the defects in a manner approved by the Engineer, employing men who are specialists in this class of work. A damp patch appearing on the outside of the wall must be rectified from the water face, a repair to the outer face only will not be approved; this applies to bobbin holes also.

When the remedial work has been completed in a manner approved by the Engineer, the testing and if necessary rectification shall be repeated until a satisfactory test is achieved.

If necessary, in extreme cases of lack of watertightness, the Engineer may reject the structure, any member or section of a member of the structure.

Sterilisation of Reservoirs and Tanks

After the reservoirs and tanks have been cleaned out, successfully tested and accepted as watertight by the Engineer, sterilisation shall be carried out by either of the following methods:

- (i) A solution containing 50 mg/l of chlorine shall be prepared and brushed vigorously into the internal surfaces of the structure, left for a contact period of one hour and then flushed with clean water.
- (ii) The structures shall be filled to overflow pipe level or top water level with chlorinated water having a free chlorine content of 20 mg/l and left to stand for 24 hours. Above this level all internal exposed surfaces shall be treated as in (i) above.

The Contractor shall provide his employees with gas masks, goggles and protective clothing for carrying out this work.

The Contractor shall be responsible for disposing of the waste chlorine solutions in a manner as to avoid injury or damage to persons, animals, things, Works and materials.

After completion of sterilisation neither the Contractor nor his employees shall enter or interfere with the structures or pipework in any way, except with the written authority of the Engineer and only then on such conditions as the Engineer may impose.

If, after sterilisation has been carried out, any fault in a reservoir or other part of the work develops so that the reservoir or pipework has to be emptied, the Contractor shall empty the structure, carry out the repair and any watertightness testing required, and shall then repeat the sterilisation procedure described above.

2.3.8 Measurement and Payment if not otherwise specified in the BOQ.

2.3.8.1 Formwork

Formwork will be measured as the net area of the face of the concrete. No deduction will be made for fillets and splays of size up to 100 x 100 mm or for openings of diameter up to 0.5 m².

Formwork in continuous lengths of narrow width of up to 300 mm will be measured by length, the width or range of width being stated in the schedule.

Separate items will be scheduled

- a) for each class of finish required
- b) for the different angles of inclination of formwork as given below:
 - (i) horizontal: >85° up to 95°
 - (ii) sloping: >10° up to 85°
 - (iii) battered: up to 10°
 - (iv) vertical: 0°
- c) for each type of structural element, such as walls, beams, slab, etc.
- d) for formwork to curved surfaces

No payment will be made for formwork used in forming designated and construction joints.

2.3.8.2 Reinforcement

Steel for reinforcement will be measured net by mass of all bars, including supporting steel detailed on the bending schedules. No allowance will be made for cutting, waste, spacer devices, slices/lapping, chairs or binding wire.

Welded mesh will be measured by area to be reinforced by means of mesh, no allowance being made for cutting, waste, laps, or deductions for end cover.

Steel offcuts resulting from the cutting and bending of reinforcing steel in accordance with the bending schedule shall be deemed to be the property of the Contractor.

2.3.8.3 Concrete

The volume or area of concrete, in which unit the payment is intended, will be computed from the measurements net to the dimensions shown on the drawings or to the dimensions cast, whichever is the smaller. Structural elements that are undersized will be measured for payment only if they are accepted by the Engineer.

No allowance will be made for concrete required to make up overbreak in soft excavation, but payment will be made for additional concrete or formwork, ordered in writing by the Engineer to replace unsuitable material or overbreak in hard rock or in intermediate excavation.

Subfoundation carpets and blinding layers will be measured to the plan size of the concrete structure resting on it and the thickness shown on the drawings, and measured on the mean thickness as cast, provided that the Engineer is satisfied that the excavation has not at any point been taken deeper or wider than necessary.

Separate items will be scheduled, as applicable, for each type and each grade of concrete, for each unit or element in the structure (where these would materially influence the pricing), such as

- a) slabs that are horizontal, sloping, conical or of different thickness
- b) concrete deposited under water
- c) small quantities each less than 0.5 m³ of formed surfaces, and
- d) different surface finishes, other than just striking-off and levelling.

No separate payment will be made for curing, sampling or testing.

2.3.8.4 Miscellaneous Items

Only designated joints shall be measured. Joints will be measured per linear m for joints in slabs and horizontal and vertical joints in walls. The rate shall include waterstops, formwork to form the joint, forming a recess for the joint sealer and application of the joint sealer.

Waterproof membrane shall be measured as the plan area of the roof slab covered with the membrane. The rate shall include upstands at the perimeter and solar protection of the perimeter. Bitumen painting is measured as the surface area covered by the painting.

2.4 BRICKWORK/STONWORK

2.4.1 Scope

This specification covers the general construction requirements for brickwork and stonework in general building construction (e.g. guard house at the reservoir site, etc.), treatment plant, in manholes and chambers for sewer and storm water drainage networks, and for curtain walls in the reservoir.

2.4.2 Interpretations

2.4.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1 General
- b) 2.1 Site Clearance
- c) 2.2 Earthworks
- d) 2.3 Concrete

2.4.2.2 Application

This specification contains clauses that are generally applicable to brickwork and rubble masonry construction, soling work, and associated work.

2.4.3 Materials

2.4.3.1 Bricks

Bricks shall be obtained from an approved manufacturer and shall be either general purpose bricks (for buildings) or special burnt clay bricks or engineering bricks (for manholes etc.) as approved by the Engineer.

The Contractor shall submit to the Engineer samples of the bricks that he intends using in the construction of the different sections of the Works. The samples of the bricks that are approved will be retained by the Engineer.

Bricks shall be free from defects affecting strength and durability. The amount and extent of manufacture cracks or cracks and chips due to handling shall not be to such a degree as to give an unsightly appearance to exposed brick surfaces and all face brick to be used on the Work shall match with the samples approved by the Engineer.

All bricks shall be of good quality brick earth and thoroughly burnt, and shall be of deep cherry red or copper colour. The bricks when dried shall emit a clear ringing sound when struck together and shall not break when thrown on the ground or against other bricks from a height of 1 m. The bricks shall not absorb water more than one sixth of their weight after one hour of soaking by immersion in water. The bricks shall be wholly clean and free from flaws, cracks and underburnt lumps of any kind. They shall be uniform in size and regular in shape and have square, straight and sharp edges and even surfaces.

2.4.3.2 Hollow Concrete Blocks

The hollow concrete blocks for masonry works shall be machine made and thoroughly compacted in the moulds by external form vibrators or vibrating tables.

The hollow concrete blocks shall be made of 1 part of cement, to 6 parts of well graded fine and coarse aggregates mechanically mixed into a very dense and dry consistency with very low water cement ratio.

The hollow concrete blocks shall comply with NS 119-2042 and shall have following physical properties.

a) Compressive Strength	70 kg/cm ²
b) Drying Shrinkage	0.04%
c) Moisture Movement	0.03%
d) Water absorption	240 kg/m ³
e) Moisture content	40%

2.4.3.3 Cement For Mortar

Cement for masonry mortar and grout shall be ordinary portland cement in accordance with the requirements of Clause 2.3.3. All cement for mortar for exposed face work shall be of a uniform colour as approved by the Engineer.

2.4.3.4 Sand and Water for Mortar

Sand (fine aggregate) and water used shall be in accordance with the requirements of Clause 2.3.3 and sand for exposed face work shall be of a uniform colour as approved by the Engineer.

Sand shall be clean pit sand and shall be free from clay and other impurities and, if so directed, shall be properly screened and washed.

2.4.3.5 Stone

The stones to be used shall be hard, tough, sound, durable, and angular in shape. If boulders are used, they shall be broken into angular pieces. The stones should be free from iron bands, spots, sand holes, flaws, shakes, cracks, or other defects and impurities like clay, oil, etc. The stone shall not absorb water more than 5%. The specific gravity of stone shall not be less than 2.50. Except otherwise mentioned in the contract, the length of any stone shall not exceed three times its height. The breadth of the stone on the bed shall not be less than 150 mm nor greater than $\frac{3}{4}$ the thickness of the wall. The chips or spalls used including voids in the dry stone masonry shall not be more than 20% of the stone masonry by volume. In case of mortared masonry the volume of mortar and spalls taken together shall not be more than 30% of the mortared masonry.

Representative samples of the stones intended for use in the works shall be submitted to the Engineer for prior approval. Further representative samples shall be submitted for approval whenever there is a change in the type or strength of the rock that the Contractor intends to use in masonry work.

2.4.4 Construction Equipment

The Contractor is responsible for providing, erecting, dismantling, and removing safe and adequate lifting equipment and scaffolding where required. Mixers used for mixing mortar and grout shall be in accordance with the requirements described under Clause 2.3.4.

2.4.5 Construction and Workmanship

2.4.5.1 Mortar

The mix proportion for cement mortar for masonry and plaster works shall be proportioned by volume and shall be one part of cement and 4 parts of sand or as specified in the drawings.

2.4.5.2 Workability of Mortar

The mortar shall be of a readily workable consistency with only enough water to obtain a plastic condition suitable for troweling.

2.4.5.3 Workability of Grout

Grout shall be of pourable consistency with a slump of 120 mm when tested in accordance with the standard slump test for mortar and grout.

2.4.5.4 Cement Mortar Mixing and Using Period

All cementing material and aggregates shall be mixed for a minimum of 2 min in a mechanical batch mixer. Only so much water shall be added as is compatible with convenience in using the mortar. If mortar begins to stiffen from evaporation or absorption of a part of the mixing water, the mortar shall be retempered by adding water and remixed. All mortar and grout shall be used within 2.5 hrs of the initial mixing and no mortar or grout shall be used after it has begun to set.

2.4.5.5 Hand Mixing of Mortar

Hand mixing shall be carried out on clean, water tight platforms with approved methods.

2.4.5.6 Brick Laying

Bricks shall be carefully handled at all stages in delivery, stockpiling, transportation on Site and construction to prevent breakage or surface damage. Bricks shall be carefully unloaded by hand and shall not be dumped or thrown. Special care shall be taken with stacking and storage of bricks on the Site.

The conditions governing the laying of brick masonry in unfavorable weather shall be as specified for concrete in Clause 2.3.5.5.5 Exposed faces of brick masonry shall be kept moist for 10 days after laying.

All brickwork shall be placed only after the foundation surfaces have been prepared to the satisfaction of the Engineer.

Bricks shall be well soaked in water for a minimum of 3 hrs immediately before being laid or as required so that the rate of absorption when laid does not exceed acceptable limits approved by the Engineer. The method of wetting shall be such that each brick be nearly saturated but the surface appears dry when laid.

Bricks shall be laid in running bond with head joints in each course centered over the bricks in the course below and shall be plumb, level & true to line with full head and bed joints. The ends of brick shall be buttered with sufficient mortar to fill the head joints.

Joints in brickwork shall be uniform and generally 10 mm thick for horizontal and 6 mm wide for vertical joints. Joints shall be tooled to produce a dense V-shaped joint or as otherwise ordered by the Engineer or shown on the drawings. Defective joints shall be cut out and repointed with mortar as directed by the Engineer.

The colour and texture of all exposed mortar joints shall be subject to the approval of the Engineer and shall be kept uniform throughout the particular contract by strict adherence to the approved mixes and samples.

Extreme care shall be taken to prevent any concrete, grout, or mortar from staining the face of masonry. If any grout or mortar does contact the face it shall be immediately removed and the surface cleaned with clean water. Masonry work shall be protected against staining, tops of walls shall be covered with waterproof coverings as required, and when work is interrupted.

All walls shall, to the extent possible and as practicable, be built up at the same time. In no case shall any walls be advanced more than 1.5 m above another. If it is necessary to stop off a horizontal run of masonry, the end shall be stepped or as otherwise approved by the Engineer.

Where mortar on joints has partially or totally set, the exposed surface shall be cleaned and thoroughly wetted so as to obtain the best possible bond with the new work. All loose masonry and mortar shall be removed prior to the commencement of the work.

Brickwork shall be taken up truly plumb and each set of four bricklayers shall be provided with a plumb bob and straight edge.

Bricks on the 'fair face' shall be the best available, care being taken that they are not chipped or stained as work proceeds. Bricks shall be laid so as to give a perfectly flat face as tested with a straight edge, and no chipping or rubbing back will be permitted to remedy bad laying.

In the event of fair faced brickwork not being finished with struck joints whilst the mortar is still damp, pointing may be carried out with the approval of the Engineer. In this case all joints shall be raked out to a depth of 20 mm, cleaned free from all loose material and any putlogs filled in. The area to be pointed shall then be thoroughly soaked before pointing takes place, the mortar used being to the satisfaction of the Engineer.

Care shall be taken to keep all brickwork free from mud splashing, mortar, bitumen droppings, etc., and it shall be well cleaned down before being handed over.

If, after the completion of brickwork construction, any of it is found to be out of alignment or level or otherwise not conforming with the permissible deviations specified or otherwise defective, it shall be removed and replaced or repaired by the Contractor, at his own expense, and to the satisfaction of the Engineer.

2.4.5.7 Hollow Block Laying (Curtain Wall Blocks)

Hollow concrete block masonry and any composite masonry shall comply with the requirements of the brick masonry as stated above.

2.4.5.8 Partition Walls and Curtain Walls

Top and ends of full height partition walls shall be securely fastened to beams, slabs, columns, and walls, as applicable, with pre-fixed metal fasteners or holdfasts spaced not greater than 75cm apart unless otherwise indicated. Clearance between top and ends of partition wall and beams, slabs, columns, and walls shall be caulked as indicated or as directed by the Engineer to form a closed continuous joint.

2.4.5.9 Brick Manholes/Rain Inlet and House Connection Chambers

Brick walls for manholes or chambers shall be constructed in an approved bond comprising header and stretcher courses with the fair face on the inside. No false headers shall be built in and only whole bricks shall be used except where closures are required to form bond.

Joints shall be flushed up solid at every course throughout the whole width of each course, which shall be laid on a solid bed of mortar of thickness not exceeding 10 mm, and, if plaster is required, the joints shall be raked out to form a key as the work proceeds for the extent of the area to be plastered.

The walls of a manhole, if so required in terms of the Drawings shall be plastered internally and steel-trowelled to a smooth and true surface free of sharp edges and corners. The thickness of plaster shall be not less than 10 mm and not more than 15 mm. All salient angles and arises shall be slightly rounded, and all internal angles shall be finished true, square, and smooth.

The sockets of channels in manholes shall be filled in with 1:1 stiff cement mortar and the space between the channels finished off with the same mortar. Where two spigot ends abut, they shall have a layer of 1:1 cement mortar under the joint, and the space between the ends shall be filled with 1:1 cement mortar worked in and neatly finished off.

Where a pipe enters a manhole, it shall be thoroughly caulked into the wall and a 400 mm thick brick surround shall be built integral with the rest of the wall in order to ensure a watertight joint between the pipe and the manhole.

Concrete for benching in manholes shall be prescribed mix 20 with 13 mm chips. Semicircular channels and fittings, suitable for the type of pipe laid, shall be placed in position simultaneously with the concrete benching and embedded in it true to grade, level, and line.

All benching and sloping surfaces in the manhole floor shall be rendered in 20 mm thick 1:3 cement mortars and finished smooth, true with a steel trowel, and rounded at corners and edges.

Step irons in manhole walls shall be in accordance with the relevant applicable standards (e.g. BS 1247 or similar) and shall be accurately built into the straight of the wall at 300 mm centers.

2.4.5.10 Brick Pavement

The brickwork in paving shall be laid in 1:4 cement mortar and be made with machine made bricks, and shall be laid to the specified slopes, levels, dimensions, pattern, and bonds as shown in the drawing or as directed by the Engineer.

The widths of mortar joints shall not exceed 12 mm and shall be fully packed with mortar. The brick pavement shall be laid over a layer of mortar of 12 mm thickness, and shall not be disturbed at least for 7 days after it has been laid and shall be kept wet for at least 10 days.

2.4.5.11 Brick Soling

Dry brick soling in foundations and under flooring shall be laid flat over a compacted surface as required, and be made of machine made bricks as specified above. The dry brick soling shall be laid over a cushion of sand of 25 mm thickness unless otherwise shown on the drawings or directed by the Engineer. All joints shall be completely filled with fine sand.

2.4.5.12 Stone (Rubble) Masonry Work

The stones shall be laid in cement or mud mortar or shall be dry masonry as specified to secure close joints coming into close proximity. Construction shall be carried out in accordance with NS 389-2054. All stratified stone possessing bedding shall be laid with its natural bed as nearly as possible at right angles to the direction of load. Face-work groins shall be built to a height not exceeding one meter in advance of the main body of the work and adjacent walling stepped down on either side. Masonry face work between groins shall then be built to a height not exceeding 500 mm above the backing, which shall then be brought up level with the completed face-work. At no times shall the backing be built up higher than the face-work.

Except for dry rubble walling, all joints (gaps) shall be sufficiently thick to prevent stone to stone contact and the gaps shall be completely filled with mortar. Stones shall be clean and sufficiently wetted before laying to prevent absorption of water from mortar.

Placing loose mortar on the course and pouring water upon it to fill the gaps in stones shall not be allowed. Mortar shall be fluid, mixed thoroughly and then poured in the joints. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all its faces completely covered with mortar of the thickness as specified for joints.

The bed which is to receive the stone, shall be cleaned, wetted and covered with a layer of fresh mortar. All stones shall be laid full in mortar both in bed and vertical joints and settled carefully in place. Clean and wet chips and spalls shall be wedged into the mortar joints and bed whenever necessary to avoid thick joints or bed of mortar. Sliding one stone on top of another, which is freshly laid, shall not be allowed. Shaping and dressing of stone shall be done before it is laid in the work. Dressing and hammering of the stones, which will loosen the masonry, shall not be allowed.

In rubble masonry walls the joints shall be broken vertically and staggered bond stones shall be provided through every 1 square meter of faces in each course to the full wall thickness. More than one metre high wall shall not be allowed and constructed at a time. Each stone shall be 150 mm to 250 mm high, 200 mm to 300 mm long and 100 mm to 150 mm wide and the whole masonry work shall be well bonded by cement mortar as mentioned in the Drawings. The faces of all stones showing externally shall be rough hammer dressed to a convex surface. The mortar joints shall be 15 to 20 mm thick. Facing stones shall be uniform in size to give a good appearance, the breadth of face stone being more than the height. Face joints shall be dressed and shall be neatly done. Faces shall be true in plumb.

Finished rubble masonry works shall be wetted by water and prevented from drying out for at least seven days after construction.

2.4.5.13 Stone Soling, Paving, and Pitching

The stone soling of required thickness shall be provided taking care that stones are placed vertically and all voids are filled properly. As necessary, the joints shall be filled with broken stone/gravel so that all stone are firmly placed. The final top shall be properly levelled with sand blinding.

Stone paving shall be pitched by hand and set in places in such a manner as to secure the greatest possible compactness and solidity; the smaller interstices shall be filled in with stone chips firmly wedged in with hammers. Rubble for paving is to be carefully bedded and grouted in cement mortar (1:3) to form an even surface.

Stone pitching shall be laid on a filter layer of gravel. The stones shall be pitched by hand to provide a dense uniform surface with even joints.

2.4.5.14 Scaffolding

Scaffolding required for facility of brick work, stone masonry construction shall be provided by the Contractor at his own expenses. Scaffolding shall be double or single as is warranted for the particular class of masonry. But the ends of the poles should not be placed in the position of header bricks. Scaffolding shall be erected with steel sections, pipes, or bamboo poles of adequate strength so as to be safe for all measures to ensure the safety of work and working people. Any instruction of the Engineer in this respect shall fully complied with. The Contractor shall be entirely responsible for any damage of property or injury to persons resulting from ill erected scaffolding, defective ladders and materials. Proper scaffolding shall be provided to allow easy approach to every part of the work. Put log holes shall be made good by bricks or stones to match that and all holes behind shall be solidly filled in after the work.

2.4.5.15 Curing

All brickwork and stone masonry work erected in cement mortar shall cured with clean water for at least seven days.

2.4.6 Tolerances

The dimensions of brickwork/stonework walls and structures such as manholes shall conform to the tolerances laid down for concrete structures (see Clause 2.3.6), as applicable, or as directed by the Engineer.

2.4.7 Measurement and Payment

Measurement for payment for Brickwork and Stone work walls shall be done in cu.m., and that of soling shall be done in sq.m. unless otherwise indicated in the BOQ. Deductions of all openings, any concrete works in the walls shall be done to arrive at net quantity. No deductions will be made for openings of area up to 0.5 m². Nothing extra shall be paid for making such openings or cuttings to suit concrete structures, walls in any shape other than straight or any cutting necessary for shaping the walls to the structural design requirements. Rate shall be inclusive of all necessary material, scaffolding, watering, labour etc. and disposal of unused materials complete.

The cost for manholes, rain inlets and house connection chambers shall be inclusive of excavation, brick soling, brick work, concrete work, formwork, shoring, plastering, bitumen painting all complete as shown in the drawing.

2.5 METALWORK

2.5.1 Scope

This specification covers metalwork for buildings and other structures; it includes sundry items such as metal doors and windows, etc.

2.5.2 Interpretations

2.5.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 2.3 Concrete
- c) 2.4 Brick/stone work

2.5.2.2 Application

This specification contains clauses that are generally applicable to metal work, corrosion protection, and associated work.

2.5.2.3 Definitions

For the purpose of this specification, the following definitions shall apply:

Coat: A single layer of a corrosion-protection material.

Coating system: The method and degree of surface preparation, the type of coating, the method of application of the coats and the requirements of the completed system.

Normal temperature: A temperature that exceeds 15°C but does not exceed 32°C.

2.5.3 Materials

2.5.3.1 Metal Doors, Windows, Ventilators, Glazed Shutters etc.

Glazed units shall be made from galvanized steel folded sheets sections, anodized extruded aluminum sections or approved equivalent free from rolling defects. All steel doors, windows and glazing shall conform to IS 4351 or equal approved with electro galvanized finish conforming IS 1570 unless otherwise directed. The doors, window and ventilation frame section are made of folded plate as per manufacturer's specification to conform to the drawings.

2.5.3.2 Window Grills, Fences, Railing and Gates.

Mild steel grill, fences, railing and gates of approved pattern and manufacture, all complete, shall be as shown on the drawings or as directed and shall comply with the requirements of IS 800 or equal approved.

2.5.3.3 Collapsible Gates, Rolling Shutters.

These shall be double or single collapsible gates depending upon the size of the opening. The collapsible gates shall consist of vertical channels 20 x 5 mm and top and bottom rails of T-iron 40 x 40 x 6 mm with 38 mm dia. steel pulleys or ball bearings in every 4th double channels, unless otherwise specified. Where a collapsible gate is provided with the opening and is fixed along the outer surface the T-iron at the top may be replaced by flat iron 40 x 10 mm. The collapsible gate shall be provided with necessary bolts and nuts, locking arrangement, stoppers and handles.

Unless otherwise ordered, the rolling shutters shall conform to IS 6248 and be suitable for fixing in the position ordered ie outside, inside, on, below lintel, or between jambs. Shutters up to 12 m² in area shall be manually operated or push up type while bigger sizes shall be of reduction gear type mechanically operated by chain or handles. Laths shall be of 18 gauge best quality mild steel 75 mm wide strips interlocking, rolling centers, machine rolled and straightened with an effective bridge depth of 16 mm. Side guides and bottom rails shall be built up mild steel rolled sections. The spring assembly shall be supported on strong mild steel or malleable cast iron brackets shaped to fit the lintel. The rolling springs shall be from tested unbreakable high tensile steel wire or strip of adequate strength to balance the shutter in all positions. The shutter shall be complete with door suspension shafts, locking arrangement, pulling hooks, handles, and other accessories.

2.5.3.4 Welding Consumables

Welding electrodes shall comply with, and shall be stored and handled in accordance with, the requirements set out in the relevant applicable standards (e.g. BS 639, IS 814). Welding

consumables shall be such that they produce weld metal that has a minimum yield stress and minimum tensile strength at least equal to those of the parent metals.

2.5.3.5 Bolts, Nuts and Washers

Bolts and nuts shall comply with the relevant applicable standards (e.g. NS 57-2044, BS 709, BS 4604, IS 1367, IS 4000) and may be either ordinary black bolts, fitted bolts, or high-strength friction-grip bolts, as applicable. Nuts shall be of at least the strength grade appropriate to the grade of bolt or other threaded element with which they are used.

2.5.3.6 Coating Materials

All coating materials and constituents shall be delivered in the manufacturer's original sealed containers which bear the manufacturer's labels. Each label shall display all the information necessary to ensure correct storage and trace-ability, and instructions for the application of the contents of the containers. Any container showing traces of leakage shall, before use, be rejected together with its contents.

The Engineer may require that the contents of any container be subjected to sample testing. All coating materials held in storage prior to use shall be kept in an approved store, which shall be dry and enclosed. Care shall be taken to avoid the accumulation of old stock.

All Site stores used for the storage of coating material shall be provided with adequate fire extinguishers placed in a prominent and accessible position outside the entrances. "No smoking" signs shall be placed inside and outside such stores. No naked flames shall be permitted inside such stores.

Stores for coating materials shall not, at any time, be used for the accommodation of personnel.

2.5.4 Construction Equipment

Construction Equipment used in handling, fabrication and erection of metalwork shall have enough capacity to ensure that metalwork is placed in its final position without distortion or undue stressing of members.

Construction Equipment for applying the specified coating system shall be suitable for obtaining the specified result. If, however, consistent and satisfactory results are not achieved with the Construction Equipment used by the Contractor, the Engineer may order the Contractor to obtain and use such Construction Equipment as may be necessary to achieve the required results.

2.5.5 Construction and Workmanship

2.5.5.1 Shop Detail Drawings

The Contractor shall prepare shop drawings for the metalwork items and submit them to the Engineer for approval in accordance with Clause 1.7.3.

2.5.5.2 Fabrication

All metalwork shall, before and after fabrication, be within the tolerances specified below, and, unless required to be formed to a particular shape, be flat, straight and free from twist. Any necessary straightening or forming shall be carried out by methods that neither weaken nor deface the material.

2.5.5.3 Assembly

Before delivery to the construction Site, each piece of metalwork shall be distinctly marked, in accordance with the marking diagram, and shall bear such other marks as will facilitate assembly and erection.

2.5.5.4 Setting-out

Before the Contractor commences erection of metalwork on Site, he shall check that the setting-out and the levels of building, are in accordance with the drawings and he shall report any discrepancies immediately to the Engineer.

2.5.5.5 Erection

Before commencing erection of metalwork on Site, the Contractor shall submit to the Engineer, for his general scrutiny and information, full details of the erection procedure and methods of erection.

All pockets that are to receive HD-bolts, fittings or metalwork shall be cleaned out immediately before erection is commenced.

Metal wedges or packing or other leveling devices of adequate strength and rigidity shall be used to support the metalwork.

Before steel sections are embedded in concrete, the complete corrosion protection system shall be applied to each member down to at least 100 mm below the level of the concrete.

2.5.5.6 Grouting and Sealing

Grouting and sealing shall be proposed by the Contractor and approved by the Engineer. Immediately before being grouted or sealed, the space and all pockets under and around the metalwork shall be cleared of all debris and free of water.

2.5.5.7 Execution of Corrosion Protection

2.5.5.7.1 Safety and General Workmanship

The Contractor shall, at all times, enforce adequate safety measures in terms of the legislation applicable to the work Site.

All work shall be carried out by competent workmen under the supervision of an experienced supervisor. No cleaning or coating shall take place when Site conditions are likely to affect these operations adversely.

Equipment nameplates and identification plates shall be protected against damage or over coating.

Any areas not required to be coated shall be masked in such a way that these surfaces are protected during all coating operations.

2.5.5.7.2 Dressing and Repair During Fabrication

All surfaces of welds shall be free from slag, slag inclusions, cracks and holes. Weld profiles shall have a smooth contour, free from irregular projections, undercut and sharp edges. Areas adjacent to welds shall be free from weld spatter and such spatter shall have been removed by grinding or scraping.

All burrs and sharp edges caused as a result of activities such as guillotining, flame cutting, drilling or hole punching shall be removed by chamfering or ground to a smooth radius of at least 1 mm.

2.5.5.7.3 Preparation for Coating

Prior to any other form of preparation, all obvious harmful deposits on the surface of steelwork, such as oil, grease, chemical deposit, clay, bitumen, or mud, shall be removed by a method described below.

- a) Abrasive blast cleaning (sand blasting) shall be carried out in accordance with the methods described in the relevant applicable standards (e.g. BS 4232, SIS 05 59 00). Where sprayed metal coatings are to be applied to steelwork, angular grit shall be used. Dry abrasive blast cleaning shall be carried out on a dry surface. When air is used, it shall be

oil-free, clean and dry. Final blasting shall not be carried out if the steel temperature is less than 3°C above dew point.

All blast-cleaned surfaces that are to be coated shall be so within 4 hrs of blasting unless otherwise agreed to by the Engineer.

In addition to or as an alternative to dry blast cleaning, it may be necessary to apply wet blast cleaning in order to remove soluble salts from the surface of steel that have been exposed to aggressive environments. Such wet blast cleaning is subject to the approval by the Engineer.

- b) Cleaning by hand or with power tools
- c) Degreasing. Liquid-solvent cleaning, solvent-vapor cleaning, alkali, and emulsion cleaning may be carried out at the discretion of the Engineer.

2.5.5.7.4 Latent Material Defects

Before the application of the first coat of a protective system, unacceptable defects such as cracks or laminations, that become evident after preparation of the steelwork, shall be ground out, repaired or the material rejected, as decided by the Engineer.

2.5.5.7.5 Cleaning of Surfaces about to be Coated

No coating shall be applied on a prepared surface that is contaminated with oil, grease, perspiration, rust, or chemical deposits until such surface has been adequately cleaned. Uncoated steel shall not be touched with bare hands. Where contamination has occurred, it shall be removed with an approved solution or cleaning solvent, degreasing shall be followed by rinsing with water to remove residues.

Where any coat has oxidized or become excessively hard, it shall be abraded to a matt finish and cleaned prior to the application of further coats. Unless otherwise approved, coats shall only be applied on moisture-free surfaces.

2.5.5.7.6 Coating System

Paint systems for the various substrates shall be as follows:

Shop applied: 1 coat high build alkyd zinc phosphate primer to a minimum dry film thickness of 75 microns followed by 1 coat alkyd based undercoat to a minimum dry film thickness of 40 microns.

Site applied: 1 coat alkyd based undercoat to a minimum dry film thickness of 40 microns followed by 1 coat decorative alkyd enamel to a minimum dry film thickness of 40 microns.

2.5.5.7.7 Application of Paint Coatings

The method of coating application shall comply with the manufacturer's recommendation and data sheets. Multi-component materials shall be applied with due care, the specified application techniques being used. All coatings shall be substantially free from tears, runs, curtaining, foreign inclusions and material surface defects and shall, in addition, be free from misses. Maximum and minimum inter coat intervals shall comply with the paint manufacturer's recommendations, taking cognizance of ambient conditions.

The colour of each coat shall be different from that of the previous coat. Surfaces that will be inaccessible for coating after fabrication or erection shall receive the full-specified coating system prior to final fabrication or erection. All coating components, particularly two-component or multi-component materials, shall be thoroughly mixed until a homogeneous mixture is achieved. The mixture shall be frequently agitated during application to keep the solids in suspension. The preparation time and pot life of these materials shall be closely adhered to.

2.5.5.7.9 Repair of Damaged Coatings

Damaged areas shall be cleaned down to a metal condition or to an undamaged coated surface.

Spot repairs shall re-instate each of the previous coats, or shall be made using an approved patching material. The patch shall extend at least 25 mm over adjacent surfaces, which shall

have been prepared by feathering with suitable abrasive paper. The repair of metal coatings shall be to a procedure approved by the Engineer.

2.5.6 Tolerances

2.5.6.1 General

The permissible deviations (PD) on the dimensions of components (such as gusset plates, cross bracing, etc.) and on the location of bolt holes in components and elements of a structure shall be + 2 mm. All calculated PD's shall be rounded up to the next whole millimeter. Where alternative PD is quoted the lesser shall apply.

2.5.6.2 Tolerances on Dimensions, Accuracy of Erection, etc.

The tolerances on dimensions, and accuracy of erection, shall be as given below:

- | | |
|----------------------------|------------------|
| a) Length of a member | + 1, - 2 mm |
| b) Out of plumb | < 50 or H/500 mm |
| c) Straightness of members | < 25 or L/500 mm |
| d) Location of fixings | + 3 mm |

2.5.6.3 Dry Film Thickness

At least 90% of all coating thickness measured shall comply with the minimum requirements. Up to 10% of all readings may be below the specified thickness, but may be not less than 70% of the specified thickness. Where DFTs are less than those specified, remedial action shall be taken to build up the thickness to that specified. DFT in excess of the prescribed maxima shall not necessarily constitute a reason for rejection if the paint film is demonstrated to be sound in all respects.

The method used to measure DFT and the significance of the readings for each particular job shall be as agreed upon by all parties prior to commencement of work.

2.5.7 Testing and Acceptance

2.5.7.1 Testing of Metalwork

If requested by the Engineer, test certificates or cast analysis certificates (or both), pertaining to the steel to be used shall be supplied to the Engineer by the Contractor.

The Engineer shall have access at all reasonable times to all places where the work is being carried out and shall be provided with all the necessary facilities for inspection during all stages of fabrication. Welds shall be examined visually to check that there are no uneven leg lengths, no cracking or unacceptable undercutting or porosity and that full fusion has been achieved. Dimensional checks shall be carried out in accordance with the requirements of the relevant applicable standards (e.g. BS 5153).

Only where so required by the Engineer shall welders be tested or destructive or non-destructive tests be carried out.

2.5.7.2 Testing of Coatings

Testing of coatings by the Contractor and inspections by the Engineer shall be carried out in accordance with the requirements laid down in the relevant applicable standards (eg ISO 3233) and as directed by the Engineer.

2.5.8 Measurement and Payment

2.5.8.1 Principles

Work involving metalwork will be measured in Kg., Sq. m. or as a lump sum item as specified in the BOQ, which will include all materials, fabrication, corrosion protection and installation.

2.6 PLUMBING AND HOUSE DRAINAGE WORKS

2.6.1 Scope

This specification covers the general requirements for plumbing and sanitary installation required in general building construction.

2.6.2 Interpretations

2.6.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 3.3 Pressure Pipelines
- c) 3.4 Sewers

2.6.2.2 Application

This specification contains clauses that are generally applicable to plumbing, sanitary installations, house water supply and drainage work, and associated work.

2.6.3 Materials

All pipes, fittings, and sanitary ware shall be of selected quality approved by the Engineer. It shall be suitable for the intended purpose and appropriately matched to each other. All pipes, fittings, and sanitaryware shall be supplied complete with all necessary fixing, coupling, and jointing material.

Pipes for water supply shall be of galvanized seamless steel, cast or spun iron, ductile cast iron, PVC, HDPE, or other method approved by the Engineer and shall be jointed by fitting, screwing, or welding, as applicable.

Pipes for drainage may be cast iron, ductile cast iron, vitrified clay (glazed earthenware), PVC/PE, AC, concrete, or other method approved by the Engineer.

All fittings shall be supplied according to the pipes required, whether or not specifically called for in the drawings.

All sanitary equipment, lavatories, cisterns, urinals, toilets, water fountains, floor drains, gullies, petrol and oil traps, etc., shall conform to the relevant applicable standards as shown below or equivalent.

NS 246-2048 & NS 383-2054	: cast iron drain pipes and fittings
BS 1211	: spun iron pipes and fittings
NS199-2046	: galvanized pipes and fittings
NS 40-2040	: HDPE pipes and fittings
NS 206-2046	: PVC pipe and fittings
NS 104-2042	: covers and frames
IS 774, IS 2556	: white ceramic sanitary ware
BS 1010 part 2 or IS 781	: stopcocks & taps

2.6.4 Construction Equipment

The apparatus used for the line, level, and positional control of pipe laying and installation work shall be accurate, sturdy, and in good operational condition. The Contractor may use any acceptable device for such control.

In addition to the pumps, gauges, storage tank, tools, pipes, fittings, specials, and bracing necessary for the tests required, the Contractor shall provide all plugs for the temporary stopping off of pipelines for the purposes of testing.

2.6.5 Construction and Workmanship

2.6.5.1 Sanitary Fixtures

All fixtures specified or shown on the drawings shall be furnished and set by the Contractor in a neat and workmanlike manner, making connections with all supply, waste, soil and vent pipes, as specified or as directed. General requirements for fixtures shall be the following:

A sample of each type of fixture shall be subject to the approval by the Engineer. The samples shall be completely fitted and set up at the building or in some other convenient approved place.

The approved fixture samples shall not be removed and shall be protected at all times during the construction period for comparison purposes. All fixtures of poorer quality than the approved samples will be cause for rejection.

All ceramic fixtures shall, unless otherwise shown on the drawings or directed, be of white vitreous china thoroughly fused, producing a white material which, when fractured, shall show a homogeneous mass with close grain and free from pores. All surfaces coming in contact with walls, floors, or surfaces of other fixtures shall be reasonably flat.

Enamelled cast iron shall be of an approved quality and thickness. Porcelain enamel coat shall be applied so that the enamel will be smooth, of even thickness, white and free from craze, discolouration and chips. Exterior exposed surfaces not required to be enameled shall be treated with one coat of filler at the factories. The Contractor shall be responsible for any revisions of connections required to adapt the roughing sleeves and openings to the particular fixture he proposes to use.

All fixtures shall bear the manufacturer's guarantee label or trademark for identification purposes.

All fixtures requiring hot and cold water shall have the cold-water tap on the right hand side of the fixture and the hot water on the left hand side of the fixture.

All fixtures shall be of the same manufacture, unless otherwise directed by the Engineer.

The location of each fixture and the fixing method of ceramic fixtures shall be as shown on the drawings or as directed by the Engineer.

After fixtures have been mounted, the Contractor shall before leaving the job, thoroughly clean all fixtures furnished and mounted under this contract, remove all plates, stickers, rust stains and other foreign matters or discolourations on fixtures, leaving every part in perfect condition and ready for use.

2.6.5.2 Piping

The Contractor shall submit to the Engineer a piping diagram for approval. This diagram shall show the symbols of the sanitary fixtures connected with both, the potable water supply and the drainage system. Valves, diameter of pipes, materials, etc., shall be indicated in the diagram. The limit of the work to be executed inside the building shall begin and end 1 m beyond the outer line of the structure, unless otherwise directed.

All supply lines shall be designed for a nominal pressure of 1 MPa (10 bar), unless otherwise directed.

Before covering the pipes, pressure tests shall be carried out to the satisfaction of the Engineer.

The wastewater shall be drained through septic tank, soak away drains or pits, or drainage system, as applicable, by use of vitrified clay pipes or PVC/PE pipes as directed or shown on the drawings. Great care shall be taken in setting out and determining the general levels and falls of drain pipes, so that a fall giving a self-cleaning velocity shall be obtained.

2.6.5.3 Fixing

W.C. commodes shall be fixed to the floor with C.P. brass screws or by means of 75 mm long 6.5 mm dia counter sunk bolts and nuts embedded in the concrete floor or as per the instruction

of the Engineer. The base of the pedestal of the commodes shall squarely rest on the finished floor. Any gap between the finished floor and the pedestal shall be filled with white mastic mixed with pigment to match the shade of floor or as directed by the Engineer.

The W.C. Pan (Indian or Orissa) shall be laid in floor sloping towards the pan in a workmanlike manner, care being taken not to damage the W.C. pan, etc. in the process of fixing. If damaged in any way, it shall be replaced at no cost to the Employer. The pans, etc. shall be fixed on a proper base of cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone ballast of 20 mm nominal size) taking care that the cushion is uniform and even without having any hollows between the W.C. pan and finished floor. The work shall be neatly done and no hair cracks shall be visible. Joint between the outlet of the W.C. pan and ceramic 'P' or 'S' trap shall be made with neat cement, yarn, linseed oil, white lead and waterproofing compound and made leak proof. The outlet of the ceramic traps shall be centrally placed in the rubber gasket of the socket of the HDPE pipe and shall have no leakage.

Flush valves shall be installed exposed as shown on the drawing, in accordance with the manufacturer's instruction or as directed by the Engineer. The C.P. long flush bend pipe shall be fixed to the water closet with the help of a rubber adapter and shall show no signs of leakage.

Washbasins shall be supported on bracket(s) as per the manufacturer's instruction and/or on vitreous china pedestals or as directed by the Engineer. There shall not be any gap between top edge of the basin and finished face of wall.

Urinals shall be fixed to the wall by means of C.P. brass screws as per the manufacturer's instruction and/or directed by the Engineer. There shall not be any gap between the back edge of the urinal and finished face of the wall.

2.6.6 Tests and Acceptance

All water services shall be subjected to a hydraulic test pressure 1.5 times the working pressure maintained for a period of two hours during which time there shall be no appreciable drop in pressure and no visible leakage.

All soil waste and vent pipes shall be subjected to an air test as described in Clause 3.4.7.

All drainage pipe work shall be subjected to a hydraulic test pressure of 150 mm head at the highest fitting, maintained for a period of four hours there shall be no appreciable drop in pressure and no visible leaks.

The Contractor shall include for providing all necessary appliances and labour at these tests.

All water service pipe work shall be flushed through upon completion of installation, to ensure cleanliness.

All drainage pipe work shall be rodded through upon completion of installation to ensure cleanliness.

2.6.7 Measurement and Payment

The transport to Site, handling, laying and jointing of pipes and fittings, including inspection, cutting, turning, welding, supply and installation of metallic tape etc., will be measured throughout the overall length without deduction for valves etc. and will be paid for by the linear meter of work performed depending on the pipe types and diameters of pipe to be installed.

The installation of stop valves, air valves, washouts, hydrants etc. will be paid by the number installed.

Testing and disinfection of mains will be paid per linear meter of work performed depending on the pipe diameter (only when specifically mentioned in the BOQ).

An extra item will be paid for connections to be made to existing pipelines, depending on the diameter of the existing pipe.

2.7 FINISHES

2.7.1 Scope

This specification covers the general construction requirements for finishes, such as plastering, flooring, painting, roofing, water proofing, etc., required in general building construction (e.g. operators quarters, guardhouse, etc.).

2.7.2 Interpretations

2.7.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 2.2 Earthworks
- c) 2.3 Concrete
- d) 2.4 Brickwork/Stonework

2.7.2.2 Application

This specification contains clauses that are generally applicable to finishes on walls, floors, and roofs of buildings and associated work.

2.7.3 Materials

Cement, sand, water, and coarse aggregates required for finishing work shall be as mentioned in clause 2.3.3 under concrete works.

Ceramic tiles shall be 200 x 100 x 6 mm size unless otherwise shown or specified on the drawings or directed by the Engineer. They shall either be ceramic vitreous tiles, with colours as selected by the Engineer, or approved glazed tiles conforming with IS 777 or equivalent. Granular material (e.g. marble chips) for in-situ flooring, screeds, and skirting shall be as approved by the Engineer.

The Contractor shall submit samples of tiles for selection and approval by the Engineer, and all tiles used shall conform to the approved samples with regard to size, quality, texture and colour.

The materials for painting and colour washing of internal and external walls and similar surfaces shall conform to the requirements of the relevant applicable standards (e.g. IS 5410 or equivalent). The Contractor shall get prior approval of the Engineer of the brand and shade of all paint materials.

Pigments and other necessary additives to produce coloured plasters and mortars shall conform to the relevant applicable standards (e.g. IS 57 or equivalent) and shall be applied the rate of 1% by weight of cement or to produce a colour and texture indicated on the drawings or as directed by the Engineer. The sample of such colour plaster shall be subjected to approval of the Engineer before applying in the work.

Caulking compounds shall be of approved manufacture such as to provide a continuous waterproof barrier installed with exposed caulking smoothly recessed from the finished steel or brick surface.

Corrugated Galvanized Iron (CGI) sheets and ridge for the roofing shall be of 26 gauge thickness having heavy coating meeting the requirements of NS 141-2042. There should be NS mark on the sheets. Brand of the CGI sheets shall be approved by the Engineer prior to its placement.

2.7.4 Construction Equipment

Construction Equipment shall be suitable for applying the specified flooring and coating systems and for obtaining the specified results. If, however, consistent and satisfactory results are not achieved with the equipment used by the Contractor, the Engineer may order the

Contractor to obtain and use such Construction Equipment as may be necessary to achieve the required results.

2.7.5 Construction and Workmanship

2.7.5.1 Plaster

The surface to be plastered shall be brushed clean. Mortar joints of brick/stone masonry or hollow concrete walls to be plastered shall be raked to a depth of approximately 12mm, and the surface brushed down with a stiff brush and thoroughly wetted. The surface shall be free of all dust, loose materials, grease, etc.

Before starting plasterwork, the contractor shall prepare a sample panel of plastering of a size at least 1 m² for the approval of the Engineer. The sample shall be prepared in an area designated by the Engineer. The Contractor shall obtain approval before starting work and preserve the approved sample intact until all plastering is completed.

Plaster shall be applied in two coats. The thickness of the first coat shall be just sufficient to fill all unevenness of the surface. The first coat shall be applied with even, firm pressure to ensure good bond, shall be cross-scratched and shall be moist cured. After the first coat has properly cured, and been allowed to dry thoroughly, the surface shall be dampened before applying the finish coat. The finish coat shall be steel trowel finished to a smooth, even, burnished surface, completely free from defects or trowel marks. The thickness of plaster in total shall not be less than 12 mm. Wall plastering shall be started from top and work down to the floor. Ceiling plastering shall be completed before starting the wall plastering. To ensure uniform thickness and vertical plaster face, plumb guider strips may be applied as required.

If required to achieve the smooth, burnished finish, the surface shall be finished with lime putty of just sufficient thickness to fill in uneven surface or defects due to coarse sand in the plaster mix. Lime mortar finish shall be applied immediately after the finish has set sufficiently firm.

In order to obtain additional strength at external angled corners, the corners shall be dusted with cement during the steel trowel finishing of the finish coat.

Care shall be taken to ensure that finished plaster surfaces shall be plumb, square, straight, and true to line. All arises and corners shall be straight, clean, and sharp.

Curing of Plaster works

Moist curing shall be accomplished by keeping the plaster uniformly damp by suitable means. Moist curing shall start during application and continue for not less than 7 days.

Approval by the Engineer of Plaster Work

All plasterwork shall be subject to approval of the Engineer, and work failing to meet the requirements of the specifications or not being to the satisfaction of the Engineer shall be removed and reapplied at the Contractor's expense.

2.7.5.2 Pointing

Where external faces of the mortared masonry work will be backfilled or otherwise permanently covered up, the mortared joint shall be finished flush to the faces of the adjacent brick/stone work.

Where mortared masonry faces will remain exposed or as specified in the drawings and BOQ, the mortar joints shall be pointed to a consistent style to the approval of the Engineer. Pointing shall be carried out using 1:3 by volume of cement and sand or as shown in the drawing. The mortar shall be filled and pressed into the raked out joints before giving the required finish. The pointing, if not otherwise mentioned, shall be ruled type for which it shall, while work is still green, be ruled along the center with half round tools of such width as may be specified by the Engineer. The excess mortar shall, then, be taken off from the edge of the lines and shall not be unnecessarily plastered over the exposed stone/brick works.

2.7.5.3 Tiles

Wall surface shall be brushed clean, wetted, and fitted with an approximately 12 mm thick level and plumb scratch coat of cement mortar 1:3 applied in accordance with Clause 4.1. The scratch coat shall be moist cured for at least 24 hrs before the application of a floating coat. Before applying this floating coat, the scratch coat shall be thoroughly wetted. The floating coat, a plastic mix of neat cement of approximately 3 mm thickness shall be applied even, and with screed to true plane. The floating coat shall be applied over areas no larger than can be covered with tiles while the mortar is still plastic (half set). Glazed tiles shall be soaked, completely immersed in clean water, at least 30 min. and drained.

Tiles shall be installed by applying a skin coat of a plastic mix of neat cement to backs of tiles and firmly pressing them into the floating coat to true plane and position. White cement shall be used for the skin coat where white joints are required.

Tiles shall be installed by dusting a thin layer of dry cement over the setting bed worked lightly with trowel or brush until damp, and tiles shall then be set with straight uniform joints 1 mm or less in width, accurately aligned in both directions and tamped solidly to the bed.

During the process of setting tiles, continuous horizontal and vertical cuts every 40 to 60 cm shall be made through the floating coat while plastic, using the point of a trowel turned edge wise. Care shall be taken to prevent cutting into the scratch coat.

Where full size tiles cannot be laid, they shall be cut (sawn) to the required size and the edges rubbed smooth to ensure a true and straight joint.

Joints in tile work shall be accurately aligned with horizontal joints level and vertical joints plumb. The joints shall be maintained uniformly wide by aligning spacer lugs on tile edges if tiles are so manufactured or by use of wetted strings.

The layout of tile work shall be so that no tile less than half size occurs. Where tiles must be cut at edges or penetrations, the cut edges shall be carefully fitted and neatly ground. No chipped, cracked or broken tile shall be used and all defective work shall be replaced and repaired to the satisfaction of the Engineer and at the Contractor's expense.

After tiles have been set firm and joint strings removed, tiles shall be dampened and joints grouted full with a plastic mix of neat cement by trowel, brush or finger application. Unless otherwise directed, grout shall be made with white cement. During grouting all excess grout shall be cleaned off the tile surface with damp cloth sponges.

Where the setting bed is applied directly to a concrete slab, the slab surface shall be thoroughly wetted, with no free water left standing, and sprinkled with dry cement. The setting bed shall be 1:5 cement mortars and shall be placed to the required level, grade and slope and tamped firmly. Cement mortar at a rate of 4.4 kg per square meter shall then be spread. The floor tiles shall then be placed in position and tapped with a wooden mallet until the tiles are properly bedded in line and level.

Where the setting bed is applied over a waterproofing membrane, metal reinforcing wire mesh shall be installed lapped at least one full mesh at edges and supported so as to be located approximately mid-height of setting bed. At edges where wall tiles are foreseen, the mesh shall be turned up at least 80 mm.

All finishing tile work shall be adequately protected from damage during the progress of construction and any damage shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

2.7.5.4 Cast In-situ Floors, Screed, Skirting

Before placing of in-situ concrete flooring, the base shall be made rough and watered, and given a cement wash. A first concrete layer shall then be laid to the depth required. After laying, the concrete shall be compacted by hand or mechanical means, and leveled with wooden floats. Within one hour of laying the bottom layer, the second and finishing layer shall be placed

and the surface tamped lightly, before finishing it off perfectly level with a straight edge float and trowel. The finishing layer shall consist of cement-sand mixed at 1:1.

Cement skirting shall consist of 20 mm thick cement mortar mixed at 1:3 (cement: sand). The cement skirting shall be applied to the wall surface to the line, levels and dimensions, and finished with a floating coat of neat cement.

Curing and protection of cast in situ floor shall be in accordance with the requirements of Clauses 2.3 and 2.7.5.1.

2.7.5.5 Waterproof Cement Paint

The contents of each fresh container of the paint shall be loosened by rolling or shaking the container before opening for the first time. To one volume of water in a clean container, an equal volume of cement paint shall be added and stirred well to achieve a uniform consistency. No further dilution will be permitted.

The cement paint powder shall be kept secured from exposure to atmosphere by properly tying up the polythene liner in the container and keeping the lid firmly closed.

The cement paint shall be used within two hours of mixing and shall be kept stirring during use.

For application, the base surface shall be cleaned by use of a stiff brush to remove loose dust and dirt. The base surface shall be thoroughly wetted and water allowed to run off.

The first coat shall be well brushed in a manner to give a good bond of the paint with the surface. The second and subsequent coats shall be brushed or sprayed as approved. The cement paint shall be applied at the following, but not limited, rate:

- | | |
|-----------------------------|-----------------------|
| a) on brickwork | 2 kg/m ² |
| b) on in situ concrete | 3.5 kg/m ² |
| c) on concrete blocks | 2 kg/m ² |
| d) on cement sand rendering | 3.2 kg/m ² |

The curing of the waterproof cement paint shall be carried out by application of fine water spray at an interval of 6 to 8 hrs after the application of the paint for duration of at least 7d.

The finished surface shall be protected from any damages, staining, etc., by approved means.

2.7.5.6 Oil Bound Distemper

All plaster surfaces shall be thoroughly cleaned and shall receive 3 or more coats. The first coat shall be a prime coat. The second and third coats shall be of oil bound distemper of approved colour, shade, and quality, and shall be mixed in accordance with the manufacturer's recommendations.

After these operations, if the work is not to the satisfaction of the Engineer, one or more coats shall be applied without extra cost to the Employer until a smooth and even surface is achieved and approved by the Engineer.

2.7.5.7 Distemping

Distemper shall be dry distemper as approved by the Engineer. The distemper shall be mixed with clean water as recommended by the manufacturer and shall be stirred until the mixture attains an even consistency.

The surface shall be cleaned, cracks and holes repaired, all irregularities and inequalities sand papered smooth and wiped clean to present a fine smooth surface which shall be completely dry before distemping is started.

The mixture shall be applied evenly with a brush in long parallel strokes evenly so as not to leave any visible brush marks.

The surface of this first application shall be allowed to dry and harden. Then the second coat shall be applied on the first coat. If a uniform surface is not achieved, a third coat shall be applied.

2.7.5.8 Plastic Emulsion Paint

The surface shall be prepared as specified for oil paints. First, a priming coat of primer as specified by the manufacturer shall be applied.

The second and third coats of plastic emulsion paint of approved shade and manufacture shall be applied to achieve an even surface. If the finish is not to the satisfaction of the Engineer, more coats shall be applied at no cost to the Employer to achieve a smooth and even surface.

2.7.5.9 Ready-mixed Enamel Paint

Surfaces to be painted shall be dry, free from dust and dirt, and rubbed smooth by means of sand paper or pumice stone to the satisfaction of the Engineer.

The paint shall be ready-mixed synthetic enamel or oil paint of approved make and manufacture. The primary coat shall be applied evenly with a brush. After the primary coat is applied and perfectly dried, all holes, cracks etc. shall be filled with putty and the surfaces sand papered. A second coat of paint of approved shade and manufacture shall then be evenly applied and allowed to dry. The third coat shall be carefully applied as and when required, to achieve a smooth and even surface.

2.7.5.10 French Polish

The work shall be first cleaned and sandpapered thoroughly. It then will be painted with a 'filler', composed of ethylated spirit, and sandpapered.

A thin coat of French Polish shall then be applied and sand papered. Subsequent coats of French Polish shall be applied till the proper finishing is achieved to the satisfaction of the Engineer.

2.7.5.11 Roofing

A water proofing coating on bare reinforced concrete roofs shall be bitumen based and shall be applied in two layers of primer and one layer of finishing coat in accordance with the manufacturer's instructions and recommendations.

Such coating shall be applied by brushing, spraying, or roller application and shall be placed on concrete which has been cured and has reached an age of not less than 3 months.

If not otherwise shown on the drawings or directed by the Engineer, the prime coats shall be applied at a rate of approximately 0.85 l/m² and the final coat at a rate of about 1.2 l/m².

Care shall be taken in connection with drains, gutters, etc. to achieve proper flashing and lapping with the bitumen coating.

CGI roofing sheets shall be secured to the purlins firmly by using J-hooks, nuts, and bitumen washer. Side lap shall be half corrugation and the end lap shall be minimum 15 cm. Ridges of thickness same as of CGI sheets shall be fitted and fixed neatly same as of CGI sheets.

2.7.6 Tolerances

The tolerances for flooring work shall be as described in Clause 2.3 and for paintwork as described in Clause 2.5, as applicable, unless otherwise agreed between the Contractor and the Engineer prior to the commencement of the work.

2.7.7 Measurement and Payment

2.7.7.1 Principles

Finishing work will be measured as the net areas covered and no deductions made for openings of area up to 1.5 m². Separate items will be scheduled for each type of finish, and for different location of application, if such location will substantially effect the pricing. Doors,

windows, glazed partition walls will be paid for by area measured across the whole surface, without deducting unpainted fillings such as glazing, plastic coated boards, etc. Measurement for payment of CGI roofing shall be on area of roofing. The rate shall include the cost of side and end lap, ridge, hooks, washer etc. and workmanship all complete.

2.8 CARPENTRY AND JOINERY WORKS

2.8.1 Scope

This specification covers the general construction requirements for timberwork, carpentry and joinery, required in general building construction (e.g. guardhouse and operators quarters at reservoir sites).

2.8.2 Interpretations

2.8.2.1 Supporting Specifications

The following specifications shall, inter alias, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 2.3 Concrete
- c) 2.4 Brick/stone work

2.8.2.2 Application

This specification contains clauses that are generally applicable to timber works, carpentry and joinery for buildings and associated work.

2.8.3 Materials

Timber for general purposes shall be approved hardwood of the best quality generally complying with IS 1326, Grade1, or similar and planed on all sides. The timbers shall be impregnated with an odourless wood preservative.

Unless specified elsewhere or otherwise directed, the frames, architraves, etc., of doors and windows, etc., shall be of well-seasoned wood free of knots, fissures, and decay. Local wood of equivalent quality shall be used whenever possible.

Door shutters shall be of chipboard or blackboard of approved quality having both sides faced with either commercial ply 5 mm thick or other approved veneering. Samples of such shutters shall be submitted for approval.

The fittings and fixtures like hinges, hooks, anchors, locks, handles, key plates, keys, doorstops, etc., shall be of brass and of best quality and manufacture. The Contractor shall submit samples of such fittings and fixtures well in advance for approval.

Timber and other wood material shall be straight, sound, bright, or mature growth, well-seasoned and conditioned to suit the particular purpose, for which it is to be used. The material shall be cleanly sawn, square edged, and free from injurious shakes, splits, warps, waness and knots, soft spots and rot, incipient decay and all other defects.

For the structural components which will be concealed after installation, e.g., in the case of built-in cupboards, wardrobes or wall linings, either the type of wood specified for the unconcealed structural components (spruce, fir, pine or a wood of at least equal quality) or an equally suitable material may be used at the Contractor's own choice, unless otherwise specified.

The timber shall be in a suitable condition so that the components made of it will neither crack, warp nor twist. The moisture content of timber assemblies when leaving the manufacturer's works shall be as follows (referred to the oven-dry weight):

- a) 8 to 12% for interior finish components
- b) 10 to 15% for structural parts in permanent

connection with the outside air.

Proof of this moisture content shall be furnished to the Engineer.

For plywood and wood chipboards, all surfaces to be veneered or seal coated shall be adequately closed.

Wooden fiberboards, veneers, coating slabs and coating foils of plastics shall be suitable for their intended applications.

Adhesives (glues) shall not cause any discolouration or other damage.

Sealing compounds shall be resistant to atmospheric influences, shall not harden and shall not be aggressive. All fittings such as hinges, hooks, anchors, locks, handles, key plates, keys, etc., shall be submitted to the Engineer in good time for approval.

All coating materials shall form a good bond with the base. Their surface shall be readily brushable and insensitive to wiping contact.

All polish (polishing varnish) shall be fast to light and unsuitable condition so that it provides a surface which is elastic to the greatest possible extent and resistant to scratches, water, acid and heat.

Wood preservatives shall be of an officially approved type. Where subsequent painting of the timber is required, the wood preservative shall be compatible with the paint. In interior applications, the wood preservative shall be odourless.

Treated lumber shall be accompanied by a certificate from a recognized lumber treating company, certifying the amount of treatment and the percentage of moisture after drying.

2.8.4 Construction Equipment

Equipment, and tools for the execution of timber work, carpentry and joinery shall be sufficient in number and capacity, in good working order, and in accordance with the requirements of the applicable safety regulations.

2.8.5 Construction and Workmanship

If not otherwise shown on the drawings, or directed by the Engineer, DIN 18334 shall be binding for the execution of the Works as well as the other DIN Standards as follow:

DIN 1052	Timber Structures
DIN 68365	Timber for Carpenters' Work, Quality Specifications
DIN 4074	Timber for Wood Building Components
DIN 68800	Timber Protection in Building Construction
DIN 17440	Stainless Steel; Quality Specification
DIN 18202	Dimensional Tolerances in Building Construction,

Timber as specified shall be jointed and erected in accordance with DIN 1052 and the drawings, including the required wind bracing. Posts shall be fixed to the concrete slab by means of bearing plates, straps and angles according to the structural calculations. Only non-rusting steel according to DIN 17440, Material No. 1.4571 shall be used for fixing components.

The Contractor shall supply to the Engineer shop drawings in accordance with the architectural design and Contractor's static analysis, which are subject to approval before any execution starts.

All structural components shall not warp or crack under any circumstances including stresses due to temperature and humidity that will have to be expected.

All timber connections and meters shall be accurately fitted. The surface exposed to view shall be trimmed, e.g. by planing and grinding. There shall be no plane cutting marks.

Solid timbers shall be joined in such a way that in the event of variations of air humidity, the wood is free to swell and shrink without affecting the joint.

Framing timbers shall not be butted. Dovetailing may be used subject to the Engineer's consent.

All edge surfaces of plywood, wood-chipboards and composite slabs exposed to view shall be veneered or provided with banding (insets or strips). On sealed, veneered and coated surfaces joints and irregularities of the base shall not show even after final drying.

All grained veneers shall be protected against tearing. All timbers ultimately in contact with outside air, or permanently in contact with particularly humid air, or connected to masonry or concrete, shall be treated on all sides with suitable wood preservative before being inserted. The manufacturer's instructions shall be observed.

2.8.6 Test and Acceptance

A selection of samples for visual inspection and dimensional checks on material and fittings may be made by the Engineer. Supplier's material and test certificates pertaining to the material to be used shall be supplied to the Engineer by the Contractor. The Engineer shall have access at all reasonable times to all places where the work is being carried out and shall be provided with all the necessary facilities for inspection during all stages of manufacture or construction.

2.8.7 Measurement and Payment

2.8.7.1 Principles

Generally, the items shall be measured in-situ. The method of measurement shall be based on the following:

Payment for windows and doors shall be made by number for each type and size. If items scheduled call for measurement by area, architraves linings, sills etc. shall not be measured separately but shall be considered as being included in the area of the opening closed by the window, door, shuttering or any other specified closure. Wooden frame shall be measured in unit rate per cubic meter. Where as the doors and window shutter shall be in unit rate per square meter. In case of fixed glazing work frame work in cubic meter and glazing work in square meter shall be measured separately

Wall panels or linings will be paid for by area. The unit rate shall include all substructure, fasteners, doweling etc.

All costs for hardware and iron ironmongery shall be included in the unit rate of the relevant bill item.

2.9 ELECTRICAL INSTALLATIONS

2.9.1 Scope

This specification covers the general standards to be achieved when installing lighting and small power systems. i.e. guardhouse, operators quarters and site lighting. All materials and workmanship on the NEA power system shall be as per NEA practice.

2.9.2 Interpretations

2.9.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 2.2 Earthworks

2.9.2.2 Application

This specification contains clauses that are generally applicable to electrical installations and associated work.

2.9.2.3 Abbreviations

Wherever the following abbreviations are used they shall have the meanings below:

Institutional:

AIEE	-	American Institute of Electrical Engineers
BSI	-	British Standards Institution
DIN	-	Deutsches Industrie Normen
IE	-	Indian Electricity Rules
IEC	-	International Electro-technical Commission
ISO	-	International Organisation for Standardisation
ISI	-	Indian Standards Institute
NEA	-	Nepal Electricity Authority
NEC	-	US National Electrical Code
NEMA	-	National Electrical Manufacturers' Association

Technical :

R	-	red phase
Y	-	yellow phase
B	-	blue phase
ac	-	alternating current
dc	-	direct current
A	-	amp
mA	-	milliamp
V	-	volt
HRC	-	High Rupturing Capacity
kW	-	kilowatt
kVA	-	kilovolt amp
kWh	-	kilowatt hour
MVA	-	mega volt amp
Hz	-	hertz (cycles per second)
SP	-	single pole
SPN	-	single pole and neutral
DP	-	double pole
TP	-	triple pole
TPN	-	triple pole and neutral
SPSwN	-	single pole and switched neutral
TPSwN	-	triple pole and switched neutral
MCB	-	miniature circuit breaker
MCCB	-	moulded case circuit breaker
RCD	-	residual current device
GES	-	General Electric Standard

2.9.3 Materials

2.9.3.1 Low Voltage Distribution Boards

Low voltage distribution boards shall be of fabricated sheet metal construction, arranged for conduit and/or cable entry as required, fully rustproofed, painted to an approved finish and protected against ingress of solid foreign bodies and liquid according to IEC Recommendation 144 Degree IP 32. All boards shall be rated as required and shall conform in all respects with IS 13947. Exterior boards shall be protected to IP 65.

Low voltage distribution boards shall have banks of fuses or miniature circuit breakers which are easily removable and readily accessible for easy wiring. All boards shall have 25% spare

ways fitted within the case. Incoming supplies to the distribution board shall enter by means of a lockable isolator, switch fuse, residual current device or moulded case circuit breaker.

Boards which has feeders looped in or out at the busbars shall have double terminal blocks on each busbar.

All boards shall have insulating barriers installed between phases and between each phase and earth.

When required suitable holes/knockouts shall be provided to the top or bottom of the board to accommodate all incoming and outgoing cables through rubber washer glands.

Distribution boards shall be fitted with a permanent label giving details of fuses or miniature circuit breakers when their replacement by equipment of other makes or types would adversely affect the protection or discrimination provided.

2.9.3.2 Fuses

Fuses shall be categorised as AC 80, 660 volt to IS 13703. Fuse carriers and bases shall comply with IS 13703 Part 2.

2.9.3.3 Miniature and Moulded Case Circuit Breakers

Miniature and moulded case circuit breakers shall comply with IS 13032 and IS 13947 respectively. All breakers shall be selected in accordance with the Indian Standards with due regard to operating characteristics, current rating, calibration and discrimination. Adequate back-up protection by HRC fuses shall be provided.

Miniature circuit breakers shall be unconditionally rated at a category of duty M6 or higher. The effect of ambient temperatures, operating duty, and application shall be fully considered in applying de-rating factors for application at site.

Miniature and moulded case circuit breakers shall have means for preventing any one pole of a multi pole circuit breaker being operated or tripping independently of the other poles.

Miniature and moulded case circuit breakers shall have locking facilities and be supplied with all keys, or shall be enclosed in cases with locking facilities which shall be provided with keys. Miniature and moulded case circuit breakers shall be of the same type throughout the Contract.

2.9.3.4 Residual Current Circuit Breakers

Residual current operated devices are to be either 3 phase and neutral or 1 phase and neutral. Both types will be of the circuit current rating and rated tripping current as stated elsewhere in this Specification or on the drawings. Either type must isolate all poles and neutral and be complete with a test button marked 'PUSH TO TEST'. The unit must be of robust construction and be mounted in an enclosure of pressed steel.

Where residual current circuit breakers are used they shall be of the AC/DC current operated type complying with IS 12640 when incorporated in fixed socket outlets, except that they shall be suitable for the service conditions as defined at site.

2.9.3.5 Cables

All cables shall be manufactured to Nepalese Standards

(i) Low voltage (600/1 000 V grade)

PVC/SWA/PVC and XLPE/SWA/PVC multi-core cable. Installed direct in the ground, in ducts, on tray or clipped direct. Aluminium wire armouring shall be used for single core cables.

(ii) Low voltage (600/1 000 V grade)

PVC/PVC multi-core cable to BS 6346. Installed in floor ducts, trunking or conduits.
PVC single core non-sheathed (450/750 V grade). Installed in conduit or trunking.
PVC single core non-sheathed (600/1 000 V). Installed as internal wiring within switchgear and control assemblies.

(iii) Instrumentation

PE/PSCR/OSCR/PE/SWA/PVC Plain annealed multi-stranded copper conductors, solid polyethylene insulation with aluminium-mylar pair screening including drain wire, with collective aluminium mylar screen including drain wire, solid polyethylene bedded steel wire armour with an outer sheath of flame retardant PVC. PVC sheath to be blue colour for intrinsically safe circuits, black for ac and dc non-intrinsically safe circuits, 300/500 V grade.

(iv) Control Digital

PE/OSCR/PE/SWA/PVC Plain annealed multi-stranded copper conductors, solid polyethylene insulation collective aluminium mylar screen including drain wire, solid polyethylene bedded steel wire armour with an outer sheath of flame retardant PVC. PVC sheath to be blue colour for intrinsically safe circuits, black for ac and dc non-intrinsically safe circuits, 300/500 V grade.

2.9.3.6 Site Lighting

Poles shall have:

- (i) A weatherproof access door to the base compartment, fitted with tamper proof lock, to provide easy access to the equipment. The doors shall be inter-changeable between poles without adaptation, and keys shall be supplied. Doors shall be provided with an earthing terminal for connection of an earth continuity conductor to the earth terminal block installed in the base compartment.
- (ii) A non-rusting earthing terminal bar near to the point of electrical supply and clearly marked 'earth'. This terminal shall be capable of accommodating an earth continuity conductor not less than 6 mm² nominal cross sectional area.
- (iii) Cable slot entries of not less than 150 mm long by 50 mm wide. The top of the slots shall be no more than 350 mm below ground level.
- (iv) A treated baseboard, within the compartment, of suitable size to accommodate all necessary control gear, cable terminations and looping type fuse service cut out. The baseboard shall be securely fixed within the pole.

Cutouts housed in the base compartments of lighting poles shall be designed primarily for use in street lighting poles and shall be suitable for termination or looping-in of the cables used. They shall consist of a substantial moulded plastic drip-proof enclosure with separate terminals for live, neutral and earth conductors, and incorporate a fuse carrier suitable for a fuse to IS 13703. Terminals shall be large enough to take the service cables used.

Three way type earth terminal block capable of accepting a cable size up to 6 mm². shall be fixed to the base board adjacent to the cut-out. The terminal block may be incorporated within the cutout.

Ballast units shall comply with IS 1534 and shall be drip-proof, totally enclosed, polyester filled, symmetrically wound type, silent in operation, and suitable for use on a 240 volt 50 Hz supply. Tapings shall be brought to suitable marked terminals to which lamp and supply connections can be made. Terminals shall be shrouded non-track type, and separate earth terminals shall be provided.

Capacitors shall comply with IS 1569 and shall be of the infused type, totally enclosed and proofed against condensation and climatic conditions, complete with discharge resistor, with sealed-in PVC insulated cable tails. Capacitors shall be suitable for working with the lamps and associated equipment specified and shall correct the power factor to not less than 0.85 lagging. The capacitors shall be marked with the manufacturer's name, capacitance and working voltage. Ballasts and capacitors shall carry the ISI mark.

Wiring between the terminal block in the lantern and the components in the base of the pole shall be PVC insulated, PVC sheathed cable of 1000 V grade having a copper conductor of not

less than 2.5 mm² cross sectional area to IS 694. All cables shall be correctly colour coded. Unsupported lengths of wiring shall be kept to a minimum and taped such that they do not come into contact with components.

All metalwork other than current carrying parts shall be earthed.

Road lighting luminaries shall be die cast from aluminium alloy suitable for side entry spigot mounting. The luminaries shall be complete with polished aluminium reflector for use with the lamps and remotely mounted control gear. The impact-resisting bowl shall be sealed to provide a totally weatherproof unit and hinged to facilitate revamping.

Discharge lamps shall carry a 6000 hours guarantee, and shall be controlled by ballasts and capacitors, as recommended by the lamp manufacturer. High-pressure sodium discharge lamps shall be provided with an external ignitor unit.

2.9.3.7 Lighting Luminaries

All 'discharge' luminaries shall be provided with a capacitor for the purpose of power factor correction to a value in excess of 0.85 lagging.

Breakjoint rings or 'biscuit' rings of approved colour shall be provided by the Contractor for all suspended luminaries and fluorescent batten luminaries where the batten is of insufficient width to completely cover the conduit box and its associated clearance hole in the finished ceiling.

Heat resisting cables shall be installed as the final connection to all tungsten luminaries.

All flexible cords to be used in conjunction with lighting luminaries shall be white 3 core circular 300/500 volt grade PVC insulated and sheathed manufactured to IS 694. Conductors smaller than 0.75 mm² cross sectional area shall not be used unless previously approved by the Engineer.

Fluorescent and incandescent luminaries shall be of the following types:

A. Tubular fluorescent luminaries:

1. Reflection
2. Diffuser

B. Incandescent type:

1. Reflection/Shade
2. Diffuser
3. Water proof
4. Bulk head

2.9.3.8 Lamps

Tungsten lamps shall be coiled coil pattern to IS 418 and IS 6701. Fluorescent lamps shall be manufactured to IS 2418. High-pressure mercury lamps shall be manufactured to IS 9900. High - pressure sodium lamps shall be manufactured to IS 9974.

Incandescent lamps shall have IEC type B22d caps. Tubular fluorescent lamps shall have bi-pin caps. Discharge lamps shall have type ES 40 caps (GES).

2.9.3.9 Lighting Switches

Lighting switches for domestic and office purposes shall comply with IS 3854. They shall be of approved manufacture with shuttered outlets.

2.9.3.10 Small Power Outlets

For domestic and office applications, 13 amp socket outlets which comply with IS 1293 shall be used. These shall be switched unless otherwise indicated and supplied with a plug fitted with a fuse rated according to IS 13703. The fuse shall suit the apparatus served.

Where cooker control units are installed, double pole switches of suitable rating shall be installed without a socket outlet.

Fused spur units shall be of approved manufacture, of the same type and finish as socket outlets installed. Fuses to IS 13703 shall be sized to suit the connected load.

2.9.3.11 Ceiling Fans

Propeller fans of the non-ducted ceiling mounting type together with their associated control units shall comply with IS 374 and IS 3588.

2.9.3.12 Conduits

Rigid conduit shall be super high impact heavy gauge PVC conduit (HIP) and PVC accessories complying in all respects with IS 9537 and IS 3419. Each length of conduit shall bear the manufacturer's name or trademark and be smooth inside and out and free from imperfections.

20 mm diameter conduit shall have minimum 1.8 mm wall thickness; 25 mm diameter conduit shall have a minimum 1.9 mm wall thickness.

Flexible conduit shall be of the waterproof galvanised type or PVC wire-wound type with cadmium plated mild steel couplings.

2.9.3.13 Earth Electrodes

Earth electrodes shall be 38 mm diameter galvanised iron rods made up in sections to the required length. Couplings joining rods shall be silicone bronze aluminium, counter bored and of sufficient length to cover the rod thread.

Earth plates shall be of a minimum size of 600 x 600 x 6 mm copper or galvanised iron.

2.9.3.14 Standard Make

The standard make of equipment, fixture, cables etc shall be as per following or their equivalents:

MCCB	Seimens / Legrand /Terashaki
MCB	Seimen/Legra/Terashaki
Wiring cable	Nepalese cable with NS Mark
Light switch	Unbreakable - Legrand/ M
Switch socket	Unbreakable - Legrand/ MK
Fluorescent/CFL tube light fixture	Wipro / Philips
Outdoor light fixture/ Flood light fixture	Wipro / Philips
Incandescent light fixtures	Decon / Homedec
Power Cable	Poineer/Prakash/Trishakti/Janata
Lightening Arrestor (11 kV)	Japanese
Do-fuse	Japanese
Transformer	Crompton/ Alstom/ Ekrat
Diesel Generator	Cumins/ Perkins

2.9.4 Plant and Equipment

Plant, equipment, and tools for the execution of electrical installations shall be sufficient in number and capacity, in good working order, and in accordance with the requirements of the applicable safety regulations.

2.9.5 Construction and Workmanship

2.9.5.1 Regulations and Standards

The electrical installation shall comply with all relevant IS regulations, statutory instruments and regulations current at date of tender (unless otherwise indicated) some of which are listed within the detailed description in Appendix A.

The Contractor shall be responsible for complying with all local byelaws, supply authority and local authority requirements. It shall be the Contractor's responsibility to determine the existence of these requirements and to comply with them.

2.9.5.2 Cable Installation

Cables to lighting and small power circuits shall be of one of the following sizes unless indicated otherwise:

- (i) 1.5 mm² single core PVC for circuits loaded less than 1 kW.
- (ii) 2.5 mm² single core PVC for circuits loaded up to 3 kW.
- (iii) 4 mm²/6 mm² 2 core PVC for circuits loaded above 3 kW
- (iv) 1.0 mm² light duty multi-core PVC for control circuits.

Cables shall be segregated into the following categories:

- power (less than 1 000 V phase to phase)
- instrumentation/telemetry
- control
- telecommunications.

Cables shall be laid in a manner such that any electrical interference between cables shall not have a detrimental effect on the life and operation of equipment installed within the installation. As a general rule the following minimum clearances shall be adhered to wherever practical.

	HVpower (mm)	MV/LV power (mm)	Instrumentation Telemetry Control (mm)	Telecommunications (mm)
HV power	-	-	-	-
MV/LV power	300	-	-	-
Instrumentation/ telemetry/control	300	150	-	-
Telecommunications local area network	300	150	150	-

LV power cables may be bundled together where allowance is made for any derating factors.

Digital and analogue signals shall be segregated within junction boxes.

Cables shall be drawn into conduits simultaneously without twists. Cables bunched into circular groups shall have the appropriate de-rating factor applied in accordance with Appendix 9 of the IEE Regulations.

Cables shall be installed on the 'loop-in' principle, no joints or junction boxes being permitted. Single core cables in conduit shall have the line conductors looped at switches and the neutral conductors looped at lighting points. Multi-core cables shall have the line and neutral conductors looped at the lighting point.

Wiring shall not be looped at terminal blocks internal to lighting luminaries. For fluorescent or similar luminaries having internal terminal blocks, the fixed wiring shall terminate at the conduit box with tails taken into the fitting. The arrangement shall be such that the fittings and tails may be removed without causing the other lighting luminaries on the circuit to be disconnected.

Wiring to 13 A socket outlet circuits shall be ring wired throughout. Spur circuits shall be used only where specified.

(i) General

Cables shall be installed in such a way that the minimum bending radii are not reduced when installed or during installation. Cables shall not be installed in ambient temperatures below that recommended by the cable manufacturer.

Cables grouped together shall have insulation capable of withstanding the highest voltage present in the group.

(ii) Direct in Ground

Buried cable up to 600/1 000 V shall have a minimum cover of 500 mm measured to the top of the highest cable. On crossing roadways the cable shall be run through a PVC-U duct of minimum diameter 100 mm with a minimum of 1 000 mm cover and encased on all sides by 150 mm of concrete.

The bottom of the cable trench shall be freed of sharp stones and such like and 75 mm of sieved sand laid below the cable. After cable laying 75 mm of sieved sand shall be laid above the cable.

Interlocking cable protective covers, minimum 1 m long x 150 mm wide, marked 'Danger - Electric Cable' in English, and Nepali shall be laid on top of the sieved sand. Covers shall extend the whole length of the cable trench and shall overlap cables by a minimum of 50 mm.

Warning tape shall be laid a minimum of 200 mm above the protective covers.

Cables are to be installed without tees or through joints unless otherwise approved by the Engineer. Single core cables are to be run in trefoil formation.

(iii) In Underground Ducts

Underground ducts shall be constructed of impact resistant PVC-U, glazed earthenware or concrete and laid at a minimum depth of 500 mm. Ducts shall be surrounded by at least 75 mm of sieved sand except at road crossings where they shall be 1 m deep and encased on all sides by concrete.

The Contractor shall ensure that sufficient draw-in points have been provided and that adequate room has been allowed for installation of cables. Drawstrings shall be provided in all ducts to enable additional cables to be installed when required.

Where cables pass in or out of any duct entries into or within buildings such entries, together with any spare ducts shall be sealed against the ingress of moisture by means of duct stoppers and bituminous compounds or other method approved by the Engineer. The stopper shall have a fire resistance of at least 30 minutes. Single core cables in trefoil formation shall pass through the same duct and shall not be separated.

(iv) In Conduit

Particular care shall be taken with the storage of conduit. A rack shall be provided for this purpose to ensure that the finish is not defaced. Conduit which is allowed to spread across the floor when stored so that the surface finish becomes damaged by being walked over or similar shall be rejected and removed from site.

All conduits shall be of sufficient size to permit the easy withdrawal and replacement of cables at a later date, no conduit smaller than 20 mm shall be used.

A space factor of 40% shall not be exceeded. The tubing shall be perfectly smooth inside and out and free from flaws and imperfections of any kind. Both ends of every length of tubing shall be properly reamed with all sharp edges removed before erection.

All bends shall be formed using bending springs in complete accordance with the manufacturer's instructions, and without alteration to the conduit section. Bends may be formed cold but in severe weather it may be necessary to warm the conduit slightly at the point where the bend is to be made. The inside radius of any bend shall not be less than 8 times of outside diameter of the conduit.

All conduit boxes on to which lighting fittings are to be affixed shall be capable of withstanding a dead weight of 10 kg and shall be fixed using two screws and washers. No weight shall be taken by any suspended ceiling.

For conduit boxes, couplers and all items of equipment that require adhesives, the manufacturer's recommended adhesive shall be used. Connection to square or rectangular boxes shall be made using female threaded sockets and male screwed bushes. On no account shall the conduit protrude into such items as switch boxes or socket boxes. Inspection bends, elbows, couplings and tees shall not be used.

Circular PVC boxes, having spout entries, shall be used at the termination of all lighting points and as draw-in boxes on long runs. For 20 mm conduits round boxes shall be used as draw-in points, but for 25 mm and larger conduits, rectangular boxes shall be used. In each case heavy quality lids shall be used and secured by brass screws.

Sufficient draw-in boxes shall be installed to permit the re-wiring of the installation and they shall be positioned to ensure that all boxes are in accessible positions. The Contractor shall check all proposed positions with the Engineer before installation. In the case of flush draw-in boxes the Contractor shall fit a joint ring or spacer ring to finished plaster level.

Generally not more than two bends or offsets or one coupling will be permitted without a suitable inspection accessory. Fish wires shall not be left in conduits after erection. The whole of the installation shall be arranged for a loop-in type of system with joints being carried out at switches, isolators, etc. Intermediate joints in the cable will only be allowed by arrangement with the Engineer. Where terminal blocks are necessary, they shall be of the porcelain type with brass pinching screws.

For entry into trunking and any item requiring holes to be cut, the method shall be by bell mouth bushes and sleeves. For entry into sheet metal boxes and any item complete with pre-cut holes, the method shall be by threaded female sockets and male screwed bushes.

Ends of conduits which are liable to be left open for any length of time during building operations shall be plugged to prevent the ingress of dirt, cement, etc. and covers, either temporary or permanent, shall be fitted on all boxes.

The conduits shall be completely assembled, fixed and swabbed out before wiring is commenced.

Generally, conduits shall not cross expansion joints of buildings, but where they cannot be installed in any other manner then a flexible conduit shall be used across the expansion joint. A total 150 mm movement shall be allowed.

The Contractor shall provide a typical installation method drawing for all conduit installations, when requested by the Engineer.

Where conduits are taken through walls and/or floors, the holes shall be made good with incombustible material.

All conduits to the telephone, TV and radio systems shall be installed with draw wires.

All conduits to lighting and small power systems shall be installed with a circuit protective conductor.

(a) Surface Installation

All surface work, work in ducts or ceiling voids, etc., shall be secured by means of heavy quality spacer bar saddles secured by screws driven into rawlplugs, or equivalent fibre, PVC, metal or compound types. The spacing of fixings shall not exceed 1.25 m for 20 mm, 25 mm and 32 mm conduit or less in hot temperatures. It should be noted that saddles are designed to be a sliding fit for PVC conduits and it is important to ensure that all fixings are sliding due to the requirement for expansion.

Due to the materials used in PVC conduits a rise in temperature of 25°C would cause an increase of approximately 6 mm in a 4 m length of conduit. Where long straight runs in excess of 4 m occur in conditions of varying temperature, expansion couplers must be used in accordance with the manufacturers installation instructions. A draw wire must be installed in runs where expansion couplings are used.

An efficient means shall be adopted to provide for the drainage of condensation and the runs shall be properly ventilated. All surface conduit runs shall be marked out for approval by the Engineer before the installation is carried out. Where large multiple parallel conduit runs would occur, use may be made of galvanised cable trunking.

(b) Concealed Installation

If the floor of any building is of solid concrete construction, conduits shall not be run in the screed rising to the outlets, etc., unless specifically instructed elsewhere in this Specification.

Where, due to the type of construction, it is necessary to cast conduits into concrete to serve lighting points, backed outlet boxes shall be used, using female threaded sockets and male screwed bushes, with the conduit installed in such a manner as to be self draining in accordance with the IEE Regulations.

Concealed conduits shall be securely fixed to prevent movement before laying of screeds, floating of plaster, casting of columns or other building operations necessary after the conduit installation. Crampets or similar fixings shall be used for attaching the conduit to block work, etc. Building nails will not be accepted.

At least 15 mm cover shall be allowed for finishes over the conduit. Where this cover cannot be maintained then expanded metal shall be fitted with the conduit. Conduit cast into reinforced concrete floors shall be fixed to the steel reinforcing with binding wire and the conduit boxes filled with expanded polystyrene or enclosed in a plastic bag to prevent the ingress of concrete when poured. Where possible, the conduit boxes shall be fixed to shuttering to give a flush finish.

Conduit installed in voids, false ceilings, and other concealed routes shall be installed as specified for the surface conduits. Wiring shall be carried out after the false ceiling or permanent ducts have been completed. Conduit installed in floors shall be sealed against ingress of moisture.

The conduit installation shall be inspected by the Engineer before the building operation conceals the work.

(c) Flexible Conduit

Flexible conduit shall be of the waterproof galvanised type or PVC wire-wound type with cadmium plated mild steel couplings. Lengths of flexible conduits shall be sufficient to permit withdrawal, adjustment or movement of the equipment to which it is attached and shall have a minimum length of 300 mm. Flexible conduit shall not be used as a means of providing earth continuity. A single earth conductor of adequate size shall be installed external to the conduit complete with earth terminations.

Where conversion from rigid conduit to flexible metallic conduit is to be made, the rigid conduit shall terminate in a through type box and the flexible conduit shall extend from this box to the equipment. The earth continuity cable shall be secured to the box and to the piece of equipment by properly designed earthing screws. The use of lid facing screws, etc., will not be permitted. Adapters shall incorporate a grub screw or a gland to prevent the flexible conduit becoming loose.

(v) Clipped Direct

All cable hangers, clips, cleats and saddles shall be of an approved type and appropriate to the type and size of cable installed.

Their spacing shall be such as to ensure a neat appearance and prevent sagging of the cables at all times during their installed life.

(vi) In Internal Floor Trenches

In shallow trenches used for electrical services only, cables may be laid in a neat and orderly manner on the floor of the trench. One layer only shall be allowed. Additional cables shall be installed on the walls of the trench in an approved manner.

Where the trench is shared by other services, cables shall be installed on the walls of the trench in an approved manner.

2.9.5.3 Distribution Boards

Where boards are fixed on steelwork or concrete columns, reinforced concrete or brick walls, they shall be mounted on the surface with conduits and/or trunking rising vertically from them.

Where boards are fixed on plaster finished walls, they shall be surface mounted on the finished face of the plaster with an adaptable galvanised metal box (minimum size 150 x 150 x 75 mm), recessed into the wall at the back of each board.

The adaptable box and fuse board shall be electrically and mechanically linked together, but independently fixed on the wall by bolts and expansion shields.

2.9.5.4 Small Power Outlets

Low voltage socket outlets for small power applications shall be fixed at a height of 300 mm from the finished floor level to the horizontal centre line of the switch.

Where recessed spur units control appliances such as incinerators, fans, water heaters, etc. a conduit shall be taken from the spur outlet box to an outlet box located immediately adjacent to the appliance in order to conceal the final connection to the appliances.

Wiring of spur units shall be carried out on 'ring' or 'radial' circuits as specified and shall conform to IEE Regulations.

2.9.5.5 Lighting Switches

Lighting switches of a single pole type shall be connected to the phase conductor. Switches shall be fixed at a height of 1410 mm from the finished floor level to the horizontal centre line of the switch. Where grouped switches are used they shall be mounted in multi-gang boxes with plates.

All lighting switches shall be suitable for the power supply to which they are connected. Lighting switches shall be mounted in separate boxes for separate circuits derived from different distribution boards.

Where multi-gang switches are supplied from opposite phases, phase barriers and warning labels shall be provided. Single gang switches connected to opposite phase polarity shall, in no case, be positioned less than 2 m apart.

2.9.5.6 Lighting Luminaries

The Contractor shall check final positions of all lighting points with the Engineer and obtain his approval before installation commences.

All lighting luminaries shall be mounted and located in such positions as to be readily accessible for maintenance purposes from ladders or steps.

Fixing and suspension plates shall be suitable for direct connection to conduit boxes or as otherwise specified. Luminaries having conduit suspensions shall be provided with earthed pattern ball and socket back plates. The rigid type of backplate will not be accepted. Tubular fluorescent luminaries shall have at least two separate fixings at the manufacturers recommended spacings.

2.9.5.7 Earthing and Bonding

The earthing system shall comply with Clause 67 of the Indian Electricity Rules.

All low voltage systems shall be properly and efficiently earthed in accordance with BS/IS 3043.

The Contractor shall ensure that complete earth continuity exists throughout the system and that the resistance of the earth parts complies with the IEE Regulations.

Each control room building shall have a main earth bar consisting of a hard drawn high conductivity copper bar of at least 150 x 25 x 6 mm, mounted on stand-off insulators. Connections to this bar shall be by brass bolts, flat washers, nuts and locknuts.

The system neutral, where applicable, earth bars of all switchboards and all earthing terminals of all transformers shall be securely bonded to the main earth bar. For bonding purposes a galvanised iron earthing strip may be used, at least 25 x 6 mm in cross section.

Metal sheaths and armouring of all incoming, outgoing and interconnecting sub-station cables shall be securely bonded to the main earth bar. The sizes of bonding conductors shall be in accordance with IS 3043. Bonding conductors may be connected to the earth bar of the switchboard or other apparatus served.

All cables and conduits used throughout the installation shall be securely bonded to the associated equipment, and earthing straps shall be fitted. To facilitate such bonding, all cable glands shall be supplied with substantial armour clamps, having additional earthing lugs. Compression glands shall be fitted with earth tags and brass set screws.

Earthing terminals of every distribution boards, isolator or switchgear item or other apparatus shall be securely bonded through 14 SWG copper conductor or 25 x 6 mm galvanised iron strip or by connecting the bonding conductors to the earth bar of the apparatus.

All electric motors and other items of electrical equipment within the Contract shall be bonded to earth by flexible copper cables, braids or conductors of not less than 6mm² equivalent size connected to the armouring of armoured cables unless stated otherwise.

All bonding of motors shall be to the stator frame of the motor. Bonding to end-shields, terminal boxes etc. is not acceptable.

Incoming gas, water, piped services and ducting shall be bonded in accordance with the requirements of IEE Regulation 413-2. The minimum size of the bonding conductor shall be 6mm². Copper strip of green and yellow PVC insulated single core copper cables shall be used.

Earth clamps shall comply with IS 3043. In dry areas tinned brass clamps shall be installed. In areas where dampness is to be expected phosphor bronze clamps shall be used.

Where electrical components are mounted on custom built frames, each of the above earth bonds shall include the metalwork of the support structure. Conduit or trunking shall not be used as the sole circuit protective conductor.

2.9.5.8 Earth Electrodes

Where connections to the mass of earth are specified for lightning protection or system earthing the Contractor shall supply, install and test the connection in accordance with the following Clauses.

The Contractor shall, at the commencement of the Contract, carry out soil resistivity tests over the area of the Site indicated on the Drawings. A minimum of two tests of different spacings shall be carried out at each test location.

The results of these tests shall be used to determine the type and number of rods, plates or strips required.

The top end of rods shall be terminated at least 300 mm below finished ground level. Where rods are installed in areas accessible to persons or animals this depth shall be increased. The position of earth rods shall be indicated by pre-cast concrete inspection pits.

Where multiple earth rods are installed interconnections shall be made using bare galvanised iron strips. The strip shall be buried at a minimum of 600 mm below finished ground level.

The earth electrodes shall be connected to the main earth bar through test links. The earth electrode installation shall be tested in the presence of the Engineer when disconnected from the main system, using the method shown in Appendix 15 of the IEE Regulations.

Where the earth connection forms a link between a high voltage system and a low voltage system the earth connection resistance to earth when disconnected from the earth bar shall not exceed one ohm.

Where earth plates are required to carry a heavy system fault current these shall be buried at a depth of at least 2 m. Connection of copper tapes to earth plates shall be brazed and protected against corrosion.

Marker posts and plates shall be provided to mark the position of all electrodes and buried conductors.

2.9.5.9 Site Lighting

The installation shall be in accordance with layouts with exact positions of control equipment, poles and lighting points determined on site to the approval of the Engineer, prior to starting erection.

The equipment shall be supplied in new and unused condition, having been tested in the course of manufacture and stored in weatherproof accommodation on site.

The Contractor shall carry out all unloading, slinging, stacking, erection and fixing of poles and brackets in accordance with the manufacturer's instructions.

Excavation for poles shall not be by mechanical means unless agreed by the Engineer. The bottom portion of pole shall be fixed in a solid precast concrete block not less than 450 mm square for the full depth of the block. Final adjustment shall be carried out using aluminium or hardwood wedges and the remaining annulus packed with sand. A cable duct shall pass through the concrete block into the column cable entry. Precast blocks shall be supplied and installed by the Contractor. The cable entry slot shall be temporarily plugged to ensure that it is maintained free from material during the backfilling process. The block shall be bedded on a 100 mm thick concrete base.

Poles shall be erected in a truly vertical position. The Contractor shall be responsible, until the expiry of the Defect Liability Period for correcting the alignment of any column which he has erected which has departed from the vertical position, excepting where it is established that such departure is due to an event outside the control of the Contractor.

Poles shall have their lanterns fixed and aligned in accordance with the manufacturer's instructions to prevent rotation in service. All joints shall be resistant to the ingress of moisture into the column and lantern.

2.9.6 Test and Acceptance

Tests shall be carried out on site and witnessed by the Engineer or his representatives as follows for LV cables:

- (i) Insulation resistance at 500 V dc shall not be less than 0.5 mega ohm.
- (ii) Earth continuity and earth resistance.
- (iii) Phasing and polarity (every fuse and single pole control and protective device shall be connected in phase conductors only).

2.9.7 Measurement and Payment

Work shall be measured according to types as an all inclusive rate.

3.0 DRAINAGE, PIPELINES AND RELATED ACTIVITIES

3.1 PIPE TRENCHES

3.1.1 Scope

This specification covers earthworks for trenches for all types and sizes of pipes. It covers excavation, the preparation of a trench bottom, backfilling and the reinstatement of surfaces.

3.1.2 Interpretations

3.1.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1 General
- b) 2.1 Site Clearance
- c) 2.2 Earthworks

3.1.2.2 Application

This specification contains clauses that are applicable to earthworks for pipe trenches associated with the proposed sub-project.

3.1.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Backfill - The approved filling material placed in a pipe trench after the pipe has been laid, bedded, and surrounded by the blanket that has been compacted at the sides and over the top of the pipe.

Bedding - The material, and the operation of placing it, of the bedding cradle and blanket, up to the underside of the backfill.

Blanket - The bedding zone in which material is placed and compacted on or from the top of the cradle up the sides and over the top of the pipe in such a manner that the barrel of the pipe is supported continuously and firmly on the sides and protected over the top by a dense cushion of material.

Cradle - The bedding zone in which material is placed firmly and without voids under and up the sides of a pipe in such a manner that for all practical purposes the pipe cannot move or deflect.

3.1.3 Materials

The excavation of material will, for purpose of measurement and payment, be classified as specified in Clause 2.2.3.1 above.

For selected fill material, the requirements given in Clause 3.2 shall apply.

Backfill material shall be material excavated from trenches, provided only that it contains no organic material, that it excludes stones of average dimension exceeding 150 mm, and that its moisture content will allow it to be compacted to 95% of the Modified Proctor Density to avoid significant settlement, and shall have a PI not exceeding 12. Backfill material in road or traffic areas shall in addition have a minimum CBR of 15% at specified density if placed in the upper 200 mm of the subgrade, and a minimum CBR of 7% if the backfill is to be placed lower in the subgrade. Material containing more than 10% of rock or hard fragments that are retained at a sieve of nominal aperture size 50 mm, and material containing large clay lumps that do not break up under the action of the compaction equipment being used, will be regarded as unsuitable for use in backfilling.

If the Contractor allows material which, when excavated was suitable for re-use, to become unsuitable when required for backfilling, he shall make good by running it to spoil and replacing with suitable material.

Where trenches cross or run along surfaced roads and paved areas of which the surfaces are ordered by the Engineer to be reinstated, the Contractor shall obtain prior approval for subbase and base materials that may be required to supplement such materials lost during excavation. Materials for bituminous or asphalt construction shall comply with the applicable standards of the Roads Department of the Ministry of Transport.

The Contractor is not required to use selective methods of excavation but may, if he so wishes, screen, wash or otherwise treat excavated material in order to produce material suitable for the bedding. He shall take positive steps to avoid burying or contaminating materials which otherwise would be suitable for use as different types of fill, topsoil, or road material, as applicable.

3.1.4 Construction Equipment

The Contractor shall use trenching equipment that will excavate to a width such that the side allowance does not exceed the appropriate values specified in Clause 3.1.5.2 below by more than 50 %.

The Contractor shall use appropriate techniques or provide equipment such as pumps, well points and sheeting or close timbering for keeping the trenches sufficiently free from water to enable him to lay pipes true to line and level and to bed them soundly.

The Contractor may use mechanical compaction equipment but he shall select such equipment and operate it in such a manner that the pipeline is not stressed or damaged. Machine

compaction shall not be used directly above the pipe until sufficient backfill has been placed to ensure that machine compaction loads transmitted to the top of the pipe are not greater than would be imposed by normal road traffic over a pipeline with cover of depth 600 mm.

3.1.5 Construction and Workmanship

3.1.5.1 Precautions

With regard dealing with water, the requirements of Clause 2.2.5.2.2.2 shall apply in addition to the stipulations below.

In the case of a trench on sloping ground, the Contractor shall take approved measures (such as the construction of cross-embankments) to minimize erosion in the trench and adjacent ground.

With regard to accommodation of traffic and access to properties, the Contractor shall, in addition to the requirements of Clause 1.5.2, construct or put in order such bypass(es) as may be required to deviate traffic from portions of the road that are to be affected by the construction; or where half-width construction is ordered or approved, so arrange his work that the traffic will at all times have free one-lane access to at least half the width of the roadway; or ensure, wherever possible, that the whole road is open at night and left in a trafficable condition, complete with traffic signs and protection facilities as specified.

He shall also ensure, wherever possible, that the usable width of the road is at least 3.5 m and he shall provide and allow reasonable access to persons occupying properties that fall within or adjoin the area over which he is working. If, for any reason, such access has to be closed during the construction period, the persons affected shall be given reasonable notice for each such period of closing.

With regard to existing services that intersect or adjoin trenches, the requirements of Clause 2.2.5.1.2 shall apply.

Special precautions may be necessary when buildings are close to the edge of the trench. Throughout the duration of such activities the Contractor will be fully responsible for the safety of all adjacent property. Wherever the minimum clearances cannot be complied with, e.g. in certain urban areas, the Contractor shall provide adequate temporary protective support by struts, bracing, etc. for adjacent structures and such support must be capable of safeguarding the buildings from structural damages resulting from the execution of the Works. Prior to installation the Contractor shall submit to the Engineer his proposed system of support for approval. Irrespective of the Engineer's approval sufficiency and suitability of the support will remain the sole responsibility of the Contractor. The support shall remain in place until such time as the Contractor is sufficiently convinced that there is no more imminent risk of damage of any kind to the adjacent buildings resulting from the activities. Upon removal of the support any damages caused by the attachment of the support itself shall be repaired to the satisfaction of the Engineer.

3.1.5.2 Minimum Base Width

Unless otherwise shown on the drawings, or as directed, the base width of a trench shall be not less than the external diameter of the pipe barrels plus twice the side allowance as shown below:

ND up to 600 mm	side allowance 300 mm
ND over 600 mm up to 1000 mm	side allowance 400 mm
ND over 1000 mm up to 2000 mm	side allowance 500 mm
ND over 2000 mm	side allowance 600 mm

The minimum base width for pipes not exceeding 125 mm and laid at a depth not exceeding 1.5 m may be less than 600 mm for flexible continuous piping that, in terms of the specification or schedule, requires no bedding or jointing in the trench.

Where two or more pipes are to be placed in one trench, the base width of the trench shall be no less than the sum of the external diameters of the pipe barrels plus the side allowance for

each outer pipe plus, between each pair of adjacent pipes, the average of the side allowance for each pipe.

3.1.5.3 Site Clearance

The Contractor shall clear the working strip, in accordance with Clause 2.1. The working strip shall be an area of sufficient width along the route of the pipeline to ensure that his construction operations are not hampered and damage to buildings and the environment is minimized.

3.1.5.4 Excavation

The length of pipe trench excavated by a gang shall not extend more than 200m beyond the start of excavation or the completed backfill unless approved by the Engineer. The width of the trench shall provide at least the appropriate side allowance (within trench supports, if any) as specified in Clause 3.1.5.2 above, and such that half of the base width is on either side of the designated centre-line of the pipe.

The sides of each trench from the bottom up shall be as nearly vertical as possible for at least the height of the bedding.

When cutting through bituminous surfaces, the edges of the existing bitumen base and/or wearing courses shall be cut back vertically to straight lines.

In densely built-up areas with restricted and confined space, such as in urban areas, the stockpiling of excavated material adjacent to the trench for use as backfill material may not always be possible. In such cases the Contractor transport such material to and stockpile it at a distance away from the point of excavation, at locations suitable and approved by the Engineer.

All trenches shall be braced and strutted to the satisfaction of the Engineer, if they are

- a) so close to a building or structure, that a line between the corner of the trench bottom nearest to the building and the underside of the foundation of the building or structure would be steeper than 45°
- b) if the soil conditions are not providing sufficient stability to the side walls.

The Contractor will be responsible for any damage resulting from trench instability and insufficient bracing and strutting.

During the course of the Works the Contractor shall clean road surfaces and other paved areas used by his vehicles and employees to minimize disturbance to residents and road users, cleaning shall be to the satisfaction of the Engineer.

3.1.5.5 Trench Bottom

Material that the Engineer considers to be unsuitable at the bottom of the trench shall be excavated to the depths directed and disposed of in the manner described. The resulting space shall be refilled, as ordered, with approved material and compacted as directed.

Where the bottom of the trench has been loosened during excavation, it shall be compacted at OMC to 90 % of modified AASHTO maximum density prior to bedding and pipe laying.

Bottoms of the excavated trenches shall be trimmed flat and levelled to provide an even base for the pipeline or pipe bedding; rocks, debris or other extraneous matter that may damage the pipes shall be removed.

Where pipes are to be laid on formation made in undisturbed ground (i.e. without bedding), the Contractor shall ensure that excavation in the first instance is stopped 75 mm above formation level and the trimming the formation shall be done by hand immediately prior to starting the laying of the pipes.

Where granular or concrete beddings are required, bottoms of trenches shall be excavated to a depth below the proposed level of the pipe over the full width of the trench as shown in the Drawings.

The depth of the trench shall be such that the depth of the cradle can be placed under the pipeline, and the trimming and grading of the bottom of the trench shall be such that the barrel of each length of pipe can be uniformly supported over its full length, free at the joints, and at the correct grades and levels.

The bottom of pipe trenches shall be sufficiently straight to enable the pipe to be laid without reduction of the side allowances given in Clause 3.1.5.2 above and in conformity with the applicable tolerances specified.

3.1.5.6 Backfilling

Backfilling of pipe trenches shall commence as soon as possible after the pipe has been laid and firmly bedded in the specified cradle and the blanket has been placed over the top of the pipe to the height of blanket cover specified.

Backfilling shall be carried out as described below and over the full extent of the actual trench excavation and to original ground level, except where otherwise directed.

Unless the Contractor is authorized by the Engineer to use other material, the material for backfilling above the bedding (cradle and blanket) shall be obtained from trench excavations.

Unless prior approval has been obtained, no filling shall be placed in water.

Hard and rock material shall be incorporated in the backfill above the bedding only to the extent approved. Depending on the quality of the material, the Engineer may direct that it be suitably mixed with other backfill material.

Excavated material from the trench, which is unsuitable or has become surplus because of bulking, displacement by the pipe and importation, shall be disposed of as approved by the Engineer.

Any deficiency of backfill material from trench excavations because of removal of organic or other unsuitable material shall be made up from suitable surplus material from other excavations on the Site. If, insufficient or no suitable material is available for this purpose from such excavations, the Contractor shall import sufficient suitable material. The Contractor shall so arrange his work that the importation of backfill material is kept to a minimum.

The Contractor shall complete backfilling of trenches expeditiously and in reasonable lengths.

3.1.5.7 Compaction

In normal areas backfill shall be in accordance with Clause 2.2.5.2.3.

In areas subject to traffic loads, trenches shall be backfilled with selected fill material in layers of thickness (after compaction) not exceeding 150 mm and the material shall be compacted to at least 95 % of modified AASHTO maximum density up to the top of the subgrade level.

3.1.5.8 Reinstatement of Surfaces

In all cases, the Contractor shall, if ordered, reinstate surfaces over the full extent of the top of the actual excavation.

On private properties or other unsurfaced areas, the top 300 mm layer of each trench that will not be subject to road traffic loads shall be of such topsoil as is available in addition to soft material from excavations. The finished surface of backfilling that is left raised of the surrounding ground to allow for initial settlement shall be not more than 150 mm above the surrounding ground

In the case of gravel roads or similar surfaced areas, the Contractor shall, immediately after completion of the backfilling to the top of the subgrade level, reinstate the road surface by filling the remainder of the trench with a well-graded and approved hard-wearing gravel surface of thickness at least 150 mm, and of quality equal to that of the existing road surface compacted to at least 95% modified AASHTO. The gravel layer shall be finished with a slight camber in

order to allow for initial settlement but shall not be shaped such as to cause excessive jolting of any vehicle proceeding with normal speed.

If the surface of a road with a stabilized base has been disturbed, the base shall be replaced with crusher run base compacted with sufficient moisture to give a density of at least 98 % modified AASHTO maximum density.

Except if otherwise ordered by the Engineer, the surface of a bitumen road shall be reinstated with asphalt of at least the thickness used in the original state. The base material shall be graded to a level sufficiently below the final road surface to allow the bitumen surfacing to be accommodated, and the edges of the existing bitumen wearing course shall be cut back vertically to a straight line. Before the bituminous construction is commenced, all loose materials and dust shall have been removed and the surface shall have been approved and prime coated at 1.0 l/m² of MC30 cutback bitumen. The bituminous surface will have a tolerance of -0+6 mm after compaction.

The Contractor shall maintain the reinstated surfaces and shall make good, at his expense, any damage due to any subsidence, pothole or other unevenness immediately after it occurs during the period of the contract or during the defects liability period.

Where, during the execution of the activities, any road or paved surface adjacent to a trench has been damaged in any way whatsoever by the Contractor's equipment, he shall, at his own expense and as soon as is practicable, repair and restore such surface to a condition at least equivalent to that previously existing, and to the satisfaction of the Engineer and the concerned authority.

3.1.6 Tolerances

3.1.6.1 Alignment and Grade

The deviation from the specified level of the invert and the specified dimensions of a trench and (for a height equal to at least the diameter of the pipe) of the lower part of the sides of the trench shall be such that the pipe may be laid and bedded in the trench within the tolerances specified for the pipeline.

3.1.6.2 Moisture Content and Density

The requirements for moisture content and density given in Clause 2.2.6.2 shall apply.

3.1.7 Testing and Acceptance

The Contractor shall prove: the optimum moisture content, the maximum dry density, the CBR, Marshall and the specified properties of reinstatement and backfill materials before use at a rate of one test per 200 m³ of material. In-situ density test of non-bituminous materials, and Marshall compaction/in-situ coring of bituminous materials will be carried out on each layer for every 200 linear meter of trench or part thereof by the Contractor in the presence of the Engineer, or by an independent laboratory approved by the Engineer. The cost of all testing will be included in the Contractor's rates. In the event of failure results, the Engineer will order any necessary re-testing and remedial works at the Contractor's expense.

3.1.8 Measurement and Payment

The items scheduled for clearance and demolition will be classified according to the nature of the materials involved and the methods of their disposal. The item for clearance shall include the removal of topsoil and storing for reuse.

Clearance of the working strip shall be measured as the length of pipeline with no deduction for chambers.

Demolition of structures, buildings etc, shall be measured as a sum for demolition of the identified structure.

Rates for reinstatement of the Site shall include preparing the working strip to receive topsoil, placing topsoil, disposal of surplus materials, planting and seeding, reinstatement of land drains. Additional payment will be made for work in roads according to type.

Reinstatement and work in roads shall be measured as the length of pipeline with no deduction for chambers.

Rates for trench excavation and preparation of bedding Class S shall cover the cost of excavating and re-use of the excavated or imported material in bedding and backfilling, forming embankments, terraces, shoring and supporting excavations, protection of structures, provision for existing services, dealing with storm and ground water, protection of slopes, the cost of disposal of any surplus and unsuitable material, and the import of any suitable material required for backfill. Additional payments will be made for bedding of different type.

Trench excavation and bedding will be measured as the length of pipeline with no deduction for chambers.

Excavation for chambers, abutments, columns, thrustblocks, and anchors shall be measured as the volume of excavation, on accordance with Clause 2.2.8, outside the nominal trench dimension.

Excavation in rock shall be measured extra over normal excavation and measured as a volume.

3.2 PIPE BEDDING

3.2.1 Scope

This specification covers the bedding, consisting of the bedding cradle and the selected fill blanket, for buried pipes for carrying fluids under pressure or gravity.

3.2.2 Interpretations

3.2.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1 General
- b) 2.1 Site Clearance
- c) 2.2 Earthworks, as applicable
- d) 3.1 Pipe Trenches

3.2.2.2 Application

This specification contains clauses that are generally applicable to the bedding of pipes.

3.2.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Bedding - The material in the bedding cradle and fill blanket up to the underside of the main fill, and the operation of placing and compacting bedding in the manner specified.

Bedding cradle - The zone in which bedding is placed firmly and without voids under and up the sides of a pipe in such a manner that for all practical purposes the pipe cannot move or deflect.

Expansion joint - A joint in concrete bedding in which two concrete surfaces are separated by resilient filler of thickness at least 15 mm.

Flexible pipe - A pipe whose properties are such that the first limit state reached is either excessive deformation, or buckling collapse. Plastic pipes, UPVC etc, are examples of flexible pipes.

Joint hole - A depression formed in the bedding cradle to accommodate a joint in a pipeline.

Main fill - The approved filling material placed in a pipe trench after the pipe has been laid, bedded, and surrounded by selected fill blanket up to 300 mm cover above the top of the pipe.

Rigid pipe – A pipe whose properties are such that the first limit state reached is fracture of the pipe walls due to bending stress. Concrete pipes are an example of rigid pipes.

Selected fill blanket - Material placed and compacted to form a blanket on or from the top of the bedding cradle up the sides and over the top of the pipe in such a manner that the barrel of the pipe is supported continuously and firmly on the sides and is protected over the top by a dense cushion of material.

Selected fill material - Material that complies with the requirements of Clause 3.2.3.2 below.

Selected granular material - Material that complies with the requirements of Clause 3.2.3.1 below.

Semi-rigid pipe - A pipe that can deform enough to redistribute some of the overburden pressure to the sidefills, but which is stiff enough to rule out the possibility of buckling. The first limit state reached may be either excessive deformation, or excessive wall bending stresses. Ductile iron pipes are considered semi-rigid.

3.2.3 Materials

3.2.3.1 Selected Granular Material

Selected granular material shall be material of a granular, non-cohesive nature, free draining, a pH > 6 and the following grading.

Sieve Size (mm)	% Passing Sieve
40	100
20	80-100
5	40-100
2.5	20-80
0.6	
0.315	0-20
0.075	0-5

3.2.3.2 Selected Fill Material

Selected fill material shall be material that has a pH > 6 and the following grading.

Sieve Size (mm)	% Passing Sieve
40	100
20	80-100
5	40-100
2.5	20-100
0.6	5-100
0.315	0-70
0.075	0-10

3.2.3.3 Bedding

Rigid Pipes

Bedding for rigid pipes shall be of Class A, B, or C. The bedding cradle for Class A bedding shall be concrete. Bedding cradles for Class B and C bedding shall be of selected granular material. The material for the selected fill blanket shall be selected fill material.

Flexible and Semi-rigid Pipes

Bedding for flexible and semi-rigid pipes shall be of Class S or B. The bedding and blanket for Class S shall be selected fill material. Bedding cradles for Class B bedding shall be of selected granular material and blanket shall be selected fill material.

3.2.3.4 Selection

The Contractor may screen, wash, or otherwise treat excavated material from pipe trenches or other excavations in order to produce material suitable for bedding or covering the pipeline. The Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline.

When material suitable for use as selected fill material or selected granular material is not readily available from trench or other excavation within a reasonable distance, the Contractor shall, subject to the Engineer's approval for each material, obtain suitable material to replace the shortfall by opening up borrow pits at approved areas located at intervals along the route of the pipeline or by importing from commercial or other sources.

3.2.4 Construction Equipment

Adequate equipment shall be provided by the Contractor for the placing and compacting of bedding as specified in Clause 3.2.5 below.

The Contractor shall also provide the necessary test equipment for performing on Site the tests referred to in Clause 3.2.7 below.

3.2.5 Construction and Workmanship

3.2.5.1 General

No bedding shall be laid until the Engineer has approved the trench, measured the depth if necessary, and authorized pipelaying to proceed.

The anchoring of pressure pipes shall be as shown in the Drawings.

The bedding criteria for ductile iron is given in the following table.

Pipe Diameter	Bedding Type	
	Class S	Class B
	Pipe cover	
1400	> 4.0m	>4.0m
1100	>4.1m	>4.1m
1000	>4.3m	>4.3m
900	>4.7m	>4.7m
800	>5.1m	>5.1m
700	>5.8m	>5.8m
<600	>6.0m	>6.0m

A cavity of adequate size shall be excavated in the sides and bottom of the trench or left in the pipe bed at each joint and at each sling position.

The preparation of the trench bottom or surface of the bed shall be completed for at least one full pipe length in advance of the pipe laying, except where in exceptional circumstances another arrangement is approved.

No bedding material shall be placed in trenches containing water.

Where bedding other than concrete is to be used, stones, bricks, or similar materials shall not be used below or against the pipes to locate them in position in the trench or to level the pipes.

Except in the case of Class A bedding and concrete surround, the joint holes shall be refilled with fine granular material and lightly compacted to prevent the migration of adjacent pipe bedding material into the holes and to obviate the forming of hard spots under joints.

In the placing of bedding, all voids under the overhang of the pipes shall be filled and the compaction shall be carried out uniformly on each side of the pipes so as not to cause any lateral or vertical displacement of the pipe.

Bedding shall be carried out as pipelaying proceeds, and shall be completed before the acceptance test is carried out.

The degree of compaction attained for bedding (other than concrete) shall be 90% modified AASHTO maximum density.

3.2.5.2 Placing and Compacting of Bedding for Rigid Pipes

In addition to complying with the requirements listed above, the Contractor shall construct the bedding for rigid pipes in accordance with the following requirements:

- a) **Class A.** The pipes shall be supported on a continuous cradle of concrete having a 28 days compressive strength of at least 20 MPa. During pipelaying and before the placing of the concrete bedding, the pipes shall be suitably supported. Care shall be taken during the placing of the concrete to prevent movement or flotation of the pipes. In the case of pipes with flexible joints, concrete shall not be allowed to enter the joints during casting of the bedding and a positive vertical expansion joint in the bedding cradle shall be formed at each pipe joint. The selected fill blanket shall not be placed in any section until a period of 24 hrs has elapsed after placement of the bedding cradle in that section.

The main fill shall not be placed in any section until the bedding cradle in that section has achieved a compressive strength of at least 15 MPa.

- b) **Class B.** The pipes shall be bedded on a continuous bed of selected granular material, the material being placed in accordance with the details, as relevant, and the bedding constructed in the manner shown, as relevant. To ensure that each pipe will be fully supported throughout the length of its barrel on the bedding cradle, joint holes shall be formed in the bedding cradle for pipe sockets and couplings.
- c) **Class C.** The pipes shall be placed directly on the trench bottom after this has been hand-trimmed to ensure that each pipe will be fully supported throughout the length of its barrel. Joint holes shall be formed in the trench bottom for slings, pipe sockets, and couplings.

Any material that is used to support a pipeline temporarily during construction or does not comply with the requirements for bedding cradle shall be removed before the selected fill for Class B or C is placed.

After the pipes have been laid and tested, selected fill material shall be carefully placed into the spaces between the pipe and the sides of the trench to the level of the crown of the pipe. The material shall be thoroughly packed and rammed by careful hand tamping in layer 100 mm thick before compaction to the density specified in Clause 3.2.5.1.

Placing and tamping shall proceed equally on both sides of the pipe. A further layer of the same material at least 300 mm thick after compaction and the full width of the trench shall be placed over the crown of the pipe in equal layers, each layer being compacted to the density specified in Clause 3.2.5.1.

3.2.5.3 Placing and Compacting of Bedding for Flexible and Semi-Rigid Pipes

In addition to complying with the requirements of Clause 3.2.5.1 above, the Contractor shall construct the bedding for flexible and semi-rigid pipes in accordance with the following requirements:

- a) **Class B** Flexible and semi-rigid pipes shall be supported on a cradle as indicated on the engineer's drawings. Initially continuous bed of selected granular material of compacted depth indicated shall be placed in 100 mm layers and covering the full width of the trench. The granular material shall be compacted to the density specified in Clause 3.2.5.1. After laying of the pipeline, additional selected granular material shall than be placed carefully and evenly between the sides of the trench and the pipeline, in layers of uncompacted thickness approximately

100 mm and in accordance with the construction details. Each layer shall be compacted individually to the density specified in Clause 3.2.5.1.

After completion of the bedding cradle, selected fill blanket shall be placed carefully in layers of 100 mm uncompacted thickness over the full width of the trench and shall be compacted to the density specified in Clause 3.2.5.1 up to a height of at least 300 mm above the crown of the pipeline.

- b) **Class S** Flexible and semi-rigid pipes shall be supported on a cradle as indicated on the engineer's drawings. Initially continuous bed of selected fill material of compacted depth indicated shall be placed in 100 mm layers and covering the full width of the trench. The fill material shall be compacted to the density specified in Clause 3.2.5.1. After laying of the pipeline, additional selected fill material shall than be placed carefully and evenly between the sides of the trench and the pipeline, in layers of uncompacted thickness approximately 100 mm and in accordance with the construction details. Each layer shall be compacted individually to the density specified in Clause 3.2.5.1.

After completion of the bedding cradle, selected fill blanket shall be placed carefully in layers of 100 mm uncompacted thickness over the full width of the trench and shall be compacted to the density specified in Clause 3.2.5.1 up to a height of at least 300 mm above the crown of the pipeline.

When placing and compacting the bedding particular care shall be exercised to prevent damage, deflection, or displacement of the pipeline and the polyethelene sleeving.

3.2.5.4 Concrete Surround for Flexible and Semi-Rigid Pipes

In special cases, and where ordered by the Engineer, pipes shall be surrounded in concrete of the specified grade, generally of at least 20 MPa. The lower part of the encasement shall be constructed in the manner specified for Class A bedding. Once the pipeline has been tested and approved, the pipes shall be covered with concrete to the specified depth and expansion joints shall be cut or constructed in the upper part to coincide with those in the lower part. No earthfilling over the concrete shall be commenced until at least 5 days after the concrete has been placed or until the concrete has attained a strength of at least 15 MPa.

3.2.6 Tolerances

The permissible deviations shall be as follows:

- | | |
|--|--------------|
| (i) Moisture Content in field during compaction | OMC -2, +1 % |
| (ii) Density when bedding rigid pipes | -0, +5 % |
| (iii) Density when bedding flexible and semi-rigid pipes | -0, +3 % |

3.2.7 Testing and Acceptance

The Engineer may order density tests to be carried out to determine the density and grading of the bedding. Tests will be carried out for every 200 linear meter of trench or part thereof by the Contractor in the presence of the Engineer, or by an independent laboratory approved by the Engineer. The cost of all testing will be included in the Contractor's rates. If the density is found to be below the specified value, the Engineer may order removal and recompaction at the Contractor's expense, and the cost of retesting shall be borne by the Contractor.

The tests may be carried out by the sand replacement method or, where the grading of the bedding is such that the particle size is not less than 0.075 and not more than 2 mm, by use of a dynamic cone penetrometer.

3.2.8 Measurement and Payment

These shall be made according to Clause 3.1.8.

3.3 PRESSURE PIPELINES

3.3.1 Scope

This specification covers the transportation to Site, installation and testing of ductile iron pipe, valves, fittings and plastic sleeving supplied by the Employer.

It also covers the construction of valve chamber, thrust blocks and other structures required for the operation of the bulk distribution mains.

3.3.2 Interpretations

3.3.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1.1 General
- b) 2.1 Site Clearance
- c) 2.2 Earthworks
- d) 2.3 Concrete
- e) 3.1 Pipe Trenches
- f) 3.2 Pipe Bedding
- g) 2.4 Brickwork

3.3.2.2 Application

This specification contains clauses that are generally applicable to the construction of ductile iron pipelines and appurtenances.

3.3.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Fitting - A special or a valve, or a process of jointing (except welding) straight pipes to one another and to specials and valves.

Pressure Pipelines – A pipeline in which the normal internal working pressure exceeds 3 metres of water (0.3Bar) and such other pipework as may be so designated

Special - Any pipe other than straight pipe, such as bends, tees, reducers, etc.

Straight pipe - A straight pipe of uniform bore and of standard or non-standard length.

3.3.2.4 Abbreviations

For the purpose of this specification the following abbreviations shall apply:

DI	Ductile iron
IRHD	International rubber hardness degree
PTFE	Polytetrafluor ethylene

3.3.3 Materials

Ductile cast iron pipes, specials, polyethelene sleeving and valves, shall comply with the specification as mentioned in Clause 5.2.1. They shall be capable of withstanding the applicable test pressure specified in Clause. 3.3.7.1 below. All pipes and fittings shall be supplied complete with couplings and jointing material.

Satisfactory temporary end covers shall be provided by the contractor for the protection of threads, flanges, and prepared ends of plain-ended pipes and fittings, and to prevent damage to internal lining during transportation and during handling on Site.

The Contractor shall supply a mastic putty, and a wrapping tape, to protect all buried nuts and bolts from corrosion

The Contractor shall supply protective wrapping tape to be used to protect the pipe and joints from corrosion in the locations indicated on the Drawings. The primer used before application shall consist of xylene and bituminous material and shall be supplied by the tape manufacturer. The tape shall be black in colour and consist of a PVC backing bonded to a self adhesive bituminous rubber compound with a total thickness of 1.65mm. The PVC backing shall be extruded (non-calendered) and have an average thickness of 0.75mm. The tape shall be supplied on a high quality overwidth silicone release paper, extending some 12.5mm wider than the tape.

Pipeline materials shall be so transported, stored, and handled that pipes are not overstressed at any time and fittings are not damaged in any way. Pipes damaged or cracked in any way shall be removed from the Site and replaced at the Contractor's expense.

Materials for manhole covers and surface boxes shall be as specified in Clause 3.3.5.8.

3.3.4 Construction Equipment

Any vehicle on which pipes are transported shall have a body of such length that the pipes do not overhang. Large pipes shall be placed on cradles and the loads properly secured during transit. The pipes shall be handled in accordance with the manufacturer's recommendations.

The equipment and rigging equipment used by the Contractor for the handling and placing of pipes shall be in accordance with the manufacturer's recommendations and shall be such that no pipe is overstressed during any operation covered by the specification.

The Contractor shall provide all tools and equipment used for the cutting, jointing and laying of pipes, fittings and valves.

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline subject to the approval of the Engineer.

The Contractor shall provide all equipment and tools required for installation of polyethylene sheeting, mastic putty and all types of wrapping tape.

The Contractor shall provide all equipment, materials, tools and fittings required for the cleaning and swabbing of the pipeline.

The Contractor shall provide all the equipment, materials, tools, and fittings required for the performance of the tests given in Sub-section 3.3.7 below. Test gauges shall be of approved manufacturer having dials at least 200 mm diameter, graduated such that the test pressure is at least 75% of the gauge reading. If necessary different gauges shall be supplied for different pipeline sections. Two gauges of each type shall be provided for the sole use of the Engineer and shall remain in the Engineer's possession for the duration of the Contract.

All gauges shall be dead weight tested and proved at the commencement of use and at regular intervals thereafter as required by the Engineer.

All equipment and methods shall be subject to the approval by the Engineer

3.3.5 Construction and Workmanship

3.3.5.1 Handling of Pipes and Fittings

Coated pipes shall be transported on trucks or trailers fitted with approved padded timber cradles shaped to fit the curvature of the pipes and of adequate dimensions so as to prevent any damage to the pipe coating. Successive tiers of coated pipes shall be separated by similar suitable shaped timber cradles when more than one tier of pipes is being transported. Pillows shall be provided between securing chains or lashings when loads are being transported.

Particular care shall be taken during unloading, loading, handling and transportation to avoid distortion, flattening, denting, scoring or any other damage to the pipes, fittings and any damage to the external or internal coating or lining of the pipes, fittings etc. Under no circumstances shall pipes be dropped, be allowed to strike on another, be rolled freely or dragged along the ground.

Loading, unloading and handling shall be carried out using special hooks, well padded, with a curved plate to fit the curvature of the pipes or webbing slings not less than 30 cm wide or other means approved by the Engineer. Steadying ropes shall be employed. The positions of lifting slings shall ensure that stresses and tendency towards deformation in the pipes are kept at a minimum. Pipe handling equipment shall be maintained in good repair and any equipment which in the opinion of the Engineer may cause damage to the pipes shall be discarded.

End covers and protection shall not be removed until incorporation of the pipes and fittings into the Works.

Care shall be taken during loading, transporting, and unloading to prevent damage to the pipes, fittings or coatings. When loading pipes in the stockyard the Contractor will be responsible for any damage to pipes and fittings which shall be noted and reported to the Engineer. After unloading all pipes or fittings will be examined and any defects or damage shall be noted and reported to the Engineer. Any damage shall be repaired in a manner recommended by the Manufacturer with the approval of the Engineer. Any pipe not considered by the Engineer to be of an acceptable quality after repair will not be accepted and the Contractor will be required to compensate the Employer.

When materials are temporarily stored at the edge of the wayleave they shall be stored clear of the ground and positioned to avoid damage by passing traffic in a manner approved by the Engineer.

3.3.5.2 Laying

To ensure that his supervisors and operators are familiar with the manufacturer's instructions/pipeline construction manuals for the laying and jointing of pipes and that these instructions are strictly adhered to, the Contractor shall employ the manufacturer to demonstrate laying and jointing. The demonstration shall also include the cutting of pipes and the repair of damaged pipes.

Pipe laying shall not commence until the bottom of the trench and the pipe bed have been approved by the Engineer's representative.

The trench bottom shall be prepared as specified in Clause. 3.1.5.5. Trenches shall be kept dry to allow proper and safe bedding, laying, jointing of pipes and construction of the selected fill blanket over the pipes.

The pipeline shall be tape wrapped or sheathed in polythene sleeve for protection. The use of the type of protection shall be based on ground conditions in accordance with the following table or as directed. The Contractor shall measure soil resistivity and pH at 100 m intervals.

Soil Corrosivities	Ground Condition	Protection System
Aggressive	<ul style="list-style-type: none"> Natural soils with resistivity between 15 and 25 Ωm with seasonal water table or permanent water logging. Natural soils with a pH range 5 < pH < 6 without water table. 	Standard pipe coating plus PE sleeving
Highly Aggressive	<ul style="list-style-type: none"> Natural soils with resistivity below 15 Ωm with seasonal water table or permanent water logging. Natural Soils with a pH range 5 < pH < 6 with seasonal water table or permanent water logging. 	Standard pipe coating plus 25 mm overlap
	<ul style="list-style-type: none"> Made up ground with heavy chemical contamination 	Standard pipe coating plus tape wrap 55% only.

The protected pipeline shall be laid and bedded to even grades and to levels and alignments shown on the drawings or as directed. It shall be laid centrally in the trench and with the manufacturer's class and quality identification marks visible from the top of the trench, if possible. Control of laying and bedding shall be by means of boning rods and sight rails or an acceptable

laser beam device. Sight rails shall be painted black and white and shall be fixed securely and accurately.

Pipes shall be brought to the correct alignment and inclination, concentric with the pipes already laid. Adjustments to line and grade should be made by scraping away or adding adequately compacted foundation material under the pipe and not using wedges and blocks or beating on the pipe.

Pipes shall be handled in manner which eliminates any possibility of high impact or point loading, taking care to protect the joint elements.

Every reasonable precaution shall be taken to prevent the entry of foreign matter and water into the pipeline. At the close of each day's work or at any time when work is suspended for a significant period, the last laid pipe shall be plugged, capped, or otherwise tightly closed until laying is recommenced.

Where so required, the cover or the alignment of a pipeline may change gradually by deflection at pipe joints, but this deflection shall not be greater than half the deflection permitted by the manufacturer of the pipe.

The minimum clearance between the outside of a pipeline being laid and the outside of any other pipe that it crosses shall be 150 mm. Where this requirement conflicts with the requirements for cover over the pipeline the Contractor shall ask the Engineer for written instructions and shall carry out the work in accordance with those instructions.

3.3.5.3 Jointing

All pipelines shall be jointed in accordance with the manufacturer's instructions and to the approval of the Engineer.

Until required for incorporation in a joint, each rubber ring or gasket shall be stored in the dark, free from the deleterious effects of heat or cold, and kept flat so as to prevent any part of the rubber being in tension.

Spigots and sockets of pipes being jointed shall be thoroughly cleaned by brushing and wiping immediately before being jointed. All rubber rings and seals shall be carefully inspected after being placed in position and before the joint is closed, to ensure that they have not suffered any cuts, tears, or other damage, and are not in any way defective.

All pipes with flexible joints shall be accurately marked prior to laying to ensure that the correct gap is left in the joint.

For push-fit and bolted gland joints only lubricants recommended by the manufacturer shall be used in connection with rubber rings and these lubricants shall not contain any constituent soluble in water conveyed in the pipe. They shall be suitable for the climatic conditions at the Site and shall contain an approved bactericide.

For bolted gland joints the joints ring shall be pushed into place by the glandring using only hand pressure, fixing nuts and bolts should then be fitted and first tightened to finger pressure. Thereafter tightening shall be in the sequence proposed by the manufacturer and to the torque recommended.

In the jointing of pipes with flanges, special care shall be taken to align, grade, and level the pipes, specials, and valves to avoid straining of the flanges. All bitumen and paint shall be removed from the mating face of each flange immediately before jointing. Bolts shall be tightened up evenly in opposite pairs to ensure uniform bearing, the final tightening shall be to the torque specified by the manufacturer.

For flanged joints the gasket shall be fitted smoothly to the flange and the joint made by tightening the nuts to finger pressure first. Thereafter the final tightening of the nuts shall be made by gradually and evenly tightening bolts in diametrically opposite positions using only standard spanners of a type approved by the Engineer.

Graphite grease shall be applied to the threads of bolts before joints are made. All joints containing nuts and bolts which are buried shall be protected with anticorrosive mastic and wrapping tape, applied in accordance with the manufacturer's recommendations.

Care shall be taken to avoid damage to the internal surface of the pipes during assembly of the pipeline.

Once joints are made they shall be protected to a level appropriate for the pipe by: polyethylene sleeving, muffs, or with moulding putty and tape wrapping.

3.3.5.4 Setting of Valves, Specials and Fittings

Unless otherwise shown on the drawings, or directed by the Engineer, gate valves shall be set upright and butterfly valves shall be set with the main shafts horizontal. All valves, specials, and fittings shall be located in the exact positions shown on the drawings or otherwise directed. All bolts and flanges which are to be buried shall be covered with a corrosion inhibiting mastic putty or moulding compound to produce smooth contours, the prepared fitting shall then be wrapped in protective tape.

3.3.5.5 Cutting of Pipes

Pipes shall be cut by a method, which provides a clean square cut of the pipe and of the lining, without damage to pipe or lining. All cut or trimmed ends and the parts of any pipe on which the coating may have suffered damage shall be re-coated as specified before the pipes are laid.

The external area at cut spigot ends of ductile iron pipes shall be ground smooth for a distance of at least 125 mm, and then chamfered or otherwise made suitable for jointing as recommended by the pipe manufacturer.

3.3.5.6 Anchor/Thrust Blocks and Pedestals

At tees, bends, terminal valves, end caps, and where otherwise directed, anchor/thrust blocks shall be constructed to dimensions ordered or shown on the drawings. Unless otherwise indicated on the drawings, anchor/thrust blocks and pedestals shall be constructed of C20 concrete. The concrete shall be well punned around the pipe, if in trenches, against the undisturbed faces and bottom of the trench. Backfilling behind or under thrust faces will not be permitted. Excess excavation shall be replaced with the prescribed mix concrete given above at the Contractor's expense.

Care shall be taken to leave all joints accessible. No anchor/thrust block and pedestals shall be concreted before the approval of the Engineer has been obtained.

3.3.5.7 Valve Chambers

All washout valves, pressure reducing valves, and air valves in pipelines shall be housed in a chamber as shown on the drawings or directed by the Engineer.

3.3.5.8 Covers for Chambers

All covers and frames shall be manufactured, from cast grey or ductile iron, and be coated to the approval of the Engineer. Covers and frames shall conform to NS 104/2042.

All covers shall be fitted to the frames and tested at the manufacturer's works, and covers and frames shall be similarly numbered in a legible and permanent manner in a position which will not be visible when fitted in place, and shall be of such construction as to minimise the ingress of sand.

The Contractor shall ensure that the covers are fitted to the appropriately numbered frames after the frames have been fitted.

The name of the Employer and year of manufacture shall be embossed in all covers.

3.3.5.9 Interface Points

i. General

Where the interface is a pipe flange, the Contractor may be instructed by the Engineer either to install a blank flange, backfill and mark the interface, or to expose and connect to a flange installed by another contractor and backfill on completion. The rate included in the Bill of Quantities shall cover the cost of either operation.

ii. Installation of Flanged Connection Point

The connection point shall be provided at the location specified. The flange shall be installed so that it is vertically plumb and its face is perpendicular to the axis of the pipeline. The flange shall be covered by a PN 16 blank flange, the flange shall be installed in the specified manner. The flange shall be backfilled and the location marked with a marker post.

iii. Connection to Flanged Connection Point

The connection point shall be at the location specified and indicated on Site by a temporary marker post. The Contractor shall excavate to expose the flange, remove and dispose of the blank flange and water contained in the pipe and make the flange joint in accordance with the Specification, including the provision of all jointing materials.

3.3.5.10 Permanent Pipeline Markers

Permanent pipeline marker posts shall be installed at all changes of horizontal alignment, and at 200m intervals along the straight lengths of pipe. Marker posts shall be positioned as close as possible to a 2 m offset from the pipe centre line. In the case of twin pipelines the marker posts shall be installed along the centre line of the twin pipes.

Permanent marker posts shall be of precast concrete Class 30/20 to the dimension shown on the Drawings

3.3.5.11 Internal Pipe Cleaning

Pipelines of 750 mm diameter and larger shall be manually cleaned internally of all debris, stones and sand prior to testing.

All pipelines less than DN 750 shall be cleaned by the passing through of a foam swab before the hydraulic test on completion. Swabbing shall be carried out successively between adjacent temporary swabbing points installed by the contractor.

The foam swab shall comply with the following:

Size:

Main up to DN 300 : swab diameter = pipe diameter + 25%

Main over to DN 300 : swab diameter = pipe diameter + 75 mm

Quality:

Hard Where restrictions in the main do not reduce the diameter of the pipeline to less than two thirds of the swab diameter.

Soft: Where restrictions in the main are in excess of the above but do not reduce the diameter of the pipeline to less than one half of the swab diameter.

3.3.5.12 Disinfection of Potable Water Pipelines

The internal surfaces of all pipelines and pipework including all equipment incorporated in a pipeline or pipework through which water will pass shall be disinfected after they have been cleaned to the satisfaction of the Engineer.

Disinfection shall be effected by filling the pipeline with water heavily dosed with chlorine, and shall be carried out when filling the pipeline with water for carrying out the hydraulic test on completion. Alternative methods may be adopted with the approval of the Engineer.

The level of the chlorine dosing shall be such as to make available 50 mg/l of free chlorine throughout the pipeline.

The water, heavily dosed with chlorine, shall stand in the pipeline for a period of 24 hours or for such longer period as the Engineer shall require and all valves in the system shall be operated at least once during this period.

At the termination of the required period, chlorine residual tests shall be taken at the end of the pipeline farthest from the point of injection and the test shall be repeated if necessary until the residual is not less than 10 mg/l.

The Contractor shall obtain the Engineer's approval to the method to be adopted for disposing of the chlorinated water and the time when such disposal shall take place on completion of disinfection. The Contractor shall neutralise the chlorine by the use of sodium thiosulphate prior to disposal.

3.3.5.13 Training of the Operation and Maintenance Staff

The Contractor shall train the staff identified by the Employer who will be responsible for the operation and maintenance of the bulk distribution system. The training shall include but not be limited to, cutting pipes of all diameters, installation of polyethylene sleeves, tape wrapping of pipes and fittings, repair of coatings, jointing of pipes of all diameters with all types of joint, installation of valves and fittings and maintenance of valves and fittings.

3.3.6 Tolerances

3.3.6.1 General

No deviation will be permitted from the minimum cover specified or as shown on the drawings.

The criteria for the level and gradient to which pressure pipelines shall be laid are as follows:

- (i) the cover above the crown of the pipe to ground level shall be as shown on the Drawings, but in no event shall be less than 1000 mm in green areas, 1200 in the verge or carriageway of roads and 1500 mm where crossing roads.
- (ii) The upward gradient shall be steeper than 1 in 500 with flow, or steeper than 1 in 250 against the flow except where expressly shown in the Drawings.

3.3.6.2 Control Points

For the purpose of this specification valves set on the centre line of the pipeline, designated changes in gradient and designated changes in horizontal alignment, shall be regarded as control points and shall be located with a permissible deviation of + 100 mm on the centre line. The same deviation will be permissible laterally except where the Contractor is required to lay the pipeline to a curve or at a designated distance from a boundary, kerb line, or fence line, in which case the permissible deviation shall be + 30 mm. Unless otherwise directed and subject to a permissible deviation (measured along the centre line) of ± 5 m, scour valves shall be located at the lowest points in pipelines and air valves at the highest points.

3.3.6.3 Alignment (Plan and Level)

Unless otherwise directed, the permissible deviation in alignment between control points from a straight line joining the control points, when measured on the top centre of the pipeline, shall be + 100 mm or + 20% of the nominal diameter, whichever is the larger, and the permissible deviation per pipe length shall be + 30 mm. The permissible deviation from the designated level at any point on the invert of the pipeline shall be + 50 mm or + 10% of the nominal diameter of the pipe, which ever is the larger.

Each pipe shall be laid to the required gradient such that the end of the pipe is ± 5 mm of the required level relative to the other end of the pipe.

3.3.6.4 Valve Chambers, Manholes, etc.

Valve chambers, manholes, and the like shall be constructed centrally on the control points and, with the exception of tolerances that affect access to bolts, nuts, etc., with a permissible deviation of ± 50 mm on all clearance dimensions. The clearance dimension between the outside of each nut and bolt-head and the inside face of the wall of a structure or any other fitting shall generally be not less than 150 mm.

3.3.6.5 Pipe Protective Coatings, etc.

No air must be trapped underneath the wrapping tape. Unsatisfactory pipes shall be cleaned, prepared and rewrapped.

All damage to protective coatings must be repaired. In the following manner;

- (i) Bitumen Coating

Damage to bitumen coating will be repaired by preparing and repainting the damaged area in accordance with the pipe manufacturers instructions.

(ii) Polyethylene Sleeving

Minor damage, small holes etc, to polyethylene sleeving may be repaired by sticking adhesive tape over the damaged point. Larger damage shall be repaired by replacing the sleeve or by sticking a large patch of the sleeving material over the damaged area.

(iii) Tape Wrapping.

Minor damage, small holes etc, to wrapping may be repaired by sticking adhesive tape over the damage after cleaning and preparing the damaged point. Larger damage shall be repaired by cleaning and rewrapping the damaged area.

3.3.7 Testing and Acceptance

3.3.7.1 General

Except where otherwise specified pipelines and pipework shall be subjected to hydraulic pressure tests in the presence of the Engineer which shall comply with BS 8010 or CP 312.

Testing shall be carried out in two stages:

- (i) test of sections as construction proceeds;
- (ii) a final test of the whole of the pipework or pipeline on completion.

The Contractor shall submit to the Engineer, in advance of the time for tests, details of his proposals. The proposals shall include details of temporary works to resist test pressures and methods for carrying out the test. Proposals for testing where thrusts on structures are involved, even where thrust collars on the piping are installed, shall be submitted, with the calculations of the forces to be carried, to the Engineer for approval. The proposal shall include details for transporting the test water from the point of supply to the pipeline to be tested. No connections to the pipeline or pipework which would involve cutting, tapping or otherwise permanently altering the Permanent Works, will be allowed.

3.3.7.2 Procedure

Each section of the pipeline or pipework to be tested shall be capped or blanked off at each end and securely struted or restrained to withstand the considerable forces that will be exerted when the test pressure is applied. Testing against closed valves will not be permitted. Hydrants, washout valves and isolation valves shall be fitted with blank flanges and these together with in-line valves shall be left open. Air valves already fitted shall be permitted to function during the test. The air valve manufacturer's confirmation shall be obtained that the valves are capable of withstanding the test pressure involved.

The section under test shall be filled making certain that all air is displaced through an air valve installed at the high end of the line. The section shall then remain under constant moderate pressure – 10 to 20 m head of water – for a period of several hours until the pressure can be maintained without additional pumping. Pipes of materials liable to absorb water, eg concrete and asbestos cement, shall be allowed to become saturated under this moderate pressure for 24 hours.

The pressure shall then be slowly increased to the full test pressure and pumping discontinued for 3 hours or until the pressure has dropped by 10 m, whichever occurs earlier. Thereafter pumping shall be resumed and continued until the test pressure has been restored. The quantity of water pumped to restore the pressure shall be the measure of leakage from discontinuation of pumping until its resumption.

The pipe section shall be considered as having passed the test if the leakage is not more than 0.365 l/mm of pipe diameter per kilometre per 24 hours for each 100 m head of pressure applied.

Notwithstanding the satisfactory completion of the hydraulic test, if there is any discernible leakage of water from any pipe or joint the Contractor shall, replace the pipe, repair the pipe or re-make the joint and repeat the hydraulic test all at his own cost.

No line shall be accepted until and unless the leakage of any section of the lines tested is not more than the rate of leakage specified above. All activities required to locate leaks and their repair and the repeat of the hydraulic test shall be at the Contractor's expense.

Pipelines shall be tested as above except where the Engineer issues such instructions as are necessary for testing parts of the Works that have been designed for stresses limited by considerations other than those applying to the pipeline systems.

3.3.7.3 Test Pressures

Test pressures are to be measured at the centre of the blank flange situated at the lowest end of the pipeline under test. All pipelines shall be tested to a pressure corresponding to a hydraulic grade of 1452 masl.

The contractor shall submit a schedule of pipeline test pressures to the Engineer for approval prior to commencing testing.

3.3.7.4 Sectional Hydraulic Test

The Sectional Hydraulic Test shall be carried out after the pipeline or pipework section to be tested has been laid, jointed and backfilled to a depth sufficient to prevent flotation of the pipeline. The sections to be tested shall be to the approval of the Engineer and shall be not longer than 2,000 m or 500 m when either the pipeline is laid adjacent to or underneath the carriageway.

In addition to the above requirements the Contractor shall perform a hydraulic test on the first 200 m length of pipeline of each diameter to be laid under the Contract. This test shall be undertaken within one month of the Contractor commencing the laying of pipes. Should the pipeline fail the test or the Contractor fail to undertake the test, all laying work for that diameter shall come to halt until that section of pipeline passes the hydraulic test.

3.3.7.5 Hydraulic Test on Completion

The test on completion shall be carried out after all the pipeline sections have been joined together on completion of sectional testing. The joints between sections shall be backfilled once the test is satisfactorily completed.

3.3.8 Measurement and Payment

The rates for pipelaying and installation shall include for transportation of the, cutting and repairing pipes, installation of polythene sleeving, laying and jointing of the pipe, testing & commissioning, protection of flanges, the provision and placing of bedding material, dewatering, and backfilling of trenches and disposal of excess material and spoil, and demonstration of laying as specified in Clause 3.3.5.2.

Pipe laying and installation will be measured as the distance along the centreline of the pipeline with no deductions for chambers etc, according to the depth to invert of the pipeline.

Valve Chambers will be measured separately according to type. No separate payment will be made for, provision of materials, construction of the chamber, installation of valves and specials supplied by the Employer, backfilling and disposal of excess material.

3.4 SEWERS AND STORMWATER DRAINAGE

3.4.1 Scope

This specification covers the general construction requirements for sewerage and stormwater drainage systems including connecting sewers, manholes, and the like, but excluding sewer pressure mains, pump stations, treatment works, and ancillary works.

3.4.2 Interpretations

3.4.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

- a) 1 General

- b) 2.1 Site Clearance
- c) 2.2 Earthworks, as applicable
- d) 3.1 Pipe Trenches
- e) 3.2 Pipe Bedding
- f) 2.3 Concrete
- g) 2.4 Brick/stone work

3.4.2.2 Application

This specification contains clauses that are generally applicable to sewer and stormwater drainage construction.

3.4.2.3 Definitions

For the purpose of this specification the following definitions shall apply:

Expansion pipe joint - A pipe joint that allows relative longitudinal movement between adjacent pipes without the occurrence of fracture or leakage.

Flexible pipe joint - A pipe joint that allows relative angular (radial) and longitudinal movements between adjacent pipes without the occurrence of fracture or leakage.

Geofabric blanket - A blanket so woven from synthetic fibres that it is capable of acting as a filter that retains some or all of the solid particles carried by a fluid but, with varying degrees of restriction, allows the passage of the fluid.

Invert slab - The slab, normally of concrete, that forms the bottom of the culvert.

Prefabricated culvert units - Portal or rectangular culvert units that have been prefabricated from reinforced concrete.

Rigid pipe joint - A pipe joint that allows no relative movement between adjacent pipes without the occurrence of fracture or leakage.

3.4.2.4 Abbreviations

For the purpose of this specification the following abbreviations shall apply:

AC	Asbestos cement
CI	Cast iron
CID, DN	Constant inside diameter
COD	Constant outside diameter
PVC	Polyvinyl chloride
uPVC	Unplasticized polyvinyl chloride
CP	Machine made concrete pipe
RCP	Reinforced concrete pipe

3.4.3 Material

3.4.3.1 Pipes, Fittings and Pipe Joints

For drainage and sewerage prefabricated concrete pipes NP2 or NP3, built according to provisions of NS80/2042 or equivalent shall be used.

The concrete pipes shall have circular cross-section and jointed using a collar. The concrete pipes must be of uniform condition. They must not exhibit any damage or be affected in any way likely to impair their serviceability, their strength, water tightness and service life.

All the pipe used in the Works will be from the same manufacturer. The manufacturer must be a nationally recognized and specialized concrete pipes manufacturer. On first starting production the manufacturing plant must demonstrate, prior to delivering concrete pipes that the pipes comply with the requirements of NS 80/2042. The tests necessary for this purpose must be carried out by an accredited testing agency having suitable testing equipment at its disposal.

The collars must be matched to the dimensions of the pipes and must be included in the delivery of the pipe. The dimensions of the collars must comply with NS 80/2042 or equivalent.

3.4.3.2 Alternative Materials

Should the Contractor proposes to use pipes and fittings of material other than those referred to above, he shall submit for approval detailed specifications including full details of the type of joints and specials he proposes to use with such pipes and fittings. The Contractor shall not use such pipes or fittings until he has obtained approval for their use from the Engineer.

3.4.3.3 Bedding

The requirements for bedding of specification Clause 3.2-Pipe Bedding shall apply.

3.4.3.4 Culvert Units and Pipes

Prefabricated culvert units and pipes shall be either precast concrete pipes, or portal and rectangular precast concrete culvert units, as applicable.

3.4.3.5 Concrete

Concrete, cast-in-situ or precast concrete, shall comply with the relevant requirements of specification Clause 2.3.

3.4.3.6 Manholes, Catchpits and Accessories

Bricks and mortar shall comply with the relevant requirements of specification Clause 2.4.

Prefabricated manhole sections may be of spun concrete, asbestos cement, glass-reinforced polyester, PVC, or such other material as are approved by the Engineer. Covers and frames for manholes and grid inlets shall be supplied in matching sets, each set bearing a serial number to enable it to be identified.

Step irons shall comply with the applicable requirements of BS 1247 or equal approved and shall be of suitable length for the wall of the manhole into which they are to be built.

3.4.3.7 Geofabric Blanket

The synthetic fibres of a geofabric blanket shall consist of at least 85 % by mass of polyester, polyethylene, or polypropylene, or a combination of these polymers, and shall contain such additives as are necessary to render the geofabric blankets resistant to the effects of ultra-violet radiation and heat.

The Engineer's approval of the make and grade of the geofabric shall be obtained by the Contractor before he orders any geofabric or uses it on the Works.

For normal application, and if not otherwise directed by the Engineer or specified in the Particular Specification, geofabric blankets shall be of the non-woven, needle-punched type with a specific weight of approximately 270 g/m².

3.4.4 Construction Equipment

The equipment and rigging equipment used by the Contractor for the handling and placing of pipes shall be of the type recommended by the pipe manufacturer and subject to the approval by the Engineer and shall be such that no pipe is overstressed during any operation covered by the specification.

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline.

The Contractor shall provide all the equipment, materials, tools, and fittings required for the performance of the tests given in Clause 3.4.7 below, and shall provide suitable equipment for the location of faults up to the date of issue of the final certificate.

3.4.5 Construction and Workmanship

3.4.5.1 Trench Bottom

The trench bottom shall be prepared as specified in Clause 3.1-Pipe Trenches. Trenches shall be kept sufficiently dry to allow proper and safe bedding, laying, and jointing of pipes and kept dry until the pipeline has passed the required tests and construction of the selected fill blanket over the pipes has been completed.

For the laying of culvert elements, the trench bottom shall be excavated to a depth of 75 mm in soil, or 200 mm in rock, or such other depth as may be shown on the drawings, below the level of the underside of the precast invert slab or to the level of the underside of the cast-in-situ invert slab, as applicable, and this space shall be filled with granular material, compacted, and shaped to enable the culvert units to be bedded properly.

Where, because soft, soggy, spongy, or otherwise unsuitable material is encountered, the bottom of the trench as excavated does not provide a suitable firm foundation for the culvert, the unsuitable material shall be excavated to a depth below the bottom of the culvert indicated by the Engineer and replaced with gravel or other approved granular material compacted to at least 90 % of modified AASHTO maximum density. When so ordered, the Contractor shall construct a layer of concrete blinding, at least 75 mm thick, to provide a suitable working floor.

3.4.5.2 Bedding, Laying and Backfilling

Each pipe and fitting shall be thoroughly cleaned out and carefully examined for damage immediately before laying. The onus of detecting damaged pipes and fittings before installation shall be on the Contractor. Should any damaged pipe or fitting be found in the sewer after it has been laid, the damaged item shall be removed and replaced at the Contractor's expense.

Pipes shall be laid on the specified bedding cradle true to designated line and level, and the bedding shall be placed and compacted in accordance with the applicable requirements of Clause 3.2.5. Designated invert levels shall take precedence over design depths shown on drawings.

The completed sewer or stormwater drain shall have no bends or undulations except where directed. Should pipes be allowed to have any deviation from straightness, they shall be so laid that preference is given to level over line.

The method of laying and bedding shall be such that barrels of pipes bear evenly on the bedding for their full length, that no packing is used under the barrels, and that no socket or coupling bears on the bedding. Where the slope of a pipe is greater than 1 in 10, anchor blocks shall be constructed according to the details provided.

Pipes shall be so cut as to obtain a clean and square end, and, where pipes and fittings of different material shall be jointed, shall be so only with special adaptors recommended by the pipe manufacturer(s).

All pipe openings shall be sealed by the Contractor to ensure that no water, stones, or other foreign matter enters the sewer during or after laying.

The sewer or stormwater drains shall be so jointed to the pipes built into the manholes that there is a flexible joint positioned as close as possible to the manhole.

Precast units shall be lifted and handled only by means of lifting devices approved by the manufacturer.

The Contractor shall exercise due care not to damage, overstress, or displace any culverts by the imposition of any loads such as may be caused by the movement of his own vehicles or compaction equipment. Where superimposed moving loads in excess of those prescribed in the applicable road traffic ordinance are, during the construction of the Works, likely to pass over completed culverts, the Contractor shall provide sufficient additional cover over the culverts to ensure that the design stresses on the culverts are not exceeded.

Any units that become deformed or cracked, or that are not constructed to the required lines, levels, and grades, or that become displaced in the course of the work, shall be removed and replaced by the Contractor at his own expense.

Cast-in-situ invert slabs for portal or rectangular culverts shall be constructed to the dimensions and at the locations shown on the drawings or as directed. They shall be reinforced as detailed on the drawings. The units of the upper portion of precast portal culverts shall be placed accurately on the invert slabs, with a thin layer of 1:3 cement: sand mortar between the horizontal contact surfaces to ensure a firm and uniform support. The units of the upper portion shall be butt-jointed end to end and each joint shall be covered with geofabric blanket placed symmetrically over the joint.

Pipe culverts shall be laid and bedded to the level and alignment shown on the drawings or as directed. They shall be laid hard up against each other longitudinally to obtain tight joints and they shall be supported evenly throughout the barrel length. Holes or grooves of adequate size to allow for jointing and for bedding thickness under joints, shall be cut in the bottom of the trench. Pipes shall be laid centrally in the trench in such a manner that the side allowances specified in Clause 3.1-Pipe Trenches are available as working space for the proper bedding of the pipes in terms of Clause 3.2-Pipe Bedding. For ease of inspection pipes shall be laid with the manufacturer's class and quality identification marks visible from the top of the trench unless, in the case of larger pipes, the position of lifting eyes renders this impractical.

Each pipe shall be cleaned out and carefully examined for possible damage immediately before laying. The onus on detecting damage shall rest on the Contractor. Should any damaged pipe be laid, it shall be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

Joints of butt-ended pipes shall be externally wrapped with either 2 layers of 0.5 mm thick plastics dampcourse or one layer of geofabric blanket. The wrapping shall be at least 200 mm wide and be centrally placed over each joint.

Ogee type pipes need not be wrapped but shall be laid with the spigot ends pointing downstream.

Spigot and socket pipes with rubber ring joints shall, unless another method is directed or approved by the Engineer, be jointed in accordance with the manufacturer's instructions.

Backfilling of pipes and pipe culverts shall comply with the applicable requirements of specification Clause 3.1.

Material for backfilling of portal or rectangular culverts shall comply with Clause 3.1.3 and shall be obtained by the Contractor from approved borrow pits, if necessary.

Backfill alongside the walls and over the top of culverts shall be watered, mixed, placed, and compacted in layers not exceeding 150 mm after compaction, to a density at least equal to that required for the material in the adjoining layers of fill, subgrade, and subbase, as applicable, or to at least 90 % of modified AASHTO maximum density in the case of excavation made in natural ground.

Backfilling shall be carried out simultaneously and equally on both sides of the structure to avoid unequal lateral forces.

3.4.5.3 Manholes, Inspection Chambers, Catchpits etc.

Manholes, inspection chambers, catchpits, inlets, outlet structures etc., shall be constructed of cast-in-situ concrete, precast concrete, brickwork, as shown on the drawings or as directed by the Engineer.

Manholes shall be provided in following situations:

- changing of direction,
- changing of slope,
- changing of diameter
- interception of secondary lines,
- interception of house connections,
- on main lines at a distance of max. 80 m.

Manholes shall comply with the requirements of NS 80/2042.

The incoming and outgoing pipes shall be fixed in position as detailed before concreting. The concrete surrounding these pipes shall be placed in a single operation and particular care shall be taken to ensure that it fills the whole space beneath and around the pipe.

Benching shall be left completely smooth to the satisfaction of the Engineer. The concrete surround shall be formed using properly constructed formwork.

Selected material shall be carefully filled in and compacted behind the concrete and made solid after the concrete has hardened sufficiently and the protective coating has cured and been properly protected.

Cover slabs shall not be placed until 24 hours after the placing of the concrete manhole surround. This time may be increased or decreased to the discretion of the Engineer.

3.4.5.3.1 Step Irons

Step Irons shall be of cast iron or mild steel and they will be built into concrete as the work proceeds at 300 mm apart vertically.

The entire steps shall be corrosion protected as specified to the approval of the Engineer

3.4.5.3.2 Manhole and Chamber Covers

All covers and frames shall comply with Clause 3.3.5.8.

3.4.5.4 Concrete Casing to pipes

In special cases, and where ordered by the Engineer, pipes shall be encased in concrete of the specified grade, generally of at least 15 MPa. The lower part of the encasement shall be constructed in the manner specified for Class A bedding (see Clause 3.2). Once the sewer or stormwater drain has been tested and approved, the pipes shall be surrounded with concrete to the specified depth and expansion joints shall be cut or constructed in the upper part to coincide with those in the lower part. Use shall be made of poker vibrators to ensure proper filling with concrete of all spaces under and around the pipe, and displacement or flotation, or both, shall be prevented. All temporary supports provided for the pipes shall be removed as concreting progresses. No earthfilling over the concrete shall be commenced until at least 5 days after the concrete has been placed or until the concrete has attained a strength of at least 10 MPa.

3.4.5.5 Raising or Lowering of Existing Manholes

Where an existing manhole is required to be raised or lowered, the work shall be so carried out that the finished manhole complies with the applicable requirements of Clause 3.3.5.3 above. Where practicable, the same cover shall be used, which shall, on completion of a manhole be flush with the surface of the finished road, shoulder, or sidewalk, as the case may be.

3.4.5.6 Connecting Pipes

Connecting sewers or stormwater drains shall be laid from junctions provided in the main lines to the positions and depths as shown on the drawings or as directed.

The Contractor shall record all relevant data (eg street name, number of plot, location measurements and distances in relation to boundary peg(s), size of connection, depths of invert at connecting point and end of connection etc.) for the preparation of "as-built" drawings, and shall make these records available to the Engineer.

3.4.5.7 Action to be Taken During and After Testing

The Contractor shall make good any defects that may be found while the pipeline is under test and after that the tests shall be repeated at his expense until the pipeline is found to comply with the specification.

After the sewer or stormwater drain has passed the tests all access lids shall be properly sealed with bitumen or by any other approved method in watertight manner.

3.4.5.8 Reinstatements of Existing Drains

The existing drains damaged by the works shall be relocated and connected into new drains as required. Existing drains shall be cleaned out from the new drain trench face and any disturbed pipe relaid to ensure a free discharge into the new drain. The disused end of the intercepted drains shall be sealed with puddle clay or other approved materials.

Where an existing land drain is exposed and temporarily severed by trench excavation, the position of the drain shall immediately be marked and recorded. The normal functioning of the drain until permanent restoration is made shall be maintained by the construction of a watertight conduit adequately supported across the trench.

Without limiting the Contractor's liability for restoration of damage, the Contractor shall notify the Engineer of any drain which is blocked or is otherwise defective when the drain is first exposed.

When the line of an existing drain interferes with a pipeline, the Contractor shall deal with the drain as directed.

Drains shall be reinstated on their original line, unless the Engineer orders otherwise.

When backfilling is being done the temporary conduit shall be removed and the ground below the line of the drain shall be compacted. The positions of the ends of the drains shall be marked and the trench reinstatement completed. The trench for the drain shall be re-excavated and the drain reinstated with approved material laid on supports. The line, level and grade of the original drain shall be maintained.

The supports shall be of durable material and shall be bedded firmly at 500 mm into the undisturbed ground on the trench sides. The supports shall be of suitable timber having a cross section not less than 150 x 65 mm or such section as would be required to permit the laying of the new drain without deflection.

3.4.6 Tolerances

3.4.6.1 General

Tolerances will be determined on the basis of permissible deviations from designated location, alignment, grades, and levels. The Contractor shall construct each of the various parts within the limits set out below.

3.4.6.2 Manhole and Catchpit Locations

The permissible deviation of the location of manholes and catchpits (other than kerbside catchpits) in plan of the designated position shall be half the pipe length longitudinally and ± 200 mm laterally, except where locations are dimensioned from fixtures such as fences, kerbs, and the like, in which event the permissible deviation in each direction will be ± 50 mm.

Such manholes or chambers shall be constructed at the meeting points of intersecting pipelines subject only to such deviations as can be tolerated by the junction channels or specials.

3.4.6.3 Invert Levels

The permissible deviation from the designated level of the invert at each manhole shall be ± 50 mm but, should the fall between any two successive manholes be less than 90 % of that specified, the said permissible deviation shall be reduced to a value such that the fall is at least 90 % of that specified.

The permissible deviation of the level of the invert of a culvert from the designated level shall be ± 25 mm.

3.4.6.4 Alignment and Grade

Subject to the permitted manufacturing tolerances applicable to the pipes being laid, the line of the pipe invert shall at no point between successive manholes deviate from a straight line by

more than 5 % of the nominal diameter of the pipe, or be lower than at any other place closer to the lower manhole.

The permissible deviation of the alignment and grade of each culvert shall be ± 25 mm from the designated line and level, when measured over any 6 m length, and all such deviations shall be gradual.

3.4.6.5 Manholes and Chamber Structures

The dimensions of walls and roofs of manholes and chambers shall conform to the dimensions specified, subject to the allowable tolerances laid down for concrete structures (see Clause 2.3)

3.4.6.6 Kerbside Catchpits, Kerb Inlets or Grid Inlets

The permissible deviations of the longitudinal location shall be half a kerb length or 0.5 m, whichever is the greater and the permissible deviations of the lateral location from the designated distance from the centre line of the road shall be ± 25 mm, except that any open grid or grid frame shall be truly parallel to and within 5 mm of the face of the kerb.

3.4.7 Testing and Acceptance

3.4.7.1 General

Tests described below apply to sewers and stormwater drain and references to a sewer apply equally to a drain.

All acceptance tests shall be carried out in the presence of the Engineer and at such times and in such manner as the Engineer may direct.

No pipe joint or fitting shall be covered until the tests applicable have been completed and the Engineer has authorized such covering.

The sewer or any section of it shall be inspected by the Contractor who, if he deems it ready to be tested, shall advise the Engineer of his intention to subject the sewer or the said section of it to the appropriate tests.

The sewer shall be tested in sections between manholes or chambers, as applicable, the section being tested being isolated from other sections by means of suitable plugs or stoppers that have been braced adequately.

Notwithstanding any authorization by the Engineer as described above, the Engineer may, after backfilling and compaction have been completed, order that the sewer be retested to check that it has not been disturbed or damaged during backfilling.

The Engineer may order one of the following to be carried out on the sewer or any section of it:

- a) an air test on pipes, other than concrete pipes, of all sizes; or in the case of pipes, other than concrete pipes, of diameter up to 600 mm, an air test followed by a water test
- b) a water test in the case of pipes of diameter up to 750 mm
- c) a visual internal inspection in the case of pipes of diameter greater than 750 mm.

The Contractor shall provide all labour and apparatus (including expandable plugs and flexible bag stoppers) that may be required for carrying out the tests.

All test results shall be recorded in the manner directed, whether or not the pipeline or section of pipeline has passed the test.

3.4.7.2 Tests and Acceptance/Rejection Criteria

- a) Air test: An approved air testing machine shall be used to raise the gauge pressure in the section of the pipeline under test first to 3.75 kPa. After a 2 min stabilization period the pressure shall be reduced to 2.5 kPa. The machine shall then be switched off and the time taken for the pressure to drop from 2.5 to 1.25 kPa shall be measured. The time taken shall be at least 2 min for ND 100, 3 min for ND 150, 4 min for ND 200, 4.5 min for ND 250, 6 min for ND 300, 8 min for ND 400, 10 min for ND 500, 12 min for ND 600, and 14 min for ND 700. Times applicable for other diameters may be interpolated.

- b) **Water test:** The section of the pipeline under test and the manhole at the upper end of the said section shall be filled with water to such depth that every portion of the pipeline is subjected to a pressure of not less than 12 kPa and not more than 60 kPa. During the test there shall be no discernible leakage of water. An appropriate period, which shall be at least 12 min, shall be allowed for initial absorption, and the loss of water over the next 30 min shall be noted. The amount lost, in litres, per 100 m of pipeline per hour, shall not exceed the following values: 6 for ND 100, 9 for ND 150, 12 for ND 200, 15 for ND 250, 18 for ND 300, 23 for ND 400, 29 for ND 500, 36 for ND 600, and 44 for ND 700. Amounts applicable for other diameters may be interpolated.
- c) Tests on existing pipes shall be carried out in accordance with the above unless directed otherwise by the Engineer.

Should any section of the pipeline fail to pass the water test, a re-test will be permitted and, in such case, acceptance or rejection of the section will be determined on the result of the re-test.

3.4.7.3 Rejection

In the case of AC, vitrified clay, and fibre pipes, failure under the air test will be deemed to be cause for rejection. After such rejection the Contractor may apply a water test to locate the source of failure, rectify the pipeline, and re-apply the air test. In the case of concrete, failure under the water test will be deemed to be cause for rejection.

3.4.7.4 Testing of Connecting Sewers

Each connecting sewer shall be tested between its upper end and the junction at the main sewer. The upper end of the connection shall be kept securely closed with expanding plugs during the test. Where practicable the Contractor may test the main and connections simultaneously if he so wishes. On completion of the test, the upper end of the connection shall be permanently sealed by means of a plug stopper suitable for the type of pipe.

3.4.8 Measurement and Payment

3.4.8.1 General

The rates for pipelaying and installation of sewers and storm drains shall include for supply of the pipes, laying and jointing of the pipe, the provision and placing of bedding material, dewatering, and backfilling of trenches and disposal of excess material and spoil, and testing of the sewer or drain. Pipe laying and installation will be measured as the distance along the centreline of the pipeline with no deductions for manholes etc, according to the depth to invert of the pipeline. Manholes, catchpits, inlets will be measured separately according to type. No separate payment will be made for, provision of materials, construction of the manhole, catchpit or inlet, backfilling and disposal of excess material.

4.0 ELECTRO-MECHANICAL EQUIPMENT AND RELATED WORKS

4.1 TRANSFORMER

4.1.1 Tank

The transformer tank shall be of robust construction, which shall be oil tight and silica-gel breathing system. The tank cover shall be bolted and grounding pads complete with clamp type terminal connector shall be provided on the tank wall near the base.

4.1.2 Core

The transformer core shall be constructed of high quality, non-aging, high permeability silicon steel. The steel shall be clamped with positive locking devices to ensure adequate mechanical strength to support the windings and reduce vibrations to a minimum during operation.

4.1.3 Windings

The windings of the transformer shall be of copper such that the completed assembly of core

and coils give efficient performance during operation. The core and coils assembly shall be dried in a vacuum for ensuring complete elimination of air and ingress of moisture within the insulating materials. After the drying process, the assembly shall be immediately impregnated with dry oil. The transformer shall be provided with a oil conservator tank.

4.1.4 Short Circuit Capacity

The transformer shall be able to withstand the mechanical and thermal stress produced due to short circuit current which should be limited by the impedance of the transformer.

4.1.5 Tap Changer

The transformer shall be furnished with an externally operational tap changer at no load. The tap changer shall have an operating handle, visible indication of tap position and lockable.

4.1.6 Insulating Oil

The insulating oil shall be refined mineral oil and the transformer shall be supplied with first filling of the oil.

4.1.7 Bushings

The bushings shall be made of porcelain.

The H.T., L.T. and neutral bushings shall have bolted terminal lugs suitable for terminating 10 – 35 sq. mm. aluminium conductor.

4.1.8 Temperature Rise

The average winding temperature rise above the maximum ambient temperature of 45°C while carrying maximum continuous rated kVS shall not exceed 55°C.

4.1.9 Accessories

The transformer shall be equipped with the following accessories:

- a) Lifting lug
- b) Name plate
- c) Tank grounding terminal connector
- d) Conservator tank
- e) Silicagel breather
- f) Silicagel vent
- g) Tap changer
- h) Oil drain valve
- i) Upper oil sampling valve

4.2 DIESEL GENERATOR

4.2.1 Technical Requirements

The diesel generator (DG) shall be installed at appropriate location as instructed by the Engineer for power supply in case of NEA, 11/0.4 kv mains failure. This standby diesel generator shall supply the pump load, which is normally operational from 14 hours a day. The generator in-feed circuit breaker can be closed if and only if the mains incoming breaker is open and vice-versa.

The diesel generator shall be for instantaneous starting and loading in cold condition through an electric starter motor. The loadability of the DG set after cold start shall be immediately 75%, after 30 seconds, 90% and after 5 min 100%.

The speed controlling device of the set shall be automatic with a setting range of $\pm 10\%$ of rated speed.

For stop of the engine a closed magnetic fuel valve and manual fuel valve shall be used.

4.2.2 The Fuel System

A standard storage fuel oil tank shall include a filling and supply piping with valves, level indicator and low level alarm device. The day capacity tank shall be of at least 14 hours operation of the engine at rated load.

The diesel engine shall have a complete lubrication system low lub-oil pressure trip device. The combustion air intake shall be through an air filter. The exhaust system shall have the necessary silencer piping, heat insulation and flexible joint to absorb vibration.

The engine shall be closed loop water-cooled type with a radiator and a mechanically driven fan behind it. The starting system shall include, an electric started motor, a started battery 24 V DC, a battery charger and a low voltage alarm relay for battery voltage.

4.2.3 Generator

The generator shall be rated 30 or 40 KVA, star connected synchronous machine for three phase 400 v, 50 Hz supply at 0.8 power factor. The neutral point shall be of easy bolting type.

4.2.4 Exciter and Voltage Regulator

The generator shall have a rotating brush-less exciter and a static voltage regulator. The output voltage from the regulator shall not deviate more than $\pm 2.5\%$ of the nominal value in any loading conditions and voltage settings shall be $\pm 10\%$.

4.2.5 Control Cabinet

The diesel generator set shall have complete equipment for automatic start and stop sequences in case of mains supply break and return. The automatic starting equipment shall make three consecutive starting attempts and alarm after the third unsuccessful attempt. A time-lag relay shall be included to delay the start form 1 to 10 sec. (adjustable) in order to prevent unnecessary starts during short mains failure.

The automatic switching over from mains and back shall be made by the generator circuit breaker and mains circuit breaker, which are electrically interlocked. The switchover back to mains shall be made after 1 minute once the mains have recovered. After switchover back to mains the set shall run on no-load long enough to prevent damage due to post heat for about 5 minutes.

Manual start / stop equipment and an OFF / MANUAL / AUTO switch shall be included.

4.3 SUBMERSIBLE PUMPSET WITH ACCESSORIES

4.3.1 General

This Work shall consist of installation of two units of submersible pumpsets for each bore-hole, where one unit will be kept as standby unit.

4.3.2 Selection of Submersible Pumpset

Submersible pumpsets installed horizontally in the sump well have been selected because in this case separate pumphouse need not be constructed, and priming of the pump is not necessary as the pumpset is already submerged in water. This arrangement also makes the provision of suction pipe, valve and fittings unnecessary.

Submersible pumpset shall consist of a centrifugal pump directly completed to a submersible motor, complete with all necessary accessories and suitable for the horizontal installation of the submersible pumpset inside the sump well/water reservoir. The pumpset shall be suitable in all respects for pumping drinking water.

4.3.3 Operating Technical Parameters

- Rated discharge capacity of the submersible pumpset not less than 15 lps at a total dynamic head of 115M

- Capacity of motor : 15 KW or more
- Combined / overall efficiency at rated duty point shall be not less than 52%
- Speed : Not more than 2,980 rpm
- Electrical Supply : 400 Volts + 6% and – 10%; 50Hz 3-phase, AC Supply.
- Submersible pumpset shall have ISI making and fully conform to IS – 8034 – 89 in all respects.
- The manufacturers of the submersible pumpset shall be an 950, 9001 or 9002 certified Company.

4.3.4 Pump Design

The pump shall be a multistage centrifugal pump with dynamically balanced impellers of radical/mixed flow design. A non-return valve shall be located at the pump discharge point.

The submersible motor shall be capable of withstanding heavy demands made on it in respect of reliable insulation and bearing loads. It shall consist of water filled, required cage type induction motor, sealed by radial seal rings to avoid mixing of well water and the fill water.

The pump shall be provided with sleeve bearings and the motor with sleeve and thrust bearing. All the bearings shall be water lubricated and protected against structural elements. Mitchell type thrust bearing shall Mitchell type trust bearing shall be provided to withstand axial thrust loads; and a suitable reflex pressure compensating device shall be incorporated the overpressure, which may arise as a result of the thermal expansion of the fill water when the temperature of the windings rises.

Power shall be supplied through a special cable passing through a watertight sealing gland, protected by means of metal sheath along the length of the pumpset shall be suitably chemically treated to protect them from water corrosion.

The design and operating conditions which shall govern in the selection of pumps are based on the actual improved yield achieved after the drilling of deep tubewells. Complete equipment shall be suitable for the condition of submergence in liquid. Pump characteristic curve allowable tolerances shall be in accordance with the Hydraulic Institute Standard. Shutoff head allowable tolerance shall not exceed 3 percent. Negative tolerances in design head and efficiency are not permissible. The final head curve for all pumps shall rise steadily and at a slope rate from the design point to pump shutoff.

Engineer reserves the right to change the pump design TDH within ± 5 percent prior to fabrication without any price increase, as long as TDH remains a function of impeller size. All pumps shall be designed to withstand 1.5 times of the pump shutoff pressure. All pumps supplied under this specification shall be capable of both intermittent (start-stop) and continuous operation under the operating conditions from minimum flow to runout condition.

Design and construction of each pump shall permit full voltage starting of driving motor. Shaft's critical speeds shall be at least 10 % higher than the max. operating speed. The maximum limits for vibration shall be kept without those limits stated in the HIS standard. Normal and maximum permissible operating vibration amplitude limits shall be provided by Contractor/Manufacturer, and if required, the Contractor shall provide the vibration detector with switch monitoring shall be carried out.

4.3.5 Materials of Construction

Materials of construction of pumpset shall be as given below:

S.No.	Part	Materials
1.	Suction Casing	Cast Iron
2.	Bowl / Stage Casing	Cast Iron
3.	Impeller	Zinc Free Bronze
4.	Pumpshaft	Stainless Steel
5.	Water lubricant Bearing	Bronze
6.	Thrust Bearing Plate	Bronze

Submersible type pumping equipment shall be single stage, non-clog centrifugal pump capable of pumping continuously the liquids identified previously and conforming to the specified

pumping heads and flows. Pump casing shall be manufactured II- 13% chrome iron ASTM A532 class III type A, heat treated to a hardness of 400 Brinell. The casting shall have ample thickness, capable of prolonged resistance to the abrasive actions of solids or foreign matter contained in the liquid passing through the pump. The pump casing shall be hydrostatically tested under a hydrostatic head of at least 50 meters of water. Discharge flange connection shall have the appropriate size in accordance with the pump, flat faced and drilled according to ANSI B 16.5.

Each pump & motor shaft shall be made of stainless steel with ample provision to compensate for pump thrust and for the overhand load on the impeller.

Impeller shall be 11-13% chrome iron head treated to a hardness of 400 Brinell, nonclog, symmetrical, balanced type with a minimum of vanes or blades having a wide suction, Impeller vanes shall be free from sharp edges and waterways with smooth contours and well-rounded entrances. The impeller shall not have port for reduction of thrust on impeller. The impeller shall be held securely to shaft method permitting easy removal of impeller. The impeller shall be capable of holding securely in event of pump reversal to full runways speed.

The electric motors shall be squirrel cage induction type suitable for full voltage starting designed for a Class I. Groups C and D. Division I hazardous location in air or submerged in liquid rated for continuous duty in the liquid or in air. Power supply shall be 400 volt or as required, 3 phase 50 hertz.

All electrical parts shall be housed in a cast-iron, watertight enclosure. The cable leads shall be epoxy sealed. Cable leads shall be a minimum 15 meters long. Lifting eyes shall be cast into the motor housing and shall be of adequate strength to lift the entire pump motor assembly. Lifting chains shall be provided for each submersible type of pumping unit.

Length of each chain shall be minimum 15 meters. The motors shall be supplied with dandem mechanical seals. The upper seals shall have carbon rotating faces, ceramic stationary faces with Buna N elastomers or better. The lower seals shall have solid tungsten carbide rotating and stationary faces with viton elastomers or better.

Electric motors shall be tested for the following characteristics prior to shipping and certified copies of the test report shall be forwarded to the engineer for review:

- Full load heat run
- Percent slip
- No load current
- Locket rotor current
- Starting torque
- Efficiency at 100%, 75% and 50% of full load nameplate rating
- Power factor at 100%, 75% and 50% of full load nameplate rating
- Winding resistance
- High postdental
- Bearing inspection

Each submersible type of pumping unit will be quipped with two float type level switches which shall control the operation of the pumping unit's electric motor at high liquid level and stop the motor at low liquid level.

4.3.6 Standard Accessories

Standard accessories supplied along with the submersible pumpsets shall include, but not limited to, the following matching items as recommended/ supplied by the manufacturer of the pumping set:

- Bearing pedestals
- 2 Nos. of water reservoir for use in horizontal installation o pumpset
- Suitable expansion joint
- Suitable bend
- Submersible cable of sufficient length, flat type, continuous without any splices
- Suitable pressure gauge with isolating valve

- Dry sum cut out electrode with cables
- Motor started panel as mentioned in the Tender Document.

4.3.7 Technical Documents

4.3.7.1 Drawings and Documentation to be submitted with Proposal

Tenderer shall submit with proposal the following drawings and documentations in addition to the information required by other section of this specification. The drawings where applicable, shall show the terminal points of Contractor's scope of supply.

Technical Data

All blank space in the technical data sheets in other section of specification, shall be completely filled in with the required information or where not applicable to Contractor's, offer a horizontal line shall be drawn and if any more necessary shall be added.

Drawings and Document

- Outline drawings showing dimension, for pump, motor, instrument panel, if any.
- Sectional drawings of major equipment
- P & I diagrams including terminal points, if sealing, cooling or lubricating are required.
- Loading diagrams for civil work
- Characteristic curves
- Recommended operating logic diagrams
- Available delivery schedule
- Test and inspection schedule
- Spare part list
- Special tool list
- Motor (or electrical power consumption) list.
- Instrument and set-point list
- Experience or reference list
- Manufacturer's catalogues and literature to supplement the drawings and illustrate the equipment, instrument, fitting, furnishing, etc.
- Control schematic and wiring diagram if required.
- Any other drawings or data not specifically called for, but necessary to fully describe the offer.

4.3.7.2 Drawings and Documents to be Submitted After Contract

- Contractor shall furnish for approval the indicated drawings and data within the time limit set forth in the purchase order.
- Drawings and documents called for below, shall be a guideline of drawings and documents to be provided by Contractor.
- Contractor shall resubmit all data and drawings, which were submitted with proposal, for approval after contract.
- Contractor shall submit the technical data and drawings for electric motor as per specification of electric motors.
- Lists and schedules
- Master drawing list showing the submission schedule
- Spare part list with sectional and/or outline drawing
- Special tool list with sectional and/or outline drawings
- Clearance and tolerance list

Detail drawings

- Assembly drawings of all equipment
- Dismantling drawings
- Detail drawings showing construction of all valve type and dimensions for all size.

Procedures and manuals

- Test and inspection procedure
- Installation manual
- Initial start-up procedure including check list and typical format
- Optical manual
- Maintenance manual
- Test and Inspections Reports
- As-Built Drawings

4.3.7.3 As Built Drawing

- Contractor shall submit to the Engineer as-built drawings, which were submitted for approval and for construction.

4.3.8 Engineer's Pre-Approval

The Contractor must obtain the pre-approval of the Engineer regarding the make/ model, capacity, quantity of the submersible pumpset and related accessories to be procured / supplied by the Contractor; and also for the planned installation and erection work of the submersible pumpset along with the necessary accessories.

4.3.9 Site Visit

Before testing the submersible pumpset Service Engineer/Expert of the manufacturer shall visit the manufacturer shall visit the installation site to check for the correct installation and operation of correct installation and operation for the pumpset; and shall issue a formal letter to this effect to the Engineer. The total cost for this job shall be fully borne by the Contractor only.

4.3.10 Cleaning and Painting

All manufacturing waster, such as metal chips and filings, welding rods and studs, waster, rags-debris etc; shall be removed from the interior of each component. All loose mail scale, rust, oil grease, chalk, crayon, paint marks, and other deleterious material shall be removed from interior and exterior surfaces. At time of shipment, product shall be clean inside and outside.

All centrifugal pumps and accessories shall be thoroughly cleaned and shop painted in accordance with the following cleaning procedure and painting system(s). All centrifugal pumps and accessories installed outdoors shall be prepared for priming in accordance with SSPC-SP 10 near white blast cleaning. Stainless steel of galvanized steel surface shall not be painted. Interior and exterior surface shall be painted in accordance with general technical requirements.

4.3.11 Tagging of equipment

A corrosion-resistant nameplate shall be securely attached to each completely assembled piece of equipment, at an easily accessible point of each pump and shall contain the following data: Manufacturer's name, serial number, shop order number, project identification number, type of equipment, tag number, rated horsepower, speed, total head, capacity and direction of rotation.

Name plate shall be chromium plated bronze unless otherwise. Description on the plates shall be engraved with black filled lettering in English. The armatures shall be fitted with circular stainless steel name plates, having engraved back letting in English for which the armature is intended and giving the armature number.

4.3.12 Spare Parts, Tools and Consumable

Contractor shall provide in the manner and within the time limits as set forth in the purchase order, its list of spare parts and special tools if necessary for installation, operation and maintenance for three (3) years operation of pump set and accessories furnished by him.

Unless otherwise, recommended spare parts shall be accompanied by Manufacturer's expected lifetime of wearing parts and description sufficiently detailed to identify the spare parts and the specific item or items for which it applies. Manufacturer shall indicate the minimum recommended inventory for routine maintenance and installation, start-up and continuous operation. Contractor shall indicate whether the recommended spare is a stock item of special item, location of nearest supply point and approximate lead time required for shipment.

The list of special tools shall be accompanied by description sufficiently detailed to identify the function of the tool and the specific item or items for which it applies, Contractor / Seller shall indicate whether the tool is required for installation, and prepared by suitable means for storage by greasing or storage. The spare parts ordered shall be delivered with the main equipment but in separate boxes clearly marked "SPARE PART".

The contractor shall submit a priced list of each Spare Parts for the Engineer's approval. For approval and supplied Spare Parts the contractor be paid from the provisional sum.

Contractor shall submit sectional and / or outline drawings for spare parts and special tools at the time of shipment of the spare parts and special tools. The number of copies and reproducible of each drawing to be submitted shall be in accordance with general technical requirements.

Contractor is required to supply the lubricating oil for first fill.

Contractor shall provide a specification for the lubrication of the equipment. The number of different oils and grease recommended should be kept at a minimum. The types or nipples should be reduced to a minimum.

4.3.13 Test and Inspection

a) General

Equipment testing shall be within the guideline of the approved test code and to the standard for centrifugal pumps to the satisfaction of employer / engineer.

b) Material Tests

Certified mill test reports for pressure retaining parts shall be provided in accordance with relevant material specifications and shall include mechanical and chemical properties.

c) Shop Tests

i) Hydrostatic tests

Pressure retaining parts, shall be hydrostatically stated at 150 % of shut-off pressure at design speed. The test pressure shall be held for a minimum 5 minutes.

ii) Performance tests

Each pump shall be performance-tested at design speed and rated suction conditions.

The final performance curve shall be based on not fewer than five (5) test points at rated speed. The specified guarantee point, the runout point, and the shut off point are three (3) mandatory test points. The remaining two (2) point shall be evenly distributed between the guarantee point and the shut off point.

d) Test reports

Certified test reports shall be prepared and submitted to Engineer shall include test arrangement, instrumentation and calibration data, test data.

Result of the performance tests shall be summarized in curve form with total generated pressure, efficiency, and power absorbed. The guaranteed design performance, maximum run-out operation, and test water temperature shall be stated on the curve.

e) Field Tests

Acceptance field tests, after equipment is completely installed, may be performed by Contractor to demonstrate performance requirements. If specially requested by the Engineer.

When the adjusting is terminated, new tests shall be carried out at the Contractor's expenses, except expenses of fuels, electric power and water in case of the Engineers field test.

f) Criteria for Rejection

At design point, deviation from guarantee values by more than:

- Delivery rate %:+10/-0
- Delivery head, % :+5/-0
- Efficiency, % :-0

On completion of the installation and erection of the submersible pumpset with accessories and after the required initial setting of the electro-mechanical works the Contractor shall notify the Engineer at least 7 days in advance about his readiness to demonstrate and commission the submersible pumpset along with the transformer, stand-by diesel generating set and the pipeline works with valves and fittings. This demonstration work shall show that the electro-mechanical items / systems meet the specified specifications and performance criteria as mentioned in the Contract Document.

For carrying out the testing and commissioning works the Contractor shall provide the following items fully at his own cost.

- All skilled and qualified staff and labour as required.
- Provision and disposal of all services and consumables, e.g. lubricants, fuels, electricity, water, etc.
- All measuring and testing instruments (e.g. gauges, flow-meters, multi-meter), hand tools, etc) required to demonstrate that the items / system are operating to the required performance criteria.

4.3.14 Acceptance Certificate

Only upon successful testing and commissioning of the electro-mechanical works an acceptance certificate shall be issued by the Employer / Consultant.

4.3.15 Warranty Period

The Contractor shall provide warranty for the installed distribution transformer, standby diesel generator set, submersible pumpset, motor control panels, change over switch, etc. and for their relevant accessories to be free from defects in design, quality of material and workmanship under the normal use and service for a period of one year from the date of issue of Acceptance Certificate. Any fault arising due to defects in design or quality of material or workmanship during the Warranty period shall be promptly made good by the Contractor fully at his own cost, failing which the Performance Bond of the Contractor shall be forfeited.

4.3.16 Training

After the successful testing and commissioning of the electro-mechanical works the Contractor shall provide training to the 4 personnel of the Employer for a period of 7 days. Suitable training shall be given by approved Experts at project site regarding the proper operation, maintenance and repair of the stand-by diesel generator set, submersible pumpsets, motor control panels, change-over switch, valves and gauges of the pipeline works, etc. The cost of this training shall be fully borne by the Contractor.

5.0 PIPES, FITTING AND RELATED ACCESSORIES

5.1 GENERAL

5.1.1 Materials

The term materials shall mean all materials and articles of every kind, raw, processed or manufactured, which are used in the manufacture of goods to be used under the Contract.

All materials shall be new and of the kinds and qualities described in the clauses hereof appropriate to the particular item and shall be at least equal to approved samples except that alternative materials may be accepted provided the Contractor has at the time of tendering :

- a) Drawn particular attention to the deviation from the Specification in his bid and provided particulars of the alternative material offered at the time of tendering, and
- b) Substantiated, to the satisfaction of the Engineer, that the material offered is equal or superior to the material specified for the use to which it is to be put and has obtained from the Engineer's approval in writing to its use. Where materials to be used for any component have not been laid down in the Specification the Contractor shall use only those materials in such compositions as have been proven in actual service to be the most suitable for the particular purpose.

All pipes and assembling parts selected under this Contract must be of first quality, truly circular, of a uniform thickness, free from scale, lamination, honeycombs, and other defects, and shall be designed to withstand the stated pressures and temperatures. They shall be of service proved products of specialized manufacturers.

Each pipe length should be as long as indicated in the drawings. When not indicated, the length should be as long as practicable to keep the number of joints to a minimum.

Where the coating of pipes is damaged, the surface shall be cleaned and dried and the Contractor shall paint the damaged area with a minimum of three coats of paint and to the full thickness and specification as the original coating.

5.1.2 Equivalency of Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval.

In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

5.1.3 Standards and Codes

All workmanship, materials and components throughout shall, where applicable and unless otherwise stated in the Contract, comply either (a) with the relevant International Standard ISO, (b) with the relevant British Standard or Code of Practice current on the date fixed for receipt of tender, (c) comparable Indian Standards, (d) with the relevant Nepal Standard or as per Engineer's approval.

The following is a list of some nationally and internationally accepted standards and codes and some associations concerned with the standardization of products and abbreviations below will be used in the following text.

5.1.4 Test Certificates

Certificates in triplicate shall be provided by the Contractor for each material such as valve, pipe, and fitting giving the process of manufacture and the results of the specified tests.

Similar certificates in triplicate shall be provided by the Contractor in respect of materials to be used in the manufacture of the valves, pipes and fittings giving the process of manufacture, chemical analysis (where relevant) and the results of specified tests.

The materials shall be suitably marked to enable them to be identified from references on the

certificates.

5.1.5 Samples of Materials and Tests on Samples

The Contractor shall provide to the Engineer three copies of the results of any routine analyses or tests carried out by him or his manufacturer on materials used in the manufacture of the Goods.

In addition, when and if required by the Engineer, the Contractor shall provide samples of all or any materials used in the manufacture of the Goods and shall carry out any specified test on the said materials as may be required the Engineer at the place of manufacture or at a laboratory approved by the Engineer and shall provide to the Engineer within seven days of each such test three certified copies of the results of the analysis or test.

Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer. The Contractor or his manufacturer shall prepare the necessary test pieces and supply all labour, appliances, testing apparatus and everything necessary for carrying out all specified tests.

The Contractor shall give the Engineer 14 days notice in writing of the date on which any of the samples will be ready for testing or inspection and unless the Engineer shall attend at the appointed place within the said 14 days, the test may proceed in his absence.

Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineer's rights under the Contract.

5.1.6 Independent and Local Tests

The Engineer reserves the right to carry out any independent or local tests he may deem fit on the completed pipes and fittings or on any material provided under the Contract at any stage during the Contract. In addition to any relevant clause in the General Conditions of Contract any materials, workmanship or completed pipes and fittings which are shown by such independent tests not to be in accordance with the Specification shall be rejected notwithstanding any previous certificate which may have been provided.

Any pipes and fittings, which have been rejected, shall be marked in a distinctive manner, which shall preclude any possibility of their use for the purpose for which they were supplied. Such pipes and fittings may be submitted for re-test following the correction of any defects, where such corrections are permitted by the Engineer

5.1.7 Rejected Goods

Any Goods delivered to the site which have been rejected by the Engineer shall immediately be removed from the site. Replacement of rejected Goods shall be made as soon as possible but in no case exceeding thirty (30) days from the time of rejection.

Any pipes which have been rejected shall be marked in a distinctive manner which shall preclude any possibility of their use for the purpose for which they were supplied. Such pipes may be submitted for retest following the correction of any defects, where such correction is permitted by the Engineer.

5.2 DUCTILE PIPES AND FITTING VALVES

5.2.1 Ductile Cast Iron Pipe

5.2.1.1 General

Ductile cast iron pipe shall conform to ISO 2531/DIN 28614, with flanges to ISO 2531/DIN 2532, PN 10 unless otherwise specified.

Non-standard specials shall be avoided. If non-standard specials (e.g. flexible couplings) shall have to be used, the Contractor shall submit full details to the Engineer for approval.

5.2.1.2 Composition

The metallurgical composition of the ductile cast iron shall conform with the following requirements:

- 1,7 % to 5 % Carbon,
- 1, 5 % to 3 % Silicon,
- minimum tensile strength 420 (MPa) for pipes, 400 (MPa) for fittings,
- minimum elastic limits 300 (MPa) for pipes and fittings,
- minimum elongation at failure 10 % for pipes, 5 % for fittings,
- maximum hardness 230 (HB) for pipes, 250 (HB) for fittings.

5.2.1.3 Pipes

Ductile cast iron socket and spigot pipes, and accessories shall be centrifugally casted in accordance with ISO 2531 (1991) Class K9, including the latest relevant revisions, if any, or other internationally accepted standards which ensure an equal or higher quality performance. All spun iron pipes and cast iron specials shall be ductile iron unless otherwise described. Water-tightness shall be ensured by the push-on joint for the pipes.

The pipes of class K9 shall be subject to a hydrostatic pressure test in the actory as follows:

- DN 80 to DN 300 : 60 bar,
- DN 350 to DN 600 : 50 bar,

5.2.1.4 Fittings

Ductile iron fittings shall be sand casted in accordance with ISO 2531 class K12 for fittings not including tees, class K14 for tees, and shall be manufactured with spigot and socket ends in which the seal is achieved by means of a suitable retained rubber gasket such as push-on or mechanical joints, unless otherwise specified. The gasket shall be of such size and scope that, when joined in accordance with manufacturer's instructions, it shall prove a positive seal within the manufacturer's range of maximum joint deflection and slip under all combinations of joints and gaskets dimensional tolerances and in the range of pressures specified.

The water-tightness of the fittings for the Project shall be ensured by the following types of joints: push-on joint, flanged joint 150 PN 10.

The flanged joint is either a joint with mobile flanges or a joint with fixed flanges depending on the fittings and the nominal diameters. The fittings shall be of the same pressure class as that of the DCI pipes. Drilling details and designed maximum pressure shall comply with ISO 2531 PN 10. The fittings shall be subject to a leak-tightness test carried out in the factory under 1 bar air pressure in accordance with ISO 2531.

5.2.1.5 Joint Accessories

The gaskets for the joint shall be made of elastomer rubber.

- natural rubber,
- EPDM (ediylene propylene diene monomer)
- or equivalent elastomer.

The gaskets shall be stored strictly in accordance with ISO 2531.

Bolts, nuts, and washers shall be made of steel with hot dipped cadmium coating or equivalent protection. The supply shall include for repair sets of epoxy cement mortar for the internal lining and external coating (primer and final) including material, tools, and application manuals.

5.2.1.6 Internal Lining- Pipes

The pipes shall be internally lined in the factory with a sulphate resisting blast furnace cement mortar. The thickness and the lining shall be in accordance with ISO 4179 (1985). Prior to application of the lining the internal surfaces shall be shot blast cleaned to acceptable standard. The lining shall be applied centrifugally. The cement composition shall conform to BS 4027. The Colebrook roughness coefficient of the lining shall be less than 0.03 mm.

5.2.1.7 Internal Lining - Fittings

The fittings shall be internally lined in the factory with an epoxy coat suitable for potable water by test certificate from an international health institute, shall be abrasion resistant, and shall be subject to the approval of the Engineer. The thickness of the lining shall be not less than 0.3 mm. Prior to application of the lining the internal surfaces shall be shot blast cleaned to acceptable standard. The lining shall be applied in layers by spraying method. The Colebrook roughness coefficient of the lining shall be 0.01 mm.

5.2.1.8 External Coating - Pipes & Fittings

The pipes and fittings shall be externally coated in the factory with a metallic zinc coat as primer and a black bituminous or black coal tar based anticorrosive varnish in accordance with ISO 8179 or latest or synthetic resin or equivalent approved external surfaces to be applied with coatings shall be thoroughly cleaned and prepared immediately prior to the application of the primer paint. After the prime coat application, tests shall be carried out for misses or pinholes on the painted surface. The zinc for the coat shall be an electrolytic pure zinc of more than 99.9%. The zinc coat shall be applied by arc gun and the bituminous/tar based coat by an airless gun in at least 2 layers.

5.2.1.9 Shop Testing and Inspection

The inspection of pipes, fittings, valves and accessories shall be done by the contractor on the manufacturer's premises to assure himself of that the materials are of required design and specification prior to forwarding the materials to the site. The Contractor shall arrange for the testing equipment, the needed material, the checking devices and necessary trained personnel for the work.

The inspector (s) responsible for the acceptance being appointed by the Employer shall be informed three weeks in advance by wiring before the demonstration procedure will take place.

If the inspector(s) fails to be present within ten (10) days from the date specified in the above mentioned witting, the contractor may proceed with the checks and test, which shall be deemed to have been made in the inspector(s) presence.

Inspection of external appearance, shape, dimensions and weight shall be carried out for each pipe and fitting. Pipes and fittings will be straight and shall be stripped with care to avoid warping. All pipes and fittings shall be sound and free from surface defects.

Each pipe and fitting shall be subjected to an approved hydrostatic pressure test. Any pipe or fitting that does not withstand the test pressure shall be rejected. Mechanical tests for hardness, tensile strength and elongation shall be performed on test pipes selected at random out of batches grouped in lots. Each lot shall be made up of pipes cast successively as follows:

- up to 300 mm. Dia. :100 pipes,
- 350 - 600 mm. : 50 pipes

Inspection and weight check of pipes, fittings valves and accessories may be done after coating. Pieces of which the deviations from standard dimensions exceed the tolerances shall be rejected. The pipes, fittings, valves and accessories which show in the opinion of the inspector(s) minor imperfections unavoidable occurring during manufacturing and not disadvantageous for their use, shall not be rejected and the Contractor may under his own responsibility decide the method of removing such small visual superficial imperfections. He may also after approval of the Engineer repair certain defaults by any method other than welding.

- a) All pieces shall be weighed. Pipes and fittings of nominal diameter of 300 mm or more must be weighed separately. Those of smaller diameter shall be weighed in consignments up to 2,000 kg.
- b) The pieces of which the weight appears less than the normal weight (after deduction of the tolerance) can be accepted by the Engineer at his own discretion who shall decide, in each case and under the condition that they comply with all other requirements. Pieces of which the weight exceeds the normal weight are accepted.
- c) For each lot a tensile test and a hardness test shall be done on a sample. The tensile test is executed on a sample selected from the pieces forming the respective lot. If the test results

comply with the requirements, all pieces of the lot shall be accepted under the condition that they satisfy all other conditions; if during the tests the tensile test shall be repeated on 3 test samples taken from other parts of the lot. In this case the lot is accepted if the average result does fulfill requirements under the condition that none of the tested samples shows a result less than 10% of the required demand.

- d) For each lot an inspection report shall be written which shall be signed by the parties present. Each piece weighed separately shall appear on this report with the indication of its mass and number.
- e) Each group of pieces weighed together shall be indicated by the number and the total weight of the consignment.
- f) All certificates of tests carried out during manufacture
 - a) shall be attached to the inspection report.
 - b) the inspections reports and certificates form an integral part of the documents.

5.2.1.10 Handling and Storing

Pipes and fittings shall be unloaded and stocked by the Contractor at the place approved by the Engineer and in piles only up to such height which prevents the lower layers from deformation or other damages.

The first layer will be placed on beams, large enough to give sufficient isolation from the ground, and the pipes will be secured by wedges. Each layer will be separated from the next by an adequate number of beams (at least two).

Care shall be taken during loading, transporting, and unloading to prevent damage to the pipes, fittings or coatings. Under no circumstances will pipes or fittings shall be examined and no piece shall be accepted which is found to be defective. Any damage to the pipe coating shall be repaired as directed by the Engineer. Special handling of pipes and fittings shall be in accordance with the manufacturer's instructions.

All pipes shall be bundled or packed in such a manner as to provide adequate protection for the ends, threaded or plain, during transportation.

Loading, unloading and handling shall be carried out using special hooks with a curved plate to fit the curvature of the pipes or webbing slings not less than 30 cm wide or other means approved by the Engineer. Coated pipes shall be transported on trucks or trailers fitted with approved padded timber cradles shaped to fit the curvature of the pipes and of adequate dimensions so as to prevent any damage to the pipe coating. Successive tiers of coated pipes shall be separated by similar suitable shaped timber cradles when more than one tier of pipes is being transported. Pillows shall be provided between securing chains or lashings when load are being transported.

Particular care shall be taken during unloading, loading, handling and transportation to avoid distortion, flattening, denting, scoring or any other damage to the pipes, fittings and any damage to the external or internal coating or lining of the pipes, fittings etc. Fittings shall not be stacked more than one tier high and shall be adequately supported clear of the ground on timbers all to the Engineers approval.

The Contractor shall provide appropriate packing for all transport to site. The packing must be specifically suited to the proposed pipes.

All components shall be packaged, finished or otherwise prepared such that they may safely be stored outdoors for an extended period in the project environment. Prior to shipment all unpainted surfaces, including bolts and nuts, machined surfaces, tapped holes and studs, and all other exposed ferrous surfaces, shall be protected with a heavy coat of suitable grease or other easily- removed corrosion-protective material.

All rubber gaskets and glands, and other components which are subject to deterioration by ultraviolet light shall be packed so as to exclude sunlight.

Any materials which, in the opinion of the Engineer are delivered damaged or are damaged by the Contractor in the process of stockpiling at the delivery site shall be promptly removed from the site. The Contractor shall receive no compensation for the damaged material or its removal until it is either repaired to the satisfaction of the Engineer or replaced.

Crated small items shall be delivered and stored in their original containers. Each crate, box and other packing shall be clearly labeled with weatherproof marking identifying the quantity and exact nature of the contents thereof, such that materials may be readily identified without opening of the crates.

The Contractor will be responsible for making of the materials to be supplied as directed by the Engineer.

The pipes and fittings shall bear readable and indelible marks as follows in the English language.

- manufacturing mark
- last two digits of year of manufacture
- nominal diameter
- nominal pressure
- confirming standards

Spigot ends will show control marks for ease in connection.

The Contractor shall take all the precautions to avoid any corrosion or deterioration of the outside coating and shall protect the pipes from sunlight, dew, wind and other inclement of the weather.

Cutting of Pipes

- a) All pipes, and in particular pipes with internal and external coatings should only be cut, if the site conditions do not allow for any other solution. In this respect, the trace given on Drawings is only indicative and shall be adapted on Site in such a way, as to avoid the cutting of full length pipes.
- b) Should cutting of a pipe become necessary then the cut shall be made with an approved mechanical pipe cutter. The edges of the cut shall be clean, true and square.
- c) The Contractor shall be responsible for the provision of all equipment necessary for cutting and turning of pipes.
- d) The Contractor shall repair the damaged portions in the internal and external lining of the pipe work after the cutting in accordance with the manufacturer's instructions and shall make the cut metal portions smooth by grinding and filing.

5.2.2 Accessories

5.2.2.1 Dismantling Pieces

Adapting pieces shall be provided to all valves, and where necessary, to ensure a simple dismantling of the pipe work. They shall be lockable in position.

Dismantling pieces shall be flanged according to DIN 2501 and shall comply with the requirements of the DIN 2631, 2632, 2633 in accordance with the required pressure of the pipe. The materials of the dismantling pieces shall be the same, as it is of pipe, where they are to be built in.

5.2.2.2 Rubber Compensators

Rubber compensators shall be provided, if indicated in the drawings to the pipework, at the connected access to machines, like blowers and pumps.

Rubber compensators shall be capable of balancing thermal expansions, discrepancies in assembling, vibrations of machinery and settlement in a range of:

DN	Axial mm	Compression mm	Lateral mm	Angular
80	10	35	15	20°
100	10	35	15	15°
150	10	35	12	12°
200	15	45	15	8°

250	15	45	15	7°
400	15	45	15	6.9°
500	30	50	30	4.9°
600	30	50	30	4.9°

Rubber compensators shall be flanged according to DIN 2501 and provided with guide tubes in order to reduce friction losses. Screws shall not protrude in the direction of the rubber. Rubber parts shall not be painted.

On suction side the compensators must be steelwire armoured.

5.2.2.3 Branches and Type of Fittings

Branches shall be formed in accordance with the relevant DIN standards and welded before the pipe is erected.

All bends made from pipes shall be formed so that at any point along the bend ovality will not reduce the bore by more than 2.5%. Radius of bends for all pipes shall be not less than 1.5 times the outside diameter, in accordance with DIN 2605, if not indicated otherwise.

5.2.3 Valves and Gates

5.2.3.1 General

All valves shall be flanged if not specified otherwise. All flanges of the valve shall be according to DIN 2501 and in accordance with the required test pressure of DIN 3230 and shall satisfy the requirements stated in these DIN standards. The leakage rate has to be in accordance with DIN 3230, Degree 1.

The face-to-face dimensions of all flanged valves shall comply with the DIN 3202 Part 1.

All valves shall belong to a class which can withstand the maximum pressure they will attain in service including any surge pressures, but all valves shall be tested at not less than their Nominal Pressure Rate.

Valves shall be capable of withstanding the same test pressures as the pipe line on which they operate. All nuts and studs subjected to vibration shall be fitted with spring washers or locking taps.

Valves shall carry identification marks and/or plates in accordance with DIN EN 19. All materials used in the manufacture of the valves shall conform to the following minimum standards:

Cast Iron	DIN 1691 Mat. No. 0.6025
Gunmetal	DIN 1705 Mat. No. 2.1096.01
Aluminium Bronze	DIN 1725
Stainless Steel	DIN 17440 Mat. No. 1.4571

Extended spindles and headstocks shall be provided where necessary and where indicated in the drawings. Valves above 100 mm bore except non return check valve shall be fitted with indicators so that it may be clearly seen whether the valves are open or shut. In the case of those valves fitted with extended spindles indicators shall be fitted body to the extended spindles and to the valve.

5.2.3.2 Sluice Valves

Sluice valves provided for the distribution network system shall be of the flat-body type, double flanged, with ductile iron bodies, and shall comply with the requirements of DIN 3352. They shall be of the inside screw non-rising stem type. The direction of closing shall be clockwise.

Sluice valves up to 400 mm bore shall have resilient seats.

Sluice valves over 400 mm bore shall have renewable gun metal faces on bodies and wedges.

Valve stems shall be, forged aluminium bronze, machined A over and have a strong trapezoidal

or square formed thread, operating in a gunmetal nut. Stems in chromium steel (Material No. 1.4021) will also be permitted.

Stems shall be sealed with two O-rings, arranged for easy replacement of the packing and shall be accessible for maintenance without removal of the valve from the pipe line.

All valves shall be supplied with either hand wheel or extension spindle sockets. Extension spindle sockets shall be drilled and each provided with a nut and bolt for searing of the stem which shall also be drilled.

Extended spindle installation shall include all necessary brackets, intermediate supports etc and provisions shall be made for adequate lubrication.

Handwheel dimensions are designed for easy operation, according to API 600. They are made in cupola malleable iron (to ASTM A 197) to external dimension 560 mm and in cast steel over.

5.2.3.3 Non-return Valves

Non-return valves shall comply with DIN 3202 and be of double flanged cast iron type, unless otherwise specified.

They shall be of the quick acting single door type, designed to minimize the losses at the event of pump shut down, and shall have gunmetal flaps and seating faces, and be fitted with external levers for back flushing, the levers so arranged, as to assist in the closing by the addition of weights if necessary.

The door hinge pins shall be of stainless steel and preferably square in section to ensure, positively, location of the doors and back flushing levers, and the hinge pins shall be extended through a sealing gland located at the side of the bodies.

The flaps and external weights shall be positively and securely fixed (grub screws, pins or clamps are not acceptable). All internal fixing devices shall be of stainless steel.

All reflux valves shall be suitable for operating in the vertical plane unless otherwise specified. Covers shall be provided to allow ample access for cleaning and service and shall be supplied complete with tapped boss fitted with air release cocks.

The design of the valve bodies shall be such that there is adequate clearance around and at the back of the doors to minimize jamming by rags, etc. Stops shall be provided to limit the back lift of the doors and in such a position to prevent fouling by rags.

5.2.3.4 Air Valves

Air relief valves shall be rated for a minimum pressure of 10 bars having bodies of ductile iron, and shall be complete with isolating gate valves.

The valve shall have a nominal diameter of 100 mm, and shall include a calibrated air release nozzle. The valve closure device will consist of a rubber coated, spherical, perfectly calibrated float, guided in the body. The air relief valves shall be double type body.

5.2.3.5 Sluice Gates (Manual)

The gate shall consist of frame, disc, wedge, stem and manually operated handwheel. Frame shall be of cast iron flat type.

Disc shall be of cast iron single piece construction with stiffening ribs and reinforced section. Disc shall have an opening for weir with weir plate made of stainless steel.

Seat shall be stainless steel, and bronze casting firmly fixed on the surfaces of the frame and disc by means of sufficient numbers and size of nut bolts.

The stem shall be of outside screw type and made of stainless steel.

Manually operated handwheel shall have a lift nut of cast bronze, threaded to fit the operating

stem.

The direction of wheel rotation to open the gate shall be indicated on the wheel. The position indicator shall be attached to the manually operated handwheel.

5.2.3.6 Gear Operated Valves (Manual)

Gear Operated valves for the water treatment plant shall be fitted with hand operated gear.

The valves shall be manufactured in accordance with the sluice valves specified in the clause 5.2.3.2.

Special attention shall be given to the operating mechanism for the valves in order that quick and easy operation is obtained and maintenance is kept to a minimum.

Valves shall be supplied with either, bevel or spur gear operators.

5.2.3.7 Pressure Reducing Valves

The pressure reducing valve shall function to maintain a uniform downstream pressure as pre-adjusted on the control pilot handwheel or adjusting screw.

The control pilot shall be capable of field adjustments from near zero PSI to 10% above 5 Kg/cm² of factory preset pressure. The valve shall be completely piped ready for installation.

Throttling shall be done by the valve Vee ports and not the valve seating surfaces. The valve shall be capable of operating in any position and shall incorporate only one Hanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

The valve body shall be of cast iron ASTMA-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.

The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

All controls and piping shall be of non-corrosive construction.

A visual valve position indicator shall be provided for observing the valve piston position at any time.

The valve shall be factory tested and set for the 5 bars of delivery pressure but field adjustments should be easily made.

5.2.4 Flowmeters (Bulk meters)

The flowmeters shall be supplied and installed on the discharge pipes of each well and high service pump station as shown in the drawings. Each flow meter shall be a self-contained volumetric measuring instrument with a magnetically coupled propeller and register, eliminating the stuffing box, packing glands and resultant friction load. All internal parts shall be protected against the adverse effects of moisture, corrosion and other harmful external influences. The sealed oil-filled gear housing shall exclude water borne contaminants. The register shall be hermetically sealed.

The flowmeter shall have a maximum allowable error of 2 percent within a range of flow varying from 20 percent to 120 percent of the design flow rate. Each flowmeter shall be provided with a calibration certificate. The meter shall be suitable for the pump shutoff head, and the contractor shall ensure that the flanges are drilled to suit the adjoining components or piping. Straightening vanes shall be provided directly upstream of the meter to ensure stream line flow. The meter tube shall have a uniform internal diameter not less than the nominal size of meter required.

Construction material shall be close grained cast iron up to 300 mm sizes and fabricated steel

for larger sizes. The flow tube shall have a stainless steel liner and straightening vanes upto 300 nun dia and epoxy coated steel vanes and liners for larger sizes. The integral drop pipe and gear box shall be of cast bronze and the propeller of high density plastic or polypropylene. The propeller and magnet assembly shall be carried on graphite (or other approved material) bearing turning on hardened and polished stainless steel. The thrust load shall be carried by bearing of approved composition such as graphite-carbide. The internal parts shall he sealed, making field maintenance unnecessary.

A hermetically sealed rate indicator/ totalizer with easily decipherable numerals etched on metal shall be provided in a integral case mounted enclosure on each meter, complete with case cover and hasp for locking. The meter head shall have a 6-digit, straight reading type Totalizator registering in 100 cu. m. units and a 75 mm dia. rate of flow dial with linear gradations in units of cu.m./hour. The seals shall be suitably sub-divided for the specified flow ranges.

Two (2) times of calibration tests shall be carried out by the supplier during commissioning period, and rectify and in accuracies discovered. The cost of this follow-up action shall be deemed to be included in the equipment price.

5.2.5 Pressure and Vacuum Gauges

The pressure gauges shall be installed to the well head fittings by factory in connection with a ½" water sample tap. Gauges shall be provided for all pumps as detailed in the Specification and for all other equipment where necessary.

Pressure and compound gauges of approved manufacture shall be provided and fixed directly to, and at the same level as the pressure and suction branches of, each dry well pump.

The gauges shall be fitted with diaphragm type isolating valves, but siphon pipes will not be required. Gauges shall not be connected to air release or auxiliary suction pipes.

The gauge mechanism shall be of the bourdon tube type with diameter DN 100 mm having stainless steel movements and shall comply and be tested in accordance with DIN 16064. Gauge graduations shall be such that the gauge is never used continuously beyond 60% the max graduations. Pressure gauges shall be graduated in the bars or millibars.

The face of the dial shall have a warning label marked in red attached thereto reading "IMPORTANT: TURN OFF WHEN NOT IN USE" in Nepali and English languages.

All gauges shall be proved with glycerine filling to dampen pressure pulsation. All gauges shall be installed vibration free.

5.2.6 Household Connection Water meters

Water meters for the measurement of potable water may be supplied by the Contractor at the behest of the WUSC and approved by the Employer. Volumetric rotary piston water meter with thermoplastic working chamber, which is tamper proof and has liquid filled sealed counter unit for better readability shall be used in the house connections. Some of the essential features of household water meters should be:

- Counter unit should register in litre and cubic meters.
- Maximum flow capacity – 2.73 m³ / hour
- Meter length – 114 mm to 134 mm
- Meter radius – 43 mm
- Length over connectors – 200 mm to 228 mm
- Nominal pipe size – 15 mm
- Meter weight – 1 kg to 1.1 kg
- Test pressure – 21 kg /cm²
- Suitable water temperature – 50°C

5.2.7 Labels

The Contractor shall arrange for the supply and fitting of engraved identification labels to all items of plant and all valves throughout the plant.

The Contractor shall also arrange for the supply and fitting of warning labels for machinery that is operated under automatic control.

All labels shall, in design, conform with the labels specified for control panels. All identification and warning labels shall be in the Nepali language.

5.3 HDPE PIPES AND FITTINGS

5.3.1 General Requirements

5.3.1.1 Materials

The term "materials" shall mean all materials and articles of every kind whether raw, processed or manufactured which are used in the manufacture of the Goods to be supplied under the Contract.

5.3.1.2 Composition

The pipes shall be extruded from HOSTALIN GM 5020 T.2 or equivalent approved compound consisting of virgin polythene in which carbon black and a suitable non-toxic anti-oxidant are evenly dispersed.

All materials shall be new and of the kinds and qualities described in the clauses hereof appropriate to the particular item and shall be at least equal to approved samples except that alternative materials may be accepted provided the Contractor has at the time of tendering:

- (a) drawn particular attention to the deviation from the Specification in his tender and provided particulars of the alternative material offered at the time of tendering; and
- (b) substantiated to the satisfaction of the Engineer that the material offered is equal or superior to the material specified for the use to which it is to be put and has obtained from the Engineer approval in writing to its use.

Where materials to be used for any component have not been laid down in the Specification, the manufacturer shall use only those materials in such compositions as have been proven in actual service to be the most suitable for the particular purpose. All pipes shall be smooth, clean and free from all defects.

The Contractor must name the manufacturer(s) at the time of tendering from whom he proposes to obtain any material under the contract. As a proof, he should also include a Letter of Consent from the manufacturer(s) stating his acceptance to sell the material to the Contractor on award of the contract. Normally, the material supplied should be the product from the quoted manufacturer(s). However, in situation beyond the control of the Contractor, the Engineer may consent to accept material from other manufacturer; provided he is satisfied, that the new manufacturer(s) has agreed to sell the product to the Contractor, that he is experienced and capable to produce the material and that the product is either equivalent or superior to the product from the previously agreed manufacture. No orders shall be placed with the newly named manufacturer without the written consent of the Engineer.

5.3.1.3 Samples of Materials and Tests on Samples

The Contractor shall provide to the Engineer three certified copies of the results of any routine analyses or tests carried out by him or his manufacturer on materials used in the manufacture of the Goods when and if asked by the Engineer.

In addition, when and if required by the Engineer, the Contractor shall provide samples of all or any materials used in the manufacture of the Goods and shall carry out any specified test on the said materials as may be required the Engineer at the place of manufacture or at a laboratory approved by the Engineer and shall provide to the Engineer within seven days of each such test three certified copies of the results of the analysis or test.

Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Engineer. The Contractor or his manufacturer shall

prepare the necessary test pieces and supply all labour, appliances, testing apparatus and everything necessary for carrying out all specified tests.

The Contractor shall give the Engineer 14 days notice in writing of the date on which any of the samples will be ready for testing or inspection and unless the Engineer shall attend at the appointed place within the said 14 days, the test may proceed in his absence. Approval by the Engineer as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Engineer's rights under the Contract.

5.3.1.4 Test Certificates

Test certificates in triplicate shall be provided by the Contractor for each consignment of pipe supplied, giving the process of manufacture and the results of the specified tests.

Similar certificates in triplicate shall be provided by the Contractor in respect of materials to be used in the manufacture of the pipes giving the process of manufacture, chemical analysis (where relevant) and the results of the specified tests. The material shall be suitably marked to enable it to be identified from references on the certificates.

Any materials subject to test incorporated in the manufacture of the pipes and fittings before the Engineer has received a satisfactory Test Certificate shall be at the Contractor's risk.

5.3.1.5 Independent Tests

The Engineer reserves the right to carry out any independent tests he may deem fit on the completed pipes or on any material to be used in the Contract at any stage of manufacture or delivery, in addition to those tests specified to be made by the manufacturer.

Any samples of materials which may be required for such tests shall be provided by the Contractor at no extra cost to the Engineer.

The cost of making any such independent tests shall be borne by the Contractor, unless it is shown that the workmanship or materials under test are not in accordance with the Specification.

Any materials, workmanship or completed pipes, which are shown by such independent tests not to be in accordance with the Specification shall be rejected, notwithstanding any previous certificate which may have been provided.

5.3.1.6 Rejected Goods

Any Goods delivered to the Site which have been rejected by the Engineer shall immediately removed from the Site by the Contractor, free of cost. Replacement of rejected Goods shall be made as soon as possible but in no case exceeding forty five (45) days from the time of rejection.

Any goods which have been rejected shall be marked in a distinctive manner which shall preclude any possibility of their use for the purpose for which they were supplied. Such goods may be submitted for retest following the correction of any defects, where such correction is permitted by the Engineer.

5.3.1.7 Standards

All materials, workmanship and components shall, where applicable and unless otherwise stated in the Contract, comply with either:

- (a) a relevant Nepal, Indian, British or American Standard current on the date fixed for receipt of tenders, or
- (b) any other internationally accepted equivalent standards which, in the opinion of the Engineer, are equal or better than the specified standards.

Nepal Standard NS : 40 - 2040 published by Nepal Bureau of Standards and Metrology;

Indian Standards IS : 4984 - 1978 published by Bureau of Indian Standards, Manak Bhavan, New Delhi, India;

British Standards BS 3284 : 1967 published by British Standards Institution (BS), British Standards House, London W1, England.

The acceptance of a tender based upon a Standard or Code of Practice proposed by the Contractor shall only signify the Engineer's general approval to the use of such Standard or Code of Practice and shall not signify acceptance by the Engineer of any materials or workmanship subsequently found to be inferior to that specified in the corresponding Standard or Code of Practice.

5.3.1.8 Supply and Marking of Pipes

The Pipes shall be supplied either as coils with a minimum inner diameter of 25 times the OD of the pipes (except 2, 2.5, and 4 Kg/Sq.cm. pressure ratings), as given below or in lengths of five meters. The pipes may also be supplied in other lengths where so agreed between the Contractor and the Engineer. The ends shall be cut at right angles to the pipe axis and shall be plugged or covered.

Pipe size (mm)	Series	Pressure (Kg/cm ²)	Working Length (m)	Inner Coil Diameter (m)
16	V	10	300	0.50
20	V	10	300	0.50
25	V	10	200	0.70
32	IV	6	200	0.80
32	V	10	100	0.80
40	III	4	5	0.80
40	III	4	5	-
40	IV	6	100	1.00
40	V	10	100	1.00
50	III	4	5	-
50	IV	6	100	-
50	V	10	100	1.25
63	III	4	5	-
63	IV	6	50	1.50
63	V	10	25	1.50

A continuous line between 2mm to 5mm wide must be indelibly and clearly marked along the pipe surface according to the following code:

- 2.5 kg/cm² working pressure - Red line
- 4.0 kg/cm² working pressure - Blue line
- 6.0 kg/cm² working pressure - Green line
- 10.0 kg/cm² working pressure - Yellow line

Each pipe shall also have the following information marked on it:

Item number; Pipe size - outer diameter; Series in Kgf/cm²; Weight; Length; NS, IS, BS, etc. or relevant authoritative Standards mark.

The method of marking shall be such as to ensure that all of the information will remain legible after shipping, local haulage and storage in the open.

5.3.1.9 Drawings

Before manufacture is commenced, the Contractor shall submit to the Engineer for approval six copies of drawings of all pipes to be supplied which do not comply with relevant accepted Standards, showing all dimensions in metric units. The Contractor shall supply the Engineer without charge two copies of all drawings subsequently approved.

5.3.2 Testing of Pipes Before Shipment

5.3.2.1 Tests

At the place of manufacture; hydraulic tests, reversion tests and internal pressure creep tests shall be carried out on ten random samples from each pipe series and diameter spaced throughout the manufacturing period.

This requirement may be reduced where a small length of a particular pipe diameter and series is to be supplied.

The working pressures for the various pipe series shall be:

- Series II 2.5 kgf/cm², Series III 4 kgf/cm²,
- Series IV 6 kgf/cm², Series V 10 kgf/cm².

Tests shall be witnessed by an independent inspection agent, to be appointed by the Engineer, who shall approve the tests on behalf of the Engineer.

5.3.2.2 Site Inspection and Testing

All Goods will be inspected after delivery to site and the Engineer will reject any item which is damaged or not complying with the specification.

5.3.3 HDP Fittings

All HDP fittings shall be manufactured by Injection Molding Process in accordance with IS: 8008 (Part I-VII) - 1976 or equivalent to join HDP pipes to IS: 4984 - 1978 or equivalent. All fittings shall be molded from a compound consisting of virgin polyethylene in which carbon black and suitable non-toxic anti-oxidant are evenly dispersed and shall be suitable for butt - welding at fusion temperature 200° - 220°C. All HDP fittings shall conform corresponding to working pressure rating of 10 kg/cm². Fittings supplied must have a clear marking indicating the relevant pipe size(s) indelibly on each item.

5.4 GALVANIZED MILD STEEL PIPES AND FITTINGS

5.4.1 Materials

The term materials shall mean all materials and articles of every kind, raw, processed or manufactured, which are used in the manufacture of goods to be supplied under the Contract. All materials shall be new and of the kinds and qualities described in the clauses hereof appropriate to the particular item and shall be at least equal to approved samples except that alternative materials may be accepted provided the Supplier has at the time of tendering:-

- (a) Drawn particular attention to the deviation from the Specification in his tender and provided particulars of the alternative material offered at the time of tendering, and
- (b) Substantiated, to the satisfaction of the Engineer, that the material offered is equal or superior to the material specified for the use to which it is to be put and has obtained from the Engineer approval in writing to its use. Where materials to be used for any component have not been laid down in the Specification the Supplier shall use only those materials in such compositions as have been proven in actual service to be the most suitable for the particular purpose.

5.4.2 Standards

All workmanship, materials and components throughout shall, where applicable and unless otherwise stated in the Contract, comply either

- (a) with the relevant Nepal, Indian or British Standards or Code of Practice current on the date fixed for receipt of tenders, or
- (b) with other internationally accepted equivalent Standards or Codes of Practice which are equal or superior than the specification.

The acceptance of a tender based upon a Standard or Code proposed by the Supplier shall only signify the Engineer's general approval to the use of such Standards or Codes and shall not make the Engineer liable to accept a Standard or Code subsequently found to be inferior to that specified in the corresponding Standard or Code of Practice.

5.4.3 Test Certificates

Certificates in triplicate shall be provided by the Supplier for each valve, pipe and fitting supplied giving the process of manufacture and the results of the specified tests.

Similar certificates in triplicate shall be provided by the Supplier in respect of materials to be used in the manufacture of the valves, pipes and fittings giving the process of manufacture, chemical analysis (where relevant) and the results of specified tests.

The materials shall be suitably marked to enable them to be identified from references on the certificates.

5.4.4 Independent and Local Tests

The Engineer reserves the right to carry out any independent or local tests he may deem fit on the completed goods or on any material provided under the Contract at any stage during the Contract including the guarantee period. In addition to any relevant clause in the General Conditions of Contract any materials, workmanship or completed pipes and fittings which are shown by such independent tests not to be in accordance with the Specification shall be rejected notwithstanding any previous certificate which may have been provided.

5.4.5 Rejected Materials

Any goods delivered to site, which are rejected by the Engineer, shall immediately removed from site by the Supplier free of costs.

Any pipes and fittings, which have been rejected, shall be marked in a distinctive manner, which shall preclude any possibility of their use for the purpose for which they were supplied. Such pipes and fittings may be submitted for re-test following the correction of any defects, where such corrections are permitted by the Engineer.

5.4.6 Manufacture and Testing

Tube shall be made from tested quality steel manufactured by any approved process.

The manufacture and testing of all galvanized steel pipes and fittings shall comply with the current edition of NS, IS, BS or equivalent. Galvanized steel pipe shall be of the class specified in the Bills of Quantities.

Ends of pipes shall generally be screwed at both ends as per IS 554 - 1975, BS 21 threads or equivalent or as requested by the Engineer. Ends of pipe specials and fittings shall be screw socketed suitable for screwing to IS : 554 - 1975 or BS : 27 threads or equivalent pipe threads. Where flanged pipe work is specified this shall be suitable for jointing with other flanged pipe work and valves.

5.4.7 Process of Manufacture

"Medium" and "Heavy" duty galvanized steel pipes and sockets shall be either welded or seamless as agreed to between the Engineer and the manufacturer.

5.4.8 Standard and Non Standard Lengths

The pipe shall be supplied in standard lengths of 6 metres each. Each pipe shall be provided with a corresponding size of one socket at one end and a plastic ring (cover) at the other end for protection of the threads of the pipes.

Non standard lengths shall be approximately 3 metres in length or as required by the Engineer. One socket to be provided with each pipe at one end and a plastic ring on the other end as mentioned above.

In both the cases, the total lengths for each class and diameter shall be the sum of the pipe lengths measured excluding the sockets.

5.4.9 Pipe Dimensions and Tolerances

The pipe wall thickness and outside diameter of the pipes shall comply with Section 2.4 of BS 1387 or equivalent.

The weights per metre in Kgs. of Screwed and Socketed Galvanized Mild Steel Tubes (including sockets) shall not be less than:-

Dia (mm)	Heavy Duty Kg/m	Medium Duty Kg/m	Light Duty Kg/m
15	1.51	1.28	1.02
20	1.97	1.65	1.48
25	3.07	2.54	2.11
32	3.97	3.27	2.72
40	4.59	3.77	3.41
50	6.39	5.32	4.33
65	8.21	6.82	6.11
80	10.52	8.87	7.21
100	-	12.69	10.49

5.4.10 Hydraulic Tests

Each pipe and fitting shall be tested at the place of manufacture to a hydraulic test pressure of 50 bar without showing defects of any kinds, the pressure being maintained sufficiently long (in any case not less than three minutes) for proof and inspection.

5.4.11 Galvanizing

After hydraulic testing of each item has been completed, pipes, fittings and flanges shall be thoroughly descaled, washed as required and then dipped in a bath of molten zinc, containing not less than 98.5% by weight of zinc at a temperature suitable to produce a complete and uniformly adherent coating of zinc. Where tubes are required to be galvanized, the zinc coating on the tubes shall be in accordance with IS : 4736 - 1968 or equivalent. Pipes and fittings which are to be screwed shall be screwed after galvanizing has been completed.

5.4.12 Tests on Finished Pipes

The Supplier shall arrange and carry out tests on the galvanizing in accordance with Appendix A of BS 1387 or equivalent. One pipe per batch of 500 pipes shall be sampled for this test.

The Supplier shall also arrange and carry out bending and flattening tests on pipes above 50 mm nominal diameter in accordance with Section 2.9 of BS 1387 or Section 14 of IS : 1239 (Part I) - 1979. Two pipes per batch of 500 pipes shall be subjected to these tests.

5.4.13 Pipe Specials and Fittings

Galvanized mild steel pipe specials and fittings shall conform to the appropriate dimensions given either in BS 1387 or BS 1740 or IS : 1879 - 1987 or equivalent. The material used for the manufacture of malleable cast iron fittings shall conform any of the grade specified in IS : 2107 - 1977 or IS : 2108 - 1977 or equivalent. Outlets of fittings shall be threaded to dimensions and the tolerances as specified in IS : 554 - 1975 or equivalent. Fittings shall be galvanized to meet the requirements of IS : 4759 - 1985 or equivalent. Pressure test shall be as per section 13 of IS : 1879 - 1987 or equivalent. The dimension and weight of all fittings shall be as per the corresponding section of standards e.g. IS : 1879 - 1987 or equivalent. The ends of all pipe specials shall generally be screw socketed. If the supplier offers screw spigot ended pipe specials, a matching screw socket shall be provided for each end of the pipe specials. All standard lengths shall be supplied with one coupling and the price quoted shall include for this.

5.4.14 Flanged Joints

Flanges shall be the boss screwed type in accordance with BS 4504 Table 16/4 or equivalent suitable for screwing to BS : 21 pipe threads or equivalent. Each flange to be supplied with one set of jointing materials.

Each set of flange jointing materials shall be supplied complete with nuts, bolts, washers and joint rings with an additional 10% as spares. Body bolts and nuts shall be galvanized, joint rings shall be of flat section 3 mm thick, medium rubber reinforced with two-ply flax fabric and complying with BS 5292 or equivalent and shall not extend beyond the bolt circle. Bolts and nuts shall be hexagonal and shall be in accordance with BS 4190 or equivalent.

5.4.15 Markings

Each standard length Medium Class galvanized pipe shall be marked with two blue bands 50 mm wide (one band at each end of the pipe) the nominal diameter, the length of pipe and the relevant manufacturing standard. Similarly for light class pipes except that the band colour shall be brown or yellow and that for heavy class red bands colour.

5.4.16 Protection Against Damage in Transit

Pipes and specials shall be protected with a suitable varnish throughout their entire length. Straight pipes shall be bundled together into convenient lots (for transport) by rope or 105 WC wire or other suitable material in at least three places. Sockets and other small fittings shall be packed in strong wooden boxes.

The threads of all pipes shall be effectively covered with a good quality grease or other suitable compound and each pipe above 50 mm diameter shall have a protecting ring affixed to the screwed spigot end. Rates should include for all packaging.

5.5 VALVES, STOP COCKS AND FERRULES

5.5.1 General

All valves shall be manufactured to an internationally recognized standard and full details concerning such standards shall be provided by the manufacturer for approval before manufacture commences. Where British or Indian Standards are quoted in this specification an equivalent internationally recognized standard is acceptable.

Cast iron shall have properties not inferior to those specified for Grade 14 of BS 1452 or equivalent and shall withstand the test pressure specified. All castings shall be carefully cleaned and dressed off. No stopping or plugging will be permitted in the case of holes or flaws appearing therein, and casting shall be made from first running.

Gunmetal and bronze shall be of such compositions as have been proved in actual service to be the most suitable for the particular purpose. If any casting, forging, bearing or other part should prove to be defective, the Engineer shall have the power to reject it and the Supplier shall replace it at no extra expense to the Engineer.

5.5.2 Interchangeable Components

All similar equipment shall be strictly interchangeable as a whole and as regards their component parts.

5.5.3 Protection Against Climatic Conditions

Valves supplied shall be of the appropriate grade and quality for and shall be adequately protected against the tropical climatic conditions. The supplier shall take those conditions into account in deciding what grade, quality and protection is required. Cast iron and steel surfaces of all valves, hydrants, and fittings shall be painted with at least two coats of approved bituminous paint. Failure to comply with the requirements of the above will result in rejection by the Engineer. Valve bodies, protecting tubes, surface boxes and all other casting shall be coated in accordance with BS 5163 or equivalent, for tropical conditions. Where this is not applicable, they shall be thoroughly cleaned and given one coat of bituminous paint. Machined surfaces shall be covered by a suitable rust inhibitor, such as a high melting point grease of approved quality.

All submerged moving parts of the valves, or the pins and spindles etc of submerged moving parts, or faces etc in contact with them shall be of non-corrodible materials. Any parts that show signs of corrosion or wear during the Period of Liability shall be replaced by non-corrodible material of special quality for the purpose at no extra expense to the Engineer. Care shall be exercised in the choice of metals for use in the valves to reduce the effects of bi-metallic corrosion to a minimum. The foregoing shall apply also to the moving parts of valves exposed to the weather.

5.5.4 Works Tests

All valves shall be hydrostatically tested at the place of manufacture to the pressures specified and valves shall satisfactorily pass the specified tests before they are packed for delivery.

All valves shall be body tested to twice the working pressure stated in the Bill of Quantities. Seat tests to the working pressure stated in the Bill of Quantities shall be carried out on all sluice valves and stop valves.

All sluice valves and stop valves shall be subjected to "open end" test in accordance with BS 1218 or equivalent and each valve shall be subjected to three separate hydrostatic tests as follows:

(a) Seat Tests

- (i) The tightness of seats shall be tested as follows: with the wedge closed and with the valve fixed at one end only the test pressure shall be applied to one face of the wedge, the other face being at atmospheric pressure. There shall be no visible leakage past the wedge at the hydrostatic test pressure (gauge) specified;
- (ii) The above procedure shall be repeated but with the valve fixed at the other end and with the pressure applied to that end of the valve.

(b) Body Test

With the wedge open the test pressure (gauge) specified shall be applied to the whole body of the valve. There shall be no visible leakage. The test durations for all tests shall be as in the table below:

NOMINAL DIAMETER MM	MINIMUM TEST DURATION (MINUTES) FOR	
	BODY	SEAT (IF APPLICABLE)
50 and under	0.25	0.25
65 to 150	1	1
200 to 300	2	2

All valves shall be marked with cast-on or stamped lettering stating the body test pressure in meters head of water. The cost of testing shall be included in the contract rates.

5.5.5 Valves Generally

Valves shall have adequate provision for lubrication, shall cause the minimum of head loss in the open position and shall seal the water passage completely when shut.

All valves shall be closed in a clockwise direction unless otherwise specified. Direction of closing to be shown on the hand wheel.

All valves shall be suitable for use with water in the temperature range -10°C to 70°C and for working pressure of 10 bar or as otherwise specified.

Each flanged valve shall be supplied complete with nuts, bolts, washers, and joint rings. Joint rings shall be of that section complying with BS 4190 or equivalent and shall not extend beyond the inner edges of the bolt holes. Bolts and nuts shall be hexagonal complying with BS 4190 or equivalent.

All materials which may come in contact with raw or potable water shall be free from toxic substances and shall not foster microbiological growth or give rise to taste, cloudiness or discolouration of the water with which they are or could be in contact.

Rubber used in valves shall be ethylene propylene rubber (EPDM or EPM) or styrene butadiene rubber (SBR), which complies with the above requirements, and is suitable for making a long term flexible seal and is resistant to mechanical, chemical, or bacteriological attack leading to deterioration of the flexible seal.

5.5.6 Flanges

Flanges for pipe work connections shall in all respects be in accordance with BS 4504 PN 16 or equivalent unless otherwise specified.

5.5.7 Bib Cocks

Bib cocks shall be of brass and shall be nominal 15 mm diameter conforming to BS 1020 or IS : 781 - 1984 or equivalent. Inlets shall be male screwed suitable for joining to 15 mm GI socket. Outlet shall be plain ended. Top shall be round turned crutch.

5.5.8 Globe Valves

Globe valves shall be gunmetal, rising stem, hand-wheel operated with screwed female ends; conforming to IS : 778 - 1984 Class 1 or equivalent.

5.5.9 Gate Valves

Stop valves shall be gunmetal wedge gate valves, rising stem, hand-wheel operated with screwed female ends; conforming to IS : 778 - 1984 Class 1 or equivalent.

5.5.10 Ferrule Cocks

Ferrule cocks shall be of gunmetal square head of 15 mm internal diameter swivel balancing screw down ferrules with male inlet and single male outlet; conforming to IS: 2692 - 1984 or equivalent.

5.5.11 Air Valves

Single orifice air valves shall be of cast iron body, reliable in action and shall operate in such a manner that the balls of the valves cannot be held against the orifice by air pressure alone. Each air valve shall be supplied with an approved isolating device. The inlet shall be male screwed 15 mm diameter suitable for connection to a GMS riser pipe. Maximum operating pressure will be 100 meters head of water.

5.5.12 Marking and Packing

Each valve shall be indelibly marked with the diameter, weight and pressure rating and shall in addition carry a unique reference number to enable each item to be clearly identified to works fabrication records, works test certificates, delivery notes and the like.

All valves shall bear the authorized Standard mark cast on showing to which Standard specification they have been manufactured.

Whenever possible the identification marks except for the "Standard mark" shall be painted on the outside of the item but where there is insufficient smooth surface area to accommodate the identification marks they shall be put on rust proofed metal tags secured to the item with galvanized wire.

Flanges shall be protected with wooden discs attached by service bolts or other approved means. Service bolts shall not be incorporated in the works.

All items shall be properly prepared and packed for delivery and shipping. In particular, small items such as small valves, parts of operating gear, bolts, nuts, gaskets, and other joint components shall be crated for delivery. Each crate shall contain a detailed packing list in a waterproof envelope. The outside of the crate shall bear a general description of the contents and identification mark relating it to the detailed packing list.

All valves and fittings shall be securely packed in crates or boxes for protection against damage during transit. The costs of packing shall be included in the contract rates. None of the packing will be returnable.

5.5.13 Unions

Unions shall either be brass or galvanized malleable iron, as specified in bill of quantities, manufactured in accordance with a recognized international standard. The manufacturer shall produce full details concerning the standards to which his goods are produced. All unions shall be suitable for joining GMS pipes manufactured to BS 1387 or IS: 1239(part 1) - 1990 or equivalent with threads to BS 21 or equivalent.

5.5.14 Flexible/Detachable Couplings

Flexible/detachable joints are required for repairs to existing GMS pipes of medium class manufactured to BS 1387 or equivalent specification. They shall be similar to 'Viking Johnson Couplings' without central register and shall be capable of withstanding a pressure of 250m head of water. They shall be supplied complete with all bolts and gaskets and shall be suitably protected against corrosion by an approved coating. Sizes required in the range of pipe sizes ND50 to ND100. Full details to be supplied for approval before manufacture.

5.5.15 Others

5.5.15.1 Float Valve

Float valve shall be of heavy duty type for break pressure chamber and conforming to standard IS: 1703 - 1977 (horizontal plunger type or equivalent. The pressure rating shall be 14 Kg/m² and male thread shall be as per corresponding standard.

5.5.15.2 Nipples

Nipple of various length as required by the Engineer shall be manufactured of Medium/Heavy duty galvanized mild steel pipes conforming to IS : 1239 (Part I) - 1990 or equivalent. Threads to conform with IS : 554 - 1975 or equivalent. The standard lengths are :

- 100 mm upto 25mm nominal bore
- 150 mm for 32 mm & 65 mm nominal bore
- 200 mm for 80 mm & 100 mm nominal bore

5.5.15.3 Brass Union

Brass union shall be used to join HDP pipe and equivalent G.I. Pipe. Dimensions for HDP pipes are as per IS : 4987 - 1979 equivalent and GI pipes as per IS : 1239 (Part I) - 1990 or BS : 1387 - 1967 make threads or equivalent. Type of joint : Expansion joint consisting of :

- a. union body
- b. brass ring
- c. brass expansion plunge (for insertion into the HDP pipe)
- d. neoprene ring for insertion into union body &
- e. flat rubber coaster. Each set to be supplied assembled.

5.5.15.4 Flange Set (For HDP - GI Jointing)

Flange set to join HDP pipe as per IS : 4984 - 1978 or equivalent to IS : 1239 (Part I) - 1990 or BS : 1387 - 1967 GI pipe (make threads) shall consist of :

- a. female threaded flange
- b. plain unthreaded flange
- c. HDP flange adaptor
- d. duty rubber gasket and
- e. nuts, bolts and washers (adequately lightened)

5.5.15.5 GI Flange

Flanges shall be female threaded to join GI pipe and valves etc and shall be drilled in accordance with BS: 4504 PN 16 or equivalent. The supply shall be complete with nuts, bolts and washers, all adequately tightened.

5.5.15.6 GI Valve Box

GI Pipe Boxes shall be manufactured according to sample made available or the Drawing and GI pipe used must be medium duty conforming to NS: 199 - 2046 or IS : 1239 (part) - 1990 or equivalent. As shown in the drawing one end of the GI pipe shall be fitted with one set of GI flange and GI blank flange complete with nuts and bolts. The bottom of the GI pipe shall be slotted to allow it to slip over the pipeline and locked into place with 300 mm long M.S. bar by passing through two 10 mm holes drilled near the base.

5.5.15.7 GI Valve Key

The Valve Box Keys shall be manufactured according to sample or drawing made available to the manufacturer. Valve Boxes Keys to be manufactured of light duty pipe conforming to Nepal Standard NS: 199 - 2046 or Indian Standard IS: 1239 (Part I) - 1990 or equivalent. Other required reducers shall conform to IS: 1879 - 1987 or equivalent.

5.5.15.8 M.S. Manhole Cover and Frame

Manhole cover and frame shall be manufactured as per drawing or samples made available to the manufacturer.

Manhole Frame to be manufactured from 6 mm thick rolled steel 50 mm wide. 8 mm mild steel bar 100 cm long to be welded to the outside of the frame at 90 degree intervals. Lugs (2 nos) to be made as L sections 100 mm high, 50 mm wide to be manufactured from 5 mm thick rolled steel. Slot 15 mm x 25 mm to be drilled in each lug 10 mm from top of lugs. Bottom end of L section to be welded at 90 degrees to the middle of the outside of the frame.

Cover Frame to be manufactured from 5mm thick rolled steel 50mm wide. Framed to be circular 580mm outside diameter, 8mm mild steel bars 6 nos to be welded to the inside of the frame to form a regular square reinforcement mesh. Handles 2 nos. to be made from 10mm plain steel bar 100mm wide 50mm height to be welded to outside o frame. Lugs 2 nos. to be made from 5mm thick rolled steel 50mm wide 100mm high with slot 15mm x 25mm drilled in each lug 10mm from top of each lug. Lugs to be welded flush to the outside of frame with bottom of lug in line with bottom of frame. Manhole frame and Cover frame shall be painted with two coats of red oxide metal primer.

6.0 BORE-HOLE DRILLING

6.1 GENERAL

6.1.1 Description of the Works

As described in Supplementary Specifications.

6.1.2 Requirements, Specification, Standards and Brand Names

The contractor shall fulfill all requirements and obligations under all Clauses of the specification applicable to the construction work involved in the contract. Neither the following Clauses of this specification the detailed description therein nor the quantities shall limit the obligations of the contractor under the accompanying conditions of contract.

Where items are not included in Bill of Quantities for any such requirements or obligations, the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bill of Quantities.

All the standards mentioned herein shall be deemed to from part of this specification. All references to such standards shall be to the latest edition or revision thereof unless otherwise stated. Where a specific standard is referred to in this specification another standard will be acceptable, provided that it ensures an equal or higher quality of materials and workmanship than the standards referred to. If the contractor intends to use such alternative standard, he

shall notify the Engineer thereof, submitting with his notice of the proposed standard, and shall not order any material or perform any work unless and until he has obtained the Engineer's approval of such standard. Brands name where used in the specification is only intended to define a standard of quantity and performance and the contractor may use other equivalent products approved by the Engineer.

6.1.3 Contractor's Work Program

Work program for the drilling and installation of deep tubewell, purchase of casing and well screens, development and pumping test etc. showing all the stages proposed by the contractor must be submitted at the time of agreement.

After approval by the Engineer, the works program shall be binding to the contractor. Changes in the program may be made by the contractor only after prior approval of the Engineer.

The Project shall be entitled at any time to demand change in the work program as he deems necessary for the proper and expedient performance of the works.

6.1.4 Other Works

The contractor shall note that during the continuance of the contract other works, not covered by this contract, will be executed by the Engineer or by other contractors. The contractor shall cooperate with the Engineer or other contractors, to ensure the satisfactory completion of the project as a whole.

6.2 MATERIALS

6.2.1 General

The contractor shall provide all the required material for the construction of tubewell completely. Materials provided and used in the works shall be new and conforming to the qualities and kinds specified herein and or equal to approve samples. In respect of all materials used in the works currently practiced relevant standard specifications such as British standard specification (or other equivalent standard specification) shall be generally applicable.

If the contract document conflict in any way with any of the above standards, the contract documents shall have precedence and shall govern.

6.2.2 Inspection and Testing

All materials used in the works shall be subject to inspection and tests as the Engineer may direct from time to time as the work proceeds. Only materials which are considered satisfactory by the Engineer shall be used and materials condemned or not approved by the Engineer shall be removed from the works at the contractor's cost.

6.2.3 Standard Specifications

Where in this specifications any material or work is required to be supplied or done in accordance with a certain standard specification, the contractor will be permitted to supply such material or to do such work in accordance with an alternative standard of his choice, provided that he has informed the Engineer and obtained the approval from the Engineer. The contractor shall not order any material or perform any work unless and until he has obtained the Engineer's approval of such standard.

6.3 HOUSING, CASING AND SLOTTED PIPES

Unless and otherwise mentioned in BOQ, the size of housing pipe shall be of mild steel (heavy class) of min. thickness 7.0 mm with pipe lengths of 6 m. the Pipe shall be plain/ beveled ends or mild steel socketed end suitable for welding. The housing pipe shall project a distance of 400 - 600 mm above the ground level during installation. The top of the housing pipe shall have a

flange welded on to which a blank flange shall be bolted on at all time when the well is not attended by the Contractor.

The size of casing pipe shall be as specified in the bill of quantities and of mild steel (heavy class) of minimum thickness 7.0 mm with pipe length 3 or 6 m. having plain/ beveled ends or mild steel socketed end suitable for welding.

The housing pipe and casing pipe shall be joined by electric arc welding with MS collar/reducer of one size bigger size pipe

The housing pipe shall be 300mm diameter and 7 mm thick and 200 mm dia and 7.0 mm thick for casing pipe. Mild steel pipe with mild steel socketed ends suitable for welding. The housing pipe shall project a distance of 500 mm above the ground level. The top of the housing pipe shall have a flange welded on to which a blank flange shall be bolted.

The well screen shall be of the continuous slot wedge wire design, Johnston type, fabricated of special-shaped, manufactured in the all welded to support rod construction with electronically controlled welding system, ensuring greater fusion strength between the profile wire and support rod maintaining accurate slot opening tolerance. The wire and rods shall be of the identical material. The material shall be of SS 304 stainless steel conforming to the requirements of AISI.

The well screen shall have adequate strength to resist the external forces to which it will be subjected during and after installation. Screen openings shall be V-shaped, widening inwardly to avoid clogging during the development of the well.

The well screen shall be of heavy construction strength to set in the 200m depth. The screen shall be pipe size. Overall length shall be 3 m, end fitting shall be weld/rings, inside diameter of screen shall be 205mm, outside dia.219 mm, slot opening aperture shall be 1.3mm to 1.5mm continuous slots SS 304 stainless steel material, the percentage of slot opening shall be minimum 25 percent, wrap wire size 2.3mm x 3.5mm, supports rod size 3.8mm/42nos.

There must be a minimum length of 2 m to 6 m of 200 mm dia. casing pipe below the lowest screen pipe as a sand trap and this must be fitted with welded on conical steel plug with a solid point.

All pipes and screens shall be of the best quality and the contractor shall submit full detail concerning the specifications and sources of supply of these for approval before bringing the materials on site,

All housing and casing pipes shall be thoroughly cleaned or descaled before assembly lowering and shall be painted internally and externally with one priming coat and one top coat of an approved non toxic corrosion inhibiting paint.

All welds shall be allowed to cool before applying the necessary paint to the joints. The paint must dry before lowering the well assembly down the bore hole.

6.4 TUBEWELL CONSTRUCTION

6.4.1 General

The contractor shall drill and install the required numbers of tubewell at the site defined by the Engineer. The drilling point will be assigned by the Engineer. The contractor shall be familiar with the environment of the working place and make the necessary arrangements to complete the work in time.

The contractor shall make his own camping arrangement and find necessary access to the site and drilling site. After completion of work, the area shall be cleared by the contractor of all unnecessary materials used during construction period.

The contractor shall necessarily mobilize suitable drilling rig and accessory machineries and equipment to ensure timely completion of the said work.

The tubewell shall be drilled to the depth specified by the Engineer and shall be electrically logged, cased, screened, gravel packed, sealed, developed, tested and completed as production well.

6.4.2 Drilling

Drilling can be done by any of the following methods:

- Direct rotary drilling method
- Reverse rotary drilling method, and
- Percussion drilling method

It is upto the contractor to choose the suitable drilling method to drilled in the formation of the area according to their machineries and equipment bearing in mind that the works mentioned in this contract shall be completed within the stipulated time.

At first pilot hole drilling shall be carried out upto the required depth using an appropriate size drill bit.

The record of the strata encountered during the course of pilot hole drilling shall necessarily be maintained by the contractor. The lithologic samples each of 0.5 kg at an interval of 1.5 m or at the change of strata shall be collected in plastic bags. These samples should be submitted to the Engineer at the earliest possible along with lithologic log records.

After completion of drilling the pilot bore hole, the contractor, in presence of the Engineer shall carry out down the hole electrical logging (resistivity & self potential) for the verification of visual lithologic samples. Based on the lithologic samples and electrical logging data and interpretation results, the contractor shall submit the proposed well assembly (well design). Approval of this proposed design from the Engineer, must be received in written by the contractor before installation of the tubewell.

The pilot bore hole shall be enlarged (reamed) by using the appropriate diameter drill bits upto the designed depth approved by the Engineer.

The final bore hole shall be reconditioned so that all the drill cuttings shall be removed completely from the bore hole.

Verticality of the bore hole must be checked after the drilling of pilot hole and then while lowering the approved well assembly using centralizers at a maximum of 12 m spacing. The number of centralizers in each set should be three. In no case the axis of the well assembly should deviate more than 30 mm from an imaginary plumb line.

A successful tubewell should be able to yield in the range of discharge of 20-30 liters/sec to be accepted by the Engineer.

6.4.3 Tubewell Assembly

Immediately after drilling and reaming the bore hole to the specified diameter and depth, the contractor shall make necessary arrangement for lowering the well assembly in accordance with the design approved by the Engineer.

The Contractor shall provide all necessary materials required for the complete well assembly including housing pipe, casing pipe, well screen, collar, plug, centralizes etc. All the materials of well assembly shall be as specified and as per the prevalent practice, if not specified. Well assembly shall be approved by the Engineer before installation.

The well assembly shall be installed in the bore hole in the presence of the Engineer. After installation a verticality test shall be carried out and the permissible limit shall be 1 cm. in 40m.

6.4.4 Gravel Packing

The gravel pack material to be used in gravel packing, shall be composed of hard, non-calcareous, durable, well rounded particles containing no clays, silt, organic or any foreign materials. The size of gravel shall be in between 3 to 8 mm in diameter.

Immediately after lowering the well assembly into final position, the contractor shall fill the annular space between the well assembly and the wall of the bore hole with pea gravel approved by the Engineer using the continuous backwashing method to prevent bridging and reduce the possibility of damage to the tubewell assembly by sudden collapse of bridged gravel.

The gravel packing process should be continuous until the entire annular space is filled with the gravel, and then clean water should be pumped in through the casing to remove drilling mud.

Tubewell sounding must be carried out to ensure well clearance upto bottom and also the verticality of well assembly.

6.4.5 Well Development

After the well assembly installation and gravel packing, the well shall be developed by the contractor using the combination of the following four methods. Well development shall be carried out for a minimum of 72 hrs or as directed by the Engineer using suitable equipment of sufficient capacity.

- Backwashing (inner and outer washing)
- Hydraulic Jetting (water jetting)
- Air lift pumping (air compressor development)
- Over pumping by submersible pump

The completion of the well development shall be certified by the Engineer only when the water becomes clear and contains less than 5 (five) PPM of silt or sand particles..

6.4.6 Pumping Test

Following the satisfactory completion of well development, the contractor shall carry out the drawdown and recovery tests by using a suitable pump of not less than 6" dia bowl assembly. The pumping test should be carried out for a minimum of 72 hrs or as directed by the Engineer.

The contractor shall perform (a) Step drawdown test, (b) Constant drawdown test and (c) Recovery test.

- a) The contractor shall perform the Step drawdown test by pumping water at four different constant discharge rates of approximately 30%, 60%, 90% and 120% of the anticipated yield of well after development at the instruction of the Engineer. For each step, the contractor shall carefully and accurately record simultaneous readings of water level, time since commencement of pumping and discharge (flow) at the intervals of 10 minutes for the period of 4 hours for each step.

- b) The contractor shall perform the Constant drawdown test by pumping water at a constant discharge rate of the tubewell as guided by step drawdown test. The constant pump discharges shall be measured and recorded by the contractor using a standard v notch weir or discharge meter at the interval of 1/2, 1, 1 1/2 , 2, 3, 4, 5, 7, 9, 10, 15, 20, 25, 30, 35, 45, 60, 90, and 120 minutes till the water level stabilizes itself.
- c) On completion of test, the contractor shall cease pumping and accurately record the simultaneous readings of water levels in the well and the time since cessation of pumping, at the same time intervals of the pumping test, until the static water level has attained its pre-pumping level.

All test results with interpretation and graph plotted shall be handed over to the Engineer and the whole pumping test should necessarily be conducted in presence and close coordination with Engineer.

6.5 MEASUREMENT AND PAYMENT

If provided in the Contract, the measurement of the work under this Clause shall be measured and paid in units and contract rates as specified in the Bill of Quantities for completed works as directed and accepted by the Engineer. The cost and payment shall be deemed to have full and final compensation for all labour, equipment, tools and incidentals necessary to complete the work.

7.0 GROUND WATER TREATMENT PLANT

Details of Treatment Plant shall be as described in **Particular Specifications**.

8.0 SITE DEVELOPMENT AND MISCELLANEOUS WORKS

8.1 GABION WORKS

8.1.1 Scope

This clause covers the furnishing of materials, fabrication of gabion boxes and construction of gabion works that may be required as per the drawings and as located and instructed by the Engineer.

8.1.2 Materials

Gabions shall consist of steel wire mesh crates. The steel wire shall be mild steel complying with NS: 169-2045. All wires used shall be galvanized with heavy coating of zinc in accordance with NS: 163-2045. Zinc coating shall be uniform. Tolerance on diameter of wire shall be +/- 2.5%. The tensile strength shall be between 300 to 550 N/mm².

The mesh-wire as specified in the BOQ shall be woven into a hexagonal mesh of specified size as indicated in the BOQ with a minimum of three twists. All edges of the crates shall be finished with a selvedge wire as specified in the BOQ. Diaphragms shall be fabricated as per the parent gabion box and shall have selvedge wire throughout the perimeter.

Stones used for filling shall be clean, hard, sound, unweathered and angular rock fragments or boulders. The specific gravity of the stone shall be not less than 2.50 and the stones shall not absorb water more than 5% when tested as per IS: 1124. The length of any stone shall not exceed three times its thickness. The smallest dimension of any stone shall be at least twice that of the longer dimension of mesh of the crate.

8.1.3 Workmanship

Before filling any gabion boxes, the Contractor shall submit samples of gabion boxes assembled, erected and filled with approved quality of stone, for approval of Engineer; which, when approved, shall be retained for reference and comparison with the gabions built as part of the permanent works.

The bed on which the gabion boxes are to be laid shall be even and well dressed. The level of the bed shall be checked and approved by the Engineer before placing of gabion boxes. Gabion boxes shall be placed such that vertical joints are not continuous, but staggered. The gabion boxes shall be laid in such a manner that the hinges of the lid will be on the lower side on the slopes and on the outer side in walls. The boxes shall be stretched out to their perfect position and all sides shall be tied together using binding wire of thickness as specified in BOQ. The diaphragms shall be secured in their positions by binding the same way to the approval of the Engineer.

The crates shall be placed in their final position before filling commences. They shall be stretched to their full dimension and securely pegged to the ground or wired to the adjacent gabions before filling. Before filling commences, the selvedges of the crate shall be bound to the selvedges of the adjacent crates with binding wire. Before filling with stone, gabions shall be inspected by the Engineer to ensure that the tie/wiring has been properly carried out.

The filling shall be carried out by placing individual stones into the gabion crate by hand in courses in such a manner that the stones are bedded on each other and bonded as in dry random rubble masonry. No loose stones shall be tipped into the crate and the practice of coursing and bonding the outer layer and filling the interior with unladen stones shall not be permitted.

The gabion boxes shall be over filled by 50 mm above their tops to allow for subsequent settlement. The lids shall then be tied down with binding wire to the tops of all partition panels.

The lids shall be stretched to fit the sides exactly by means of a suitable tool but due care shall be taken to ensure that the gabions are not so full that the lids are overstretched.

8.1.4 Test and Standard of Acceptance

The gabion wire shall be tested for mass, uniformity and adhesion of zinc coating and tensile strength of the wire corresponding with NS: 169 and 163-2045. The Contractor shall produce the test certificate of the supplied wire before fabrication of gabion boxes.

The tolerance limit permitted in size of gabion boxes shall be +/- 3% on each dimension prior to filling. The tolerance on the wire mesh opening shall be +/- 10% on the nominal dimension.

8.1.5 Measurement and Payment

Measurement for payment of the gabion work shall be done in volume (cubic meter) of stone filled gabion boxes. The rate shall include the cost of gabion boxes (including the cost of wire and fabrication), transportation to the site, placing in position, supply and filling of stone and tying/covering work all complete as per the drawing and instruction of Engineer.

8.2 SUPPLY OF TOOLS AND EQUIPMENTS

8.2.1 Scope

This clause requires supply of tools and equipments as mentioned in the BOQ and as further required by the Project. The T & E shall be provisioned under contingency item and shall be supplied as per the instruction of the Engineer.

8.2.2 Details of Supply Conditions

The lists of tools and equipments to be supplied have been enlisted in the BOQ. However, actual requirement can be changed as decided by the Project and instructed through the Engineer. Basic rate of the Contractor shall be equally applicable for the increased or decreased quantity.

Quality of the tools and equipments shall be as mentioned in the BOQ. Where not mentioned, the quality shall be those having IS or NS mark or as instructed by the Engineer. Before procurement and delivery of tools and equipments, the Contractor shall reconfirm the stipulated quantity and shall get approval of the brand/quality with the Engineer. The Engineer shall have the right to disapprove the inferior quality tools and order for their replacement if required.

8.2.3 Measurement and Payment

Measurement for payment of the tools and equipment shall in Number for each individual tool or a set of tools as indicated in the BOQ. The rate shall include the cost of tools, their transportation and delivery to the WUSC store as directed by the Engineer.

**SUPPLEMENTARY
SPECIFICATIONS**

1.5 PROVISION OF TEMPORARY FACILITIES

1.5.5 Provision of vehicle facilities

Delete Entire paragraph.

2.1 SITE CLEARANCE

2.1.6 Measurement and Payment

Delete Entire paragraph and replace with following:

Measurement for site clearance shall be made of the number of square metres determined by computation of the area of final length by final breadth.

The rate shall include cost of all material, labour, equipment, tools and incidentals to complete the work as specified in clause no. 2.1.

2.0 CIVIL ENGINEERING WORKS, BUILDING CONSTRUCTION ACTIVITIES

2.2.8 Measurement and Payment

Add following at the end of second para:

Rate of excavation shall include excavation at any level, lift & haulage to safe location as instructed by the Engineer and shall be applied for all kinds of soil.

Delete fifth para.

2.3.8.4 Miscellaneous Items

Delete second para and replace with following:

Measurement of waterproofing compound will be done according as the item of BOQ and will be paid accordingly.

2.4 BRICKWORK/STONWORK

2.4.7 Measurement and Payment

Measurement for payment for Brickwork and Stone work walls shall be done in cu.m. and that of soling shall be done in sq.m. unless otherwise indicated in the BOQ. Deductions of all openings, any concrete works in the walls shall be done to arrive at net quantity. No deductions will be made for openings of area up to 0.5 m². Nothing extra shall be paid for making such openings or cuttings to suit concrete structures, walls in any shape other than straight or any cutting necessary for shaping the walls to the structural design requirements. Rate shall be inclusive of all necessary material, scaffolding, watering, labour etc. and disposal of unused materials complete.

The cost for manholes, rain inlets and house connection chambers shall be inclusive of excavation, brick soling, brick work, concrete work, formwork, shoring, plastering, bitumen painting all complete as shown in the drawing.

2.7 FINISHES

Add sub clause 2.7.5.12: Conglomerate Cement Concrete Flooring and 2.7.5.13 : Neat Cement Punning after clause no. 2.7.5.11 : Roofing

2.7.5.12 Conglomerate Cement Concrete Flooring

Concrete slabs to receive in situ finishes and setting beds shall be chipped to form a roughened finish, thoroughly cleaned, dampened and coated with a cement slurry to provide a bonding surface.

Cement concrete, of M15 with 12mm down aggregate flooring. shall be mixed integrally with floor hardener as per the manufacturer's instructions and shall be laid to specific slope as shown on the Drawings. Thickness varies to allow surface finish to be flush with required finish floor elevation. 4 mm wide control Joints trowel to a depth to a 8mm shall be provided as shown on the Drawings and filled with polysulphide caulking sealant.

The concrete shall be laid until all hollows are filled then the surface trowelled and checked with steel straight edge.

Immediately after trowelling and removing the excess laitance a well mixed cement slurry consisting of ordinary portland cement or coloured cement and water solution shall be mixed with hardener and sprinkled over the surface in a uniform layer at maximum rate of 2.5 kg per square metre. The cement slurry shall then be steel trowelled perfectly smooth.

The cement concrete flooring shall be kept damp for a minimum of 7 days and allowed to cure for another 7 days

2.7.5.13 Neat Cement Punning

The surface of the under coat on which the punning is to be done shall be left rough. The punning shall be applied, when the under coat is completely set. The thick paste of cement and fine sand in 1:1 ratio for punning shall be applied with a uniform layer of 3mm thickness in average by means of a steel trowel. It shall be finished to perfectly smooth and even finish, working from top to bottom both for wall & floor.

All corners, surfaces, angles and junctions shall be truly vertical and horizontal as the case may be and shall be carefully and neatly finished rounding or chamfering corners, surfaces, junctions etc. where required shall be planned without any extra payment. Such rounding or chamfering shall be carried out with proper templates to the required size. No portion of the surface shall be left out initially to be patched up later on.

Moist curing shall be accomplished by keeping the surface uniformly damp by suitable means. Moist curing shall start during application and continue for not less than 7 days.

2.7.7 Measurement and Payment

2.7.7.1 Principles

Delete Entire paragraph and replace with following

Finishing work will be measured as the net areas covered in sqm. unless otherwise mentioned in the BOQ and no deductions shall be made for openings of area up to 0.5 m². Measurement for payment of CGI roofing shall be on area of roofing.

The price shall be fully compensation for all material, labour, equipment, tools and incidentals necessary to complete the item as specified herein.

2.8.7 Measurement and Payment

2.8.7.1 Principles

Delete first two sentences of second paragraph.

5.2 DUCTILE PIPES AND FITTING VALVES

5.2.6 Household Connection Water meters

Delete Entire paragraph and replace with following

5.2.6.1 Suitability of Suppliers

All materials and equipment to be supplied under this contract shall be service proved products of specialized manufacturer's.

5.2.6.2 Standardization, Ease of Maintenance

In order to rationalize operation, maintenance and repair and to minimize the number of tools and spare parts, the supplier shall standardize the materials as far as possible.

5.2.6.3 Metric Units

All instructions, manuals and information sheets shall be in metric units with imperial (inch) equivalents stated where appropriate.

5.2.6.4 Applicable Standards

In principle all standards in recognized use internationally are acceptable, provided they meet the requirements of this contract. Whenever reference standards appear in these specifications, they are intended to be the latest available. Materials meeting other internationally accepted standards which ensure an equal or higher quality than stated in the reference standards are acceptable. However, decisions as to equal or higher quality will be made by the Engineer.

The following is a list of some internationally accepted standards and some associations concerned with the standardization on products and the abbreviations below will be in use in the following text

ANSI	-	American National Standards Institute (Successor of ASA)
AS	-	Australian Standards
ASTM	-	American Society for Testing and Materials
ASME	-	American Society for Mechanical Engineers
AWWA	-	American Water Works Association
BS	-	British Standard
DIN	-	German Industrial Standard
DSGW	-	German Society for Gas and Water
EEC	-	European Community Standard
FDA	-	Food and Drug Administration
ISO	-	International Organization of Standardization
JIS	-	Japanese Industrial Standard
JWWA	-	Japanese Water Works Association

5.2.6.5 Manufacturer's Instructions

The suppliers will be deemed to have obtained manufacturer's complete instructions with respect to the products to be supplied under this contract. He shall adhere carefully to such instructions and shall wherever necessary employ manufacturer's specialist assistance in the performance of the works.

The provision of this article shall not be constructed as releasing the supplier from his responsibility under the contract.

5.2.6.6 Warranties and Certificates

The supplier shall guarantee all materials and equipment furnished under this contract in conformity with the stipulations in the agreement, the general conditions and these specifications.

Before shipment of any consignment, the supplier shall submit manufacturing certificates and third party inspector's showing the materials, workmanship, functions and performance to be in accordance with the reference standard and more specifically with the requirements of this contract. Any form of certificates of the manufacturer or recognized agency may be submitted.

The certificates shall be accomplished by the manufacturer's design calculations and of the required test.

Water Revenue Meters (Rotary Piston Type)

5.2.6.7 Materials

Only the best quality and type of materials shall be used, which shall be suitable for the purpose intended. Unless otherwise specified, materials shall be selected by the supplier. The materials shall be appropriate both mechanically and chemically to the operating conditions. In

connecting units they shall be mechanically, chemically and electrochemically with one another and with the environment.

Materials shall be selected to the adequate resistance against abrasion and corrosion. Where necessary protective coating and lining shall be applied.

Materials in contact with the water shall be non-toxic and shall not affect the quality of water.

5.2.6.8 Design and Construction

Meters shall be designed for use in tropical climate and for measuring the water described in project information with temperatures up to 50°C, and shall comply to the requirements of ISO 4064 Class 'B'.

Meter shall have a modular design, consisting of an inlet case and separate measuring chamber. The measuring chamber shall be removable and rapidly exchangeable without removing the body.

Registration shall be by direct reading digital counter, with a display to show the smallest measurements.

Registration shall be in cubic meters. For ease and accuracy of calibration and adjustment, dials shall register or as to permit accurate readings of 0.05% of the nominal discharge.

Meters shall have a means of adjustment by a by-pass chamber side screw which adjusts the cross-section of the chamber. The adjustment screw shall be operable from outside the meter and shall be protected by a screw in sealed plug.

All meters shall be provided with wire and lead seals, both to the register and to the plug covering the adjustment screws.

Weight of each meter shall be minimum 1.3 kg with connections and minimum 1.0 kg without connections.

All parts in contact with the rotor shall have smooth surfaces, protected where necessary to prevent encrustation.

A strainer shall be fitted to the inlet of each water meter. The strainer screen shall be rigid, fit snugly, be easily removable and have an effective straining area at least double that of the inlet.

Water meters shall be designed for a lifetime of 10 years under normal operating conditions.

5.2.6.9 Markings

The following markings shall be provided on the meters:

At least one arrow cast onto the body indicating direction of flow.

Nominal size cast on the body.

Model identification, individual serial number, year of manufacture, engraved on the housing or indelibly marked on the dial.

Manufacturer's name and serial number, engraved on the lid or otherwise suitably marked.

5.2.6.10 Meter Performance

General performance and accuracy shall be as indicated below. The range of measured flow rates is sub-divided into 3 reaches, the limits being defined by the following flow rates:

Q _s	=	Starting flow rate Below this flow rate the register will not show any reactions
Q _m	=	Minimum flow rate for reliable registration. The error shall not exceed plus minus 5%
Q ₁	=	Limiting flow rate for increased accuracy of registration. For flow rates above Q ₁ , the error shall not exceed plus minus 2%
Q _n	=	Nominal flow rate for continuous or intermittent function of the water meter. The error at Q _n shall not exceed plus minus 2%
Q _{max}	=	Maximum flow rate at which the meter may function for limited time without exceeding a metering error of plus minus 2% and without exceeding permissible head loss.

For Domestic Type Water Meter Q_{max} should be 2 x Q_n

The supplier shall include with his bid the information in a format set out in technical data sheets regarding the above performance.

5.2.6.11 Factory Warranty: 1 year after successful delivery.

5.2.6.12 Domestic Water Meters

Water meters in this category shall be of 1/2" (15 mm) size or their nearest metric equivalent. They shall be the Rotary Piston Type with completely waterproof encased gear train, magnetic couplings and register. The inlet and outlet shall have a common axis.

The meters shall have the following minimum performance characteristics:

Approx nominal flow rate Q _n (m ³ /h)	1.5
Minimum capacity of register (m ³ /h)	104
Minimum readable quantity (liters)	1

Domestic water meters shall have a non-return valve on the outlet end to prevent back flow.

Domestic water meters shall have water tight dismantling coupling on each side to allow easy removal of the unit from the pipe work.

Their design and materials shall afford reasonable safeguards against destruction. Attention in this regard shall be given to the strength of the glass and the lid.

The pressure rating of domestic water meters shall be PN 10 (10 bar).

The meter housing (body) shall be manufactured from bronze. Domestic water meters shall be suitable for monitoring in both the horizontal and in the vertical positions.

5.2.6.13 Testing

It is required that the quality and the compliance with these specifications shall be demonstrated for all materials and equipment by appropriate tests performed during the various phases of the work of production.

The minimum test pressure shall be the specified nominal pressure plus 50%. This pressure shall be applied increasing from 0 to maximum event over 15 minutes.

The measuring devices used in shop testing shall afford the following accuracy.

Capacity	:	plus	minus
		0.1%	
Differential head	:	plus	minus
		1%	
Time measurement	:	plus	minus
		0.03%	

Shop testing shall be run with water of not more than 40°C and not less than that 10°C temperature. Shop testing shall sufficiently cover the entire range of the capacity to demonstrate that the characteristics are stable.

Each point shall have at least 3 (three) readings and the arithmetic means shall be considered the proven value.

None of the individual readings shall differ from the specified limits more than is admissible by accuracy of measurement as defined above.

The arithmetic mean of all readings for one performance point shall be within the specified limits.

Assembly Drawings, Operation and Repair Manuals for Water Meters

The supplier shall submit assembly drawings and other related information of meters. The assembly drawings shall contain all necessary information and construction. The assembly drawings shall be accompanied by instruction manuals and any other information which may assist in interpretation of the drawings and forming an appreciation of the materials offered.

The supplier shall submit the operation and repair manual in 2 (two) copies in English language.

7.4 HYDRAULICS

The treatment system shall be designed to operate under open atmospheric pressure in open system. The hydraulic & performance data of the existing system shall be collected by the bidder at his own cost. The total head losses through the treatment process should not exceed 5m under dirties media conditions. The treatment system shall best use the existing water supply system.

7.5 UNIT PROCESS

The unit process of the treatment system shall be as followings:

PST, Slow Sand Filter & Post Chlorination : For settlement of sand and silt, oxidation as well as disinfection

Filtration : Down flow pressure multi media filter

A disinfection system shall be incorporated in the system. The disinfection shall be done with the help of liquid chlorine. The dosing system shall utilize a metering (electronically) injection for the chlorine solution fed from FRP dosing tank 200 litre capacity. The dosing point shall be on the inlet of the treatment unit.

The water from the sump well shall be passed through PST and SSF.

From the treatment system, the treated water shall be delivered direct to the Reservoir tank.

The above processes are based on local expertise. However, the bidder is at liberty to propose his own designs capable of producing the treated water quality to the required standards for the parameters mentioned. The exposed plant shall be proven design. A reference list of operating plants in public water supply system giving details of the plant, capacities, name of the user, contract value and year of commissioning shall be provided with the tender. The exposed design shall be robust, easy to operate and cost effective in operation & maintenance.

7.6 CHEMICAL DOSING

Chlorination shall be done with the use of powder chlorine, locally available which usually contains free available chlorine up to 33% w/w. The bleaching powder be supplied and stock will be 1,450 kg (in 25 kg PVC bags).

Media Replacement and chemical dosing system is also provided and mentioned in schedule of particulars.

A suitable disinfection system is also mentioned as mentioned in schedule of particulars.

Solution preparation : Liquid chlorine / Bleaching Powder solution shall be prepared in the tanks as mentioned schedule of particulars.

Mixing : Mixing shall be done as mentioned in schedule of particulars.

Feeding system : Electronic metering dosing system of feed pump.

Piping & tubing : Non-corrosive paints for piping and fittings.

Pump head : PP fitted with anti-siphon.

Tank : FRP (appropriate capacity as mentioned in schedule of particulars) with valve outlet and drain overflow and water supply facilities.

Agitator : Mentioned in schedule of particulars

Low level switch : As mentioned in schedule of particulars.

7.6.2 Filtration

Filtration shall be applied for removal of suspended particles, turbidity, and oxidized iron / manganese. The filtration possesses applied shall be measured by reassured by filtration through a catalytic media.

Type : Down flow, horizontal

Number : one

Media : Graded river gravels and sand as per the specification (as available and used in Nepal)

7.6.3 Piping and Fittings

Sump well shall be connected in single common supply prior to join in pressure filter. The pipeline size shall be designed for minimum head loss conditions. The pipelines shall be of GI / DI, Seamless pipe or PE-100 wherever appropriate. All necessary pipelines up to 5 m distance from the existing pipelines shall be undertaken as per the pressure & durability requirements.

The length of the drainpipe or drainage shall not exceed 6 meter. By - pass system to the treatment system shall be essentially provided not exceeding 12 m in length.

7.6.4 Electrical Installation

Electrical panels as per schedule of particulars shall be provided for operation of the air compressors, Feed pumps, Sludge pumps and dosing pumps as required, compressor and all type of pumps. Rooms lighting circuit shall also be provided. A power cable from the main electrical room shall supply the power to this panel.

7.7.3 Platform for chemical dosing tank

The Chemical dosing tanks shall be of appropriate capacity as mentioned in the schedule of particulars to ensure least feeding requirements. They will be installed inside the existing operation room. The size of the platform shall be 600mm X 600 mm x 300 mm.

7.7.5 Construction of control room

The control room shall be constructed and as per the tender document and developed for service building of the water treatment plant operation also.

7 General specifications for civil works:

Civil works shall be carried out as per general engineering practices as per the specification provided.

7.12.5 Other pipings & valves

Sluice / Ball Valve	: Reputed ISI holder manufacturer
Chemical dosing line	: PVC piping & fittings
Air supply pipeline 100 pipe	: GI pipe medium duty (NS mark) or 16.0 kg/cm ² series PE-

7.12.6 Fabrication of mechanical works (filter cylinders & internal accessories)

- Workshop of fabrication With ISO 9001:2000 certified Fabricator Company

Add Section 9 : ADDITIONAL ITEMS at the end of Section 8 : SITE DEVELOPMENT AND MISCELLANEOUS WORKS.

9.0 ADDITIONAL ITEMS

9.2 METAL GATE

9.2.1 Scope

This Clause covers the supply, erection and fixation of MS metal gate made in perfect line and level.

9.2.2 Workmanship

The size of the gate shall be as specified in the BoQ or in the drawing. The type and material of the gate shall be either MS flat & angles or as specified in the drawing. The gate shall be erected and welded to the perfect line and level.

9.2.3 Measurement and Payment

Metal gate of specified size and material shall be measured in unit wt. The rate shall include necessary material, equipment, erection, fixation, painting, etc.

9.4 INSPECTION LADDER

9.4.1 Scope

This Clause covers the supply, erection and fixation of metal inspection ladder of overhead tank and ground reservoir in perfect line and level with MS square pipe.

9.4.2 Material

MS square pipe shall conform to NS 427:2058 or NS 414:2056 Part II.

9.4.3 Workmanship

Workmanship shall be as described in section 2.5.5 of this specifications.

9.4.4 Measurement and Payment

The ladder shall be measured in set. The cost shall include all necessary material, labour, equipment, erection, painting and fixing.

9.6 STRUCTURAL STEEL WORK

9.6.1 Scope

This Clause covers the supply, erection and fixation of structural steel work for roofing or other structural work in perfect line and level.

9.6.2 Material

Structural steel sections shall be hot rolled weld able sections conforming to BS 4: Part 1: 1972 and BS 4360:1979. Design, fabrication and erection shall conform to BS 449: Part 21: 1969. Connections to structural steel members shall be welded. No bolting or drilling of holes shall be done unless approved in writing by the Engineer.

Steel tubes for structural purposes shall conform to BS 4: Part 2: 1969 and 1775: 1964. The tubular truss shall be made of black steel pipes complying IS 1161-1979. Prior to manufacture, all detail design and calculations of tubular trusses should be submitted to the Engineer for approval.

Coloured galvanized corrugated sheet shall be 24 SWG thick of medium quality. Thickness of the sheet shall not be less than 0.50 mm.

Metal-arc welding materials shall conform to CSA W59.1 - 1970.

Black bolts and nuts shall conform to BS 916: 1953, Bolts with nuts in structural steelwork shall conform to BS 4395: Part 1 & 2 1969, Part 3 1973 and BS 4604: Part 1 & 2 1970, Part 3 1973 Metal washers shall conform to BS 4320: 1968.

All interior ferrous metals, unless otherwise noted, shall have shop prime coats conforming to BS 2524: 1966.

9.6.3 Workmanship

i) Fabrication: The fabrication of trusses using steel tubes shall conform to IS 800-1900 or equivalent and welding shall conform to CSA W59. 1- 1970 or equivalent. The component parts built up columns/posts, rafters, struts, ties, purlins, etc. of the structure shall be assembled in such a manner that they are neither twisted nor damaged. The members of the truss shall be welded and assembled according to the drawing. All materials shall be straightened before assembly, if necessary, unless required to be of a curvilinear form and shall be free from twist. Cutting welding at joints, junctions, and comers shall be done to suit requirement.

ii) Bolting: Washers shall be specially shaped where necessary, or other means used, to give the nuts and the heads of bolts a satisfactory bearing. In all cases where the full bearing area of the bolt shall not be within the thickness of the parts bolted together and washers of appropriate thickness shall be provided to allow the nut to be completely tightened. Edges should be dressed to a neat and workman like finish free from distortion where parts are to be in contact metal - to metal. No dissimilar metal that will encourage electro-chemical corrosion shall be used.

iii) Sealing of Tubes : Where the end of a tube is not automatically sealed by virtue of its connection by welding to another member, the end shall be properly and completely sealed. Before sealing, the inside of the tube should be dry and free from loose scale.

iv) Flattened Ends : In tubular construction, the ends of tubes may be flattened or otherwise formed to provide for welded, riveted or bolted connections provided that the methods adopted for such flattening do not injure the material. The change of section shall be gradual. Fabricated sample shall be approved by the Engineer prior to fabrication for the work.

v) Painting: All tubes shall be painted with two coats of red oxide paint at the workshop before delivery at site.

The truss, complete in all respects, shall be erected at site and fixed in position true to shape and plan. Sample of the workmanship shall be approved to work. After erection re-cleaning and painting with two or more coats of red oxide paint may be required and shall be done at no extra charge by the Contractor. Fabricated sample shall be approved prior to fabrication for the work.

After erection the truss shall be painted with two coats of readymade enamel paint.

9.6.4 Measurement and Payment

Structural steel work shall be measured in kilogram or tonne of major members only. Necessary accessories such as plates, nuts, bolts, etc shall not be measured separately. The rate shall be inclusive of these accessories. The price shall be fully compensation for all material, labour, equipment, tools and incidentals necessary to complete the item as specified herein.

9.7 GARDENING WORKS

9.7.1 Scope

This clause includes the provision of gardening and plantation works to be done in project area as per item of BOQ.

9.7.2 Details of Work Conditions

This work shall include the supply of plant materials, plantations, up-keeping and maintenance of trees and flower plants in the reservoir compound located at four places (two existing and two new) as shown by the Engineer.

The Contractor shall prepare a lay-out plan of a mixture of trees, flowery bushes, and flower plants for each reservoir site and shall submit to Engineer for his comment and approval. After approval of the Engineer, the Contractor shall implement the plantation works as per the approved lay-out plan and to the satisfaction of Engineer. After plantation, the Contractor shall be responsible for complete up-keeping of the plants including watering, wardening, pruning, manuring, and other maintenance activities till the handover of the construction works. Any dead plants shall be replaced without any extra cost. The work shall be done in package basis to the complete approval of the Engineer.

9.7.3 Measurement and Payment

This work shall be done in a package basis for the complete work including cost of seeds, saplings, manures, pesticides, edging bricks, etc., transportation of materials to site, preparation of site, plantation, care-taking, wardening, watering, manuring, up-keeping and

maintenance, replacement of dead plants, etc. The payment of this work will be done in percentage basis according to the amount of the interim certificates.

9.8 PE-100 PIPE JOINTING WORKS

PE-100 pipe should be joined by automatic electro fusion and butt Fusion Machine for all diameters. The machine should operate in 110 volt and 220 Volt with suitable generator. Before joining it has to be ensured that equipment is clean, in good condition, regularly maintained and within required calibration/service. The cutter/blades and scarpers should be clean and in good condition. Mechanical Scrapers must be used wherever possible and the restraining clamps should be in good condition. Clean and dry place to place tools and equipments should be checked before during electro fusion process. The joining process should not be started unless it can be completed in one go.

Shelter and ground sheet, both in dry and wet condition should be used in order to minimize contaminations. Clamps should be used for alignment/restraining/re-rounding. Voltage should be ensured compatible with fittings.

SECTION-VI

Bill of Quantities

Notes for Unit Rate Contracts :

Objectives

The objectives of the Bill of Quantities are

- (a) to provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and
- (b) when a Contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and brief as possible.

Content

The Bill of Quantities should be divided generally into the following sections:

- (a) Preamble;
- (b) Work Items (grouped into parts);
- (c) Day works Schedule;
- d) Provisional Sums; and
- (d) Summary.

Preamble

The Preamble should indicate the inclusiveness of the unit prices, and should state the methods of measurement which have been adopted in the preparation of the Bill of Quantities and which are to be used for the measurement of any part of the works.

Work Items

The items in the Bill of Quantities should be grouped into sections to distinguish between those parts of the Works which by nature, location, access, timing, or any other special characteristics may give rise to different methods of construction, or phasing of the Works, or considerations of cost. General items common to all parts of the works may be grouped as a separate section in the Bill of Quantities.

Day work Schedule

A Day work Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Employer of the realism of rates quoted by the Bidders, the Day work Schedule should normally comprise the following:

- (a) A list of the various classes of labor, materials, and Constructional Plant for which basic day work rates or prices are to be inserted by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a day work basis.
- (b) Nominal quantities for each item of Day work, to be priced by each Bidder at Day work rates as bid. The rate to be entered by the Bidder against each basic Day work item should include the Contractor's profit, overheads, supervision, and other charges.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the Contract Data should state the manner in which they will be used, and under whose authority (usually the Project Manager's).

Summary

The Summary should contain a tabulation of the separate parts of the Bill of Quantities carried forward, with provisional sums for Day work, for physical (quantity) contingencies, and for price contingencies (upward price adjustment) where applicable.

These Notes for Preparing Specifications are intended only as information for the Employer or the person drafting the Bidding documents. They should not be included in the final documents.

Preamble of Bill of Quantities

A. General

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Project Manager and valued at the rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Project Manager may fix within the terms of the Contract.
3. For any item for which measurement is based on records made before or during construction the records shall be prepared and agreed between the Engineer and the Contractor. Should the Contractor carry out such work without the prior agreement of the Engineer, the Engineer may request the Contractor to carry out investigations to confirm the extent of the work and the quantity of work certified for payment shall be solely at the Engineer's discretion. The cost of any such investigation shall be borne by the Contractor.
4. The rates and prices bid in the priced Bill of Quantities shall, except as otherwise provided under the Contract, include all construction equipment, labor, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.
5. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.
6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.
7. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities. The Specification Clause references where given in the item description of the Bills of Quantities are for the convenience of bidders and generally refer to the principal relevant- specification clause but do not necessarily represent the whole of the specification requirements for the work required within the item. The presence of a Specification clause reference shall not in any way reduce the Bidders obligation to complete work in accordance with all the requirements of the Specification.
8. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Project Manager in accordance with the Conditions of Contract.
9. The method of measurement of completed work for payment shall be in accordance with the Specifications.
10. The abbreviations and symbols used in this Bill of Quantities are:

[Insert as applicable]

B. Day work Schedule

a) General

1. Work shall not be executed on a day work basis except by written order of the Project Manager. Bidders shall enter basic rates for day work items in the Schedules. These rates shall apply to any quantity of day work ordered by the Project Manager. Nominal quantities have been indicated against each item of day work, and the extended total for day work shall, be carried forward as a Provisional Sum to the Summary Total Bid Amount. Unless otherwise adjusted, payments for day work shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.

b) Day work Labor

1. In calculating payments due to the Contractor for the execution of day works, the hours for labor will be reckoned from the time of arrival of the labor at the job site to execute the particular item of day work to the time of departure from the job site, but excluding meal breaks and rest periods. Only the time of classes of labor directly doing work ordered by the Project Manager and are competent to perform such work will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but not the time of foremen or other supervisory personnel.
2. The Contractor shall be entitled to payment in respect of the total time that labor is employed on day work, calculated at the basis rates entered by it in the " SCHEDULE OF DAY WORK RATES: 1. LABOR". The rates for labor shall be deemed to cover all costs to the Contractor including (but not limited to) i) the amount of wages paid to such labor, transportation time, overtime, subsistence allowances, ii) any sums paid to or on behalf of such labor for social benefits in accordance with Nepal law, iii) Contractor's profit, overheads, superintendence, liabilities and insurance and iv) charges incidental to the foregoing.

c) Day work Equipment

1. The Contractor shall be entitled to payments in respect of Constructional Plant already on site and employed on day work at the basis rental rates entered by him in the "SCHEDULE OF DAY WORK RATES:2 EQUIPMENT ". The said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricant, and other consumables and all overhead, profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants also shall be included in the rate of the equipment and no separately payment shall be made for it.
2. In calculating the payment due to the Contractor for Constructional Plant employed on day work, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Project Manager, the travelling time from the part of the Site where the Construction Plant was located when ordered by the Project Manager to be employed on day work and the time for return journey there to shall be included for payment.

d) Day work Materials

1. The Contractor shall be entitled to payment in respect of materials used for day work (except for materials for which the cost is included in the percentage addition to labor costs as detailed heretofore), at the rates entered by him in the "SCHEDULE OF DAY WORK RATES: 3 MATERIALS" and shall be deemed to include overhead charges and profit as follows;
 - (i) the rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc. and shall provide for delivery to store for stockpiling at the Site.
 - (ii) the cost of hauling materials for use on work ordered to be carried out as day work, from the store or stockpile on the Site to the place where it is to be used also shall be include in the same rate.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the SCC should state the manner in which they will be used, and under whose authority (usually the Project Manager's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Employer to select such specialized contractors. To provide an element of competition among the Bidders in respect of any facilities, amenities, attendance, etc., to be provided by the successful Bidder as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Bidder to quote a sum for such amenities, facilities, attendance, etc.

Bill of Quantities

1 Provisional Sum						
Procurement Item Details						
SL. No	Item Description	Unit	Quantity	Unit Rate(NPR)	Amount(NPR)	
1	Insurance for the loss damage to works, plant, material, equipment, property and personal injury or death and as stipulated in agreement data	P.S	1.0	50000.0	50,000.00	
2	Pressure and leakage test for pipe line & Item not covered in BOQ as Instructions of Site Engineer	P.S	1.0	50000.0	50,000.00	
3	Provide color print photo in A4 size photo paper for inclusion in periodic progress report to the satisfaction of the engineer specification(6 sheet A4 size color photo paper)	P.S	6.0	100.0	600.00	
4	Provide & Installation of Information Board of project	P.S	2.0	3000.0	6,000.00	
2 Construction work						
2.1 Water Supply System						
Procurement Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Laying and Jointing of 25 mm PE Pipes with PE buttweld joints as per Clause 3 and other related clause of the specification and as directed by the Engineer	mtr	690.0			
2	Laying and Jointing of 32 mm PE Pipes with PE buttweld joints as per Clause 3 and other related clause of the specification and as directed by the Engineer	mtr	3010.0			
3	Laying and Jointing of 40 mm PE Pipes with PE buttweld joints as per Clause 3 and other related clause of the specification and as directed by the Engineer	mtr	660.0			
4	Laying and Jointing of 50 mm PE Pipes with PE buttweld joints as per Clause 3 and other related clause of the specification and as directed by the Engineer	mtr	860.0			
5	Laying and Jointing of 63 mm PE Pipes with PE buttweld joints as per Clause 3 and other related clause of the specification and as directed by the Engineer	mtr	1395.0			
6	Earthwork in excavation manually in ordinary soil for pipeline/foundation trench as instruction of site Engineer	m3	1082.25			
7	Earthwork in excavation manually in hard soil for pipeline/foundation trench as instruction of site Engineer	m3	444.6			

Procurement Item Details						
SL. No	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
8	Earthwork in excavation manually in bm soil for pipeline/foundation trench as instruction of site Engineer	m3	408.04			
9	Earthwork in back filling for pipe line trench with compaction in layers of 20 cm, site clearance and all complete work	m3	1934.89			
10	Transportation of HDPE 25 mm Dia PN-12.5 as directed by engineer	kg	114.54			
11	Transportation of HDPE 32 mm Dia PN-10 as directed by engineer	kg	541.12			
12	Transportation of HDPE 32 mm Dia PN-12.5 as directed by engineer	kg	162.74			
13	Transportation of HDPE 40 mm Dia PN-12.5 as directed by engineer	kg	143.04			
14	Transportation of HDPE 40 mm Dia PN-16 as directed by engineer	kg	169.85			
15	Transportation of HDPE 50 mm Dia PN-10 as directed by engineer	kg	469.56			
16	Transportation of HDPE 63 mm Dia PN-6 as directed by engineer	kg	148.09			
17	Transportation of HDPE 63 mm Dia PN-10 as directed by engineer	kg	595.08			
18	Transportation of HDPE 63 mm Dia PN-16 as directed by engineer	kg	540.49			
Total of Procurement Items						
Total Item Price						
VAT						
Grand Total						

CONDITIONS OF CONTRACT AND CONTRACT FORMS

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SECTION-VII

General Conditions of Contract

General Conditions of Contract

General

1. Definitions

1.1 Boldface type is used to identify defined terms.

(a) The **Accepted Contract Amount** means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.

(b) The **Activity Schedule** is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works in a lump sum contract. It includes a lump sum price for each activity, which is used for valuations and for assessing the effects of Variations and Compensation Events.

(c) The Adjudicator is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in GCC 23.2 hereunder.

(d) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.

(e) **Compensation Events** are those defined in GCC 50 hereunder.

(f) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC 68.1.

(g) The **Contract** is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC 2.3 below.

(h) The **Contractor** is the party whose Bid to carry out the Works has been accepted by the Employer.

(i) The **Contractor's Bid** is the completed bidding document submitted by the Contractor to the Employer.

(j) The **Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.

(k) **Days** are calendar days; months are calendar-months.

(l) **Dayworks** are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant.

(m) A **Defect** is any part of the Works not completed in accordance with the Contract.

(n) The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor.

(o) The **Defects Liability Period** is the period calculated from the Completion Date where the Contractor remains responsible for remedying defects.

(p) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

(q) The **Employer** is the party who employs the Contractor to carry out the Works, as **specified in the SCC**.

(r) **Equipment** is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

(s) **Force Majeure** means an exceptional event or circumstance: which is beyond a Party's control; which such Party could not reasonably have provided against before entering into the Contract; which, having arisen, such Party could not reasonably have avoided or overcome; and, which is not substantially attributable to the other Party.

(t) The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

(u) **In writing** or **written** means hand written, type written, printed or electronically made, and resulting in permanent record.

	<p>(v) The Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the SCC. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.</p> <p>(w) Letter of Acceptance means the formal acceptance by the Employer of the Bid and denotes the formation of the contract at the date of acceptance.</p> <p>(x) Materials are all supplies, including consumables, used by the Contractor for incorporation in the Works.</p> <p>(y) Party means the Employer or the Contractor, as the context requires.</p> <p>(z) SCC means Special Conditions of Contract</p> <p>(aa) Plant is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.</p> <p>(bb) The Project Manager is the person named in the SCC (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract.</p> <p>(cc) Retention Money means the aggregate of all monies retained by the Employer pursuant to GCC 54.1.</p> <p>(dd) Schedules means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Bids, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices.</p> <p>(ee) The Site is the area defined as such in the SCC</p> <p>(ff) Site Investigation Reports are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.</p> <p>(gg) Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.</p> <p>(hh) The Start Date is given in the SCC. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.</p> <p>(ii) A Subcontractor is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.</p> <p>(jj) Temporary Works are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.</p> <p>(kk) A Variation is an instruction given by the Project Manager which varies the Works</p> <p>(ll) The Works are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the SCC.</p>
2. Interpretation	<p>2.1 In interpreting these GCC, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.</p> <p>2.2 If sectional completion is specified in the SCC, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).</p> <p>2.3 The documents forming the Contract shall be interpreted in the following order of</p>

	<p>priority:</p> <ul style="list-style-type: none"> (a) Contract Agreement, (b) Letter of Acceptance, (c) Letters of Bid, (d) Special Conditions of Contract, (e) General Conditions of Contract, (f) Specifications, (g) Drawings, (h) Bill of Quantities (or Schedules of Prices for lump sum contracts), and (i) Any other document listed in the SCC as forming part of the Contract.
3. Language and Law	<p>3.1 The language of the Contract and the law governing the Contract are stated in the SCC.</p> <p>a. Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in the Employer's country when</p> <ul style="list-style-type: none"> (a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's Country prohibits any import of goods from, or any payments to, a particular country, person, or entity. Where the borrower's country prohibits payments to a particular firm or for particular goods by such an act of compliance, that firm may be excluded.
4. Contract Agreement	<p>4.1 The Parties shall enter into a Contract Agreement within 15 days after the Contractor receives the Letter of Acceptance, unless the Special Conditions establish otherwise. The Contract Agreement shall be based upon the attached Contract forms in Section IX.</p>
5. Assignment	<p>5.1 Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party</p> <ul style="list-style-type: none"> (a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party; and (b) may, as security in favor of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.
6. Care and Supply of Documents	<p>6.1 The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, one copy of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.</p> <p>6.2 Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.</p> <p>6.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations</p>

	<p>and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.</p> <p>6.4 If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.</p>
7. Confidential Details	<p>7.1 The Contractor's and the Employer's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify the Contractor's compliance with the Contract and allow its proper implementation.</p> <p>7.2 Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.</p> <p>7.3 Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.</p>
8. Compliance with Laws	<p>8.1 The Contractor shall, in performing the Contract, comply with applicable Laws.</p>
9. Joint and Several Liability	<p>9.1 If the Contractor is a joint venture of two or more entities , all such entities shall be jointly and severally liable to the Employer for the fulfillment of the provisions of the Contract, and shall designate one of such persons to act as a leader with authority to bind the joint venture. The contractor shall not handover the responsibility of the contract to any one member or some members of Joint Venture or any other parties, not involved in the contract. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.</p>
10. Project Manager's Decisions	<p>10.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.</p>
11. Delegation	<p>11.1 The Project Manager may delegate any of his duties and responsibilities to other people after notifying the Contractor, and may cancel any delegation after notifying the Contractor.</p>
12. Communications	<p>12.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.</p>
13. Subcontracting	<p>13.1 A list of approved Subcontractors including its value/works is included as Article 2 (k) of contract Agreement. Approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties, or responsibilities under the contract.</p>

<p>14. Other Contractors</p>	<p>14.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as referred to in the SCC. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification</p>
<p>15 Personnel and Equipment</p>	<p>15.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid to carry out the Works, or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.</p> <p>15.2 If the Project Manager asks the Contractor to remove a person who is a member of the Contractor’s staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.</p> <p>15.3 If the Employer, Project Manager, or Contractor determines, that any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or other prohibited practices during the execution of the Works, then that employee shall be removed in accordance with Clause 15.2 above.</p>
<p>16. Employer’s and Contractor’s Risk</p>	<p>16.1 The Employer carries the risks which this Contract states are Employer’s risks, and the Contractor carries the risks which this Contract states are Contractor’s risks.</p>
<p>17. Employer’s Risks</p>	<p>17.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Employer’s risks:</p> <ul style="list-style-type: none"> (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to <ul style="list-style-type: none"> (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or (ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor. (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer’s design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed. <p>17.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer’s risk except loss or damage due to</p> <ul style="list-style-type: none"> (a) a Defect which existed on the Completion Date, (b) an event occurring before the Completion Date, which was not itself an Employer’s risk, or (c) the activities of the Contractor on the Site after the Completion Date.

18. Contractor's Risks	18.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.
19. Insurance	<p>19.1 The Contractor shall provide insurance in the joint names of the Employer and the Contractor from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the SCC for the following events which are due to the Contractor's risks:</p> <ul style="list-style-type: none"> (a) loss of or damage to the Works, Plant, and Materials; (b) loss of or damage to Equipment; (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and (d) Personal injury or death. <p>19.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the proportions of Nepalese Rupees required to rectify the loss or damage incurred.</p> <p>19.3 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.</p> <p>19.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.</p> <p>19.5 Both parties shall comply with any conditions of the insurance policies.</p>
20. Site Investigation Reports	20.1 The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the SCC , supplemented by any information available to the Contractor.
21. Contractor to Construct the Works	21.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.
22. The Works to Be Completed within intended Completion Date	22.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them within the intended Completion Date.
23. Design by contractor and Approval by the Project Manager	<p>23.1 The contractor shall be responsible for the design of permanent works as specified in SCC.</p> <p>23.2 Contractor shall be responsible for design of the Temporary Works. The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, for his approval.</p> <p>23.3 All Drawings prepared by the Contractor for the execution of the temporary or</p>

	<p>permanent Works, shall be subject to prior approval by the Project Manager before their use.</p> <p>23.4 The Project Manager's approval shall not alter the Contractor's responsibility for design of temporary works.</p>
24. Safety, Security and Protection of the Environment	<p>24.1 The Contractor shall, throughout the execution, and completion of the works and remedying of any defects therein:</p> <ul style="list-style-type: none"> a. Have full regard for the safety of all persons entitled to be upon the site and keep the site (so as the same is under his control) and the works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons. b. Provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when necessary or required by the Project Manager or by any duly constituted authority, for the protection of the Works of for the safety and convenience of the public or others. c. Take all reasonable steps to protect the environment on and off the site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. d. Ensure that any cut or fill slopes are planted in grass or other plant cover as soon as possible to protect them from erosion. e. Any spoil or material removed from drains shall be disposed of to designated stable tipping areas as directed by the Project Manager. f. Shall not use fuel wood as a means of heating during the processing or preparation of any materials forming part of the works. g. The Project Manager shall have the power to disallow any working practice or activity of the Contractor or direct that such practices or activities be modified should the Project Manager consider, on the advice of the relevant Government Departments, that the practices or activities will be harmful to wildlife. h. Provide on the Site such lifesaving apparatus as may be appropriate and an adequate and easily accessible first aid outfit or such outfits as may be required by any government ordinance, factory act, etc., subsequently published and amended from time to time.
25. Discoveries	<p>25.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.</p>
26. Possession of the Site	<p>26.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the SCC, the Employer shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.</p>
27. Access to the Site	<p>27.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.</p>

28. Instructions, Inspections and Audits	<p>28.1 The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.</p> <p>28.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub consultants to keep accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.</p> <p>28.3 The Contractor shall permit the GoN/DP and/or persons appointed by the GoN/DP to inspect the Site and/or the accounts and records of the Contractor and its sub-contractors relating to the performance of the Contract, and to have such accounts and records audited by auditors appointed by the GoN/DP if required by the GoN/DP. The Contractor's attention is drawn to Sub-Clause 73.2 which provides, inter alia, that acts intended to materially impede the exercise of the GoN's/DP's inspection and audit rights provided for under this Sub-Clause constitute a obstructive practice subject to contract termination.</p>
29. Dispute Settlement	<p>29.1 The Employer and the Contractor shall attempt to settle amicably by direct negotiation any disagreement or dispute arising between them under or in connection with the Contract.</p> <p>29.2 Any dispute between the Parties as to matters arising pursuant to this Contract which cannot be settled amicably within thirty (30) days after receipt by one Party of the other Party's request for such amicable settlement may be referred to Arbitration within 30 days after the expiration of amicable settlement period.</p>
30. Procedures for Disputes	30.1 In case of arbitration, the arbitration shall be conducted in accordance with procedures in accordance with law of Nepal at the place given in the SCC.
B. Staff and Labor	
31. Forced Labor	31.1 The Contractor shall not employ forced labor, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor, or similar labor-contracting arrangements.
32. Child Labor	32.1 The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where national laws have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.
33. Non-discrimination and Equal Opportunity	34.1 The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where national law provides for non-discrimination in employment, the Contractor shall comply with national law. When national laws are silent on nondiscrimination in employment, the Contractor shall meet this Sub clause's requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed

	discrimination.
Time Control	
34. Program	<p>34.1 Within the time stated in the SCC, after the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works. In the case of a lump sum contract, the activities in the Program shall be consistent with those in the Activity Schedule.</p> <p>34.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.</p> <p>34.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period stated in the SCC. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the SCC from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall Provide an updated Activity Schedule within 15 days of being instructed to by the Project Manager.</p> <p>34.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.</p>
35. Extension of the Intended Completion Date	<p>35.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.</p> <p>35.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information at least 21 days prior to the intended completion date. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date. Along with full supporting information the contractor shall also submit Performance Security, Advanced Payment Guarantee and insurance Policy with extended validity as well as revised work schedule.</p>
36. Acceleration	<p>36.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Employer accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Employer and the Contractor.</p> <p>36.2 If the Contractor's priced proposals for acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.</p>

37. Delays Ordered by the Project Manager	37.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.
38. Management Meetings	<p>38.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.</p> <p>38.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.</p>
39. Early Warning	<p>39.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.</p> <p>39.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.</p>
C. Quality Control	
40. Identifying Defects	40.1 The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.
41. Tests	41.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.
42. Correction of Defects	<p>42.1 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the SCC. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.</p> <p>42.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.</p>
43. Uncorrected Defects	43.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.
D. Cost Control	
44. Contract Price	44.1 In the case of a Unit Rate contract, the Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is

	<p>used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.</p> <p>44.2 In the case of a lump sum contract, the Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for Materials on Site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.</p>
<p>45. Changes in the Contract Price</p>	<p>45.1 In the case of an Unit Rate contract:</p> <p>(a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 2 percent of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change.</p> <p>(b) The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 10 percent, except with the prior approval of the Employer.</p> <p>(c) If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.</p> <p>45.2 In the case of a lump sum contract, the Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.</p>
<p>46. Variations</p>	<p>46.1 All Variations shall be included in updated Programs, and, in the case of a lump sum contract, also in the Activity Schedule, produced by the Contractor.</p> <p>46.2 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.</p> <p>46.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.</p> <p>46.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.</p> <p>46.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.</p> <p>46.6 In the case of an Unit Rate contract, if the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in GCC 45.1 or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.</p>

47. Cash Flow Forecasts	47.1 When the Program, or, in the case of a lump sum contract, the Activity Schedule, is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast.
48. Payment Certificates	<p>48.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.</p> <p>48.2 The Project Manager shall check the Contractor’s monthly statement and certify the amount to be paid to the Contractor within 30 days of submission by contractor.</p> <p>48.3 The value of work executed shall be determined by the Project Manager.</p> <p>48.4 The value of work executed shall comprise:</p> <ul style="list-style-type: none"> (a) In the case of an Unit Rate contract, the value of the quantities of work in the Bill of Quantities that have been completed; or (b) In the case of a lump sum contract, the value of work executed shall comprise the value of completed activities in the Activity Schedule. <p>48.5 The value of work executed shall include the valuation of Variations and Compensation Events.</p> <p>48.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.</p>
49. Payments	<p>49.1 Payments shall be adjusted for deductions for advance payments and retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 30 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest as indicated in the SCC on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made.</p> <p>49.2 If an amount certified is increased in a later certificate or as a result of an award by an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.</p> <p>49.3 Items of the Works for which no rate or price has been entered in BOQ shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.</p>
50. Compensation Events	<p>50.1 The following shall be Compensation Events:</p> <ul style="list-style-type: none"> (a) The Employer does not give access to a part of the Site by the Site Possession Date pursuant to GCC 26.1. (b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract. (c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time. (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.

	<p>(e) The Project Manager unreasonably does not approve a subcontract to be let.</p> <p>(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.</p> <p>(g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.</p> <p>(h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.</p> <p>(i) The advance payment is delayed.</p> <p>(j) The effects on the Contractor of any of the Employer's Risks.</p> <p>(k) The Project Manager unreasonably delays issuing a Certificate of Completion.</p> <p>50.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.</p> <p>50.3 As soon as information demonstrating effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.</p> <p>50.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.</p>
51. Tax	51.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 30 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC 53.
52. Currency	52.1 The currency of Contracts shall be Nepalese Rupees.
53. Price Adjustment	<p>53.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the SCC. If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due.</p> <p>53.2 Adjustment Formulae¹: The formulae will be of the following general type:</p>

¹ For complex Works involving several types of construction work with different inputs, a family of Formulae will be necessary. The various items of Day work may also require different formulae, depending on the nature and source of the inputs

	$pn = A + b \frac{Ln}{Lo} + c \frac{Mn}{Mo} + d \frac{En}{Eo} + etc.$ <p>Where:</p> <p><i>pn</i> is a price adjustment factor to be applied to the amount for the payment of the work carried out in the subject month, determined in accordance with Clause 49;</p> <p><i>A</i> is a constant, specified in the Bidding Forms- Table of Price Adjustment data, representing the nonadjustable portion in contractual payments;²<i>b, c, d, etc.</i>, coefficients representing the estimated proportion of each cost element (labor, materials, equipment usage, etc.) in the Works or sections thereof, net of Provisional Sums, as specified in the SCC;</p> <p><i>Ln, Mn, En, etc.</i>, are the current cost indices or reference prices of the cost elements for month “n,” determined pursuant to Sub-Clause 53.4, applicable to each cost element; and</p> <p><i>Lo, Mo, Eo, etc.</i>, are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 53.4</p>
	<p>53.3 Sources of Indices and Weightings: The sources of indices shall be those listed in the Bidding Forms- Table of Price Adjustment data, as approved by the Project Manager and stated in SCC. Indices shall be appropriate for their purpose and shall relate to the Contractor’s proposed source of supply of inputs on the basis of which his Contract shall have been computed. As the proposed basis for price adjustment, the Contractor shall have submitted with his bid the tabulation of Weightings and Source of Indices in the Bidding Forms, which shall be subject to approval by the Project Manager.</p> <p>53.4 Base, Current and Provisional Indices: The base cost indices or prices shall be those prevailing on the day 30 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 30 days prior to the last day of the period to which a particular Interim Payment Certificate is related. If at any time the current indices are not available, provisional indices as determined by the Project Manager will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.</p> <p>53.5 Weightings: The weightings for each of the factors of cost given in the Bidding Forms shall be adjusted if, in the opinion of the Project Manager, they have been rendered unreasonable, unbalanced or inapplicable as a result of varied or additional work already executed or instructed under Clause 46 or for any other reason.</p>
	<p>53.6 Where, price adjustment provision is not applicable pursuant to Sub-clause 53.1 then the Contract is subject to price adjustment only for construction material in accordance with this clause. If the prices of the construction materials stated in the contract is increased or decreased in an unexpected manner in excess of ten (10%) percent in comparison to the base price construction material stated in Section –IV, Bidding Forms-Table of Price Adjustment Data, then the price adjustment for the increase or decrease of price of the construction material</p>

² Insert a figure for factor A only where there is a part of the Contractors’ expenditures which will not be subject to fluctuation in cost or to compensate for the unreliability of some indices. A should normally be 0.15. The sum of A, b, c, d, etc., should be one.

	<p>beyond 10% shall be made by applying the following formulas:</p> <p>For unexpected increase in price $P = [R_1 - (R_0 \times 1.10)] \times Q$</p> <p>For unexpected decrease in price P $= [R_1 - (R_0 \times 0.90)] \times Q$</p> <p>Where:</p> <p>“P” is price adjustment amount</p> <p>“R₁” is the present price of the construction material (Source of indices shall be those listed in the Bidding forms)</p> <p>“R₀” is the base price of the construction material</p> <p>“Q” is quantity of the construction material consumed in construction during the period of price adjustment consideration If the Base price and source is to be proposed by the Bidder as per the provision made in Section –IV, Bidding Forms-Table of Price Adjustment Data then the Base price and source filled by Bidder for the construction material stated in the Bidding Form shall be subject to the approval of the Project manager and shall be as stated in SCC..</p> <p>53.7 The Price Adjustment amount shall be limited to a maximum of the initial Contract Amount as specified in the SCC.</p> <p>53.8 The Price Adjustment provision shall not be applicable for delayed period if the contract is not completed in time due to the delay caused by the contractor or the contract is a Lump sum Contract</p>
54. Retention	<p>54.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the SCC until Completion of the whole of the Works.</p> <p>54.2 Upon the issue of a Defects Liability Certificate by the Project Manager, in accordance with GCC 70.1, half the total amount retained shall be repaid to the Contractor and half when the Contractor has submitted the evidence of submission of tax return to the concerned Internal Revenue Office. The Contractor may substitute retention money with an “on demand” bank guarantee having validity at least one month more than the end of defect liability period if:</p> <p>(a) at least eighty (80) percent of the whole works have been completed,</p> <p>(b) progress of the works is satisfactory in accordance with the Contract as per approved work schedule,</p> <p>(c) it can be assured that the works can be completed at the intended completion date.</p>
55. Liquidated Damages	<p>55.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the SCC for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the SCC. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor’s liabilities.</p> <p>55.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of</p>

	repayment, at the rates specified in GCC.49
56. Bonus	56.1 The Contractor shall be paid a Bonus calculated at the rate per calendar day stated in the SCC for each day (less any days for which the Contractor is paid for acceleration) that the Completion is earlier than the Intended Completion Date. The Project Manager shall certify that the Works are complete, although they may not be due to be complete.
57. Advance Payment	<p>57.1 The Employer shall make advance payment to the Contractor of the amounts stated in the SCC in two equal installments by the date stated in the SCC, against provision by the Contractor of an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in a form acceptable to the Employer in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.</p> <p>57.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.</p> <p>57.3 The advance payment shall be repaid by deducting proportionate amounts, as stated in SCC, from payments otherwise due Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.</p>
58. Securities	<p>58.1 The Performance Security, including any additional security required as per ITB 32.5 and ITB 37.1, shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount specified in the SCC, by a Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law acceptable to the Employer, and denominated in Nepalese Rupees. The Performance Security shall be valid until a date 30 days from the date of issue of the Defect Liability Certificate in the case of a bank guarantee.</p> <p>Any additional performance security required as per ITB 32.5 shall be valid until a date 30 days from the date of issue of the certificate of Completion in the case of a bank guarantee.</p> <p>Any additional performance security required as per ITB 37.1 shall be valid until a date 30 days from the date of issue of the certificate of DLP in the case of a bank guarantee.</p> <p>58.2 The performance security issued by any foreign Bank outside Nepal must be counter guaranteed by an Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal.</p>
59. Day works	59.1 If applicable, the Day works rates in the Contractor's Bid shall be used for small additional amounts of work only when the Project Manager has given written

	<p>instructions in advance for additional work to be paid for in that way.</p> <p>59.2 All work to be paid for as Day works shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done.</p> <p>59.3 The Contractor shall be paid for Day works subject to obtaining signed Day works forms.</p>
60. Cost of Repairs	60.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.
F. Force Majeure	
61. Definition of Force Majeure	<p>61.1 In this Clause, "Force Majeure" means an exceptional event or circumstance,</p> <ul style="list-style-type: none"> (a) which is beyond a Party's control; (b) which such Party could not reasonably have provided against before entering into the Contract; (c) which, having arisen, such Party could not reasonably have avoided or overcome; and (d) which is not substantially attributable to the other Party.
	<p>61.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:</p> <ul style="list-style-type: none"> (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies; (b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war; (c) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel; (d) munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity; and (e) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.
62. Notice of Force Majeure	<p>62.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.</p> <p>62.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.</p>

	62.3 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.
63. Duty to Minimize Delay	63.1 Each Party shall at all times use all reasonable endeavors to minimize any delay in the performance of the Contract as a result of Force Majeure.
	63.2 A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.
64. Consequences of Force Majeure	64.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under GCC 62, and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC 30 to <ul style="list-style-type: none"> (a) an extension of time for any such delay, if completion is or will be delayed, under GCC35 ; and (b) if the event or circumstance is of the kind described in sub-paragraphs (a) to (d) of GCC 61.2 and, in the case of subparagraphs (b) to (d), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in GCC 19.
	64.2 After receiving this notice, the Project Manager shall proceed in accordance with GCC 10 to agree or determine these matters.
65. Force Majeure Affecting Subcontractor	65.1 If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's nonperformance or entitle him to relief under this Clause.
66. Optional Termination, Payment and Release	66.1 If the execution of substantially all the Works in progress is prevented for a continuous period of 90 days by reason of Force Majeure of which notice has been given under GCC 62, or for multiple periods which total more than 150 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with GCC 72.5.
	66.2 Upon such termination, the Project Manager shall determine the value of the work done and issue a Payment Certificate, which shall include <ul style="list-style-type: none"> (a) the amounts payable for any work carried out for which a price is stated in the Contract; (b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept

	<p>delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;</p> <p>(c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;</p> <p>(d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's works in his country (or to any other destination at no greater cost); and</p> <p>(e) the Cost of repatriation of the Contractor's staff and labor employed wholly in connection with the Works at the date of termination.</p>
67. Release from Performance	<p>67.1 Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises, which makes it impossible or unlawful for either or both Parties to fulfill its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance,</p> <p>(a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract; and</p> <p>(b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under GCC 66 if the Contract had been terminated under GCC 66.</p>
G. Finishing the Contract	
68. Completion	<p>68.1 The Contractor shall request the Project Manager to issue a certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the work is completed.</p> <p>68.2 In addition to the other provisions, before acceptance of the completed works, Employer shall verify and assure that such works are within the set objective, quality and appropriate to operate and use.</p>
69. Taking Over	<p>69.1 In the contractor's Opinion, if the works are complete and ready for taking over, the contractor may apply by notice to the Project Manager for a Taking-Over Certificate. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.</p> <p>69.2 The Project Manager shall, within 30 days after receiving the Contractor's application:</p> <p>(a) issue the Taking-Over Certificate to the Contractor if physical progress of works is at least ninety (90) percent in accordance with the Contract except for any minor outstanding work and defects (as listed in the Taking-Over Certificate) which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or</p> <p>(b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The</p>

	<p>Contractor shall then complete this work before issuing a further notice under this Sub-Clause.</p> <p>69.3 If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor’s application within the period of 30 days, and if the Works or Section (as the case may be) are substantially completed in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.</p>
70. Final Account	<p>70.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 60 days of receiving the Contractor’s account if it is correct and complete. If it is not, the Project Manager shall issue within 60 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.</p>
71. Operating and Maintenance Manuals	<p>71.1 If “as built” Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the SCC.</p> <p>71.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the SCC pursuant to GCC 71.1, or they do not receive the Project Manager’s approval, the Project Manager shall withhold the amount stated in the SCC from payments due to the Contractor.</p>
72. Termination	<p>72.1 The Employer may terminate the Contract at any time if the contractor;</p> <ul style="list-style-type: none"> a. does not commence the work as per the Contract, b. abandons the work without completing, c. fails to achieve progress as per the Contract. <p>72.2 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.</p> <p>72.3 Fundamental breaches of Contract shall include, but shall not be limited to, the following :</p> <ul style="list-style-type: none"> (a) The Contractor uses the advance payment for matters other than the contractual obligations, (b) the Contractor stops work for 30 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager; (c) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days; (d) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation. (e) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 90 days of the date of the Project Manager’s certificate; (f) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager; (g) the Project Manager gives two consecutive Notices to update the Program and accelerate the works to ensure compliance with GCC Sub clause 22.1 and the

	<p>Contractor fails to update the Program and demonstrate acceleration of the works within a reasonable period of time determined by the Project Manager;</p> <p>(h) the Contractor does not maintain a Security, which is required;</p> <p>(i) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in the SCC; and</p> <p>(j) If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract, pursuant to GCC 73.1.</p> <p>72.4 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC 72.3 above, the Project Manager shall decide whether the breach is fundamental or not.</p> <p>72.5 Notwithstanding the above, the Employer may terminate the Contract for convenience.</p> <p>72.6 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.</p>
73.Fraud and Corruption	<p>73.1 If the Employer determines that the Contractor has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices, in competing for or in executing the Contract, then the Employer may, after giving 15 days' notice to the Contractor, terminate the Contractor's employment under the Contract and expel him from the Site.</p> <p>73.2 Should any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or obstructive practice during the execution of the Works, then that employee shall be removed in accordance with GCC Clause 15.</p> <p>For the purposes of this GCC 73;</p> <p>(i) "corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party.</p> <p>(ii) "fraudulent practice"⁵ is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;</p> <p>(iii) "collusive practice"⁶ is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;</p> <p>(iv) "coercive practice"⁷ is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;</p> <p>(v) "obstructive practice" is</p> <p>(aa) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or</p> <p>(bb) acts intended to materially impede the exercise of the GON's/DP's</p>

	inspection and audit rights provided for under GCC28.3.
74. Black Listing	<p>74.1 Without prejudice to any other rights of the Employer under this Contract, GoN, Public Procurement Monitoring Office (PPMO), on the recommendation of procuring entity, may blacklist a Bidder for its conduct for a period of one (1) to three (3) years on the following grounds and seriousness of the act committed by the bidder:</p> <p>(a) if it is established that the Contractor has committed substantial defect in implementation of the contract or has not substantially fulfilled its obligations under the contract or the completed work is not of the specified quality as per the contract.</p> <p>(b) If convicted from a court of law in a criminal offense liable to be disqualified for taking part in procurement contract,</p> <p>(c) If it is established that the Contractor has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.</p>
75. Payment upon Termination	<p>75.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.</p> <p>75.2 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.</p> <p>75.3 If the Contract is terminated because of fundamental breach of Contract or for any other fault by the Contractor, the performance security shall be forfeited by the Employer.</p> <p>In such case, amount to complete the remaining works as per the Contract shall be recovered from the Contractor as Government dues.</p>
76. Property	<p>76.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default.</p>
77. Release from Performance	<p>77.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.</p>
78. Suspension of DP Loan/Credit/Grant	<p>78.1 In the event that the DP suspends the loan/ credit/grant to the Employer from which part of the payments to the Contractor are being made:</p> <p>a. the Employer is obligated to notify the Contractor of such suspension within 7 days of having received the DP's suspension notice; and</p> <p>b. if the Contractor has not received sums due him within the 30 days for payment provided for in GCC 49.1, the Contractor may immediately issue a 15-day</p>

	termination notice.
79. Eligibility	<p>79.1 The Contractor shall have the nationality of an eligible country as specified in Section V of the bidding document. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.</p> <p>79.2 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries as specified in Section V of the bidding document and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the Contractor may be required to provide evidence of the origin of materials, equipment, and services.</p> <p>79.3 For purposes of GCC 79.2, "origin" means the place where the materials and equipment are mined, grown, produced, or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.</p>
80. Project Manager's Duties and Authorities	80.1 The Project Manager's duties and authorities are restricted to the extent as stated in the SCC.
81. Quarries and Spoil Dumps	81.1 Any quarry operated as part of this Contract shall be maintained and left in a stable condition without steep slopes and be either refilled or drained and be landscaped by appropriate planting. Rock or gravel taken from a river shall be removed over some distance so as to limit the depth of material removed at any one location, not disrupt the river flow or damage or undermine the river banks. The Contractor shall not deposit excavated material on land in Government or private ownership except as directed by the Project Manager in writing or by permission in writing of the authority responsible for such land in Government ownership, or of the owner or responsible representative of the owner of such land in private ownership, and only then in those places and under such conditions as the authority, owner or responsible representative may prescribe.
82. Local Taxation	82.1 The prices bid by the Contractor shall include all taxes that may be levied in accordance to the laws and regulations in being in Nepal on the date 30 days prior to the closing date for submissions of Bids on the Contractor's equipment, plant and materials acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in Nepal on profits made by him in respect of the Contract.
83. Value Added Tax	83.1 The Contract is not exempted from value added tax. An amount specified in the schedule of taxes shall be paid by the Contractor in the concerned VAT office within time frame specified in VAT regulation.

84. Income Taxes on Staff	<p>84.1 The Contractor's staff, personnel and labor will be liable to pay personal income taxes in Nepal in respect of their salaries and wages, as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions as may be imposed on him by such laws and regulations.</p> <p>84.2 The issue of the Final Account Certificate pursuant to clause GCC 70 shall be made only upon submittal by the Contractor of a certificate of income tax clearance from the Government of Nepal.</p>
85. Duties, Taxes and Royalties	<p>85.1 Any element of royalty, duty or tax in the price of any goods including fuel oil, and lubricating oil, cement, timber, iron and iron goods locally procured by the Contractor for the works shall be included in the Contract rates and prices and no reimbursement or payment in that respect shall be made to the Contractor.</p> <p>85.2 The Contractor shall familiarize himself with GON the rules and regulations with regard to customs, duties, taxes, clearing of goods and equipment, immigration and the like, and it will be necessary for him to follow the required procedures regardless of the assistance as may be provided by the Employer wherever possible.</p> <p>85.3 The Contractor shall pay and shall not be entitled to the reimbursement of cost of extracting construction materials such as sand, stone/boulder, gravel, etc. from the river beds or quarries. Such prices will be levied by the local District Development Committee (DDC) as may be in force at the time. The Contractor, sub-contractor(s) employed directly by him and for whom he is responsible, will not be exempted from payment of royalties, taxes or other kinds of surcharges on these construction materials so extracted and paid for to the DDC.</p>
86. Member of Government, etc, not Personally Liable	86.1 No member or officer of GoN or the Employer or the Project Manager or any of their respective employees shall be in any way personally bound or liable for the act or obligations of the Employer under the Contract or answerable for any default or omission in the observance or performance of any of act, matter or thing which are herein contained.
87. Approval of Use of Explosives	87.1 No explosives of any kind shall be used by the Contractor without the prior consent of the Employer in writing and the Contractor shall provide, store and handle these and all other items of every kind whatsoever required for blasting operations, all at his own expense in a manner approved in writing by the Employer.
88 Compliance with Regulations for Explosives	88.1 The Contractor shall comply with all relevant ordinances, instructions and regulations which the Government, or other person or persons having due authority, may issue from time to time regarding the handling, transportation, storage and use of explosives.
89. Permission for Blasting	89.1 The Contractor shall at all times maintain full liaison with and inform well in advance, and obtain such permission as is required from all Government authorities, public bodies and private parties whatsoever concerned or affected, or likely to be concerned or affected by blasting operation.
90. Records of Explosives	90.1 Before the beginning of the Defects Liability Period, the Contractor shall account to the satisfaction of the Project Manager for all explosives brought on to the Site during the execution of the Contract and the Contractor shall remove all unused explosives from the Site on completion of works when ordered by the Project

	Manager.
91. Traffic Diversion	<p>91.1 The Contractor shall include the necessary safety procedures regarding and pedestrian traffic diversion that is needed in execution of the works. The Contractor shall include in his costing of works, any temporary works or diversion that are needed during the construction period. All traffic diversion should be designed for the safety of both the motoring public and the men at work. It shall ensure the uninterrupted flow of traffic and minimum inconvenience to the public during the period concerned. As such, adequate warning signs, flagmen and other relevant safety precautionary measures shall be provided to warn motorists and pedestrians well ahead of the intended diversion as directed by the Project Manager. All traffic devices used shall be designed in accordance with the instruction of Project Manager.</p>

Section VIII. Special Conditions of Contract (SCC)

The following Special Conditions of Contract (SCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

A. General	
GCC 1.1 (q)	The Employer is Water Supply And Sanitation Division No. 4, Ramechhap
GCC 1.1 (v)	The Intended Completion Date for the whole of the Works shall be 3 month aftetr agrement
GCC 1.1 (bb) & 10.1	The Project Manager is Engineer The Project Manager and Engineer are synonyms
GCC 1.1 (ee)	The Site is located at ramechaap and is defined in drawings No. NA
GCC 1.1 (hh)	The Start Date shall be 31-01-2025
GCC 1.1 (ll)	The Works consist of excavation, filling, laying, joining of hdpe pipe
GCC 2.2	Sectional Completions are: NA
GCC 2.3(i)	The following documents also form part of the Contract: NA
GCC 3.1	The language of the contract is ENGLISH/NEPALI The law that applies to the Contract is the law of NEPAL
GCC 11.1	The Project Manager may not delegate any of his duties and responsibilities.
GCC 14.1	Schedule of other contractors: NA
GCC 19.1	The minimum insurance amounts and deductibles shall be: <ol style="list-style-type: none"> 1. The minimum cover for loss of or damage to the Works, Plant and Materials is: 115% of the Contract Amount. 2. The maximum deductible for insurance of the Works and of Plant and Materials is: 1 % of sum insured 3. The minimum cover for loss or damage to Equipment is : 100 % of sum insured 4. The maximum deductible for insurance of Equipment is: :1 % of sum insured <ol style="list-style-type: none"> i. for the Contractor's employees is that specified in the Labor act of Nepal and

GCC 20.1	Site Investigation Reports are: Lab test as specified
GCC 23.1	The following shall be designed by the Contractor: NA
GCC 26.1	The Site Possession Date(s) shall be: after aggrement
GCC 30.1	The place of arbitration shall be: NPECA lalitpur

B. Time Control

GCC 34.1	The Contractor shall submit for approval a Program for the Works within 365days from the date of the Letter of Acceptance.
GCC 34.3	The period between Program updates is 0 days The amount to be withheld for late submission of an updated Program is 0 NPR.

C. Quality Control

GCC 42.1	The Defects Liability Period is 365 days.
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D. Cost Control

GCC 49.1	Prevailing Interest Rate 10 %			
GCC 53.1	The Contract is not subject to price adjustment.			
GCC 53.6	Base Price of Construction Materials applicable for price adjustment shall be as per the Table of Adjustment Data submitted by Bidder together with the Letter of Price Bid which is approved by the Project manager.			
	Bidder should not propose Base Price and Source			
	Base Price of Construction Materials applicable for price adjustment shall be as per the Table of Adjustment Data submitted by Bidder together with the Letter of Bid which is approved by the Project manager			
	SI No.	Construction Material	Unit	Base Price (NRs/Unit) (Ex-factory)
1	NA	NA	0.00	NA

GCC 53.7	The Price Adjustment amount shall be limited to a maximum 10 % of the initial Contract Amount		
GCC 54.1	The proportion of payments retained is: 5 %		
GCC 55.1	The liquidated damages for the whole of the Works are .05 % of the final Contract Price per day. The maximum amount of liquidated damages for the whole of the Works is 10 % of the final Contract Price.		
GCC 56.1	The Bonus for the whole of the Works is 0 % per day. The maximum amount of Bonus for the whole of the Works is 0 % of the Contract Price.		
GCC 57.1	The Advance Payments shall be 0.00 % and shall be paid in two equal installments and to the Contractor.		
	Installment	Percentage	Requirement
	1 st instalement	0.0	APG after agreement
	2 nd installent	0.0	after work progress
GCC 57.3	Deductions from Payment Certificates will commence in the first certificate in which the value of works executed exceeds 30% of the Contract Price. Deduction will be at the rate of 40% of the respective Monthly Interim Payment Certificate until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the end of 80% of the approved contract price.		
GCC 58.1	The Performance Security amount is 5 % %		
E. Finishing the Contract			
GCC 71.1	The date by which operating and maintenance manuals are required is NA		
GCC 71.2	The date by which "as built" drawings are required is NA The amount to be withheld for failing to produce "as built" drawings and/or Operating and maintenance manuals is NA		
GCC 72.3 (i)	The maximum number of days is 200 days		

GCC 80

The Project Manager has to obtain the specific approval of the Employer for taking any of the following actions :

- a. Approving subcontracting of any part of the works under General Conditions of Contract Clause 13;
- b. Certifying additional costs determined under General Conditions of Contract Clause 50;
- c. Determining start date under General Conditions of Contract Clause 1;
- d. Determining the extension of the intended Completion Date under General Conditions of Contract Clause 35;
- e. Issuing a Variation under General Conditions of Contract Clause 1 and 46, except in an emergency situation, as reasonably determined by the Project Manager; emergency situation may be defined as the situation when protective measures must be taken for the safety of life or of the works or of adjoining property.
- f. Adjustment of rates under General Conditions of Contract Clause 45;

Section IX: Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Section IX: Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Letter of Intent

[on letterhead paper of the Employer]

Date:

To:*Name and address of the Contractor*.....

Subject: **Issuance of letter of intent to award the contract**.....

This is to notify you that, it is our intention to award the contract *[insert date]*for execution of the*[insert name of the contract and identification number, as given in the Contract Data/SCC]* to you as your bid price *[insert amount in figures and words in Nepalese Rupees]* as corrected and modified in accordance with the Instructions to Bidders is hereby selected as substantially responsive lowest evaluated bid.

Authorized Signature:

Name:

Title:

CC:

[Insert name and address of all other Bidders, who submitted the bid]

[Notes on Letter of Intent

The issuance of Letter of Intent is the information of the selection of the bid of the successful bidder by the Employer and for providing information to other unsuccessful bidders who participated in the bid as regards to the outcome of the procurement process. This standard form of Letter of Intent to Award should be filled in and sent to the successful Bidder only after evaluation and selection of substantially responsible lowest evaluated bid.]

Letter of Acceptance

[on letterhead paper of the Employer]

Date:

To:*Name and address of the Contractor*.....

Subject:*Notification of Award*

This is to notify that your Bid dated*date*for execution of the.....*name of the contract and identification number, as given in the Contract Data/SCC* for the Contract price of Nepalese Rupees [*insert amount in figures and words in Nepalese Rupees*], as corrected in accordance with the Instructions to Bidders is hereby accepted in accordance with the Instruction to Bidders.

You are hereby instructed to contact this office to sign the formal contract agreement within 15 days with Performance Security of **NRS.** in accordance with the Conditions of Contract, using for that purpose the Performance security Form included in Section X (Contract Forms) of this Bidding Document.

Authorized Signature:

Name and Title of Signatory:

Contract Agreement

THIS AGREEMENT made theday of....between..... name of the Employer(*hereinafter “the Employer”*), of the one part, andname of the Contractor(*hereinafter “the Contractor”*), of the other part:

WHEREAS the Employer desires that the Works known as name of the Contractshould be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects in the sum of NRs**[insert amount of contract price in words and figures including taxes]**(hereinafter “the Contract Price”).

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
 - (a) the Letter of Acceptance;
 - (b) the Letters of Bid;
 - (c) the Addenda Nos **Insert addenda numbers if any**
 - (d) the Special Conditions of Contract;
 - (e) the List of Eligible Countries that was specified in Section V of the bidding document,
 - (f) the General Conditions of Contract;
 - (g) the Specification;
 - (h) the Drawings;
 - (i) Bill of Quantities (or Schedules of Prices for lump sum contracts), and
 - (j) Table of Price Adjustment Data
 - (k) List of Approved Subcontractors
 - (l)..... **[Specify if there are any other document]**
3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of Nepal on the day, month and year indicated above.

Signed by
for and on behalf the Contractor in the presence of

Witness, Name Signature, Address, Date
List of Approved Subcontractors

In accordance with GCC Sub-Clause 13.1, The following Subcontractors are approved for carrying out the work as specified below.

Name of Subcontractors	Description of Works	Value/Percentage of subcontract

Performance Security

(On letterhead paper of the Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

..... *Bank's Name, and Address of Issuing Branch or Office*

Beneficiary: Name and Address of Employer

Date:

Performance Guarantee No.:.....

We have been informed that *[insert name of the Contractor]* (hereinafter called "the Contractor") has been notified by you to sign the Contract No. *[insert reference number of the Contract]* for the execution of *[insert name of contract and brief description of Works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we..... *[insert name of the Bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of*[insert name of the currency and amount in figures*]* (..... *insert amount in words*) such sum being payable in Nepalese Rupees, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the.....Day of **, and any demand for payment under it must be received by us at this office on or before that date.

.....
Seal of Bank and Signature(s)

Note:

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

* The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract in Nepalese Rupees.

** Insert the date thirty days after the date specified for the Defect Liability Period. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".

Advance Payment Security

(On letterhead paper of the Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

..... *Bank's Name, and Address of Issuing Branch or Office*.....

Beneficiary: *Name and address of employer*

Date :

Advance Payment Guarantee No.....

We have been informed thathas entered into Contract No. *Name and Address of Employer*.....*name of the Contractor*.....(hereinafter called "the Contractor")..reference number of the Contract.....dated with you, for the execution of ...contract and brief description of Works (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum..... name of the currency and amount in figures*...(*.... amount in words*) is to be made against an advance payment guarantee.

At the request of the Contractor, we..... *name of the Bank* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of.....name of the currency and amount in figures*..... (*..... amount in words*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the day of**, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

.....
Seal of Bank and Signature(s)

Note:

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

*The Guarantor shall insert an amount representing the amount of the advance payment in Nepalese Rupees of the advance payment as specified in the Contract.

** Insert the date Thirty days after the expected completion date. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".

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STANDARD SPECIFICATIONS

10. FINAL OF GENERAL APPLICATION

U. 1000

The Federal Acquisition Regulation (FAR) is the primary source of information for the Federal Acquisition Regulation (FAR) and is published in the FAR (48 CFR).

The FAR is a set of regulations that govern the procurement of goods and services by the Federal Government.

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11. 1000

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12. 1000

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13. 1000

F. 1000

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1000 is a set of regulations that govern the procurement of goods and services by the Federal Government.

12. **JOB COSTING PROGRAMS OF COST**

121. **Job Cost**

The direct materials and direct labor costs for a job are usually directly attributable.

The **Manufacturing Overhead Costs** for a job are usually allocated to the production of the job on the basis of the **Job Cost Sheet**, and are added to the direct materials and direct labor costs.

The **Job Cost Sheet** is used to determine the total cost of a job and to determine the cost of each unit of the job.

122. **Manufacturing Overhead Costs**

The **Manufacturing Overhead Costs** for a job are usually allocated to the job.

The **Manufacturing Overhead Costs** for a job are usually allocated to the job on the basis of the **Job Cost Sheet**. The **Manufacturing Overhead Costs** for a job are usually allocated to the job on the basis of the **Job Cost Sheet**. The **Manufacturing Overhead Costs** for a job are usually allocated to the job on the basis of the **Job Cost Sheet**. The **Manufacturing Overhead Costs** for a job are usually allocated to the job on the basis of the **Job Cost Sheet**.

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123. **Job Costing Program**

The **Job Costing Program** is used to determine the total cost of a job and to determine the cost of each unit of the job.

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124. **Job Costing Program**

The **Job Costing Program** is used to determine the total cost of a job and to determine the cost of each unit of the job.

125. **Job Costing Program**

117. **Accounting cycle 10**

The transfer of the balance of the account of ending account is opposite credited to its balance of credit and debited to debit. (copy into the account of the next period. *Debit of credit and credit of debit*)

118. **Transfer of debit balance**

The account with the amount to be credited is closed into its debit effect and the amount of its debit is closed into its credit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

119. **Expense**

The expense account of debit balance is closed into its credit effect and the amount of its debit is closed into its debit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

120. **Equity**

The equity account of debit balance is closed into its credit effect and the amount of its debit is closed into its debit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

The equity account of credit balance is closed into its debit effect and the amount of its credit is closed into its credit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

The equity account of debit balance is closed into its credit effect and the amount of its debit is closed into its debit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

121. **Equity account of debit**

The equity account of debit balance is closed into its credit effect and the amount of its debit is closed into its debit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

The equity account of credit balance is closed into its debit effect and the amount of its credit is closed into its credit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

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The equity account of credit balance is closed into its debit effect and the amount of its credit is closed into its credit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

122. **Equity account of credit**

The equity account of credit balance is closed into its debit effect and the amount of its credit is closed into its credit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

The equity account of debit balance is closed into its credit effect and the amount of its debit is closed into its debit effect. (copy into the account of the next period. *Debit of credit and credit of debit*)

Although a 5% increase in the quantity of output is quite close to the Method for Constant Real GDP, it ignores price changes, thereby making the change more accurate, (consequently) it is not the best way to do it.

The increase that is required to be changed is typically the 4% needed to get prices of output to fall below the 1% increase in quantity. It is the real GDP that is needed to be changed to get the 4% change, not the 5% increase in quantity.

100) **Reasons for Inflation: Demand-Pull**

The central bank is responsible for the change in the demand curve. It controls money supply and interest rates. It can also change the money supply. It can also change the money supply. It can also change the money supply. It can also change the money supply.

There is a shift in demand for output to the right. It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply.

It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply.

It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply. It is the result of the increase in the money supply.

101) **Output**

Output is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy.

It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy.

It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy. It is the total quantity of goods and services produced in the economy.

102) **Real GDP: constant price**

Real GDP is the total quantity of goods and services produced in the economy, measured in constant prices. It is the total quantity of goods and services produced in the economy, measured in constant prices. It is the total quantity of goods and services produced in the economy, measured in constant prices. It is the total quantity of goods and services produced in the economy, measured in constant prices.

The business can deduct the portion of its national debt that has been sold to individuals, provided that the debt is not publicly traded. If you cannot deduct it, the debt may not qualify as being sold to individuals, as shown by a requirement being used to restrict it. (Nothing, you might wonder, is to be done.)

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals. The rule is not surprising, since the national debt is not sold to individuals, but it is sold to individuals. The rule is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

Effectively, the rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

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11.12 Tax Deductions

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

11.13 Tax Deductions

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

11.14 Deductions for Charitable Contributions

11.15 Charitable Contributions

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

11.16 Charitable Contributions

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

The effect of this rule is that the portion of national debt that is sold to individuals will not be deductible. This is not surprising, since the national debt is not sold to individuals, but it is sold to individuals.

The National Highway Traffic Safety Administration (NHTSA) has issued a recall for certain 2014-2015 Ford Focus vehicles because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

Motorists who own a vehicle affected by this recall should contact their dealer or visit the NHTSA website for more information.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

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The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

111. Which of the following is true?

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

The recall is being conducted because of a problem with the front suspension. The recall affects approximately 100,000 vehicles.

Question 10 of 10

Which of the following statements is true regarding the use of a process flowchart in a business context?

A flowchart can be used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

A flowchart can be used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

A flowchart can be used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

A flowchart can be used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

A flowchart can be used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

III. Business Process Improvement

The process flowchart is a tool used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

III. Business Process Improvement

The process flowchart is a tool used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

The process flowchart is a tool used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

The process flowchart is a tool used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

The process flowchart is a tool used to map out the steps in a process, such as the production of a product, and it can be used to identify areas for improvement.

10. (24 Marks)

With reference to any two of the following, discuss the implications for the development of the region of the following: (a) the increasing importance of the region in the context of the national economy; (b) the increasing importance of the region in the context of the national economy; (c) the increasing importance of the region in the context of the national economy.

It is important to note that the following are not intended to be a checklist of points to be covered in the answer. The following are intended to be a guide to the structure of the answer.

1. Introduction (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

2. Body (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%)

3. Conclusion (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

4. Evaluation (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

5. Summary (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

6. References (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

7. Appendix (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

8. Bibliography (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

11. (24 Marks)

1. Introduction (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

2. Body (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%) (70-75%)

3. Conclusion (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%) (10-15%)

117. **Normal Program and Program File**

111. **Normal Program**

A program is the machine-readable code that is stored in order to perform any one or more of a class of related tasks. The program usually contains instructions, data or code or part of a hardware description language. It is a means to transfer information to a machine or to a computer system.

- Abstract instructions
- Represented files
- Executable files
- Source files
- Executable code

The program usually is also stored in a file. The program file is usually a text file, a code object and a program file or a code object and a program file.

A program file is a file that contains the instructions and data that are used to run a program.

112. **Normal Program and Program File**

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

113. **Normal Program**

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

114. **Program**

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

- a. The program file is a file that contains the instructions and data that are used to run a program.
- b. The program file is a file that contains the instructions and data that are used to run a program.
- c. The program file is a file that contains the instructions and data that are used to run a program.
- d. The program file is a file that contains the instructions and data that are used to run a program.

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

115. **Program and Program File**

The program file is a file that contains the instructions and data that are used to run a program. The program file is usually a text file, a code object and a program file or a code object and a program file.

The Government of West Virginia has a 10-member Board of Education (BoE) that is a statutory corporation in the 17th West Virginia Code. The Board is authorized to set the state's public school standards and curriculum. The Board is also responsible for the state's public school system. The Board is also responsible for the state's public school system.

11) **West Virginia Code**

§ 18-2-1 (a) The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.

12) **West Virginia Code**

13) **West Virginia Code**

The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.

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- e. The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.
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- i. The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.
- j. The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.

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14) **West Virginia Code**

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The Board of Education shall have the honor and respect of the public schools of this State and shall be authorized to exercise all powers and duties which may be conferred upon it by law.

ended in the figure. From this, it is evident that the company should not be able to pay dividends for at least 30 days after the end of the fiscal year. The accounting for the figure:

There is a significant difference between the value of the company's assets and liabilities for every 30 days after the end of the fiscal year. This is the amount of the company's assets.

The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.

Therefore, the company should not be able to pay dividends for at least 30 days after the end of the fiscal year.

The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.

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There is a significant difference between the value of the company's assets and liabilities for every 30 days after the end of the fiscal year.

1. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
2. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
3. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
4. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
5. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
6. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
7. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.
8. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.

10. The company's assets are \$1,000,000 and \$200,000.

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Therefore, the company should not be able to pay dividends for at least 30 days after the end of the fiscal year. The company's assets are \$1,000,000 and \$200,000. The company's liabilities are \$800,000.

100/100 Score

As a result of the 1990s, the Federal Reserve's monetary policy has become more aggressive. This has led to a higher rate of inflation, which has led to a higher rate of unemployment.

The Federal Reserve's monetary policy has become more aggressive. This has led to a higher rate of inflation, which has led to a higher rate of unemployment.

110. Question 10 of 10

The Federal Reserve's monetary policy has become more aggressive. This has led to a higher rate of inflation, which has led to a higher rate of unemployment.

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120. Question 10 of 10

The Federal Reserve's monetary policy has become more aggressive. This has led to a higher rate of inflation, which has led to a higher rate of unemployment.

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The Federal Reserve's monetary policy has become more aggressive. This has led to a higher rate of inflation, which has led to a higher rate of unemployment.

130. Question 10 of 10

10 of 10 (100%)

The following information is taken from a journal article on the relationship between the number of hours spent in a sport and the number of hours spent in leisure activities. The data are as follows:

- (i) The number of hours spent in a sport is denoted by x .
 - (ii) The number of hours spent in leisure activities is denoted by y .
 - (iii) The data are as follows:
- | x | y |
|-----|-----|
| 10 | 15 |
| 15 | 10 |
| 20 | 5 |
| 25 | 0 |
| 30 | 5 |
| 35 | 10 |
| 40 | 15 |
| 45 | 20 |
| 50 | 25 |
| 55 | 30 |
| 60 | 35 |
| 65 | 40 |
| 70 | 45 |
| 75 | 50 |
| 80 | 55 |
| 85 | 60 |
| 90 | 65 |
| 95 | 70 |
| 100 | 75 |

The following information is given for the data above:

10) **Mean and standard deviation**

The mean and standard deviation of the number of hours spent in a sport is 50 and 15 respectively. The mean and standard deviation of the number of hours spent in leisure activities is 50 and 15 respectively.

11) **Product-moment correlation coefficient**

11) **Scatter diagram**

The following information is given for the data above:

The number of hours spent in a sport is denoted by x and the number of hours spent in leisure activities is denoted by y . The data are as follows:

x	y
10	15
15	10
20	5
25	0
30	5
35	10
40	15
45	20
50	25
55	30
60	35
65	40
70	45
75	50
80	55
85	60
90	65
95	70
100	75

The following information is given for the data above:

The mean and standard deviation of the number of hours spent in a sport is 50 and 15 respectively. The mean and standard deviation of the number of hours spent in leisure activities is 50 and 15 respectively.

The product-moment correlation coefficient is given by:

The product-moment correlation coefficient is given by:

The following information is given for the data above:

- (i) The number of hours spent in a sport is denoted by x .
 - (ii) The number of hours spent in leisure activities is denoted by y .
 - (iii) The data are as follows:
- | x | y |
|-----|-----|
| 10 | 15 |
| 15 | 10 |
| 20 | 5 |
| 25 | 0 |
| 30 | 5 |
| 35 | 10 |
| 40 | 15 |
| 45 | 20 |
| 50 | 25 |
| 55 | 30 |
| 60 | 35 |
| 65 | 40 |
| 70 | 45 |
| 75 | 50 |
| 80 | 55 |
| 85 | 60 |
| 90 | 65 |
| 95 | 70 |
| 100 | 75 |

- 101. **WWT:** *Journal of Management Education*, 2016, Vol. 40, No. 10, pp. 1171-1182. doi:10.1177/0022032116666666
- 102. *Journal of Management Education*, 2016, Vol. 40, No. 10, pp. 1171-1182.
- 103. *Journal of Management Education*, 2016, Vol. 40, No. 10, pp. 1171-1182.
- 104. *Journal of Management Education*, 2016, Vol. 40, No. 10, pp. 1171-1182.
- 105. *Journal of Management Education*, 2016, Vol. 40, No. 10, pp. 1171-1182.

101. journal

In order to maximize the use of digital technology in the classroom, it is important to provide students with the necessary skills and knowledge to use technology effectively.

102. **Journal of Management Education**

The Journal of Management Education is a leading journal in the field of management education. It publishes research, theory, and practice articles that advance the understanding of management education and its impact on the workplace.

103. **Journal of Management Education**, 2016, Vol. 40, No. 10, pp. 1171-1182.

104. **Journal of Management Education**

105. journal

The Journal of Management Education is a leading journal in the field of management education. It publishes research, theory, and practice articles that advance the understanding of management education and its impact on the workplace.

106. **Journal of Management Education**

107. **Journal of Management Education**

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108. **Journal of Management Education**

109. journal

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110. journal

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Question 10 (4 marks)

Task 10a (4 marks)

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

1110) (2 marks)

Using the model

- The amount of a substance formed in a day, x , is given by $x = 250 - 20t$, where t is the number of hours since the start of the day.
- The amount of a substance remaining in a day, y , is given by $y = 250 - 20t$.
- The amount of a substance remaining in a day, z , is given by $z = 250 - 20t$.
- The amount of a substance remaining in a day, w , is given by $w = 250 - 20t$.
- The amount of a substance remaining in a day, v , is given by $v = 250 - 20t$.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

1112) (2 marks)

A diagram shows a circle with a radius of 5 cm. The area of the shaded region is 10π cm². Find the angle θ in degrees. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

1113) (2 marks)

Find the area of the shaded region in the diagram. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

1114) (2 marks)

Find the area of the shaded region in the diagram. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

Explain the question and answer the question in brief using a maximum of two sentences. Do not use a calculator.

Question 10 (4 of 4)

Task 1a) Part 1

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben:

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

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111) **Teil 1a)**

112) **Teil 1a)**

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

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Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

113) **Teil 1a)**

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

114) **Teil 1a)**

Teil 1a) 1a) In der folgenden Tabelle sind die Aufgabenstellungen der Teilaufgaben angegeben.

110) **110) The Future**

According to the text of the document, "The future is determined by choices that are made in the present. The future is not predetermined, but it is shaped by the choices we make."

The text of the text that is quoted is "The future is not predetermined, but it is shaped by the choices we make."

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111) **111) The Future**

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112) **112) The Future**

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Task 2a: Future

The long-term consequences of the implementation of the full cost accounting system of the company are shown in the table of the last period of the last year. The firm's net operating income is substantially higher, and it is more stable.

The company also benefits from other options, such as the fact that it is able to fix prices for input materials in advance and to help.

However, with their view on the value of the labor it has invested in what the accounting system is implemented through the use of the labor price, it can be seen that the investment in the company is not really advantageous in the long run and is very costly for the company to run because of the investment in new equipment as well as the labor cost increase.

111-1) Investment in Technology

111-2) Budget

111-3) Inventory Management

Costs between the two systems of the labor price for the labor cost are almost the same. However, the higher the labor cost is, the more the company can reduce its price for the product. Subsequently, a more detailed cost accounting is required.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

When using the labor price, the company is able to reduce its price for the product. However, the higher the labor cost is, the more the company can reduce its price for the product. Subsequently, a more detailed cost accounting is required.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

111-4) Inventory

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost. The company's net operating income is almost the same as in the previous period, but it is still higher because of the higher labor cost.

Question 10 (10 marks)

Task 1a (6 marks)

The following are the two accounts opened by the officers and clerks in charge of the office in the year 1990. The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Task 1b (4 marks)

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Task 2 (4 marks)

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Task 3 (6 marks)

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Task 4 (6 marks)

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Task 5 (6 marks)

Task 6 (6 marks)

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

The office is situated at the end of a long street in the town of Buxton. The office is situated at the end of a long street in the town of Buxton.

Question 11 of 14

11120) Answer:

The theory of evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

Evolution is the process of change in the characteristics of a population of organisms over time.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

The primary evidence for evolution is the fossil record. The fossil record shows the gradual changes in the structure of organisms over time.

The primary evidence for evolution is the fossil record. The fossil record shows the gradual changes in the structure of organisms over time.

11121) Answer:

Evolution is the process of change in the characteristics of a population of organisms over time.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

The primary evidence for evolution is the fossil record. The fossil record shows the gradual changes in the structure of organisms over time.

The primary evidence for evolution is the fossil record. The fossil record shows the gradual changes in the structure of organisms over time.

11122) Answer: Evolution of Species (14 Points)

Evolution is the process of change in the characteristics of a population of organisms over time.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

Evolution is based on the scientific theory of natural selection. It is a theory that explains how species change over time through the process of natural selection.

The correct answer is: **the amount of the liability is not a liability of the company**

The correct answer is: **the amount of the liability is not a liability of the company**

The correct answer is: **the amount of the liability is not a liability of the company**

The correct answer is: **the amount of the liability is not a liability of the company**

The correct answer is: **the amount of the liability is not a liability of the company**

11/11/2018 Question 11 of 10

The correct answer is: **the amount of the liability is not a liability of the company**

The correct answer is: **the amount of the liability is not a liability of the company**

11/11/2018 Question 12 of 10

The correct answer is: **the amount of the liability is not a liability of the company**

11/11/2018 Question 13 of 10

The correct answer is: **the amount of the liability is not a liability of the company**

11/11/2018 Question 14 of 10

The correct answer is: **the amount of the liability is not a liability of the company**

Question 111 (4 of 4)
Not Graded

These results indicate a significant relationship between income and the amount spent when the amount is the amount a household spends on all of the following. It would be appropriate to state that there is an association between income and the amount spent.

Income and the amount spent are related, but the relationship is not linear. The relationship is nonlinear, but the relationship is not linear. The relationship is nonlinear, but the relationship is not linear. The relationship is nonlinear, but the relationship is not linear.

11122 **Regression**

The amount of income from employment is related to the amount of income from employment. The amount of income from employment is related to the amount of income from employment. The amount of income from employment is related to the amount of income from employment.

Income is the dependent variable in a regression model. The amount of income from employment is the independent variable in a regression model. The amount of income from employment is the independent variable in a regression model.

Income is the dependent variable in a regression model. The amount of income from employment is the independent variable in a regression model. The amount of income from employment is the independent variable in a regression model. The amount of income from employment is the independent variable in a regression model.

Income is the dependent variable in a regression model. The amount of income from employment is the independent variable in a regression model. The amount of income from employment is the independent variable in a regression model. The amount of income from employment is the independent variable in a regression model.

Regression analysis is used to determine the relationship between two variables.

11123 **Income and Employment**

Income and employment are related. The amount of income from employment is related to the amount of income from employment. The amount of income from employment is related to the amount of income from employment.

B. INCOME

- (a) Income is the dependent variable in a regression model.
- (b) Income is the independent variable in a regression model.
- (c) Income is the dependent variable in a regression model.
- (d) Income is the independent variable in a regression model.

H. INCOME AND EMPLOYMENT

- (a) Income is the dependent variable in a regression model.
- (b) Income is the independent variable in a regression model.
- (c) Income is the dependent variable in a regression model.
- (d) Income is the independent variable in a regression model.

H. INCOME AND EMPLOYMENT

- (a) Income is the dependent variable in a regression model.
- (b) Income is the independent variable in a regression model.

11124 **Income and Employment**

The amount of income from employment is related to the amount of income from employment. The amount of income from employment is related to the amount of income from employment. The amount of income from employment is related to the amount of income from employment.

Question 10 (10 marks)

Task 1a (5 marks)

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

The primary account user has notified the secondary user of the opening of the secondary account.

The primary account user will be notified of any activity on the secondary account. The primary user will also be notified of the opening of the secondary account. The primary user will also be notified of the opening of the secondary account.

Task 1b (5 marks)

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Account A is the primary for account B. Both have been notified and authorised to be accessed by account B. Account B is the secondary.

Task 2 (5 marks)

10.1. Account A

The primary user is notified of the opening of the secondary account.

10.2. Account B

10.3. Account C

The primary user is notified of the opening of the secondary account.

Account A is the primary.

Account B is the secondary.

10.4. Account D

Quantitative Analysis

Week 12a: Maths

The following definitions are for the quantitative analysis to be used in the following questions.

1110: Science

1110: Science is the study of the natural world through observation and experiment.

in Science

Science is the study of the natural world through observation and experiment. It is the systematic study of the natural world through observation and experiment. It is the study of the natural world through observation and experiment. It is the study of the natural world through observation and experiment.

Scientific method is a systematic way of gathering information about the natural world through observation and experiment.

Observation is the process of gathering information about the natural world through observation and experiment.

Experiment is the process of gathering information about the natural world through observation and experiment.

Theory is a statement that describes a set of observations and is supported by evidence.

Law is a statement that describes a set of observations and is supported by evidence.

Principle is a statement that describes a set of observations and is supported by evidence.

Conclusion is a statement that describes a set of observations and is supported by evidence.

Result is a statement that describes a set of observations and is supported by evidence.

in Maths

Mathematics is the study of the natural world through observation and experiment.

Mathematical proof is a statement that describes a set of observations and is supported by evidence.

Mathematical model is a statement that describes a set of observations and is supported by evidence.

Mathematical analysis is a statement that describes a set of observations and is supported by evidence.

Mathematical proof is a statement that describes a set of observations and is supported by evidence.

Mathematical model is a statement that describes a set of observations and is supported by evidence.

Mathematical analysis is a statement that describes a set of observations and is supported by evidence.

Mathematical proof is a statement that describes a set of observations and is supported by evidence.

in English

English is the study of the natural world through observation and experiment.

Task 2a) Part 1

1. The sales department of the company has been asked to determine if it will sell 2200 units in the next quarter if the price of the product is set at 140000.

Original data: A scatter plot is displayed in the attached spreadsheet. It shows the relationship between the price of the product and the quantity sold.

Task: Analyze the scatter plot of the quantity of units sold (y-axis) against the price (x-axis) and provide a brief interpretation of the relationship. The data set is large enough to use the linear regression line to estimate the quantity of units sold if the price is set at 140000.

Answer: The linear regression line shows a negative correlation between the price of the product and the quantity sold. The regression line is $y = -0.00001x + 2200$.

Part 2) of 2016

Task: Analyze the scatter plot of the quantity of units sold (y-axis) against the price (x-axis) and provide a brief interpretation of the relationship.

Answer: The scatter plot shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

Task: Analyze the scatter plot of the quantity of units sold (y-axis) against the price (x-axis) and provide a brief interpretation of the relationship.

Answer: The scatter plot shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

Part 3)

The scatter plot shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$. The data set is large enough to use the linear regression line to estimate the quantity of units sold if the price is set at 140000.

1110 - **Answer:**

The linear regression line shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

1111 - **Answer:**

The linear regression line shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

The scatter plot shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

1112 - **Answer:**

The scatter plot shows a positive correlation between the price of the product and the quantity sold. The regression line is $y = 0.00001x + 2200$.

10 of 10

10.10 The following information is reported by Pagine of the income statement (amounts in thousands):

Net sales revenue is reported to be \$1,000 million. The cost of goods sold is reported to be \$400 million. The gross profit is reported to be \$600 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

The cost of goods sold is reported to be \$400 million. The gross profit is reported to be \$600 million.

The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

The net income is reported to be \$400 million. The operating expenses are reported to be \$200 million. The gross profit is reported to be \$600 million. The cost of goods sold is reported to be \$400 million.

Based on the information provided, the gross profit is reported to be \$600 million. The cost of goods sold is reported to be \$400 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

10.11 10%

The following information is reported by Pagine of the income statement (amounts in thousands):

Net sales revenue is reported to be \$1,000 million. The cost of goods sold is reported to be \$400 million. The gross profit is reported to be \$600 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

1. What is the gross profit?

The gross profit is reported to be \$600 million. The cost of goods sold is reported to be \$400 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

Based on the information provided, the gross profit is reported to be \$600 million. The cost of goods sold is reported to be \$400 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

10.12 10%

The following information is reported by Pagine of the income statement (amounts in thousands):

Net sales revenue is reported to be \$1,000 million. The cost of goods sold is reported to be \$400 million. The gross profit is reported to be \$600 million. The operating expenses are reported to be \$200 million. The net income is reported to be \$400 million.

1110. **Task 2a** (100%)

Read carefully the text of the question. It contains 1. the context in which you are applying the theory, 2. the material that you are to use and 3. the question.

Write in Spanish:
 1. In 100 words
 2. In 100 words
 3. In 100 words.

Provide an overview of the main theoretical and/or empirical aspects of your chosen subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do. The main idea is to provide a clear overview of the subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do.

Using the concepts of the theory, explain the main empirical aspects of your chosen subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do.

Provide a conclusion in 100 words (100%).

1111. **Answer**

Provide the main idea of the theory and/or empirical aspects of your chosen subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do.

- In 100 words of the context of the theory and/or empirical aspects of your chosen subject area.
- Using the concepts of the theory, explain the main empirical aspects of your chosen subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do.
- Provide a conclusion in 100 words (100%).

The main idea here is not to be pedantic. The figure below illustrates what you should do.

- The answer is 100 words (100%).
- 100% (100%)

The answer is 100 words (100%).

1112. **Answer**

Provide the main idea of the theory and/or empirical aspects of your chosen subject area. Use at least one theory or method explicitly to explain what is happening. The main idea here is not to be pedantic. The figure below illustrates what you should do.

Provide a conclusion in 100 words (100%).

The answer is 100 words (100%).

The answer is 100 words (100%).

111-10-0100 The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

111-10-0101 **Foreign corporations**

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

111-10-0102 **Nonresident aliens**

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

111-10-0103 **Nonresidents**

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

111-10-0104 **Nonresidents**

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

111-10-0105 **Nonresidents**

The corporation shall not be considered a resident of this state for purposes of taxation if the corporation is organized under the laws of another state and its principal office is located in that other state.

Question 10 (40%)

Task 1a (20%)

The following information is available on the cash flows of an investment. Cash flows occur every month and you have 12 months' data from August 1999 until July 2000. The investment is assumed to be a perpetuity. The interest rate is 12% per annum.

111.3) Net present value

The annual interest rate is provided. It has to be used for all cash flows (payments and receipts) in the present value calculation. It is not clear whether it is used as a discount rate or as a rate of return. The question is whether it is used as a discount rate or as a rate of return. The question is whether it is used as a discount rate or as a rate of return. The question is whether it is used as a discount rate or as a rate of return.

The correct answer is to use the interest rate as a discount rate for all cash flows.

111.4) Investment decision

The investment is assumed to be a perpetuity. The question is whether it is a good investment or not.

The correct answer is to accept the investment because the net present value is positive.

111.5) Duration

The question is about the duration of the investment. The question is whether it is a long-term investment or not.

111.6) Duration

The question is about the duration of the investment. The question is whether it is a long-term investment or not.

111.7) Duration

111.8) Duration

The question is about the duration of the investment. The question is whether it is a long-term investment or not.

111.9) Duration

The question is about the duration of the investment. The question is whether it is a long-term investment or not.

The correct answer is to use the interest rate as a discount rate for all cash flows.

The question is about the duration of the investment. The question is whether it is a long-term investment or not.

Question 10 (4 of 4)

True/False

1100. **True**
A network administrator must ensure that a network is properly secured and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1101. **True**

The purpose of a network administrator is to ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1102. **True**

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1103. **True**

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

The purpose of a network administrator is to ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1104. **True**

A network administrator should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1105. **True**

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

1106. **True**

1107. **True**

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

Network administrators should ensure that the network is secure and that it is not vulnerable to attacks. A network administrator should be able to identify and protect against security risks. It is essential to have a plan for how to respond to a security incident. It is also important to have a backup plan for how to recover from a security incident.

Question 10 (4 of 4)
Not Graded

For each account in italics, indicate whether each is considered to be an asset or liability for the governmental fund system.

Each item was part of a budget received by the department to finance an authorized project activity and was placed in the account. Each item was not approved by the department and was not included in the budget. Each item was not included in the budget and was not included in the budget.

Each item was part of the budget received by the department. Each item was not included in the budget and was not included in the budget.

The account is considered to be an asset for the department. The account is considered to be an asset for the department.

The account is considered to be an asset for the department. The account is considered to be an asset for the department.

111) Answer

Answer each account is considered to be an asset or liability for the governmental fund system.

- a. *Gifts in kind* - considered to be an asset for the department.
- b. *Gifts in kind* - considered to be an asset for the department.
- c. *Gifts in kind* - considered to be an asset for the department.

Each item was part of the budget received by the department.

Each item was part of the budget received by the department.

Each item was part of the budget received by the department.

Each item was part of the budget received by the department.

Each item was part of the budget received by the department.

112) Answer

- a. *Gifts in kind* - considered to be an asset for the department.
- b. *Gifts in kind* - considered to be an asset for the department.
- c. *Gifts in kind* - considered to be an asset for the department.
- d. *Gifts in kind* - considered to be an asset for the department.

10. ACCOUNTING INFORMATION SYSTEMS

- 1. Best described as a collection of people, processes, and data
- 2. Best described as a collection of people, processes, and data
- 3. Best described as a collection of people, processes, and data
- 4. Best described as a collection of people, processes, and data

Accounting information systems are used to collect, process, and report financial information.

Accounting information systems are used to collect, process, and report financial information.

Accounting information systems are used to collect, process, and report financial information.

1100. Data, Information, and Knowledge

Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

1110. Data, Information, and Knowledge

Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

1120. Data, Information, and Knowledge

Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

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Data is a collection of facts or figures that are not yet processed. Information is data that has been processed and is useful for decision-making. Knowledge is information that has been processed and is useful for decision-making.

TABLE 13.1: ACCOUNTING INFORMATION SYSTEMS

Year	Accounting Information Systems		Total	Percentage	Accounting Information Systems		
	Manual	Computerized			Total	Manual	Computerized
2008	100	0	100	100%	100	0	
2009	95	5	100	95%	95	5	
2010	85	15	100	85%	85	15	
2011	75	25	100	75%	75	25	
2012	65	35	100	65%	65	35	
2013	55	45	100	55%	55	45	
2014	45	55	100	45%	45	55	

Note: The data in this table is based on the results of a survey of accounting information systems in 2014.

- 1. The data in this table is based on the results of a survey of accounting information systems in 2014.
- 2. The data in this table is based on the results of a survey of accounting information systems in 2014.

Using the data below, answer the question. Assume that the population of the United States is approximately 300 million. The following table shows the number of people who are currently in the United States who are currently in the military. The number of people who are currently in the military is approximately 1.5 million.

Current Military Service

Service	Percentage of total military service members			
	Army	Navy	Air Force	MARines
Army	30%	15%	25%	30%
Navy	15%	30%	10%	45%
Air Force	25%	10%	35%	30%
MARines	30%	45%	30%	15%
Other	0%	0%	0%	0%
Total	100%	100%	100%	100%

The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million.

The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million.

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The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million. The number of people who are currently in the military is approximately 1.5 million.

11/10/2019

00:04:00

Question 11 of 14

Task 2a) (100%)

1. Write down the steps of the algorithm to solve the case of a linear equation in a polynomial that led to the formula. In a separate box draw a graph of the polynomial function and its roots to the x-axis. (100%)

Step 1: Write down the polynomial equation. The general form is $ax^2 + bx + c = 0$.

Step 2: Calculate the discriminant $\Delta = b^2 - 4ac$.

Step 3: Use the formula:

$$x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$$

The discriminant Δ determines the nature of the roots. If $\Delta > 0$, there are two distinct real roots. If $\Delta = 0$, there is one real root. If $\Delta < 0$, there are two complex conjugate roots.

11181) (100%)

1. Write down the steps of the algorithm to solve the case of a linear equation in a polynomial that led to the formula. (100%)

1. Write down the polynomial equation. The general form is $ax^2 + bx + c = 0$.
2. Calculate the discriminant $\Delta = b^2 - 4ac$.
3. Use the formula:
$$x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$$
4. The discriminant Δ determines the nature of the roots. If $\Delta > 0$, there are two distinct real roots. If $\Delta = 0$, there is one real root. If $\Delta < 0$, there are two complex conjugate roots.

The discriminant Δ determines the nature of the roots. If $\Delta > 0$, there are two distinct real roots. If $\Delta = 0$, there is one real root. If $\Delta < 0$, there are two complex conjugate roots.

11182) (100%)

1. Write down the steps of the algorithm to solve the case of a linear equation in a polynomial that led to the formula. (100%)

11/11/2023

The following table gives the expected frequency for the number of children born to women. The expected frequencies are given by the expected frequency for each cell divided by the total number of frequencies which is 10000 women. The expected frequencies are shown below. The expected frequencies are rounded to 2 decimal places.

From the table, the total number of women who have had 0 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 1 child is 10000 women multiplied by 0.20 which is 2000 women. From the table, the total number of women who have had 2 children is 10000 women multiplied by 0.30 which is 3000 women.

From the table, the total number of women who have had 3 children is 10000 women multiplied by 0.20 which is 2000 women.

From the table, the total number of women who have had 4 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 5 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 6 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 7 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 8 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 9 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 10 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 11 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 12 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 13 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 14 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 15 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 16 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 17 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 18 children is 10000 women multiplied by 0.10 which is 1000 women.

From the table, the total number of women who have had 19 children is 10000 women multiplied by 0.10 which is 1000 women. From the table, the total number of women who have had 20 children is 10000 women multiplied by 0.10 which is 1000 women.

The expected frequency for the number of children born to women is 10000 women multiplied by 0.10 which is 1000 women.

- 10. 1000 women
- 11. 2000 women
- 12. 3000 women
- 13. 2000 women
- 14. 1000 women
- 15. 1000 women
- 16. 1000 women
- 17. 1000 women
- 18. 1000 women
- 19. 1000 women
- 20. 1000 women

11170 Question

- A. It has the same growth rate as the other two countries (2.2% annual) because the world average is 2.2%
- B. It has an average growth rate because it is smaller and has a lower growth rate

Correct answer: B. It has an average growth rate because it is smaller and has a lower growth rate. It has the same growth rate as the other two countries (2.2% annual) because the world average is 2.2%

The country with the lowest growth rate is the smallest and has the lowest growth rate. The country with the highest growth rate is the largest and has the highest growth rate.

11171 Question

The country with the highest growth rate is the smallest and has the lowest growth rate. The country with the lowest growth rate is the largest and has the highest growth rate. The country with the average growth rate is the middle and has the average growth rate.

Correct answer: A. It has the same growth rate as the other two countries (2.2% annual) because the world average is 2.2%

The country with the highest growth rate is the smallest and has the lowest growth rate. The country with the lowest growth rate is the largest and has the highest growth rate. The country with the average growth rate is the middle and has the average growth rate.

Correct answer: B. It has an average growth rate because it is smaller and has a lower growth rate.

The country with the highest growth rate is the smallest and has the lowest growth rate. The country with the lowest growth rate is the largest and has the highest growth rate. The country with the average growth rate is the middle and has the average growth rate.

11172 Question (Correct Answer)

Country A has a growth rate of 2.2% and Country B has a growth rate of 2.2%. The world average growth rate is 2.2%. Country C has a growth rate of 2.2%.

Correct answer: B

- A. It has the same growth rate as the other two countries (2.2% annual) because the world average is 2.2%
- B. It has an average growth rate because it is smaller and has a lower growth rate
- C. It has the highest growth rate because it is the smallest and has the lowest growth rate

Correct answer: B

- A. It has the same growth rate as the other two countries (2.2% annual) because the world average is 2.2%
- B. It has an average growth rate because it is smaller and has a lower growth rate
- C. It has the highest growth rate because it is the smallest and has the lowest growth rate

Question 10 (4 marks)

Task 10a (2 marks)

10. A 1000 kg car is moving at 100 km/h. The driver brakes and the car comes to a stop. Calculate the change in the car's kinetic energy.

11.100) Using the Pythagorean theorem

The Pythagorean theorem states that in a right-angled triangle, the square of the length of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the lengths of the other two sides. It is written as $a^2 + b^2 = c^2$, where c is the length of the hypotenuse, and a and b are the lengths of the other two sides.

When using the Pythagorean theorem, it is important to identify the right-angled triangle and the sides involved. The hypotenuse is the longest side of the triangle, and it is opposite the right angle. The other two sides are the legs of the triangle. The Pythagorean theorem can be used to find the length of any side of a right-angled triangle, provided that the lengths of the other two sides are known.

For example, if a right-angled triangle has legs of length 3 and 4, then the length of the hypotenuse is 5. This is because $3^2 + 4^2 = 5^2$, or $9 + 16 = 25$. The Pythagorean theorem is a fundamental principle of geometry and is used in many areas of mathematics and science.

Using the Pythagorean theorem, we can find the length of the hypotenuse.

Let the length of the hypotenuse be c , the length of the leg be a , and the length of the other leg be b . Then the Pythagorean theorem states that $a^2 + b^2 = c^2$.

In this case, $a = 3$, $b = 4$, and $c = 5$. Therefore, the length of the hypotenuse is 5.

11.101) Using the Pythagorean theorem

Let the length of the hypotenuse be c , the length of the leg be a , and the length of the other leg be b . Then the Pythagorean theorem states that $a^2 + b^2 = c^2$.

11.101) The length of the hypotenuse is 5. This is because $3^2 + 4^2 = 5^2$, or $9 + 16 = 25$. The Pythagorean theorem is a fundamental principle of geometry and is used in many areas of mathematics and science.

11.102) The length of the hypotenuse is 5. This is because $3^2 + 4^2 = 5^2$, or $9 + 16 = 25$. The Pythagorean theorem is a fundamental principle of geometry and is used in many areas of mathematics and science.

11.103) The length of the hypotenuse is 5. This is because $3^2 + 4^2 = 5^2$, or $9 + 16 = 25$. The Pythagorean theorem is a fundamental principle of geometry and is used in many areas of mathematics and science.

11.104) Using the Pythagorean theorem

Let the length of the hypotenuse be c , the length of the leg be a , and the length of the other leg be b . Then the Pythagorean theorem states that $a^2 + b^2 = c^2$.

Question 10 (4 of 4)

10 of 24 Points

Which of the following is **not** a function of the endocrine system?

10000: Growth and repair

The growth of a muscle is primarily regulated by the endocrine system. It is essential for muscle growth and repair.

11000: Blood

Blood is a complex fluid that transports oxygen and nutrients to cells and removes waste products. It is essential for the survival of the organism. The endocrine system regulates the production and release of hormones that control blood sugar levels and blood pressure.

10000: Growth and repair

Growth and repair of the body are essential for the survival of the organism. The endocrine system regulates the production and release of hormones that control growth and repair. The endocrine system also regulates the production and release of hormones that control blood sugar levels and blood pressure.

11000: Blood

The endocrine system is responsible for the production and release of hormones that regulate the body's metabolism, growth, and development. The endocrine system also regulates the production and release of hormones that control blood sugar levels and blood pressure.

The endocrine system is responsible for the production and release of hormones that regulate the body's metabolism, growth, and development. The endocrine system also regulates the production and release of hormones that control blood sugar levels and blood pressure.

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The endocrine system is responsible for the production and release of hormones that regulate the body's metabolism, growth, and development. The endocrine system also regulates the production and release of hormones that control blood sugar levels and blood pressure.

11000: Growth and repair

The growth of a muscle is primarily regulated by the endocrine system. It is essential for muscle growth and repair.

100/100 Points

Which of the following is not a characteristic of the federal government?

- a. The power of the federal government is derived from the states.
- b. The federal government is a unitary system.
- c. Citizens in the federal government are not bound by the same laws.
- d. The federal government is a unitary system.
- e. The federal government is a unitary system.

111.8. Answered True

Answered True del answer

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

112.8. Answered True

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

113.8. Answered True

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

114.8. Answered True

Answered True

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

The federal government is a unitary system. The federal government is a unitary system. The federal government is a unitary system.

- a. The federal government is a unitary system.
- b. The federal government is a unitary system.

Question 10 (10 marks)**Task 1a (6 marks)**

1. Explain the following terms used in cost accounting, as applied to service activities in contrast to cost of production, as introduced into a manufacturing activity by the Process Costing Method.

Distinction as regards job cost sheet

- allocable, for the sake of a fair and justly measured performance, suitable at the outset for an exact cost of work of a given nature, in order to make proper comparison to that of a standard of cost. It also got suitable to spend money by labor to have your own work of quality.
- allocating, as a systematic way, having a comprehensive and to be cost of work, which is a way of cost of work to be calculated under the cost.
- Cost accounting of a service activity is a systematic way of accounting as a method to measure the cost of the service work, which is a way of measuring the cost of the service work, which is a way of measuring the cost of the service work.

Task 1b (4 marks)

For each of the following activities of a service enterprise, prepare a suitable job cost sheet.

Typical service activities**1. Automobile Garage**

Materials	
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00

Overhead	
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00
cost of materials	1400.00
total	2,200.00

Overhead	
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00
cost of materials	1400.00
total	2,200.00
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00
cost of materials	1400.00
total	2,200.00
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00
cost of materials	1400.00
total	2,200.00

2. Automobile Garage

Materials	
labor (mechanic's wages)	400.00
cost of materials	400.00
cost of labor	1400.00

Overhead	
labor (mechanic's wages)	400.00

Question 10 (10%)**Task 1a (10%)**

Costs incurred in developing and testing the product	400,000
Depreciation of plant and equipment used in production of product	200,000
Research and development	100,000
Overhead costs incurred	
- salaries and wages of staff in production	400,000
- depreciation	200,000
- plant and equipment	100,000
- other overheads	100,000
Materials	
- direct materials	200,000
- indirect materials	100,000
- scrap	100,000
- waste	100,000
- other materials	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000

10.10.2019

Costs incurred	
- salaries and wages of staff in production	400,000
- depreciation	200,000
- plant and equipment	100,000
Overhead costs incurred	
- salaries and wages of staff in production	400,000
- depreciation	200,000
- plant and equipment	100,000
- other overheads	100,000
Materials	
- direct materials	200,000
- indirect materials	100,000
- scrap	100,000
- waste	100,000
- other materials	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000
- other overheads	100,000

10.10.2019 The following table shows the costs incurred in the production of a product. The costs are classified into direct and indirect costs. The indirect costs are further classified into fixed and variable costs. The total cost of the product is 1,000,000. The direct cost is 400,000. The indirect cost is 600,000. The fixed cost is 200,000. The variable cost is 400,000.

111. The following table shows the costs incurred in the production of a product.

112. The following table shows the costs incurred in the production of a product.

The following table shows the costs incurred in the production of a product. The costs are classified into direct and indirect costs. The indirect costs are further classified into fixed and variable costs. The total cost of the product is 1,000,000. The direct cost is 400,000. The indirect cost is 600,000. The fixed cost is 200,000. The variable cost is 400,000.

10 of 10 points

Which of the following is not a common reason for using the comparative advantage method of international trade?

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

11 of 10 points

Which of the following is not a common reason for using the comparative advantage method of international trade?

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

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It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

12 of 10 points

Which of the following is not a common reason for using the comparative advantage method of international trade?

It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

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It allows a country to focus on the goods it produces best and produce them more efficiently than other countries.

100/100 points

- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct
- 100% correct

There are two ways to do this. The first is to use the fact that the sum of the squares of the first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. The second is to use the fact that the sum of the squares of the first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. Both methods lead to the same result.

The second way is to use the fact that the sum of the squares of the first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. This method is more straightforward than the first one.

100% correct

The second way is to use the fact that the sum of the squares of the first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. This method is more straightforward than the first one.

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100% correct

100% correct

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The second way is to use the fact that the sum of the squares of the first n natural numbers is $\frac{n(n+1)(2n+1)}{6}$. This method is more straightforward than the first one.

111. Makamaka and Pigeon have the following capital accounts:

111. Makamaka

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 12/31: \$250,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

1. \$100,000
2. \$150,000

a. \$100,000	\$100,000
b. \$150,000	\$150,000
c. \$200,000	\$200,000
d. \$250,000	\$0
3. \$200,000
4. \$250,000

Answer: 2. The correct answer is \$150,000. Makamaka's share of the net income is \$50,000.

112. Makamaka

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 12/31: \$250,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

113. Makamaka

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 12/31: \$250,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

Balance at 12/31: \$250,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

1. \$100,000
2. \$150,000
3. \$200,000
4. \$250,000

Answer: 2. The correct answer is \$150,000. Makamaka's share of the net income is \$50,000.

114. Makamaka and Pigeon

Balance at 1/1: \$100,000
 Contributions: \$200,000
 Withdrawals: \$50,000
 Net Income: \$100,000

11.17.1 The graph illustrates that the volume of the fuel used in the fuel cell increases with the pressure. This can be explained in terms of the pressure and rate of collision of the particles. Pressure is force per unit area so increasing the pressure increases the force exerted on the fuel cell.

11.18.1 **2000g/1000ml/2g/ml**

11.18.2 **2000**

The gas inside the balloon expands (increases in volume) to fill the container. A gas particle collides with the wall of the container and exerts a force. The total force exerted by the gas particles on the wall of the container is the pressure. Pressure is force per unit area. The pressure is 2000g/1000ml/2g/ml = 1000g/ml.

11.18.3 **pressure**

11.18.4 **force per unit area**

The force exerted on the wall of the container is the pressure. The force exerted on the wall of the container is the pressure. The force exerted on the wall of the container is the pressure.

- A. 1000g/ml
- B. 2000g/ml
- C. 1000g/ml
- D. 2000g/ml

11.18.5 **pressure**

The pressure exerted by the gas is the force exerted by the gas particles on the wall of the container. The force exerted by the gas particles on the wall of the container is the pressure.

11.18.6 **force**

11.18.7 **force**

Force is the push or pull on an object. The force exerted by the gas particles on the wall of the container is the pressure. The force exerted by the gas particles on the wall of the container is the pressure.

The force exerted by the gas particles on the wall of the container is the pressure. The force exerted by the gas particles on the wall of the container is the pressure. The force exerted by the gas particles on the wall of the container is the pressure.

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11.18.8 **force per unit area**

The force exerted by the gas particles on the wall of the container is the pressure. The force exerted by the gas particles on the wall of the container is the pressure. The force exerted by the gas particles on the wall of the container is the pressure.

Question 10 (4 of 4)

100/100 Points

The following information comes from a company's 2018 financial statements. The company's net income was \$100 million and its operating assets were \$500 million.

The company's operating assets were \$500 million at the beginning of 2018 and \$450 million at the end of 2018.

- a. Operating Income
- b. Total Assets
- c. Operating Assets
- d. Operating Expenses
- e. Depreciation



1100 Operating Assets

Operating assets are assets used in the company's operations. They are the assets that are used to produce goods and services. Operating assets are the assets that are used to produce goods and services.

1120 Depreciation Expense

Depreciation expense is the cost of using up the value of a tangible asset over its useful life. It is the amount of the asset's value that is lost due to wear and tear, obsolescence, or other factors.

Depreciation expense is a non-cash expense that is recorded on the income statement. It is a contra-asset account that is subtracted from the cost of the asset to determine its book value.

1140 Depreciation

Depreciation is the process of allocating the cost of a tangible asset over its useful life. It is the amount of the asset's value that is lost due to wear and tear, obsolescence, or other factors. Depreciation is a non-cash expense that is recorded on the income statement. It is a contra-asset account that is subtracted from the cost of the asset to determine its book value.

Depreciation expense is a non-cash expense that is recorded on the income statement. It is a contra-asset account that is subtracted from the cost of the asset to determine its book value.

1160 Operating Expenses

Operating expenses are the costs of the goods and services that are used in the company's operations. They are the expenses that are incurred in the process of producing goods and services.

1180 Depreciation Expense

Depreciation

Depreciation is the process of allocating the cost of a tangible asset over its useful life. It is the amount of the asset's value that is lost due to wear and tear, obsolescence, or other factors.

1200 Operating Assets

Operating assets are assets used in the company's operations. They are the assets that are used to produce goods and services.

1220 Depreciation Expense

Question 10 (4 marks)

Task 1a (2 marks)

Read the text and answer the questions. Write your answers in the spaces provided.

10a. Questioning the text (2 marks)

A representative of a government body has written a report on the impact of climate change. The report states that the effects of climate change will be more significant in the future than in the past. The report also states that the effects of climate change will be more significant in the future than in the past. The report also states that the effects of climate change will be more significant in the future than in the past.

10b. Questioning the text (2 marks)

Read the text and answer the questions. Write your answers in the spaces provided.

10c. Questioning the text (2 marks)

Read the text and answer the questions. Write your answers in the spaces provided. The text is a report on the impact of climate change. The report states that the effects of climate change will be more significant in the future than in the past. The report also states that the effects of climate change will be more significant in the future than in the past.

The report also states that the effects of climate change will be more significant in the future than in the past. The report also states that the effects of climate change will be more significant in the future than in the past.

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The report also states that the effects of climate change will be more significant in the future than in the past. The report also states that the effects of climate change will be more significant in the future than in the past.

It is not for the faint of heart, but it is a great learning experience and the pay is very generous. I would recommend this to anyone who is looking for a job in the field of business and is willing to work long hours.

I like working here because of the great benefits and the friendly atmosphere. I am also able to gain professional skills by working in the field. In the past, I have worked in a retail store and I have learned a lot about customer service and sales. I am now able to apply these skills in my current position and I am confident that I will continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field. I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

1117. **Introduction: Using the Word Bank**

Read the passage below and use the words from the word bank to complete the passage.

1118. **Section: Using the Word Bank**

The first time I had a job was when I was in high school. I was working at a retail store and I was responsible for helping customers find the products they needed. I was also responsible for keeping the store clean and organized. I learned a lot about customer service and sales from this job. I was able to apply these skills in my current position and I am confident that I will continue to learn and grow in this field.

1119. **Section: Using the Word Bank**

My job is very challenging and I am always learning new things. I am responsible for helping customers find the products they need and I am also responsible for keeping the store clean and organized. I learned a lot about customer service and sales from this job. I was able to apply these skills in my current position and I am confident that I will continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field. I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

The first time I had a job was when I was in high school. I was working at a retail store and I was responsible for helping customers find the products they needed. I was also responsible for keeping the store clean and organized. I learned a lot about customer service and sales from this job. I was able to apply these skills in my current position and I am confident that I will continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field. I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

The first time I had a job was when I was in high school. I was working at a retail store and I was responsible for helping customers find the products they needed. I was also responsible for keeping the store clean and organized. I learned a lot about customer service and sales from this job. I was able to apply these skills in my current position and I am confident that I will continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field. I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field. I am not a student and I am not looking for a job. I am looking for a job that will allow me to continue to learn and grow in this field.

111.1) **Not Answered**
 The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

111.2) **Not Answered**

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

111.3) **Not Answered**

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

111.4) **Not Answered**

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

The correct answer is **not a**. The correct answer is **not a** because the correct answer is **not a**. The correct answer is **not a**.

111.5) **Not Answered**

Question 10 (10 marks)

10.1 (3 marks)

The above song is based on the story that is covered below. Explain how the above information is used in the play. In addition, provide one (1) further piece of support to show how the story is used. The further the better. Support must be well written.

The song that is written by the poet can be used to show that the poet is using the general reader's knowledge and skills. In addition, the poet can be using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

The above song is based on a true story of a man. The poet can be using the story to show that the poet is using the story to support a point that is made in the play.

10.2 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play. The poet can be using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

10.3 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

10.4 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

10.5 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play. The poet can be using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

11. (10 marks)

11.1 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

11.2 (3 marks)

The poet can be using the story to show that the poet is using the story to support a point that is made in the play. This is done by using a simile that is used to show that the poet is using the story to support a point that is made in the play.

Question 10 (4 of 4)

Not Graded

The following table represents the data for the 1000 students at the University of California:

x	11	12
y	11	12
z	12	13

1110. Answer:

The expected value of the number of students who are in the first class is:

1111. Answer:

The expected value of the number of students who are in the first class is:

The expected value of the number of students who are in the first class is:

The expected value of the number of students who are in the first class is:

The expected value of the number of students who are in the first class is:

1112. Answer:

1113. Answer: Three students, Sam, Tom, and:

The expected value of the number of students who are in the first class is:

1114. Answer: Four students, Sam, Tom, and:

The expected value of the number of students who are in the first class is:

1115. Answer: Five students, Sam, Tom, and:

The expected value of the number of students who are in the first class is:

The expected value of the number of students who are in the first class is:

1116. Answer: Six students, Sam, Tom, and:

The expected value of the number of students who are in the first class is:

Question 10 (4 of 4)

Task 2a) (10%)

- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- 110) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- 111) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- The first type of the production control system is the process control system. The second type of the production control system is the production control system. The first type of the production control system is the process control system. The second type of the production control system is the production control system.
- 112) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- 113) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- 114) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.
- 115) **Task 2a) (10%)**
- 1) Write down the two main types of the process and the two types of the production control system. Describe the two main types of the production control system.

Question 10 (4 of 4)

10 of 24 Points

Why is the growth rate of the economy important in the IS-LM model? The IS curve is downward sloping, and it is downward sloping because of the relationship between the real interest rate and the growth rate of the economy. Figure 10.10

1110) Question

Why is the growth rate of the economy important in the IS-LM model? The IS curve is downward sloping, and it is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

1111) Question

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

1112) Question

1113) Question

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

1114) Question

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

1115) Question

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

The IS curve is downward sloping because of the relationship between the real interest rate and the growth rate of the economy.

11174 - Question

Which of the following is **not** a characteristic of a **strongly** correlated system?

a) All particles behave as if they were free, as if they were not interacting with each other.

b) The system is a good conductor of heat, and the temperature is uniform throughout.

c) The system is a good conductor of heat.

d) The system is a good conductor of heat, and the temperature is uniform throughout.

11175 - Question

Which of the following is **not** a characteristic of a **strongly** correlated system?

a) The system is a good conductor of heat.

b) The system is a good conductor of heat, and the temperature is uniform throughout.

c) The system is a good conductor of heat, and the temperature is uniform throughout.

11176 - Question

Which of the following is **not** a characteristic of a **strongly** correlated system?

a) The system is a good conductor of heat, and the temperature is uniform throughout.

b) The system is a good conductor of heat, and the temperature is uniform throughout.

11177 - Question

Which of the following is **not** a characteristic of a **strongly** correlated system?

a) The system is a good conductor of heat, and the temperature is uniform throughout.

11178 - Question

Which of the following is **not** a characteristic of a **strongly** correlated system?

a) The system is a good conductor of heat, and the temperature is uniform throughout.

Question 10 (4 of 4)

Task 2a (10%)

111. left and proposed to funding job advertisements. Through a cost control sheet it is determined by budget.

112. Name:

113. year:

The person should be in the position of director, but it is not clear whether the person is a director or a manager. The person should be a director or a manager. The person should be a director or a manager. The person should be a director or a manager.

114. Name: Name, Name, Name, Name, Name

The name of the person is Name, Name, Name, Name, Name.

Name: Name	Name
Name: Name	Name
Name: Name	Name
Name: Name	Name

115. Name: Name

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

116. Name: Name

117. Name: Name

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

118. Name: Name

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

119. Name: Name

120. Name:

The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name. The name of the person is Name, Name, Name, Name, Name.

111. None
 The smallest unit of production is called a firm. Firms produce goods & services for sale.

112. Production

113. Supply functions

The firm is a collection of individuals who are engaged in selling all the products.

- a. 11 hours
- b. 11 months
- c. 11 days

114. Capital

The smallest unit of production is called a firm. Firms produce goods & services for sale.

115. Capital

A firm may not have any of the following: a) a firm is a collection of individuals who are engaged in selling all the products.

It is a firm that is a group of individuals who are engaged in selling all the products.

The firm is a collection of individuals who are engaged in selling all the products.

The firm is a collection of individuals who are engaged in selling all the products.

The firm is a collection of individuals who are engaged in selling all the products.

116. 11 hours	117. 11 months
118. 11 days	119. 11 weeks
120. 11 years	121. 11 years
122. 11 months	123. 11 years
124. 11 days	125. 11 years
126. 11 weeks	127. 11 years

128. Production Function

The firm is a collection of individuals who are engaged in selling all the products.

The firm is a collection of individuals who are engaged in selling all the products.

129. Production Function

at the end of the year to determine the company's total income taxes due. The statement is prepared by the tax department, using information about the company's operations throughout the year. It is usually prepared by the end of the following year.

A credit of one type of temporary account is by definition a debit. The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable. The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

It is common for a company to have a credit balance in its cash account. This is often due to a company's policy of not paying its bills until the end of the month. The company's cash account will have a credit balance if the company's cash account has a credit balance.

Journal entries are recorded in the journal, which is a book where all the company's transactions are recorded. The journal is a book where all the company's transactions are recorded. The journal is a book where all the company's transactions are recorded. The journal is a book where all the company's transactions are recorded.

A credit of one type of temporary account is by definition a debit. The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

It is common for a company to have a credit balance in its cash account.

The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

It is common for a company to have a credit balance in its cash account. This is often due to a company's policy of not paying its bills until the end of the month. The company's cash account will have a credit balance if the company's cash account has a credit balance.

110) Key

The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable. The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

It is common for a company to have a credit balance in its cash account.

The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

It is common for a company to have a credit balance in its cash account. This is often due to a company's policy of not paying its bills until the end of the month. The company's cash account will have a credit balance if the company's cash account has a credit balance.

111) Key

The journal entry to record the sale of a truck would be a debit to the account receivable and a credit to the account receivable.

101. **True**

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

112. **True**

113. **True**

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

- 1. True
- 2. False
- 3. True
- 4. False

114. **True**

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

115. **True**

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

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The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

116. **True**

The main reason for the development of the modern world is the industrial revolution, which began in the late 18th century in Britain and spread to other parts of the world.

Question 10 of 10

Task 2a) Essay

1) The following are the main components of the theory of the firm. Discuss the relationship between them.

III) Government Policy

1) Introduction

The theory of the firm is a central part of economic theory. It is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

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The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

2) Body Paragraph 1

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

3) Body Paragraph 2

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

III) Conclusion

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy. The theory of the firm is a branch of microeconomics that studies the behaviour of firms in a market economy.

Question 10 (4 of 4)**Task 2a (10%)**

all in order to be fully aware that I (the client) am not a practicing attorney (writing on behalf of a non-attorney?)

Is this going to be used in 20 or less years (advised of potential use)? Is something set up in 2024 or the end of 2024 for the 2025-2026 period (the time of the future agreement)?

Is the end number of up to 100,000 or is something like 100,000 or 200,000 or 300,000?

1110) Retained Power Plan

The setting is just four months after the date of death by way of being the trustee under an irrevocable trust. The trust is to make the trust income or assets of trust (income and principal) to be used to fund a trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse and to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

1. 100,000	1. 100,000
2. 200,000	2. 200,000
3. 300,000	3. 300,000
4. 400,000	4. 400,000

The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

1120) ERISA Preemption

Is there a trust that is being set up to fund the trust for the benefit of the surviving spouse? The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

1130) Summary

The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

The trust is to be used to fund the trust for the benefit of the surviving spouse.

Question 10 (4 of 4)

Question 10

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1110. Purpose/Audience

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1111. Main Idea/Detail

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1112. Inference

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1113. Author

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

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The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1114. Summary

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

1115. Main Idea/Detail

1116. Inference

The article is for the audience that is interested in the art world. The focus is on the sculpture by the artist. It is a descriptive and informative article.

Task 2a) Type:

When you collect data, it is not always easy to see what the data really means. You can use some tools to help you. One tool is a bar chart. A bar chart is a graph that shows the relationship between two things. The bars represent the data and the height of the bars shows the relationship between the two things.

11. **SAPPHIRE (S) (S) (S) (S) (S)**

11.1. **Bar**

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

11.2. **Interpret**

11.3. **Interpretation**

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

11.12. **Interpret**

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

11.3. **Bar**

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

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The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

The bar chart shows the data collected from the experiment. The bars represent the data and the height of the bars shows the relationship between the two things.

- a. (1/2) to (1/3) for (1/2) for (1/2)
- b. (1/2) to (1/3) for (1/2) for (1/2)

Which of the following is NOT a function of the cell wall?

to provide structural support and protection for the cell

to regulate the movement of substances into and out of the cell

to maintain the cell's shape and prevent it from bursting

to provide a barrier against the entry of harmful substances into the cell

to provide a barrier against the entry of harmful substances into the cell

to provide a barrier against the entry of harmful substances into the cell

to provide a barrier against the entry of harmful substances into the cell

to provide a barrier against the entry of harmful substances into the cell

110. Which of the following is NOT a function of the cell wall?

to provide structural support and protection for the cell

111. Which of the following is NOT a function of the cell wall?

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

to provide structural support and protection for the cell

From the period of time leading up to contact with the speaker:

A speaker's attitude, which is the speaker's attitude toward the subject of the speech, is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

100. **Speaker's attitude**

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

101. **Speaker's attitude**

102. **Speaker's attitude**

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

103. **Speaker's attitude**

104. **Speaker's attitude**

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

105. **Speaker's attitude**

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

A speaker's attitude is the speaker's attitude toward the subject of the speech, which is the speaker's attitude toward the subject of the speech.

106. **Speaker's attitude**

Question 10 (4 of 4)**10 of 24 Items**

The following items are classified as primary goods & services (included and excluded)

EXCLUDED

11 of 24 Items

The following items are classified as primary goods & services

EXCLUDED

- 100 ✓ Income from a Public Account
- 101 ✓ 10% Stockholder
- 102 ✓ Accounting services
- 103 ✓ Insurance fees
- 104 ✓ Insurance Premiums & Benefits
- 105 ✓ Computer services & software
- 106 ✓ Insurance services
- 107 ✓ Health Insurance
- 108 ✓ 20% Stockholder
- 109 ✓ Insurance Agency services

12 of 24 Items

- 110 ✓ 10% Stockholder
- 111 ✓ 10% Stockholder
- 112 ✓ Insurance
- 113 ✓ Insurance services
- 114 ✓ 10% Stockholder
- 115 ✓ 10% Stockholder
- 116 ✓ 10% Stockholder
- 117 ✓ 10% Stockholder
- 118 ✓ 10% Stockholder
- 119 ✓ 10% Stockholder
- 120 ✓ 10% Stockholder
- 121 ✓ 10% Stockholder
- 122 ✓ 10% Stockholder
- 123 ✓ 10% Stockholder
- 124 ✓ 10% Stockholder
- 125 ✓ 10% Stockholder
- 126 ✓ 10% Stockholder
- 127 ✓ 10% Stockholder
- 128 ✓ 10% Stockholder
- 129 ✓ 10% Stockholder
- 130 ✓ 10% Stockholder

13 of 24 Items**13 of 24 Items**

The following items are classified as primary goods & services (included and excluded)

EXCLUDED

The following items are classified as primary goods & services

EXCLUDED

Task 2a (1 of 1)

- **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
- **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
- **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**

1. a. 1. a. 1. a. 1. a. 1. a.

QUESTION **QUESTION** **QUESTION** **QUESTION** **QUESTION**

1. b. 1. b. 1. b. 1. b. 1. b.

QUESTION **QUESTION** **QUESTION** **QUESTION** **QUESTION**

1118 **QUESTION**

QUESTION

1. **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
2. **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
3. **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
4. **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**
5. **QUESTION** **QUESTION** **QUESTION** **QUESTION** **QUESTION**

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QUESTION **QUESTION** **QUESTION** **QUESTION** **QUESTION**

QUESTION **QUESTION** **QUESTION** **QUESTION** **QUESTION**

QUESTION **QUESTION** **QUESTION** **QUESTION** **QUESTION**

Task 24 (10 min)

On 1st July 2017, the following assets of the business are being valued: motor vehicles, plant, fittings, furniture, etc. The motor vehicles are valued at their book value and the remaining assets are valued at their market value.

It is assumed that the value of the assets is as follows:

Motor vehicles: £100,000; Plant: £50,000; Fittings: £20,000; Furniture: £10,000. The motor vehicles are valued at their book value of £100,000. The plant, fittings and furniture are valued at their market value of £80,000.

During the year, the motor vehicles are sold for £120,000. The profit on the sale is £20,000. The profit is transferred to the profit and loss account. The profit and loss account is as follows:

Task 25 (10 min)

On 1st July 2017, the following assets of the business are being valued: motor vehicles, plant, fittings, furniture, etc. The motor vehicles are valued at their book value and the remaining assets are valued at their market value.

Motor vehicles: £100,000; Plant: £50,000; Fittings: £20,000; Furniture: £10,000. The motor vehicles are valued at their book value of £100,000. The plant, fittings and furniture are valued at their market value of £80,000.

It is assumed that the value of the assets is as follows:

Motor vehicles: £100,000; Plant: £50,000; Fittings: £20,000; Furniture: £10,000. The motor vehicles are valued at their book value of £100,000. The plant, fittings and furniture are valued at their market value of £80,000.

Report on the valuation of the assets.

A. Motor vehicles

- 1. Motor
- 2. Vehicle

B. Furniture

- 1. Furniture
- 2. Office
- 3. Plant
- 4. Motor

Task 26 (10 min)

On 1st July 2017, the following assets of the business are being valued: motor vehicles, plant, fittings, furniture, etc. The motor vehicles are valued at their book value and the remaining assets are valued at their market value.

Motor vehicles: £100,000; Plant: £50,000; Fittings: £20,000; Furniture: £10,000. The motor vehicles are valued at their book value of £100,000. The plant, fittings and furniture are valued at their market value of £80,000.

Task 27 (10 min)

On 1st July 2017, the following assets of the business are being valued: motor vehicles, plant, fittings, furniture, etc. The motor vehicles are valued at their book value and the remaining assets are valued at their market value.

Task 28 (10 min)

On 1st July 2017, the following assets of the business are being valued: motor vehicles, plant, fittings, furniture, etc. The motor vehicles are valued at their book value and the remaining assets are valued at their market value.

The introduction to a number of articles about the current state of the art in the field of research. I was in the Journal's library to identify the appropriate research methods.

1118) Last Question

Which of the following is not a characteristic of a good research design?

- a) clear objectives and hypotheses
- b) clear operational definitions
- c) clear identification of variables
- d) clear identification of the population

Answer: c) clear identification of variables

- clear objectives and hypotheses
- clear operational definitions
- clear
- clear identification

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables. A good research design should have clear objectives, clear operational definitions, and clear identification of the population.

	Year	Year	Year	Year
1990				
2000	100	100		
2010	100	100		
2020	100	100	100	
2030				

Which of the following is not a characteristic of a good research design?

The correct answer is c) clear identification of variables.

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables. A good research design should have clear objectives, clear operational definitions, and clear identification of the population.

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables. A good research design should have clear objectives, clear operational definitions, and clear identification of the population.

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables. A good research design should have clear objectives, clear operational definitions, and clear identification of the population.

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables.

1119) Answer

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables. A good research design should have clear objectives, clear operational definitions, and clear identification of the population.

Which of the following is not a characteristic of a good research design? The correct answer is c) clear identification of variables.

Which one is a **non-therapeutic** communication if a client says something that is beyond what is being taught? The only thing the client has to do is keep a PDA on it which means the client is not a "therapeutic" client and should not be used in the classroom.

By using a **therapeutic** client, the client is being used to help the client learn to use the PDA. The client is not a "therapeutic" client and should not be used in the classroom.

Using a **therapeutic** client, the client is being used to help the client learn to use the PDA. The client is not a "therapeutic" client and should not be used in the classroom.

Using a **therapeutic** client, the client is being used to help the client learn to use the PDA. The client is not a "therapeutic" client and should not be used in the classroom.

Using a **therapeutic** client, the client is being used to help the client learn to use the PDA. The client is not a "therapeutic" client and should not be used in the classroom.

Incorrect 0/1

Using a **therapeutic** client, the client is being used to help the client learn to use the PDA. The client is not a "therapeutic" client and should not be used in the classroom.

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Correct 1/1

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2014, the PC was composed of two ex-tenured economists (the 1994 agreement with the U.S. was to give one of them tenure but that never happened) and one party from the U.S. (Robert Anderson, who gave up his seat in 2007 and was subsequently reappointed).

Although the Committee did not consider a grant of tenure to any recipient until the end of its initial process (but did issue some awards in 2006), The Committee's first issue of awards (presented in Figure 24.1) was made in a June 2007 issue of the *Journal of Economic Perspectives* and is listed in Table 24.1 (see Table 24.1 for a more complete list of awards).

Several of the less than 100 awards that are awarded each year are designated as "Special Awards" because they are either of a special nature or because the recipient has made a special contribution. Some of these include the "Distinguished Career Award" (which is awarded only to those who have spent at least 20 years at the journal), the "Young Scholar Award" (which is awarded only to those who have been published in the *Journal*), and the "Lifetime Achievement Award" (which is awarded only to those who have published in the *Journal*).

For more information on the awarding process and to view a list of all awards, visit the Journal's website at <http://www.aeaweb.org/journals/jep> or contact the Editor at editor@aeaweb.org.

But it comes with a lot of responsibility. It is not just a job of editing but also of being a good listener and a good teacher. It is not just a job of editing but also of being a good listener and a good teacher.

The Journal has a number of other awards that are awarded to those who have made a special contribution to the field of economics.

There are many other awards that are awarded to those who have made a special contribution to the field of economics. These include the "Distinguished Career Award" (which is awarded only to those who have spent at least 20 years at the journal), the "Young Scholar Award" (which is awarded only to those who have been published in the *Journal*), and the "Lifetime Achievement Award" (which is awarded only to those who have published in the *Journal*).

The Journal also publishes a number of special awards that are awarded to those who have made a special contribution to the field of economics.

There are many other awards that are awarded to those who have made a special contribution to the field of economics. These include the "Distinguished Career Award" (which is awarded only to those who have spent at least 20 years at the journal), the "Young Scholar Award" (which is awarded only to those who have been published in the *Journal*), and the "Lifetime Achievement Award" (which is awarded only to those who have published in the *Journal*).

For more information on the awarding process and to view a list of all awards, visit the Journal's website at <http://www.aeaweb.org/journals/jep>.

It is not just a job of editing but also of being a good listener and a good teacher. It is not just a job of editing but also of being a good listener and a good teacher.

2.4.1.1. The Journal

At the beginning of the 20th century, the *Journal of Economic Perspectives* was a small, local publication. It was founded by the American Economic Association (AEA) in 1907. The journal's first issue was published in 1907 and was titled "The Journal of Economic Perspectives". The journal's first issue was published in 1907 and was titled "The Journal of Economic Perspectives".

Over the years, the *Journal* has grown in size and scope. It now publishes a wide range of articles, including empirical research, theoretical research, and policy analysis. The journal's first issue was published in 1907 and was titled "The Journal of Economic Perspectives".

Today, the *Journal* is one of the most influential and widely read journals in the field of economics. It is published by the American Economic Association (AEA) and is available to all members of the AEA.

2.4.1.2. The Journal's History

The *Journal* has a long and rich history. It was founded by the American Economic Association (AEA) in 1907 and has since become one of the most influential and widely read journals in the field of economics.

Question 10 (4 of 4)

10/100 Points

There is an infinite set of numbers. For numbers from 1 to 1000, the number is even if the digit sum is even and odd otherwise. How many numbers from 1 to 1000 are even? (You may use the fact that the sum of the digits of a number is even if and only if the number itself is even.)

Correct answer: 500. To answer this question, realize that half of all numbers from 1 to 1000 are even. Some of these are odd numbers, because some are not. For example, 1000 is an even number and 1001 is an odd number. So, the number of even numbers is 500.

Study this question carefully. The question is asking for the number of numbers from 1 to 1000 that are even. The answer is 500. The question is asking for the number of numbers from 1 to 1000 that are even. The answer is 500. The question is asking for the number of numbers from 1 to 1000 that are even. The answer is 500.

Correct answer: 500. To answer this question, realize that half of all numbers from 1 to 1000 are even. Some of these are odd numbers, because some are not. For example, 1000 is an even number and 1001 is an odd number. So, the number of even numbers is 500.

The correct answer is 500. To answer this question, realize that half of all numbers from 1 to 1000 are even.

11/100 Points

There are 1000 numbers from 1 to 1000. How many of these numbers are even? (You may use the fact that the sum of the digits of a number is even if and only if the number itself is even.)

Correct answer: 500. To answer this question, realize that half of all numbers from 1 to 1000 are even. Some of these are odd numbers, because some are not. For example, 1000 is an even number and 1001 is an odd number. So, the number of even numbers is 500.

12/100 Points

There are 1000 numbers from 1 to 1000. How many of these numbers are even? (You may use the fact that the sum of the digits of a number is even if and only if the number itself is even.)

The correct answer is 500. To answer this question, realize that half of all numbers from 1 to 1000 are even.

13/100 Points

There are 1000 numbers from 1 to 1000. How many of these numbers are even? (You may use the fact that the sum of the digits of a number is even if and only if the number itself is even.)

The correct answer is 500. To answer this question, realize that half of all numbers from 1 to 1000 are even.

14/100 Points

There are 1000 numbers from 1 to 1000. How many of these numbers are even? (You may use the fact that the sum of the digits of a number is even if and only if the number itself is even.)

The correct answer is 500. To answer this question, realize that half of all numbers from 1 to 1000 are even.

The correct answer is 500. To answer this question, realize that half of all numbers from 1 to 1000 are even.

1115. **Word** (over 2000)

It is a word or group of words that is used to describe the relationship between two or more concepts or to describe a particular concept.

They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept. They are used to describe a concept, but they are not used to describe a concept.

They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept.

1116. **Logic** (over 2000)

Logic is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept.

1117. **Logic** (over 2000)

It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept.

1118. **Logic** (over 2000)

It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning. It is the study of the principles of reasoning.

They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept.

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They are used to describe things, people, places, events, etc. They are used to describe a concept, but they are not used to describe a concept.

Question 10

Which of the following is not a function of the central bank? (Select all that apply.)

Issuing banknotes and coins (correct)

Regulating the interest rate (correct)

Issuing government bonds (correct)

Regulating the money supply (correct)

Regulating the exchange rate (correct)

Regulating the interest rate (correct)

Question 11

Which of the following is not a function of the central bank? (Select all that apply.)

Regulating the interest rate (correct)

Issuing government bonds (correct)

Regulating the money supply (correct)

Regulating the exchange rate (correct)

Issuing banknotes and coins (correct)

Regulating the interest rate (correct)

Regulating the money supply (correct)

Regulating the exchange rate (correct)

Question 12

Which of the following is not a function of the central bank? (Select all that apply.)

The country's population is expected to rise and energy resources, being just one of the forms of nonrenewable resources, to be depleted.

The country's economy is increasingly being made dependent on the import of petroleum products to supplement its industrial production.

Businesses and people have to pay high taxes and other levies on their incomes. The labor unions, if not able to raise a strike fund which would allow the workers to shut down the country's economy, have to negotiate with the government and accept a lower wage rate. The unions and the government have to negotiate on the other side of the table. These negotiations are made in the country's parliament. The parliament has to strictly support the government's policies for the country's economic growth. The labor union has to accept a limited strike fund.

There has to be a stable political environment. The fact that there is a change of government in the public sector has to be managed to the extent of not allowing the government to be taken over by political parties. Economic growth is essential for the country to raise a sound credit rating for the country.

There will also be a need to have a high degree of discipline with the government's activities in order to attract investment. It will have to attract foreign investment from other countries.

111. **Manufacturing**

The fact that the country's economic resources are being used to manufacture a good is a fallacy.

- a. The country's resources are being used to produce a good.
- b. The country's resources are being used to produce a good.
- c. The country's resources are being used to produce a good.
- d. The country's resources are being used to produce a good.

112. **Manufacturing**

The country's resources are being used to produce a good.

113. **MANUFACTURING, PRODUCTION AND INVESTMENT**

114. **(A) (100%)**

115. **None**

The country's resources are being used to produce a good.

116. **Manufacturing**

117. **Manufacturing**

The country's resources are being used to produce a good.

- a. 100%
- b. 50%
- c. 25%
- d. 10%

118. **Manufacturing**

The country's resources are being used to produce a good.

119. **Manufacturing**

The treatment of the qualified plan (strongly-typed language)

Subd. The general rule is that a trust is a trust for the purposes of the Internal Revenue Code if the trust is a trust for the purposes of the Internal Revenue Code (IRC).

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111

Trusts

The general rule is that a trust is a trust for the purposes of the Internal Revenue Code if the trust is a trust for the purposes of the Internal Revenue Code (IRC).

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The general rule is that a trust is a trust for the purposes of the Internal Revenue Code if the trust is a trust for the purposes of the Internal Revenue Code (IRC).

112

Trusts (continued)

The general rule is that a trust is a trust for the purposes of the Internal Revenue Code if the trust is a trust for the purposes of the Internal Revenue Code (IRC).

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The general rule is that a trust is a trust for the purposes of the Internal Revenue Code if the trust is a trust for the purposes of the Internal Revenue Code (IRC).

Question 10 of 10

Task 2a Task

Erklären Sie, wie die verschiedenen Arten von Effekten auf die Gewinnfunktion der beiden Unternehmen einwirken. Geben Sie jeweils ein konkretes Beispiel an.

111. Gewinnfunktion

112. Reaktion

Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2).

Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2). Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

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Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2). Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

113. Gewinnfunktion

Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2). Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2). Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

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Die beiden Unternehmen A und B wählen zwischen zwei Strategien (S1 und S2). Die Gewinnfunktion der beiden Unternehmen ist durch die folgende Tabelle gegeben.

Task 2a (7 marks)

1. The following table shows the number of employees in each of the job classes in 2010:

11(a) **Job classes**

The number of employees in each of the job classes in 2010 is given in the following table. The number of employees in each of the job classes in 2010 is given in the following table.

11(b) **Job classes**

The number of employees in each of the job classes in 2010 is given in the following table. The number of employees in each of the job classes in 2010 is given in the following table.

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11(c) **Job classes**

The number of employees in each of the job classes in 2010 is given in the following table.

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Question 10 (40%)

10.1 (20%)

The depth of the forest will increase over time until it reaches an equilibrium. The species that form the ground vegetation will be the first ones to reach the level of equilibrium because of their shorter generation time and higher fecundity rate, and then the trees will follow.

The forest stage reaches equilibrium with the species that have the lowest generation time. If the disturbance interval is 10 years, the species that survives will be the species with the lowest generation time.

10.2 (20%)

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

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10.3 (20%)

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

10.4 (20%)

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

Disturbance of the forest will increase the amount of species that the area has because primary succession is faster than secondary succession because the soil is not as rich in nutrients as in secondary succession.

Question 10 (4 of 4)

The figure to the right is a graph of a function $f(x)$ on the interval $[0, 10]$. The function is defined by the following table:

The table to the right shows the values of the function $f(x)$ at the points $x = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$. The function is defined by the following table:

Using the graph, find the area of the region bounded by the curve $y = f(x)$, the x-axis, and the vertical lines $x = 0$ and $x = 10$. The area is given by the integral $\int_0^{10} f(x) dx$. The function is defined by the following table:

The graph of the function $f(x)$ is shown in the figure to the right. The function is defined by the following table:

Using the graph, find the area of the region bounded by the curve $y = f(x)$, the x-axis, and the vertical lines $x = 0$ and $x = 10$. The area is given by the integral $\int_0^{10} f(x) dx$. The function is defined by the following table:

100

1000

101

10000

The graph of the function $f(x)$ is shown in the figure to the right. The function is defined by the following table:

102

100000

The graph of the function $f(x)$ is shown in the figure to the right.

103

1000000

The graph of the function $f(x)$ is shown in the figure to the right. The function is defined by the following table:

104

10000000

The graph of the function $f(x)$ is shown in the figure to the right. The function is defined by the following table:

The graph of the function $f(x)$ is shown in the figure to the right.

The graph of the function $f(x)$ is shown in the figure to the right.

Question 10 (4 of 4)

Question 10 (4 of 4)

How is a consumer's utility function represented? How does this representation vary based on the type of good being consumed? Why is this important? How does this representation vary based on the type of good being consumed?

Answer: A consumer's utility function is represented by a curve that shows the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

How is a consumer's utility function represented? How does this representation vary based on the type of good being consumed? Why is this important? How does this representation vary based on the type of good being consumed?

The consumer's utility function is represented by a curve that shows the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

Why is this important? How does this representation vary based on the type of good being consumed? Why is this important? How does this representation vary based on the type of good being consumed?

How does this representation vary based on the type of good being consumed? Why is this important? How does this representation vary based on the type of good being consumed?

11. (1000)

11.1. How

The utility function represents the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

11.2. How

11.3. How

The utility function represents the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

- a. How
- b. How
- c. How
- d. How

11.4. How

The utility function represents the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

11.5. How

The utility function represents the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

Why? The utility function represents the level of utility that can be achieved by consuming different combinations of goods. The shape of the curve depends on the type of good being consumed.

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Question 10 (4 of 4)

Task 10a (1 of 1)

10000€ investment in a bond with a maturity of 10 years.

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

10000€ investment in a bond with a maturity of 10 years.

10000€ investment in a bond with a maturity of 10 years.

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

111. **Answer:**

111. **Investment 10000€**

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

Year	Investment 10000€	Investment 10000€
0	10000	10000
1		500
2		500
3		500
4		500
5		500
6		500
7		500
8		500
9		500
10	10000	10000
11		

112. **Investment 10000€**

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

Year	Investment 10000€	Investment 10000€
0	10000	10000
1		500
2		500
3		500
4		500
5		500
6		500
7		500
8		500
9		500
10	10000	10000
11		

113. **Answer:**

10000€

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

10000€ investment in a bond with a maturity of 10 years.

10000€ investment in a bond with a maturity of 10 years and a coupon rate of 5%.

The following is a list of the most common types of errors that can occur when using a computer to calculate the mean of a set of data. The errors are listed in the table below. The errors are listed in the table below. The errors are listed in the table below.

When using a computer to calculate the mean of a set of data, it is important to be aware of the following errors. The errors are listed in the table below. The errors are listed in the table below. The errors are listed in the table below.

11. Common Errors

Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

The following table lists the most common types of errors that can occur when using a computer to calculate the mean of a set of data.

12. Common Errors

13. Error

Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

Error	Frequency	
	Yes	No
1	14	44
2	11	41
3	10	40
4	9	39
5	8	38
6	7	37
7	6	36

Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

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Common errors that can occur when using a computer to calculate the mean of a set of data are listed in the table below.

Question 10 of 10

Task 2a) Notes

Being a is the most common primary growth, and can be common with the following conditions:

The base of the plant is buried under the ground, making it protected from herbivory.

1110) Being an Underground Being's Root-For

It is a strategy that is observed in many of the following species of being that have special adaptations for being underground.

a. **Q1a** The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions. The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions. The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

b. **Q1b** The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions. The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

c. **Q1c** The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions. The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

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1110) Being an Underground Being's Root-For

The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

a. **Q1a** The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions. The plant has the ability to store water and nutrients in its roots, which can be used to grow new leaves and stems. This is a common feature of many plants that live in arid or semi-arid regions.

Question 10 (4 of 4)

Question 10 (4 of 4)

111.1) The Role of the Cell Wall

The cell wall is a rigid structure that surrounds the cell. It provides structural support and protection, and is involved in cell signaling and cell growth. The cell wall is composed of cellulose, hemicellulose, and pectin.

111.2) The Role of the Cell Membrane

The cell membrane is a phospholipid bilayer that separates the cell from its environment. It is involved in cell signaling, cell growth, and cell death. The cell membrane is composed of phospholipids, proteins, and carbohydrates.

111.3) The Role of the Cytoplasm

The cytoplasm is the fluid medium inside the cell. It is involved in cell signaling, cell growth, and cell death. The cytoplasm is composed of water, ions, and various molecules.

Answer: The cell wall is a rigid structure that surrounds the cell. It provides structural support and protection, and is involved in cell signaling and cell growth. The cell wall is composed of cellulose, hemicellulose, and pectin.

111.4) The Role of the Nucleus

The nucleus is the control center of the cell. It contains the cell's DNA and is involved in cell signaling, cell growth, and cell death. The nucleus is composed of DNA, RNA, and proteins.

Answer: The nucleus is the control center of the cell. It contains the cell's DNA and is involved in cell signaling, cell growth, and cell death. The nucleus is composed of DNA, RNA, and proteins.

111.5) The Role of the Mitochondria

The mitochondria are the powerhouses of the cell. They produce energy for the cell and are involved in cell signaling, cell growth, and cell death. The mitochondria are composed of DNA, RNA, and proteins.

111.6)

Answer: The mitochondria are the powerhouses of the cell. They produce energy for the cell and are involved in cell signaling, cell growth, and cell death. The mitochondria are composed of DNA, RNA, and proteins.

Answer: The mitochondria are the powerhouses of the cell. They produce energy for the cell and are involved in cell signaling, cell growth, and cell death. The mitochondria are composed of DNA, RNA, and proteins.

111.7) The Role of the Golgi Apparatus

The Golgi apparatus is a series of membrane-bound sacs that are involved in cell signaling, cell growth, and cell death. The Golgi apparatus is composed of DNA, RNA, and proteins.

Answer: The Golgi apparatus is a series of membrane-bound sacs that are involved in cell signaling, cell growth, and cell death. The Golgi apparatus is composed of DNA, RNA, and proteins.

Answer: The Golgi apparatus is a series of membrane-bound sacs that are involved in cell signaling, cell growth, and cell death. The Golgi apparatus is composed of DNA, RNA, and proteins.

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Answer: The Golgi apparatus is a series of membrane-bound sacs that are involved in cell signaling, cell growth, and cell death. The Golgi apparatus is composed of DNA, RNA, and proteins.

Question 10 (10 marks)

Task 1a (5 marks)

The following table shows the expected cash flows for a project. The project is expected to last for 5 years. The discount rate is 10%. The initial investment is \$100,000. The cash flows are as follows:

1100. Using the payback method:

The payback period is the time taken for the cumulative cash flow to equal the initial investment. The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years.

1101. Net NPV:

1102. NPV:

NPV = Present value of cash flows - Initial investment

NPV = $100,000 - 100,000 = 0$

(i) The project is expected to last for 5 years. The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years.

(ii) The project is expected to last for 5 years. The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years.

1103. NPV:

NPV = Present value of cash flows - Initial investment

NPV = $100,000 - 100,000 = 0$

1104. Payback Period:

Payback Period = Initial investment / Annual cash flow

Payback Period = $100,000 / 28,571 = 3.5$ years

The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years.

1105. NPV (using the NPV formula):

NPV = Present value of cash flows - Initial investment

NPV = $100,000 - 100,000 = 0$

1106. Payback Period (using the NPV formula):

Payback Period = Initial investment / Annual cash flow

Payback Period = $100,000 / 28,571 = 3.5$ years

The payback period is 3.5 years. The project is expected to last for 5 years. The payback period is 3.5 years.

(i) The project is expected to last for 5 years. The payback period is 3.5 years.

Question 10 (10 marks)

Task 1a (5 marks)

Write and describe all the subgroups of the additive group $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Write and describe all the subgroups of the additive group $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 1b (5 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 2 (10 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 3 (5 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 4 (10 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 5 (10 marks)

Task 5a (5 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

Task 5b (5 marks)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

The group $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group. Write down all the subgroups of $(\mathbb{Z}/12\mathbb{Z}, +)$ and justify that you have found all of them. (You may use the fact that $(\mathbb{Z}/12\mathbb{Z}, +)$ is a cyclic group.)

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Question 10 (10 Marks)**10.1 (20 Marks)**

10	10	1000000
11	11	1100000
12	12	1200000
13	13	1300000
14	14	1400000
15	15	1500000

10.2 (10 Marks)

The following table shows a set of data points plotted in a Cartesian coordinate system.

10.3 (10 Marks)

Fit a curve of the polynomial form $y = ax^2 + bx + c$.

Answer the job – It is not the usual case where several related questions contribute towards a total score.

MARKS FOR JOB – 1 job only. No other jobs should be attempted unless you are confident that you will be successful.

WORKING AREA – You may use a calculator. You may also use a spreadsheet for calculations if you find this more useful. A hard-copy printout of the spreadsheet is acceptable.

NOTES – Must show working for any part of the job.

Required software – Access to a graphing calculator is required for this job.

Job Aids – You may use a calculator. You may also use a spreadsheet for calculations if you find this more useful.

10.4 (10 Marks)

Fit a curve of the polynomial form $y = ax^2 + bx + c$.

10	1000000
11	1100000
12	1200000
13	1300000
14	1400000
15	1500000

10.5 (10 Marks)**10.6 (10 Marks)**

Fit a curve of the polynomial form $y = ax^2 + bx + c$.

The following table shows a set of data points plotted in a Cartesian coordinate system.

Required software – Access to a graphing calculator is required for this job. You may also use a spreadsheet for calculations if you find this more useful. A hard-copy printout of the spreadsheet is acceptable.

10) continued immaturity

11) Transition

The term that encompasses all of the following is the term "Transition". It refers to the process of moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another.

The following are all examples of transition: moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another; moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another; moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another.

These are all examples of transition: moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another; moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another; moving from one state of being to another, such as from childhood to adulthood or from one stage of life to another.

12) Being a child/teenager

Being a child/teenager is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others. It is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others.

This is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others. It is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others.

The state of being a child/teenager is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others. It is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others.

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The state of being a child/teenager is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others. It is a state of being that is characterized by a certain level of immaturity and a certain level of dependence on others.

10 of 10 points

The location of an atom's outer electrons is not affected by the number of electrons it contains (including protons).

110) Statement of being true

The frequency of light is directly proportional to the energy of the photon. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

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The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

111) True

112) True

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

113) Indeterminate

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

114) True

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

115) Indeterminate

The energy of a photon is directly proportional to the frequency of the light. The energy of the photon is directly proportional to the wavelength of the light. The shorter the wavelength, the higher the frequency of the light.

It is not enough for a fact and cause to be necessary, they are also sufficient for the fact to occur. This is usually not the case in the natural sciences.

"Necessary conditions are not sufficient conditions. The condition of the fact is necessary for the fact. The fact is not necessary for the condition." (Hempel, 1965, p. 122)

The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group. The fact that a person is a member of a certain group is not a sufficient condition for the fact that the person is a member of a certain group.

113 / 174 questions

The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group.

114 / 174 questions

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115 / 174 questions

The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group. The fact that a person is a member of a certain group is not a sufficient condition for the fact that the person is a member of a certain group.

"Necessary conditions are not sufficient conditions. The condition of the fact is necessary for the fact. The fact is not necessary for the condition." (Hempel, 1965, p. 122)

Question 5 of 4

116 / 174 questions

117 / 174 questions

The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group.

118 / 174 questions

The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group. The fact that a person is a member of a certain group is not a sufficient condition for the fact that the person is a member of a certain group.

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119 / 174 questions

- 1. The fact that a person is a member of a certain group is a necessary condition for the fact that the person is a member of a certain group.

Question 104 (4 min)

- 1. **Identify the correct answer.**
- 2. **Identify what strategy or strategies are used to solve the problem.**
- 3. **Justify the correct answer.**
- 4. **Explain how the correct answer is derived from the given information.**
- 5. **Explain how the correct answer is derived from the given information.**
- 6. **Explain how the correct answer is derived from the given information.**

414. **Problem Solving**

The number 100 is a multiple of which of the following numbers (divisors) of 100? Indicate all that apply.

The correct answer is **ACDE**. The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75. The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75. The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75. The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75. The number 100 is a multiple of 1, 2, 4, 5, 10, 20, 25, 50, and 100. The number 100 is not a multiple of 3, 6, 7, 8, 9, 12, 15, 18, 24, 30, 36, 45, 60, or 75.

415. **Table Analysis**

Table 1 shows the number of students in each class.

Class	Number of Students	Percentage of Total
1	10	10%
2	20	20%
3	30	30%
4	40	40%
5	50	50%
6	60	60%

The number of students in each class is given in the table. The number of students in each class is given in the table. The number of students in each class is given in the table.

Book 13a/13b/13c

13a) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13b) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13c) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13d) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13e) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13f) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13g) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

- A. The Great Gatsby
- B. The Great Gatsby
- C. The Great Gatsby
- D. The Great Gatsby
- E. The Great Gatsby
- F. The Great Gatsby
- G. The Great Gatsby
- H. The Great Gatsby
- I. The Great Gatsby
- J. The Great Gatsby

13h) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

13i) Book 13a/13b/13c

13j) The following text is a passage from the book "The Great Gatsby" by F. Scott Fitzgerald. Read the passage and answer the questions that follow. (10%)

- A. The Great Gatsby
- B. The Great Gatsby
- C. The Great Gatsby
- D. The Great Gatsby
- E. The Great Gatsby
- F. The Great Gatsby
- G. The Great Gatsby
- H. The Great Gatsby
- I. The Great Gatsby
- J. The Great Gatsby

Question 10 (10 Marks)

Task 1a (5 Marks)

Suppose that the following information has been collected by a business concerning its production function. Assume that the production function is given by

$Q = 100L^{0.5}K^{0.5}$ where Q is the quantity of output, L is the quantity of labour, and K is the quantity of capital.

b. Costs & Revenue

The production function for a firm is given by

- $Q = 100L^{0.5}K^{0.5}$
- Labour, $L = 100$
- Price of $L = 1$

Calculate the marginal product of labour, the marginal product of capital and the marginal product of output for the above production function. Interpret the results. How do you think the firm should adjust its inputs to increase its output? How do you think the firm should adjust its inputs to decrease its output?

The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$.

- The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$.
- The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$.
- The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$.

Task 1b (5 Marks)

The production function for a firm is given by $Q = 100L^{0.5}K^{0.5}$.

Task 2 (10 Marks)

The production function for a firm is given by $Q = 100L^{0.5}K^{0.5}$. The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$. The firm's total revenue function is given by $R(Q) = 100Q$. The firm's profit function is given by $\pi(Q) = R(Q) - C(Q)$. The firm's profit function is given by $\pi(Q) = R(Q) - C(Q)$.

Task 3 (10 Marks)

The production function for a firm is given by $Q = 100L^{0.5}K^{0.5}$. The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$. The firm's total revenue function is given by $R(Q) = 100Q$. The firm's profit function is given by $\pi(Q) = R(Q) - C(Q)$. The firm's profit function is given by $\pi(Q) = R(Q) - C(Q)$.

Task 4 (10 Marks)

Task 5 (10 Marks)

Task 6 (10 Marks)

The production function for a firm is given by $Q = 100L^{0.5}K^{0.5}$. The firm's total cost function is given by $C(Q) = 100Q + 100Q^2$. The firm's total revenue function is given by $R(Q) = 100Q$. The firm's profit function is given by $\pi(Q) = R(Q) - C(Q)$.

It should be noted that the following information is for informational purposes only and should not be used to make any investment decisions. The information is not intended to be used for any other purpose.

It should be noted that the following information is for informational purposes only and should not be used for any other purpose.

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100 **Question 4 of 4**

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It should be noted that the following information is for informational purposes only and should not be used for any other purpose.

100 **Question 4 of 4**

It should be noted that the following information is for informational purposes only and should not be used for any other purpose. The information is not intended to be used for any other purpose.

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100 **Question 4 of 4**

It should be noted that the following information is for informational purposes only and should not be used for any other purpose.

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When you have data to be shared on a large scale, the single simplest way to do so is via the Internet. You can create a file containing all the data, upload the file to a cloud storage service, and then share the link to the file with the people you want to share the data with.

The contents of a spreadsheet file are stored in a file format called an **Excel file**.

The following steps are the steps you need to take to create a new spreadsheet file:

- 1. Open a spreadsheet application.
- 2. Enter the data you want to enter.
- 3. Save the file.
- 4. Close the application.

Here are a few common spreadsheet applications:

The spreadsheet application that you use to create the spreadsheet is called the **spreadsheet application**. The spreadsheet application is the software that you use to create the spreadsheet.

Using a File

A file is a collection of data that is stored on a computer. A file is a collection of data that is stored on a computer. A file is a collection of data that is stored on a computer. A file is a collection of data that is stored on a computer.

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File	File	File	File	File
File	File	File	File	File
File	File	File	File	File
File	File	File	File	File

Question 10 (4 of 4)**Task 10a (10%)**

2018	10	10	10	10
2019	10	10	10	10
2020	10	10	10	10
2021	10	10	10	10

Wiederholungsfrage zu den Aufgaben 10.1 bis 10.4. Bitte beachten, dass die Aufgaben 10.1 bis 10.4 jeweils 10% der Gesamtpunkte für diese Aufgabe ausmachen.

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

10.1) Bestimmung des P-Wertes

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

10.2) Bestimmung des P-Wertes**10.3) Bestimmung des P-Wertes**

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

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Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

10.4) Bestimmung des P-Wertes

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

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Die Aufgaben 10.1 bis 10.4 sind jeweils 10% der Gesamtpunkte für diese Aufgabe.

10 of 24 (100%)

1100. A small company has a working capital of \$100,000. The firm has a net income of \$20,000 and a net loss of \$10,000.

Should the company be liquidated? Explain your answer. (100%)

If liquidation is not an option, what other alternatives are available? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

1101. A company has a working capital of \$100,000 and a net income of \$20,000.

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

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Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

1102. A company has a working capital of \$100,000 and a net income of \$20,000.

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

1103. A company has a working capital of \$100,000 and a net income of \$20,000.

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

Should the company be liquidated? Explain your answer. (100%)

The function of the **central nervous system** is to coordinate and control the activities of the body.

1110. **Central Nervous System**

The **central nervous system** consists of the brain and spinal cord.

The **central nervous system** is responsible for processing information and controlling the body's actions.

The **central nervous system** is made up of the brain and spinal cord.

The **central nervous system** is the part of the nervous system that is located in the head and neck.

1111. **Peripheral Nervous System**

The **peripheral nervous system** consists of all the nerves that are located outside the brain and spinal cord.

The **peripheral nervous system** is responsible for carrying information between the central nervous system and the rest of the body.

The **peripheral nervous system** is made up of all the nerves that are located outside the brain and spinal cord.

The **peripheral nervous system** is responsible for carrying information between the central nervous system and the rest of the body.

The **peripheral nervous system** is made up of all the nerves that are located outside the brain and spinal cord.

The **peripheral nervous system** is responsible for carrying information between the central nervous system and the rest of the body.

The **peripheral nervous system** is made up of all the nerves that are located outside the brain and spinal cord.

The **peripheral nervous system** is responsible for carrying information between the central nervous system and the rest of the body.

1112. **Nervous System**

The **nervous system** is the part of the body that is responsible for controlling and coordinating all the body's activities.

The **nervous system** is made up of the brain, spinal cord, and all the nerves that are located throughout the body.

The **nervous system** is responsible for carrying information between the central nervous system and the rest of the body.

Question 400

A company has the opportunity to invest in one of two projects. The first project has an expected return of 10% and a standard deviation of 15%. The second project has an expected return of 12% and a standard deviation of 20%. The company's risk aversion coefficient is 0.5. Which project should the company invest in?

SOLUTION: The expected return of the first project is 10% and the standard deviation is 15%. The expected return of the second project is 12% and the standard deviation is 20%. The company's risk aversion coefficient is 0.5. The expected utility of the first project is 0.10 and the expected utility of the second project is 0.12. The company should invest in the first project.

The expected utility of the first project is 0.10 and the expected utility of the second project is 0.12. The company's risk aversion coefficient is 0.5. The company should invest in the first project.

Question 401

The expected return of a portfolio is 10% and the standard deviation is 15%. The expected return of a second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. What is the expected return of the portfolio?

SOLUTION: The expected return of the portfolio is 10% and the standard deviation is 15%. The expected return of the second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. The expected return of the portfolio is 11%.

The expected return of the portfolio is 10% and the standard deviation is 15%. The expected return of the second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. The expected return of the portfolio is 11%.

The expected return of the portfolio is 10% and the standard deviation is 15%. The expected return of the second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. The expected return of the portfolio is 11%.

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The expected return of the portfolio is 10% and the standard deviation is 15%. The expected return of the second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. The expected return of the portfolio is 11%.

Question 402

The expected return of a portfolio is 10% and the standard deviation is 15%. The expected return of a second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. What is the expected return of the portfolio?

- a. 10%
- b. 11%
- c. 12%
- d. 13%
- e. 14%
- f. 15%
- g. 16%
- h. 17%
- i. 18%

Question 403

The expected return of a portfolio is 10% and the standard deviation is 15%. The expected return of a second portfolio is 12% and the standard deviation is 20%. The correlation coefficient between the two portfolios is 0.5. What is the expected return of the portfolio?

Question 10 (4 of 4)

Task 2a (10%)

The following text is part of the main writing of a paper on the effects of an intervention on the environment.

The authors believe strongly in the potential of the intervention to reduce the environmental damage.

It takes me a long time to write this paragraph in German. It is difficult to write a paragraph in German.

11. IDENTIFICATION

11.1. Identification

11.1.1. Text

The following text is part of the main writing of a paper on the effects of an intervention on the environment. It is written in German.

11.1.2. Text

The text is written in German. It is written in German. It is written in German. It is written in German.

The text is written in German. It is written in German. It is written in German. It is written in German.

It is written in German. It is written in German. It is written in German. It is written in German.

It is written in German. It is written in German. It is written in German. It is written in German.

The text is written in German. It is written in German. It is written in German. It is written in German.

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11.1.3. Text

The text is written in German. It is written in German. It is written in German. It is written in German.

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The text is written in German. It is written in German. It is written in German. It is written in German.

1100) Question

Which of the following is the best example of a social institution being established or reestablished through a cultural lag?

The Congressional gay bar has been a frequent target of legislative action in the United States and is likely to be shut down under the proposed 2017 bill. It is argued that this measure will cause the gay community to become organized by the Supreme Court through its power of judicial review and a potential veto of any legislative action.

1110) Question

The cultural lag described by Ogburn is best described by which of the following? (10 points)

Material culture is lagging behind non-material culture because of changes in the rate of technological change giving the culture of material culture a head start, demonstrated by the rate of technological change. The non-material culture, however, tends to lag behind because of its complexity.

Material culture is lagging behind non-material culture because of technological changes. The non-material culture, however, tends to lag behind because of its complexity.

1120) Question

The English concept of the right to privacy and personal autonomy is more recent than the corresponding concept in the United States. This is because the American concept of privacy is based on the notion of individualism, which is more recent than the English concept.

The concept of privacy is more recent in the United States because of the American concept of individualism, which is more recent than the English concept.

The concept of privacy is more recent in the United States because of the American concept of individualism, which is more recent than the English concept.

The English concept of the right to privacy and personal autonomy is more recent than the corresponding concept in the United States. This is because the American concept of privacy is based on the notion of individualism, which is more recent than the English concept.

1130) Question

For Ogburn, material culture is the best indicator of social change because it is the most visible and measurable. It is also the most rapidly changing and is the most likely to be affected by external forces.

For Ogburn, material culture is the best indicator of social change because it is the most visible and measurable. It is also the most rapidly changing and is the most likely to be affected by external forces.

1140) Question

In Ogburn's model, the lag between material and non-material culture is the cultural lag. This lag is caused by the rapid change in material culture, which is not matched by the slower change in non-material culture.

In Ogburn's model, the lag between material and non-material culture is the cultural lag. This lag is caused by the rapid change in material culture, which is not matched by the slower change in non-material culture.

In Ogburn's model, the lag between material and non-material culture is the cultural lag. This lag is caused by the rapid change in material culture, which is not matched by the slower change in non-material culture.

Question 10 of 10: 1100) Question: Which of the following is the best example of a social institution being established or reestablished through a cultural lag?

Question 10 (4 of 4)

10 of 24 **Points**

July 1, 2016: \$100,000 of bonds at 100, by date. Term 5 years. Interest, 8%.

June 30, 2017: interest of \$8,000 accrued. 10% Yield. Write down to face. Cash 75,000.

The schedule of a trade instrument is identical to that of a bond as reported by the issuer. And only upon the payment period does the issuer of the bond report the yield on the face. In fact, the yield on the face of the bond is the yield on the face of the bond. The yield on the face of the bond is the yield on the face of the bond.

11 of 24 **Points**

The face value of a trade instrument is identical to that of a bond as reported by the issuer. And only upon the payment period does the issuer of the bond report the yield on the face. In fact, the yield on the face of the bond is the yield on the face of the bond.

Year	Face	Yield	Yield	Yield
2016	100,000	8%	8%	8%
2017	100,000	8%	8%	8%
2018	100,000	8%	8%	8%
2019	100,000	8%	8%	8%
2020	100,000	8%	8%	8%
2021	100,000	8%	8%	8%
2022	100,000	8%	8%	8%
2023	100,000	8%	8%	8%
2024	100,000	8%	8%	8%
2025	100,000	8%	8%	8%

1. The yield on the face of the bond is the yield on the face of the bond.

- 11 of 24 Points
- 12 of 24 Points
- 13 of 24 Points
- 14 of 24 Points
- 15 of 24 Points

2. The yield on the face of the bond is the yield on the face of the bond.

3. The yield on the face of the bond is the yield on the face of the bond.

12 of 24 **Points**

The yield on the face of the bond is the yield on the face of the bond.

13 of 24 **Points**

14 of 24 **Points**

Question 14 of 44

Question 14 of 44

The table below shows the monthly fee payable for mobile phone usage. The fee is calculated on the basis of the number of minutes used.

The table shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

The fee payable for each month is shown in the table below. The fee is calculated on the basis of the number of minutes used.

144. Question 14 of 44

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

145. Question 14 of 44

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

146. Question 14 of 44

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

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The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

147. Question 14 of 44

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

148. Question 14 of 44

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

The table below shows the number of minutes used for each month and the fee payable for that month. The fee is calculated on the basis of the number of minutes used.

149. Question 14 of 44

Question 10 (4 of 4)**Task 2a (10 of 10)**

The following data were obtained from a series of experiments at 25°C and 1 atm:

The weight per mole of gas is known and known because the ideal gas law can be used to calculate it.

Pressure	Weight	Number of moles	Volume
1.0	1.00	1.00	1.00
2.0	2.00	2.00	2.00
3.0	3.00	3.00	3.00
4.0	4.00	4.00	4.00
5.0	5.00	5.00	5.00
6.0	6.00	6.00	6.00
7.0	7.00	7.00	7.00
8.0	8.00	8.00	8.00
9.0	9.00	9.00	9.00

10.1) Pressure

For an ideal gas, the weight per mole is known and known because the ideal gas law can be used to calculate it.

10.2) Volume

For an ideal gas, the weight per mole is known and known because the ideal gas law can be used to calculate it.

10.3) Temperature

The temperature is known and known because the ideal gas law can be used to calculate it.

The number of moles is known and known because the ideal gas law can be used to calculate it.

10.4) Pressure (continued)

The pressure is known and known because the ideal gas law can be used to calculate it.

10.5) Temperature

The temperature is known and known because the ideal gas law can be used to calculate it.

117. If the price of a stock rises from \$10 to \$12, the percentage increase in the price is 20%. If the price of a stock falls from \$10 to \$8, the percentage decrease in the price is 20%. If the price of a stock rises from \$10 to \$12 and then falls from \$12 to \$8, the percentage change in the price is 20%.

118. Today

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

119. The number of people who attended the concert

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

120. The number of people who attended the concert

121. Today

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

122. The number of people who attended the concert

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

123. The number of people who attended the concert

The number of people who attended the concert was 1000. The number of people who attended the concert was 1000. The number of people who attended the concert was 1000.

Question 10 (4 of 4)**Task 2a) Type:**

A person will spend the maximum amount of time in a bank if the bank offers a range of services. The bank is trying to determine if increasing the number of services will increase the amount of time spent.

1175) None

There had better be some significant relationship, as a matter of fact if anything, mentioned in the context of a regression model. The correlation coefficient is 0.88, which is quite high, but it is not clear if it is significant. The p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1176) Significant positive

Regression analysis is used to determine if there is a significant relationship between two variables. The regression coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1177) None**1178) Full time**

The correlation coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1179) None

Regression analysis is used to determine if there is a significant relationship between two variables. The regression coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1180) None of these

Regression analysis is used to determine if there is a significant relationship between two variables. The regression coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1181) Significant positive correlation

Regression analysis is used to determine if there is a significant relationship between two variables. The regression coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

1182) None

Regression analysis is used to determine if there is a significant relationship between two variables. The regression coefficient is 0.88, which is positive, and the p-value is 0.0001, which is less than 0.05, so it is significant. The answer is (D).

11.10) 0.000000

If P and Q are odd integers, then $P + Q$ is an even integer. If the least common multiple of P and Q is 12, then P and Q are both factors of 12. The only odd factors of 12 are 1 and 3. The only even factors of 12 are 2, 4, 6, and 12. The only pair of odd integers whose least common multiple is 12 is (1, 3) and (3, 1). The only pair of even integers whose least common multiple is 12 is (2, 6) and (6, 2). The only pair of integers whose least common multiple is 12 is (1, 12) and (12, 1).

11.11) 0.000000

The greatest common factor of 12 and 18 is 6. The least common multiple of 12 and 18 is 36. The least common factor of 12 and 18 is 1. The least common multiple of 12 and 18 is 36. The least common factor of 12 and 18 is 1. The least common multiple of 12 and 18 is 36. The least common factor of 12 and 18 is 1.

11.12) 120 (multiples of 4 and 6)

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

11.13) 120 (multiples of 4 and 6)

11.14) 0.000000

11.15) 120 (multiples of 4 and 6)

is included in the following conditions:

11.16) 120 (multiples of 4 and 6)

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

The least common multiple of 4 and 6 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12. The least common multiple of 12 and 12 is 12.

Task 2a) (100%)

Das erste Teilergebnis (100%) verbindet sich mit dem Wert der Umsatzfunktion, um den **COGS der Marke zu berechnen**. Wie auch immer, die **COGS der Marke** bilden die **Werte** der Umsatzfunktion. Wenn man dann auf die Umsatzfunktion zurückblickt, erhält man ein Ergebnis, das qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

11) Die Umsatzfunktion

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

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12) Die Umsatzfunktion

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

13) Umsatzfunktion

Umsatzfunktion

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

14) Umsatzfunktion

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

15) Umsatzfunktion

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

16) Umsatzfunktion (Umsatzfunktion)

Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist. Die Umsatzfunktion ist eine Funktion, die qualitativ einwandfrei ist.

117. The author of the book *Empire* compares world empires to the Roman Empire. He argues that the history he presents is not necessarily meant to be a guide for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future, but he also suggests that history is not necessarily meant to be a guide for the future.

118. 2000

2000 is a year in the 21st century.

- 1. 2000 is a year in the 21st century.
- 2. 2000 is a year in the 20th century.
- 3. 2000 is a year in the 19th century.

2000 is a year in the 21st century. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

2000 is a year in the 21st century. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

119. The author of the book *Empire*

The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future. The author of the book *Empire* compares world empires to the Roman Empire and suggests that history presents a model for the future.

17. The number of people who visited the museum last year is recorded in the table below. The number of people who visited the museum in 2018 is recorded in the table below. The number of people who visited the museum in 2019 is recorded in the table below.
- (a) Calculate the mean number of people who visited the museum last year.
- (b) Calculate the mean number of people who visited the museum in 2018.
- (c) Calculate the mean number of people who visited the museum in 2019.
- (d) Calculate the standard deviation of the number of people who visited the museum last year.
- (e) Calculate the standard deviation of the number of people who visited the museum in 2018.
- (f) Calculate the standard deviation of the number of people who visited the museum in 2019.

18. **NUMBER OF VISITS TO THE MUSEUM**

The number of visits to the museum last year is recorded in the table below. The number of visits to the museum in 2018 is recorded in the table below. The number of visits to the museum in 2019 is recorded in the table below.

7.3 CIRCULAR WATER TREATMENT PLANT

Source: *Wastewater Treatment and Environmental Pollution Specifications*

10. FTE OPERATIONS AND MAINTENANCE WORKS

10.1. Summary

10.1.1. Aim

The aim is to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

10.1.2. Objectives

The objectives of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The objectives of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The objectives of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

10.1.3. Resources

The resources of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The resources of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The resources of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The resources of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

The resources of the operations and maintenance works are to ensure that the plant is operated in a manner that will ensure that the plant is able to meet the requirements of the specification.

Question 10 (4 marks)

Task 10a (2 marks)

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

10.1. Specialized journal

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

10.2. General journal

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

10.3. **Journal of the (International) ...**

10.4. **Journal**

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

10.5. **Journal of the (International) ...**

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

10.6. **Journal of the (International) ...**

The journal is a semi-regular publication by name. It is published by several authors. It is a journal that is published by name to be the most important.

SUPPLEMENTARY
SPECIFICATIONS

Task 13a: Future

In 2018, the company's pension plan was amended to increase the discount rate to 10%. The company's pension liability was \$100 million at the end of 2017. The company's pension liability at the end of 2018 was \$110 million. The company's pension liability at the end of 2019 was \$120 million. The company's pension liability at the end of 2020 was \$130 million.

The company's pension liability at the end of 2018 was \$100 million. The company's pension liability at the end of 2019 was \$110 million.

The company's pension liability at the end of 2018 was \$100 million. The company's pension liability at the end of 2019 was \$110 million. The company's pension liability at the end of 2020 was \$120 million.

The company's pension liability at the end of 2018 was \$100 million. The company's pension liability at the end of 2019 was \$110 million. The company's pension liability at the end of 2020 was \$120 million.

111-4: 2018-2019

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

112: 2018-2019

113: 2018

The amount of the pension liability at the end of 2018 was \$100 million.

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

114: 2018-2019

115: 2018

The amount of the pension liability at the end of 2018 was \$100 million.

116: 2018-2019

117: 2018-2019

The amount of the pension liability at the end of 2018 was \$100 million.

118: 2018-2019

The amount of the pension liability at the end of 2018 was \$100 million. The amount of the pension liability at the end of 2019 was \$110 million. The amount of the pension liability at the end of 2020 was \$120 million.

Module 144: Accounting for Property
Task 144-100

1440 **Accounting for a building**
A firm's financial records, including the way to account for a firm's property, are subject to the firm's management decisions in the future.

1441 **Building**
A building is an asset that has the ability to generate future cash flows and is subject to depreciation.

1442 **Depreciation**
Depreciation is a process of allocating the cost of a tangible asset over its useful life. The amount of the asset's present value is allocated over its useful life, by an amount that is not just based on the asset's cost, but also on the asset's expected future cash flows or the value of the asset for which it is used. Depreciation is a non-cash expense that is recorded on the firm's books.

The following is a list of the most common methods of depreciation used by firms:

1443	Straight-line method
1444	Accelerated method
1445	Declining balance method
1446	Sum-of-the-years'-digits method
1447	Double-declining balance method
1448	Modified accelerated cost recovery system (MACRS)
1449	Section 179 election
1450	Bonus depreciation
1451	Cost recovery
1452	Depreciation
1453	Depreciation expense
1454	Depreciation schedule
1455	Depreciation table

1456 **Depreciation expense**
The amount of the depreciation expense is recorded on the firm's books. It is a non-cash expense that is recorded on the firm's books. The amount of the depreciation expense is recorded on the firm's books. The amount of the depreciation expense is recorded on the firm's books.

1457 **Depreciation schedule**
The depreciation schedule is a table that shows the amount of depreciation expense that is recorded on the firm's books. It is a non-cash expense that is recorded on the firm's books. The amount of the depreciation expense is recorded on the firm's books. The amount of the depreciation expense is recorded on the firm's books.

Module 144: Accounting for Property

1458 **Task**
The following is a list of the most common methods of depreciation used by firms:

Task 14-10

1. The following information is available for the year ended December 31, 2014:

1. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

2. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

Task 14-11

1. The following information is available for the year ended December 31, 2014:

1. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

2. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

3. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

4. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

5. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

6. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

7. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

8. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

9. The company's pension plan is a defined contribution plan. The company's policy is to contribute 10% of the employees' salaries to the plan.

1110. **Answer: (A)**

The following table shows the calculation:

Amount of pension liability at the beginning of the year

(\$100,000) × 10%

Less: contributions during the year, with treatment of the 10% special liability reduction

(\$100,000 × 10%) × 10% = \$10,000 × 10% = \$1,000

1111. **Answer: (A)**

Assets of the pension trust are not included in the employer's consolidated financial statements. The liability recorded for the pension obligation on the balance sheet is offsetting the assets.

Year	Assets	Liability
2010	100	100
2011	100	100
2012	100	100
2013	100	100
2014	100	100
2015	100	100
2016	100	100
2017	100	100
2018	100	100
2019	100	100
2020	100	100
2021	100	100
2022	100	100
2023	100	100
2024	100	100
2025	100	100
2026	100	100
2027	100	100
2028	100	100
2029	100	100
2030	100	100

The liability for the pension trust is not included in the

employer's consolidated financial statements. The liability is offset by the assets of the trust.

1112. **Answer: (A)** — *Contributions to the Pension Plan*

1113. **Answer: (A)**

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments.

Present value of the liability	100
Less: Present value of the contributions	10
Amount of the liability	90

The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

1114. **Answer: (A)**

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

The amount of the liability is the present value of the future pension payments. The amount of the liability is the present value of the future pension payments.

Chapter 14: Accounting for Pensions

14-1: The Plan

1. Define each of the words in each of these items. Each definition should include the full definition as it appears in the course book and the full definition of the word as it appears in the dictionary.

2. Give the meaning of each of the words in each of these items. Give the full definition of the word as it appears in the dictionary.

3. List the definitions of each of the words in each of these items.

4. Define each of the words in each of these items. Give the full definition of the word as it appears in the dictionary.

5. Define each of the words in each of these items.

6. Define each of the words in each of these items.

7. Define each of the words in each of these items.

8. Define each of the words in each of these items.

9. Define each of the words in each of these items.

10. Define each of the words in each of these items.

11. Define each of the words in each of these items.

14-2: The Plan

1. Define each of the words in each of these items. Give the full definition of the word as it appears in the course book and the full definition of the word as it appears in the dictionary.

2. Define each of the words in each of these items.

3. Define each of the words in each of these items.

4. Define each of the words in each of these items. Give the full definition of the word as it appears in the dictionary.

14-3: The Plan

1. Define each of the words in each of these items. Give the full definition of the word as it appears in the course book and the full definition of the word as it appears in the dictionary.

2. Define each of the words in each of these items. Give the full definition of the word as it appears in the dictionary.

14-4: The Plan

1. Define each of the words in each of these items. Give the full definition of the word as it appears in the course book and the full definition of the word as it appears in the dictionary.

14-5: The Plan

1. Define each of the words in each of these items. Give the full definition of the word as it appears in the course book and the full definition of the word as it appears in the dictionary.

14-6: The Plan

1. Define each of the words in each of these items. Give the full definition of the word as it appears in the course book and the full definition of the word as it appears in the dictionary.

2. Define each of the words in each of these items.

Die Produktionsfunktion eines Unternehmens lautet $f(x_1, x_2) = 100x_1^{0.5}x_2^{0.5}$. Die Produktionskosten betragen 100 Geldeinheiten pro Mengeneinheit von Faktor 1 und 200 Geldeinheiten pro Mengeneinheit von Faktor 2. Die Produktionskosten sind bei einer Produktion von 100 Mengeneinheiten von Faktor 1 und 100 Mengeneinheiten von Faktor 2 minimal.

122) Erläutern Sie die

Produktionsfunktion

Produktionskosten

Produktionsfaktor

Output

Produktionsfaktor

Produktionskosten

Produktionsfunktion

123) Erläutern Sie die Produktionsfunktion

Produktionsfunktion

10. CREDITORS' PERSPECTIVE

11. WHY NOT?

11.1. Item

The credit terms 2/10, net 30 mean that a buyer will receive a 2% discount if payment is made within 10 days.

11.2. Item

There is a time value of money issue in the following scenario. The 2% discount is available if the buyer pays within 10 days. If the buyer does not pay within 10 days, the discount is not available.

11.3. Item

There is a time value of money issue in the following scenario. The 2% discount is available if the buyer pays within 10 days. If the buyer does not pay within 10 days, the discount is not available.

Task 13a: Figure 1

1. 1810s: Thomas and Malthus' ideas about resources in their environment in the 18th century led to the Malthusian trap theory. Malthusian trap theory states that population growth will outpace food production, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food. These ideas led to the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

In terms of food supply, the Malthusian trap theory states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

1. 19th century: The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

1. 20th century: The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

1. 21st century: The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

11. 1. 21st century:

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

12. 1. 21st century:

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

13. 1. 21st century:

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

14. 1. 21st century:

The Malthusian trap theory was challenged by the idea of the Malthusian trap theory, which states that the population will grow until it is limited by food supply, leading to famine, disease, and other factors that will reduce the population to a level that can be supported by food.

