Course Code	Course Name	L-T-P-Credits	Year of Introduction
CE409	QUANTITY SURVEYING AND VALUATION	3-0-0-3	2016

Pre-requisites: CE334 Computer Aided Civil Engg. Lab

Course objectives:

- To have an awareness regarding specifications, analysis of rates, valuation etc. in connection with construction
- To prepare detailed estimates, bar bending schedules of various items of work

Syllabus :

Specifications- Analysis of rates- CPWD data book and schedule of rates- Detailed specification, preparation of data and analysis of rates for various items of work- Quantity Surveying- Types of Estimate - Valuation- Methods of valuation-Depreciation- Fixation of rent- Detailed estimate including quantities, abstract and preparation of various items of works, Preparation of bar bending schedules for various RCC works

Expected Outcomes:

The students will be able to

i. work out the quantities of materials and labour required for different types of civil works

ii. prepare schedule of rates for various items of work

Text Books

1. B N Dutta, Estimating and costing in Civil Engineering, USB publishers and distributers Ltd. New Delhi
2. D D Kohli, RC Kohli, A textbook of Estimating and costing, S Chand Publishing, 2011
3. Dr. S. Seetharaman, M. Chinnasamy, Estimation and Quantity Surveying, Anuradha Publications , Chennai.

References:

1. BS Patil, Civil Engineering contracts and estimates, Universities press
2. V N Vazirani & S P Chandola, Civil engineering Estimating and Costing, Khanna Publishers.
3. IS 1200-1968; Methods of measurement of Building & Civil Engineering works.
4. CPWD data book and schedule of rates.

Note:

For analysis of rate and cost estimation, unit rate and labour requirement should be given along with the questions in the question paper.. No other charts, tables, codes are permitted in the Examination Hall. If necessary, relevant data shall be given along with the question paper.

COURSE PLAN

Module	Contents	Hours	Sem. Exam Marks %
I	General Introduction- Quantity Surveying- Basic principles-Types of Estimates - Specifications- purposes and basic principles-general specifications - Detailed specifications-Method of measurement of various items of work. Analysis of rates- Introduction to the use of CPWD data book and schedule of rates- conveyance and conveyance statement -	6	10

	Miscellaneous charges.		
II	Preparation of data and analysis of rates for various items of work connected with building construction and other civil engineering structures with reference to Indian Standard Specification.	6	10
FIRST INTERNAL EXAMINATION			
III	Detailed estimate including quantities, abstract and preparation of various items of works- buildings- centerline method and long wall short wall method- sanitary and water supply works- soak pits, septic tanks, overhead tanks, culverts, Retaining walls, road construction. Bar-bending schedule-preparation of bar-bending schedule for RCC works connected with building construction, culverts and minor irrigation works.	18	50
SECOND INTERNAL EXAMINATION			
IV	Valuation - Explanation of terms, types of values, sinking fund, years purchase, Depreciation - Straight line method, constant percentage method, S.F method .Obsolescence. Valuation of real properties-rental method, profit based method, depreciation method. Valuation of landed properties -belting method, development method, hypothecated building scheme method. Rent calculation. Lease and Lease hold property	12	30
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks: 100 **Exam Duration: 3 Hrs**

Part A -Module I & II : 2 questions out of 3 questions carrying 10 marks each

Part B - Module III : 2 questions out of 3 questions carrying 25 marks each

Part C - Module IV : 2 questions out of 3 questions carrying 15 marks each

Note : 1. Part A should have at least one question from each module

2. Part B three full questions carrying 25 marks on building estimate, preparation of bending schedule, or estimation of any other structure.

3. Part A and C each question can have a maximum of 2 subdivisions (a, b)

CE 409 QUANTITY SURVEYING AND VALUATION

SHORT QUESTIONS AND ANSWERS

1. List the different types of estimate.
   - Preliminary Estimate or Approximate estimate or rough cost estimate
   - Detailed Estimate or Item Rate Estimate
   - Revised Estimate
   - Supplementary Estimate
   - Supplementary and Revised Estimate
   - Annual Repair or maintenance estimate

2. List the essential documents to be accompanied with the detailed estimate.

   The detailed estimate is accompanied with:-
   - Report
   - General specifications
   - Detailed Specifications
   - Drawings:- Plan, Elevation and Sectional elevation
   - Calculation and Design
   - Analysis of rates

3. What is mean by overhead charges? Give the percentage adopted for the contractor profit and overhead in CPWD DSR 2016 rate analysis.

   Overhead costs include general office expenses, rents, taxes, supervision and other costs which are indirect expenses and not productive expenses on the job.

   The miscellaneous expenses on overheads may be under the following heads:-

   (A) General overheads - (i) Establishment (office staff), (ii) Stationary, printing, postages etc. (iii)Travelling expenses (iv) Telephone (v) Rent and taxes

   (B) Job Overheads - (i) Supervision (Salary of Engineers, Overseers, Supervision etc. (ii) Handling of materials (iii) Repairs, carriage and depreciation of T. and P, (iv) Amenities of labour (v) Workmen's compensation, insurance etc. (f) Interest on investment (g) Losses on advances

   Contractor's profit and overhead in CPWD DSR 2016 rate analysis is 15 percentage.

4. Briefly explain the detailed specification of Earthwork excavation for foundation in ordinary soil.

Excavation – Foundation trenches shall be dug out to the exact width of foundation concrete and the sides shall be vertical. If the soil is not good and does not permit vertical sides, the sides should be sloped back or protected with timber shoring. Excavated earth shall not be placed within 1m of the edge of the trench

Finish of trench – The bottom of foundation trenches shall be perfectly levelled both longitudinally and transversely and the sides of the trench shall be dressed perfectly vertical from bottom up to the least thickness of loose concrete so that the concrete may be laid to the exact width as per design. The bed of the trench shall be lightly watered and well rammed. Excess digging if done through mistake shall be filled with concrete at the expense of the contractor. Soft or defective spots shall be dug out and removed filled with stabilized soil. Foundation concrete shall not be laid before the inspection and approval of the trench by the engineer in charge.

Finds – Any treasure and valuables or materials found during the excavation shall be property of the Government.

Water in foundation– Water, if any accumulates in the trench should be bailed or pumped out without any extra payment and necessary precautions shall be taken to prevent surface water to enter into the trench.

Trench Filling – After the concrete has been laid and masonry has been constructed the remaining portion of the trenches shall be filled up with earth (free from rubbish and refuse matters and all clods shall be broken) in layers of 15cm and watered and well rammed.

Measurement – The measurement of the excavation shall be broken in cum. Rate shall be for complete for 30m lead and 1.5m lift including all tools and plants required for the completion of the works. For every extra lead of 30m and every extra lift of 1.5m separate extra rate is provided.

Excavation in saturated soil –

Excavation in saturated soil or below sub soil water level shall be taken under a separate item and shall be carried out in the same manner as above item 1. Pumping or bailing out of water and removal of slush shall be included in the item. Timbering of the sides of trenches if required shall be taken under a separate item and paid separately.

5. Write the unit of measurement of (i) Carpentry fittings (ii) Pointing of Brick wall

i. All wood work of which the scantling exceeds 20sqcm section and which is not specially moulded or carved comes under carpenters work. This include or timber work in chaukhats of doors and windows, in roof works as beams, struts, ties, rafters, purlins in timber bridge etc. Timber shall be specified may be teak, shisham, sal, deodar, etc. The timber shall be one of the best quality well seasoned and free

from saps, knots, warps, crack and other defects. All wood work shall be planed and neatly and truly and accurately finished to the exact dimensions. All joints shall be neat and strong and accurately fitted and coated with white lead before being fitted together. All portions of timber built in to or contact of brick masonry or concrete shall be given two coats of tar or other approved preservations. Exposed Surfaces of timber shall be painted with two coats of approved paint over coat of priming.

Measurement –Measurement of wood work shall be taken in cu m.

ii. The joints of the brickwork shall be raked out to a depth of 20mm and the surface of the wall shall be washed and kept wet for two days before pointing. The materials of mortar, cement and sand or lime and surkhi or sand or kankar lime as specified, shall be of standard specifications (1:2 or1:3 cement sand mortar or 1:1 lime surkhi mortar or kankar lime mortar). Mortar shall then be applied in the joints slightly in excess and pressed by a proper tool of required shape and the extra mortar is removed and surface is finished.After pointing the surface shall be kept wet for seven days.

Measurement – m^2

6. Differentiate between supplementary and revised estimate.

Supplementary estimate is a detailed estimate and is prepared when additional works are required to supplement the original works, or when further development is required during the progress of work. This is a fresh detailed estimate of the additional works in addition to the original estimate.

Revised Estimate is a detailed estimate and is required to be prepared under any one of the following circumstances:-

(I) When the original sanctioned estimate is exceeded or likely to exceed by more than 5%

(ii) When the expenditure on a work exceeds or likely to exceed the amount of administrative sanction by more than 10%

(iii) When there are material deviations from the original proposal, even though the cost may be met from the sanctioned amount.

The revised estimate should be accompanied by a comparative statement showing the variations of each item of work, its quantity, rate and cost under original and revised, side by side, the excess or saving and reason for variation.

7. Explain valuation and its purpose?

Valuation is the technique of estimating or determining the fair price or value of a property such as a building, a factory, other engineering structures of various types, lands etc.

- By valuation the present value of a property is determined
- Present value of a property is decided by its selling price or income or rent it may fetch.

Purpose of Valuation

i. ***Buying or Selling Property*** – When it is required to buy or sell a property, its valuation is required.

ii. ***Taxation*** – To assess the tax of property its valuation is required. Taxes may be Wealth tax, Property tax, Municipal tax etc.

iii. ***Rent Fixation*** – In order to determine the rent of the property, valuation is required. Rent is usually fixed on certain percentage of the amount of valuation (6 to 10% of valuation).

iv. ***Security of Loans or Mortgage*** – When loans are taken against the security of property its valuation is required.

v. ***Compulsory acquisition*** – Whenever a property is acquired by law compensation is paid to the owner. To determine the amount of compensation valuation of the property is required.

vi. Valuation of a property is also required for ***Insurance, Betterment Charges, and speculations*** etc.

8. Distinguish between Scrap Value and Salvage value.

- **Scrap Value –** Scrap value is the value of dismantled materials. The scrap value of a building may be about 10% of its total cost of construction. The cost of dismantling and removal of the rubbish material is deducted from the total receipt from the sale of the usable materials to get the scrap value.
- **Salvage Value –** It is the value at the end of the utility period without being dismantled.

E.g.):- A machine after the completion of its useful span of life or when it become uneconomic, may be sold or one may purchase the same for use for some other purpose , the sale value of the machine is the salvage value.

- Normally the scarp value and salvage value of a property or asset has got some positive figure, but it may also be zero or negative. For Example the scrap value of a RCC structure will be negative as dismantling and removal will be costly.

9. Distinguish between Free hold property and lease hold property.

A freehold property means that the owner is in absolute possession of the property, and the owner can utilize the same in any manner, he likes, subject to the rules and regulations of Government and local authorities. He may use the property by himself, he may grant leases or tenancies for a short period or any period.

Lease hold property – It indicates the physical possession of the property and the use of it may be allowed by the original owner as per lease document. The person who takes lease is known as lessee or lease holder and the owner who grants lease is known as lessor.

10. Distinguish between Market Value and Book Value.

Market Value	**Book Value**
1. The value is fixed by purchaser. **2.** The value may be higher during the subsequent years due to the increase of price index. **3.** The value may be constant for a period. **4.** This is applicable to any type of property. **5.** Market value is considered for valuation.	**1.** The value is fixed by the rate of depreciation. **2.** The value cannot be higher during the subsequent year even due to the increase of price index. **3.** The value cannot be constant, rather there is gradual fall. **4.** This is not applicable in case of land, metal articles like gold, copper etc. **5.** Book value is considered for accounts book of a company.

11. Write down the Comparison between free hold and lease hold property

Free holder	**Lease holder**
• A free holder is absolute owner of his property • A free holder does not require any payment in the nature of rent • He may sell, rent or lease , develop the property without consent of any other private person	• A lease holder possess an occupational right for a specific period of duration and after that he has no longer any right for that property • He requires to pay periodic payment regularly to hold the possession of property • He cannot sell, rent or lease , develop the property without consent of leaser

12. Define capitalised value and years purchase.

Capitalised value – The capitalized value of a property is the amount of money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property.

Capitalized value = net annual income x Year's purchase

Years purchase - Years purchase is defined as the capital sum required to be invested in order to receive a net annual income as an annuity of Rs 1/- at certain rate of interest.

Year's purchase = 100/ (Rate of interest) = 1/ i

i – rate of interest in decimal

13. Define Sinking Fund.

It is an amount which has to set aside at fixed intervals of time out of the gross income so that at the end of the useful life of the building or property, the fund should accumulate to the initial cost of the property.

$$\mathbf{I = S \times I_c}$$

I - annual investment required

Ic – Coefficient of annual sinking fund

S – Total amount of the sinking fund

$$\mathbf{I = \frac{S \times i}{(1+i)^n - 1}}$$

14. Define Annuity.

Annuity is the annual periodic payment for repayments of the capital amount invested by a party. These annual payments are either paid at the end of the year or at the beginning of the year, usually for a specified number of years

a. If the amount of annuity is paid for a definite number periods or years, it is known as **annuity certain**.
b. If the amount of amount of annuity is paid at the beginning of each period of year and the payment continued for a definite periods, it is known as **annuity due**
c. If the payments of annuity begins at some future date after a number of years, this is known as **deferred annuity**
d. If the payments of annuity continue for indefinite period, it is known as **Perpetual annuity.**

15. Define outgoings. List the various types of outgoings and explain.

- Outgoings or the expenses which are required to be incurred to maintain the revenue of the building. The various types of outgoings are as follows:-

1. Taxes – These includes Municipal Tax, Property Tax etc, which are to be paid by the owner of the property annually.

2. Repairs – The repairs are required to be carried out every year to maintain a property in condition. Usually 10 to 15% of the gross income or gross rent is allowed for repairs.
3. Management and collection charges – These include the expenses on Rent collector, Watchman, Liftman, Pump attendant, sweeper etc. About to 5 to 10% of the gross rent/income may be taken on these accountant.
4. Sinking Fund – A certain amount of the gross rent/income is set aside annually as sinking fund to accumulate the total cost of construction when the life of the building is over.
5. Miscellaneous – These include electrical charges for running lift, pump, for lighting common places and similar other charges which are borne by the owner.

16. Define depreciation. Explain the different types of depreciation.

It is the loss in the value of the property due to its use, life, wear and tear, decay and obsolescence

Types of depreciation

- Physical depreciation – It may be due to wear and tear from operation or due to action of time and elements
- Functional depreciation – It may be due to inadequacy or due to obsolescence
- Obsolescence – The value of property or structure will become less due to change in fashions, in designs, in structure, inadequacy to present or growing needs necessity for replacement due to new inventions etc. Obsolescence may be
    - Internal obsolescence due to change in type of construction, change in utility demand etc.
    - External obsolescence due to specific detrimental influences such as due to construction of factories, proximity of public building, traffic noises etc.

17. Define rent. Explain the different forms of rent.

Rent may be defined as an annual periodic payment for the use of land or buildings. Rent depends on demand.

Forms of rent:-

1. Standard rent – It is the legal permissible rent that can be charged to a tenant.

2. Ground rent – It is the form of rent that is paid by a person for the use of a plot of vacant land belonging to another.

3. Fair rent – The rent payable by a tenant under existing rules of the rent control act is known as fair rent.

4. Nominal rent – It is token rent, of very small amount per annum mentioned in lease document in order to establish the relation between a landlord and a tenant or lessee.

5. Rack rent – Where the rent reserved under an occupation lease represents full rental value land and building or full annual value of property it is known as Rack rent.

6. Head rent – Where the rent reserved under lease is less than the prevailing rent for the similar property, it is known as head rent.

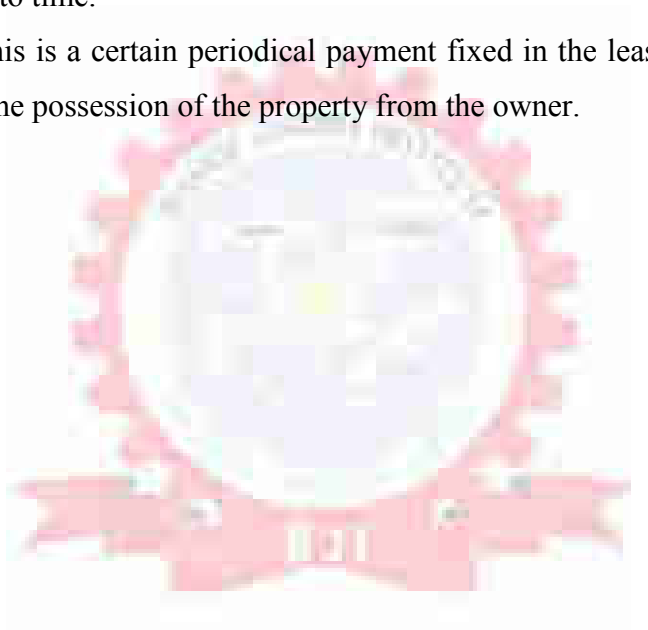
7. Contractual rent – The rent agreed by bargaining by a landlord and tenant is known as contractual rent.

8. Improved rent – When the original lease holder sub lets the property under lease at a higher rent than the original rate rent of the lease is known as improved rent.

9. Profit rent – The difference between improved rent and head rent is known as profit rent.

10. Virtual or sitting rent – It is the term applied tom the true annual cost of premises to a lessee. It is the rent paid plus the annual equivalent of any capital sums he may have expended on the premises from time to time.

11. Lease rent – This is a certain periodical payment fixed in the lease document to be paid by the lessee to enjoy the possession of the property from the owner.



MODULE I

Syllabus:-

General Introduction - Quantity Surveying - Basic Principles - Types of estimates - Specifications - purposes and basic principles - general specifications - detailed specifications - Method of measurement of various items of work.

Analysis of Rates - Introduction to the use of CPWD data book and schedule of rates - Conveyance and conveyance statement - Miscellaneous charges.

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QUANTITY SURVEYING

Quantity surveying is a term or processes used in the construction industry to take measurements of civil works, prepare specifications, and estimate the cost of works either for each trade of work or for the whole project.

To estimate how much a civil engineering project may cost, the actual quantities of materials, labour, equipment etc. that is needed for the construction work must be calculated at the beginning of the work. Such work of calculating the amount of materials and other incidentals necessary for the realization of the work is called quantity surveying.

Basic Principles:-

- The quantity of each individual item of work is workout from respective dimensions on the drawing of structure.
- Each quantity of item is multiplied with rate will give the cost of the item.

Estimation:-

An estimate is the computation of quantities required and expenditure likely to be incurred in the construction of a work.

Purpose of Estimate:-

- To ascertain the necessary amount of money required by the owner to complete the proposed work. For public construction works estimates are required in order to obtain administrative approval, allotment of fund and technical sanction.
- To calculate the quantities of material required in order to programme their timely requirement.
- To calculate the number of different categories of workers that are to be employed to complete the work within the scheduled time of completion.
- To assess the requirement of tools and equipments required to complete the work according to the programme.
- To fix up the completion period from the volume of works involved in the estimate.
- To invite tenders and prepare bills for payment.

Data for Estimate:- To make out an estimate for a work the following data are necessary - (1) Drawing (Plans, sections etc), (2) Specifications, and (3) Rates.

Types of Estimates:-

1. Preliminary Estimate or Approximate estimate or rough cost estimate
2. detailed Estimate or Item Rate Estimate
3. Revised Estimate
4. Supplementary Estimate
5. Supplementary and Revised Estimate
6. Annual Repair or maintenance estimate

1. Preliminary Estimate or Approximate estimate or rough cost estimate

Preliminary or Approximate or abstract Estimate is required for preliminary studies of various aspects of a work or project, to decide the financial position and policy for administrative sanction by the competent administrative authority.

The approximate estimate is prepared from the practical knowledge and cost of the similar works. The preliminary estimate may be prepared by various ways-

(a) Plinth Area basis:-

Plinth area estimate is calculated by finding the plinth area of the building and multiplying by the plinth area rate.

(b) Cubic Content basis:-

Cubic rate estimate is a preliminary estimate or an approximate estimate and is prepared on the basis of the cubical contents of the building. This is calculated by finding the cubical content of the building (length x breadth x height) and multiplied it by the cube rate.

(c) Approximate Quantity Method Estimate: -

In this method approximate total length of wall is found in running meter and this total length multiplied by the rate per running meter. For this method the structure may be divided in to two parts - (I) Foundation including plinth and (ii) Superstructure.

2. Detailed Estimate

Detailed estimate include quantities, rates and cost of all items in detail involved for satisfactory completion of project. It is an accurate estimate and consists of working out the quantities of each item of works, and working the cost. The dimensions, length, breadth, height and depth of each item are taken out correctly from drawing and quantities of each item are calculated, and abstracting and billing are done.

The detailed estimate is prepared in two stages:-

(I) Details of Measurement and calculation of quantities

The details of measurements of each item of work are taken out correctly from plan and drawings and quantities under each item are computed in a tabular form named as Details of Measurement form.

Measurement form

Item No	Description	No	Length, L (m)	Breadth, B (m)	Height (m)	Quantity	Remarks

(ii) Abstract of Estimated cost

The cost of each item of work is calculated in a tabular form from the quantities already computed and total cost is worked out in Abstract of Estimate Form. The rates of different items of work are taken as per schedule of rates or current workable rates or analyzed rates for finished items of work.

Abstract of estimate

Item No	Description	Quantity	Unit	Rate	Amount

The detailed estimate is usually prepared work wise, under each sub work as main building, servant quarters, garage, boundary walls etc.

The detailed estimate is accompanied with:-

(1) Report
(2) General specifications
(3) Detailed Specifications
(4) Drawings:- Plan, Elevation and Sectional elevation
(5) Calculation and Design
(6) Analysis of rates

Detailed estimate is prepared for technical sanction of the competent authority, for arranging contract and for the execution of work.

If in the ' Abstracts of Estimate ' form the columns of rates and amounts are left blank (to be filled by contractor) it is known as Bill of Quantity.

(3) Revised Estimate

Revised Estimate is a detailed estimate and is required to be prepared under any one of the following circumstances:-

(I) When the original sanctioned estimate is exceeded or likely to exceed by more than 5%
(ii) When the expenditure on a work exceeds or likely to exceed the amount of administrative sanction by more than 10%
(iii) When there are material deviations from the original proposal, even though the cost may be met from the sanctioned amount.

The revised estimate should be accompanied by a comparative statement showing the variations of each item of work, its quantity, rate and cost under original and revised, side by side, the excess or saving and reason for variation.

(4) Supplementary Estimate:-

Supplementary estimate is a detailed estimate and is prepared when additional works are required to supplement the original works, or when further development is required during the progress of work. This is a fresh detailed estimate of the additional works in addition to the original estimate.

(5) Supplementary and Revised Estimate:-

When a work is partially abandoned and the estimated cost of the remaining work is less than 95% of the original work, that is less than 95% of the original sanctioned estimate or when there are material deviations and changes in the design which may cause substantial saving in the

estimate then the amount of original estimate is revised by the competent authority. A supplementary and Revised estimate then prepared and fresh technical sanction of the competent authority is obtained.

(6) Annual Repair or maintenance estimate:-

After completion of a work it is necessary to maintain the same for its proper function and for the same and is prepared for the items which require renewal, replacement, repairs etc. in the form of a detailed estimate.

For building this include white washing, painting, minor repairs etc.

METHOD OF MEASUREMENT OF VARIOUS ITEMS OF WORK

1. **Earthwork:-**
   - Earthwork in excavation and earthwork in filling are usually taken out separately under different items, and quantities are calculated in cubic meters (m^3).
   - Earthwork in excavationin foundation is calculated y taking the dimensions of each trench length x breadth x depth.
   - Filling in trenches after the construction of foundation masonry is ordinarily neglected. If the trench filling is accounted, this may be calculated by deducting the masonry from the excavation.
   - Earthwork in plinth filling is calculated by taking the internal dimensions in between plinth wall (length x breadth) which is usually less than the internal dimensions of room and height is taken after deducting the thickness of concrete in floor. If sand filling is done in plinth, this should be taken separately.
2. **Concrete in foundation:-**
   - The concrete is taken out in cum(m^3) by length x breadth x thickness (height).
   - The length and breadth of foundation concrete are usually the same as for excavation, only the depth or thickness differs.
   - Foundation concrete consists of lime concrete or weak cement concrete (1:4:8 or 1:5:10)
3. **Damp proof course:-**
   - D.P.C usually of 2.5 cm thick rich cement concrete 1: 1.5:3 mixed with standard water proofing materials
   - It is provided at the plinth level to the full width of wall and quantities are calculated in Sqm. (Length x Breadth)
   - Usually DPC is not provided at the sills of doors and verandah openings, for which deductions are made.
4. **Masonry:-**
   - Masonry is computed in Cu m(length x Breadth x Height)
   - Foundation and plinth masonry is taken under one item, and masonry in superstructure is taken under a separate item.
   - In storeyed building the masonry in each story as ground floor above plinth level, first floor, second floor etc. is computed separately.

- In taking out quantities the walls are measured as solid and then deductions are made for openings as doors, windows etc.
- Thin partition wall is measured in sqm. Honey comb brick wall is taken under a separate item in sqm, no deduction is made for holes.
- Stone masonry is calculated in the same manner as for brick masonry.

5. **R.C.C work:-**
   - RCC work may be in roof or floor slab, in beams, lintels, columns, foundations, etc.
   - Quantities are calculated in cu m.
   - Length, Breadth and thickness are found correctly from the plan, elevation and section.
   - Bearings are added with the clear span to get the dimensions
   - The quantities are calculated in cu m exclusive of steel reinforcement and its bending but inclusive of centering and shuttering
   - Centering and shuttering are usually included in the RCC work, but may also be taken separately in sq m of surface in contact with concrete.
   - Pillars – Pillars are taken separately in cu m for their net volume and quantities are calculated by correct geometrical measurements, qty = sectional area x height
6. **Steel Work:-**
   - The reinforcement including its bending is taken up separately under steel works in quintal or kg or tone.For this purpose 0.8 – 1 % (usually 1%) of RCC work by volume may be taken for steel, if other details are not given.
7. **Flooring:-**
   - Quantity calculated in Sq m (Length x breadth)
   - Ground floor – The base lime concrete and floor finishing of C.C or stone or marble or mosaic etc. are usually taken as one job or one item (combined in one item)
   - 1^{st} floor, 2^{nd} floor etc. – Supporting structure taken separately in cu and the floor finishing is taken separately in sqm.
8. **Plastering and Pointing :-**
   - Plastering usually 12mm thick is calculated in sq m. (Length x Height)
   - For walls the measurements are taken for the whole face of the wall for both sides as solid, and deductions for openings are made in the following manner-
     - For small openings up to 0.5 sqm, no deduction is made
     - For openings exceeding 0.5 sqm and less than 3 sqm deduction is made for one face only, and the other face allowed for jambs, soffits and sills which are not taken in to account separately
     - For openings above 3 sqm deduction is made for both faces of the opening, and the jambs, soffits and sills are taken in to account and added.

Pointing – Pointing in wall is calculated in sqm for whole surface and deductions similar to plastering are made.

9. **White washing or colour washing or distempering or painting :-**
   - The quantities are computed in sq m and are usually same as for plastering.
   - The inside is usually white washed or distempered and this item will be same as for inside plaster.
   - The outside is colour washed and the quantities of colour washing will be same as for outside plaster.
   - These items need not be calculated separately, but simply written as same as for inside plaster or outside plaster.
   - The number of coat should be mentioned in the item.
10. **Doors and Windows:-**
    a. **Chowkhat or Frame –**
       - Door and window frames are calculated in cu m.
       - Length is obtained by adding length of all the members of the frame, top and two verticals if there is no sill member, and adding bottom also if there is sill
       - This length is multiplied by two dimensions of the cross section of the member.
       - If there is horn projection these projection also should be added to the length
       - If there is no sill member vertical members should be inserted in to the floor by about 2.5 cm to 4 cm

    b. **Door or window shutters –**
       - They are computed in sqm. (breadth x height of shutters)
       - The rebates (12mm to 20mm) in the frame should be taken in to consideration in finding the breadth and height
       - A clearance of 6mm may be allowed at the bottom of the door if there is no sill member
11. **Wood work:-**
    - Wooden beams, posts, wooden roof truss, door and window frames etc. comes under this item and the quantities are computed in cu m.

SPECIFICATIONS

A specification is a specific description of a particular subject. **An engineering specification describes the nature and class of work, materials to be used in the work, workmanship etc. required for completing an engineering project in accordance with its drawings and details.**

Necessity of Specification:-

(i) The cost of a unit quantity of work is governed by its specification

(ii) Specifications of a work are required to describe the quality and quantity of different materials required for a construction work and is one of the essential contract documents. Thus a contractor can make a programme to procure the materials are required for a project and the

owner can check the quality of materials conforming to the specification avoiding dispute with contractor

(iii) Specification describes the workmanship and method of doing work. Thus it serves as a guide to the supervising staff of the contractor as well as owner to execute the work to their satisfaction

(iv) As the rate of a work is based on specification, a contractor can calculate the rates of various items of woks in a tender with his procurement rates of materials and labour. Thus tender document without specification is incomplete and invalid.

(v) Specification describes the equipments, tools and plants to be engaged for a work and thus enables to procure them beforehand.

(vi) Specification is an essential contract document and is required for Arbitration or court cases.

How to write specifications

(a) *Description of Materials:*

- The quality and size of materials required to do an item of work shall be fully described
- The proportion of mixing and treatment of materials if required before use shall be clearly described

(b) *Workmanship:*

- Complete description of workmanship, the method of mixing to the proportion, laying, preparation of base or surface, compaction, finishing and curing

(c) *Tools and Plants (T&P):*

- The tools and plants to be engaged to carry out a work shall be described

(d) *Protection of new work:*

- The method of protection of new work against damage or the method of curing if required, the test of completed work if necessary shall be described

(e)*Expression:*

- While writing a specification Endeavour shall be made to express the requirements of specification clearly and concise form avoiding repetition and unusual words
- As the specifications are the legal documents, terms such as suitable, proper used and words having more than one meaning shall be avoided

(e) *Clauses of the specification:*

- The clauses shall be arranged in order in which work shall be carried out
- Correct and complete but not repeated information shall be given so that the owner and the contractor carryout the work following the specification

TYPES OF SPECIFICATIONS

a) General Specifications

b) Detailed specifications

A) General Specification:-

- It is brief description of each and every item is given. It is useful for preparing the estimate.
- In general specifications, nature and class of works, names of material and proportion that should be used in the various items of works are described

B) Detailed Specification:-

The detailed specification of an item of work specifies the **qualities and quantities of materials, the proportion of mortar, workmanship, the method of preparation and execution and the methods of measurement.**

- The detailed specifications are arranged as far as possible in the same sequence of order as the work is carried out.
- The detailed specifications if prepared properly are very helpful for the execution of work.
- The detailed specifications form an important part of contract document

THE DETAILED SPECIFICATIONS OF VARIOUS ITEMS OF WORK

1. EARTH WORK EXCAVATION IN FOUNDATION –

Excavation – Foundation trenches shall be dug out to the exact width of foundation concrete and the sides shall be vertical. If the soil is not good and does not permit vertical sides, the sides should be sloped back or protected with timber shoring. Excavated earth shall not be placed within 1m of the edge of the trench

Finish of trench – The bottom of foundation trenches shall be perfectly levelled both longitudinally and transversely and the sides of the trench shall be dressed perfectly vertical from bottom up to the least thickness of loose concrete so that the concrete may be laid to the exact width as per design. The bed of the trench shall be lightly watered and well rammed. Excess digging if done through mistake shall be filled with concrete at the expense of the contractor. Soft or defective spots shall be dug out and removed filled with stabilized soil. Foundation concrete shall not be laid before the inspection and approval of the trench by the engineer in charge.

Finds – Any treasure and valuables or materials found during the excavation shall be property of the Government.

Water in foundation– Water, if any accumulates in the trench should be bailed or pumped out without any extra payment and necessary precautions shall be taken to prevent surface water to enter into the trench.

Trench Filling – After the concrete has been laid and masonry has been constructed the remaining portion of the trenches shall be filled up with earth (free from rubbish and refuse matters and all clods shall be broken) in layers of 15cm and watered and well rammed.

Measurement – The measurement of the excavation shall be broken in cum. Rate shall be for complete for 30m lead and 1.5m lift including all tools and plants required for the completion of the works. For every extra lead of 30m and every extra lift of 1.5m separate extra rate is provided.

Excavation in saturated soil –

Excavation in saturated soil or below sub soil water level shall be taken under a separate item and shall be carried out in the same manner as above item 1. Pumping or bailing out of water and removal of slush shall be included in the item. Timbering of the sides of trenches if required shall be taken under a separate item and paid separately.

2. LIME CONCRETE IN FOUNDATION –

Materials –

Coarse aggregate shall be of **40mm** size, hard, clean, free from dust, dirt, and other foreign matters, homogeneous in texture and roughly cubical in shape.

Fine aggregate shall be of surkhi or sand or cinders as specified and clean and free from dust, dirt, and foreign matters. Surkhi shall be made of well burnt bricks or brick bats and shall pass through a sieve of 2.5 meshes per sqcm.

Lime shall be white fat lime (unless otherwise specified) and shall be freshly burnt and free from ashes and other foreign matters.

Proportion – The concrete shall consist of 1 cum of brick ballast, 0.32 cum of surkhi (sand or cinder) and 0.16 cum of white lime in the proportion of 100:32:16 by volume.

Mixing – Mixing shall be done on clean watertight, masonry platform of sufficient size. Coarse aggregate shall be stacked in a rectangular layer of uniform thickness 30 cm high, lime and surkhi (sand or cinder) shall be measured with wooden box in proportion 1:2 and mixed thoroughly dry to have uniform colour. The dry mix of lime and surkhi (or sand and cinder) shall be spread over the stacked coarse aggregate and mixed by turning at least three times. Clean water of required quantity is added in to the dry mixture and mixed thoroughly by turning at least three times so that the each aggregate coated with mortar and mix become plastic of uniform colour of workable consistency.

For big work the mixing shall be done by machine. In this case aggregate and wet mortar shall be poured in the drum while it is revolving.

Laying and compacting – Bed of foundation trench shall be lightly sprinkled with water before concrete is laid. Concrete shall be laid slowly and gently in layers of not more than 20cm and thoroughly consolidated to 15cm with 6 kg iron rammers. The consolidation can be checked by water test, by digging a hole of about 7.5 cm dia. and 7.5 cm deep in the concrete and filling water. The water level should not sink more than 1.25 cm in 15 minutes if concrete has been well consolidated.

Curing – Concrete after completion shall be kept wet for a period of 7 days and no masonry shall be constructed upon it during this period. The curing shall be done by spreading gunny bags or keeping them wet by water can at regular interval.

Measurement – Measurement shall be taken in cum for the finished concrete. The rate shall be for the complete work including the cost of form work if required and all tools and plants.

3. LIME CONCRETE IN ROOF TERRACING –

Materials –

Coarse aggregate shall be of **25 mm** size, hard, clean, free from dust, dirt, and other foreign matters, homogeneous in texture and roughly cubical in shape.

Fine aggregate shall be of surkhi or sand or cinders as specified and clean and free from dust, dirt, and foreign matters. Surkhi shall be made of well burnt bricks or brick bats and shall pass through a sieve of 2.5 meshes per sqcm.

Lime shall be white fat lime (unless otherwise specified) and shall be freshly burnt and free from ashes and other foreign matters.

Proportion – The concrete shall consist of 1 cum of brick ballast, 0.36 cum of surkhi (sand or cinder) and 0.18 cum of white lime in the proportion of 100:36:18 by volume.

Mixing – Mixing shall be done on clean watertight, masonry platform of sufficient size. Coarse aggregate shall be stacked in a rectangular layer of uniform thickness 30 cm high, lime and surkhi (sand or cinder) shall be measured with wooden box in proportion 1:2 and mixed thoroughly dry to have uniform colour. The dry mix of lime and surkhi (or sand and cinder) shall be spread over the stacked coarse aggregate and mixed turning at least three times. Clean water of required quantity is added in to the dry mixture and mixed thoroughly by turning at least three times so that the each aggregate coated with mortar and mix become plastic of uniform colour of workable consistency.

For big work the mixing shall be done by machine. In this case aggregate and wet mortar shall be poured in the drum while it is revolving.

Laying and compacting – Surface shall be lightly sprinkled with water and then concrete shall be laid slowly and gently in layers so as to have the required slope and specified thickness after compaction. The concrete shall be lightly rammed with 6 kg iron rammers. Special care shall be

taken to consolidate the concrete properly at the junction with the parapet wall and the junction shall be rounded.

Finishing – As soon as beating has been completed the mortar that has come to top shall be softened by the addition of lime, and smoothened by rubbing and pressing with a trowel or float to a final polish. No plaster shall be used on account for finishing the surface. The finished surface shall be minimum 1in50 and maximum slope of 1in36 towards the rain water outlet.

Curing – Concrete after completion shall be kept wet for a fortnight. The wetting should be done by covering with straw and watering frequently by water can or dividing in to squares by mud kiaries which shall be kept flooded with water.

Measurement – Measurement shall be taken in **sqm** for the finished concrete stating the avg.thickness. The rate shall be for the complete work including the cost of form work if required and all tools and plants.

4. CEMENT CONCRETE 1:2:4

Materials –

Coarse Aggregate shall be of hard broken stone of granite or similar stone of **20mm size** and down and shall be retained on 5mm sieve and well graded such that the voids do not exceed 42 percent.

Fine Aggregate shall be of coarse sand consisting of hard, sharp and angular grains and shall pass through screen of 5mm sieve.

Cement shall be fresh Portland cement of standard IS specification and shall have the required tensile and compressive stresses and fineness.

Water Shall be clean and free from alkaline and acid matters and suitable for drinking purposes.

Proportion – The proportion of concrete shall be 1:2:4 as cement: sand: coarse aggregate by volumes otherwise specified. Minimum compressive strength of concrete of 1:2:4 proportion shall be 14 N/mm2 on 7 days.

Stone aggregate and sand shall be measured by volume with boxes. Cement need not be measured by box, one bag of cement (50kg) should be considered as 1/30 cum. Size of measured box may be 30cm x30cm x 38 cm or 35cm x 35cm x 28 cm equivalent content of one bag of cement. All materials shall be dry.

Mixing – Mixing shall be of machine mixing and for small work hand mixing by batches may be allowed.

Hand mixing – Mixing shall be done in masonry platform or sheet iron tray. For concrete of 1:2:4 proportion, first two boxes of sand and one bag of cement shall be mixed dry thoroughly and then this dry mix of cement and sand shall be placed over a stack of 4 boxes of

stone aggregate and the whole mixed dry turning at least three times to have uniform mix. Water shall then b e added slowly and gradually with a water-can while being mixed to the required quantity 25 to 30 litres per bag of cement to give a plastic mix of required workability and water cement ratio. The whole shall be mixed thoroughly turning at least three times to give a uniform concrete.

Machine mixing – Stone ballast, sand and cement shall be put in to the mixer machine. For 1:2:4 proportion first four boxes of stone ballast, then two boxes of sand and then one bag of cement shall be put in to the mixer, the machine shall be then revolved to mix materials dry and then water shall then b e added slowly and gradually with a water-can while being mixed to the required quantity 25 to 30 litres per bag of cement to give a plastic mix of required workability and water cement ratio.

Slump – Regular slump test should be carried out to control the addition of water and to maintain the required consistency. A slump of 7.5 cm to 10 cm may be allowed for building work, and 3cm to 4cm may be allowed for road work.

Formwork – Formwork centering and shuttering shall be provided as required, as per standard specifications before laying concrete to confine to support or keep the concrete in position. The inner surface of shuttering shall be oiled to prevent concrete sticking to it. The base and formwork over which concrete to be laid shall be watered by sprinkling water before concrete is laid. Forms should not be removed before 14 days in general, side forms may be removed after 3 days of concreting. Formworks shall be removed slowly and carefully without disturbing and damaging concrete.

Laying – Concrete shall be laid gently in layers not exceeding 15 cm and compacted with rods and tamping with wooden tampers or with mechanical vibrating machine until a dense concrete is obtained.

Curing – Concrete shall be kept damp by covering with gunny bags or wet sand for 24 hours and then cured by flooding with water making mud walls.

Measurement - Cum

5. REINFORCED CEMENT CONCRETE (R C C)

Steel – Steel reinforcing bars shall be of mild steel or deformed steel of standard specification and shall be free from corrosion, loose rust scales, oil grease, paint etc. Bars shall be hooked and bent accurately and placed in position as per design and drawing and bound together tight with annealed steel wire at their point of intersection. While concreting steel bars shall be given side and bottom covers of concrete by placing precast cover blocks underneath of 1:2 cement mortar 2.5cm x 2.5cm in section and thickness of specified cover, 4cm to 5cm for beam and 1cm to 2 cm for slab. During laying and compacting of concrete the reinforcing bars should not move from their positions and bars of the laid portions should not be disturbed.

Formwork – Centering and shuttering shall be made with timber or steel plate close and tight to prevent leakage or mortar, with necessary props, bracings and wedges, sufficiently strong and

stable and should not yield on laying concrete and made in such a way that they can be slackened and removed gradually without disturbing the concrete. The inner surface of shuttering shall be oiled to prevent concrete sticking to it. The base and formwork over which concrete to be laid shall be watered by sprinkling water before concrete is laid. Forms should not be removed before 14 days in general. Formworks shall be removed slowly and carefully without disturbing and damaging concrete.

Proportion of cement concrete – Cement concrete shall be of 1:2:4 proportion by volume for slabs, beams and lintels and 1:1.5:3 proportion for columns unless otherwise specified.

Materials for concrete – Same as item No.4

Mixing – Same as item No.4

Laying – Before laying the concrete, the shuttering shall be clean, free from dust, dirt and other foreign matters. The concrete shall be deposited in its final position. In case of columns and walls it is desirable to place concrete in full height if practical so as to avoid construction joints but the progress of concreting in the vertical direction shall be restricted to one meter per hour.

Concrete shall be compacted by mechanical vibrating machine until a dense concrete is obtained.

Curing – Same as for cement concrete in item 4.

Finishing – If specified the exposed surface shall be plastered with 1:3 cement sand mortar not exceeding 6mm thickness and the plastering shall be applied immediately after removal of the centering.

Measurement – Measurements shall be taken in **cum** for the finished work and no deduction shall be made for the volume of steel. Steel reinforcement shall be measured under a separate item in quintal. Plastering if any shall not be included in the measurement. The rate for RCC work shall be for the complete work excluding steel but including centering and shuttering and all tools and plants.

6. DAMP PROOF COURSE 2.5 CM THICK CEMENT CONCRETE 1:1.5:3

Materials – Damp proof course shall consist of cement, sand and stone aggregate of 1:1.5:3 proportion with 2% of impermo or cem-seal, or Acco proof by weight of cement or other standard water proofing compound (1kg per bag of cement). The DPC shall be applied at the plinth level in horizontal layer of 2.5 cm thickness. Portland cement and 20mm size well graded stone aggregates are used.

Mixing – Mixing shall be done in a masonry platform or in a sheet iron tray in the proportion of 1:1.5:3 by measuring with measuring boxes. The cement is first mixed thoroughly with the water proofing compound to the required. Cement shall be thoroughly mixed with required 2%by weight of waterproofing compound, and then mixed dry with the required volume of sand to

make a proportion of 1:2. The cement sand mix shall then be thoroughly mixed dry with stone aggregate to maintain required
proportion. Clean water shall then be mixed gradually to give a plastic mix of required consistency. The mixing shall be done by turning at least three times to give uniform and homogeneous concrete. All the mixing shall be done in an impervious masonry platform.

Laying - Before lying concrete, the level of the surface of the plinth shall be checked longitudinally and transversely. All joints shall be racked and surfaces moisten by pouring clean water on it. The inside of the formwork shall be covered with polyethylene sheet so as to make water- tight joint between the formwork and the concrete. Concrete shall be laid uniformly by tamping to make dense concrete, leveled both transversely and longitudinally. The damp proof course shall be laid continuously except across doorways. Construction joints if unavoidable shall be given at the site of doors or wall opening. Such joints shall be sloped, and such sloped surface shall be applied with neat cement wash before starting concreting on following days.
Curing – The DPC shall be cured by watering and kept wet for 7 days and the construction of wall above may be started.

7. BRICKWORK - I CLASS

Bricks - The bricks shall be locally available kiln burnt bricks of generally regular and uniform size, shape & colour, uniformly well burn but not over burnt. The bricks shall be free from cracks, chips, flaws, stones or lumps of any kind and the rating of effloresence shall not be more than "moderate", when tested as per I.S. 3495 of latest edition. They shall not have any part unburnt. They shall not break even after being dropped on the ground on their flat face in a standard condition from a height of 60 cms. Bricks of one standard size shall be used on one work unless specially permitted by the Owner/Architects. After immersion in water, absorption by weight shall not be exceed 20% of dryweight of the brick when tested according to IS l077 of latest edition. Bricks shall have a minimum crushing strength of 10.5 N/mm^2.
Mortar - Mortar shall be specified and materials of mortar shall be of standard specifications Proportion of cement sand mortar may be of 1:3 to 1:6.
Soaking of brick - Bricks shall be soaked in water for a minimum period of one hour before use. When bricks are soaked they shall be removed from the tank sufficiently in advance so that at the time of laying they are skin dry. Such soaked bricks shall be stacked on a clean place where they are not spoilt by dirt, earth, etc.
Laying Brickwork - The brick shall be built in English bond with upwards facing frog in case of 230mm thick brickwork . The brick shall be built in running stretcher bond with upwards facing frog in case of half brick wall. Each brick shall be set with bed and vertical joints filled thoroughly with mortar. The walls shall be taken up truly plumb. All courses shall be laid truly horizontal and shall be truly vertical. Vertical joints in alternate course shall come directly over the other. The thickness of brick courses shall be kept uniform and for this purpose wooden straight edge with graduation giving thickness of each brick course including joint shall be used. All the connected brickwork shall be carried up nearly at one level and no partition of work shall

be raised more than one meter above the rest of the work. Any dislodged brick shall be removed and reset in fresh mortar.

Curing – The brick work shall be kept wet for a period of at least 10 days after laying.

Protection – The brick work shall be protected from the effect of sun, rain, frost etc. during the construction

Scaffolding – Necessary and suitable scaffolding shall be provided to facilitate the construction of brick wall.

Measurement – Brickwork shall be measured in **cum.**

8. PLASTERING CEMENT MORTAR OR LIME MORTAR –

The joints of the brickwork shall be raked out to a depth of 18mm and the surface of the wall shall be washed and kept wet for two days before plastering.

The materials of mortar, cement and sand or lime and surkhi or sand or kankar lime as specified should be of standard specifications.

The thickness of plastering shall be specified usually 12mm applied in to two or three coats.

External Plastering shall be started from top and worked down towards floor. Internal plastering shall be started wherever the building frame is ready and the centering of the roof slabs have been removed. Ceiling plastering shall be completed before starting of wall plastering. All corners and edges shall be rounded.

The work shall be tested frequently with a straight edge and plumb bob.

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for at least 10 days.

Measurement - Sqm

Note – Different proportions of mortar may be used for plastering

Cement Sand mortar – 1:3,1:4,1:5,1:6

Cement lime sand mortar – 1:1:6 ; C:L:S

Lime surkhi/sand mortar – 1:1, 1:2

For Ceiling plastering 1:3 cement mortar with coarse sand is generally used.

9. POINTING (CEMENT OR LIME MORTAR)

The joints of the brickwork shall be raked out to a depth of 20mm and the surface of the wall shall be washed and kept wet for two days before pointing.

The materials of mortar, cement and sand or lime and surkhi or sand or kankar lime as specified, shall be of standard specifications (1:2 or1:3 cement sand mortar or 1:1 lime surkhi mortar or kankar lime mortar).

Mortar shall then be applied in the joints slightly in excess and pressed by a proper tool of required shape and the extra mortar is removed and surface is finished.

After pointing the surface shall be kept wet for seven days.

10. LIME PUNNING

White stone lime and shell lime shall be slaked at site of work and mixed in the proportion of 3 of stone lime and one of shell lime and then thoroughly mixed with sufficient

quantity of water in a drum. The mixture is then allowed to settle and the cream like paste of lime shall be taken from top leaving residue at bottom for application to wall surface.

11. WHITE WASHING

Fresh white lime slacked at site of work should be mixed with sufficient water to make a thin cream. The approximate of water is required to make the cream is 5litres of water to 1kg of lime. It shall be screened through a coarse cloth and gum in the proportion of 100 gm of gum to 16 litres of wash shall be added.

The surface should be dry and thoroughly cleaned from dust and dirt. The wash shall be applied with moonj or jute vertically and horizontally alternately and the wash kept stirred in the container while using. Two or three coats shall be applied and as specified and each coat shall be perfectly dry before the succeeding coat is applied over it. After Finishing the surface shall be of uniform colour. For final coat blue pigment colour should be mixed to the required quantity with the lime water to give a bright white surface.

12. PAINTING

The brand of the paint shall be specified and readymade paint of the required colour should be used. If thinning is required pure turpentine may be added to the required extent. The surface shall be made perfectly smooth by rubbing with sand paper of different grades. All holes and joints should be filled with strong putty or with a mixture of glue and plaster of paris and smoothened by rubbing with sand paper. In steel work all rust and scales shall be perfectly removed by scraping and brushing.

The number of coats shall be as specified in new work one priming coat and then two coats of paints shall be applied. The paint shall be applied with brushes evenly and smoothly by crossing and laying in the direction of grains of wood work and no brush mark should be visible. Each coat shall perfectly dry before next is applied. Brushes should be cleaned and washed with turpentine at the end of the day's work and kept dry.

If stiff paint is used it should first prepared by mixing with double boiled linseed oil and turpentine to a thin cream.

If steel work exposed to weather , the painting should be done either with red oxide paint or with aluminium paint.

Measurement – Painting shall be measured in sqm.

13. WOOD WORK

All wood work of which the scantling exceeds 20sqcm section and which is not specially moulded or carved comes under carpenters work. This include or timber work in chaukhats of doors and windows, in roof works as beams, struts, ties, rafters, purlins in timber bridge etc.

Timber shall be specified may be teak, shisham, sal, deodar, etc. The timber shall be one of the best quality well seasoned and free from saps, knots, warps, crack and other defects. All wood work shall be planed and neat ly and truly and accurately finished to the exact dimensions. All joints shall be neat and strong and accurately fitted and coated with white lead before being fitted together.

All portions of timber built in to or contact of brick masonry or concrete shall be given two coats of tar or other approved preservations.

Exposed Surfaces of timber shall be painted with two coats of approved paint over coat of priming.

Measurement –Measurement of wood work shall be taken in cu m.

14. 2.5 CM CEMENT CONCRETE FLOOR

Materials- The cement concrete shall be of proportion 1:2:4 or 1:1.5:3 as specified. Cement Shall be fresh Portland of standard specifications. The coarse aggregate shall be hard and tough of 20mm size. Well graded and free from dust, dirt and organic matters. The sand shall be 5mm maximum size and down free from dust, dirt and organic matters.

Mixing – Hand mixing or machine mixing. Refer item No.4

Laying - Concrete shall be laid in horizontal layers and gently rammed. It shall be compacted first with wood float. The blows shall be fairly heavy but as consolidation takes place, light rapid strokes shall be given. Beating shall continue till all hollows in concrete are filled with mortar paste. Then the surface shall be trawled till the moisture disappears. The surface shall be checked with straight edge. The surface must be uniform in colour. Immediately after trawling, well mixed neat cement slurry mixed integrally with hardening liquid 2 litres. to 50kg of cement shall be sprinkled in a uniform layer at the rate of 2.2 kg. per sq.m. The cement slurry shall be trawled smooth with a steel float several times till approved finish is achieved. The surface shall be without the float marks or air holes. Sample of workmanship shall be got to approved prior to work.

Curing- Curing shall not be commenced until the top layer has hardened. Hardened concrete shall be kept wet for 15 days. Covering with empty cement gunnies shall be avoided, as the colour is likely to be bleached with the remnants of cement matter from the bags.

Measurement - It shall be measured in square meter for specified thickness measured from wall to wall exclusive of any finishing or as per instructions of Engineer.

15. ROOFING (CORRUGATED GALVANIZED IRON SHEET)

The corrugated iron shall be of gauge specified. If the gauge is not is specified they shall be 0.63mm (24 B.G). Sheet shall be free from twist or buckle, shall have uniform corrugations, true in depth and pitch.

Laying:- Sheets shall be laid on wooden or steel purlins as per the drawings. The roof slope shall not be laid flatter than 1 in 4 otherwise specified. According to I S specification an end lap of 15cm in the lengthwise direction and side laps of two corrugations shall be provided. In ridges and hips where plain sheets are used a lap of 23cm shall be maintained.

Holes for hook, bolts etc. shall be drilled but not punched in the ridges of the corrugations from the underside while the sheets are on ground. Sheet shall be fixed to the purlins by means of 8mm diameter galvanized hook bolts and nuts.

Wind Ties: 40mmx12mm flat iron wind ties fixed at the end laps

Measurement : Sqm

ANALYSIS OF RATES

The determination of rate per unit of a particular item of work from the cost of quantities of materials, the cost of labour and other miscellaneous expenses require for its completion is known as the

analysis of rate. A reasonable profit (10-15%), usually 10% for the contractor is also included in the analysis of rate.

The rate of the particular item of work depends on the following:-

(1) Specifications of works and materials, quality of materials, proportion of mortar, method of constructional operations, etc

(2) Quantities of materials and their rates, number of different type of labours and their rates

(3) Location of the site of work and its distances from the sources of materials and the rates of transport and availability of water.

(4) Profits and overhead expenses of contractor.

The analysis of rate is usually worked out from the unit of payment of the particular item of under two heads -

(i) Materials and (ii) Labour, and their costs added together give the cost of the items of work. The cost of materials are taken as delivered at site inclusive of the transport, local taxes and other charges. For tools and plants (T and P) and miscellaneous items (sundries) which cannot be accounted in details lump-sum provision is made. A provision for water charges @11/2 % of the total cost is made in the rate. Adding 10% to this cost as Contractors Profit, the rate per unit item of work is obtained.

Overhead costs:-

Overhead costs include general office expenses, rents, taxes, supervision and other costs which are indirect expenses and not productive expenses on the job.

The miscellaneous expenses on overheads may be under the following heads:-

(A) General overheads - (i) Establishment (office staff), (ii) Stationary, printing, postages etc. (iii)Travelling expenses (iv) Telephone (v) Rent and taxes

(B) Job Overheads - (i) Supervision (Salary of Engineers, Overseers, Supervision etc. (ii) Handling of materials (iii) Repairs, carriage and depreciation of T. and P, (iv) Amenities of labour (v) Workmen's compensation, insurance etc. (f) Interest on investment (g) Losses on advances

Schedule of Rates:-

Schedule of rates is a list of rates of various items of works. To facilitate the preparation of estimates, and also to serve as a guide in setting rates in connection with contract agreements, a schedule of rates for all items of work is maintained in Engineering Department in the form of a printed books is known as " Schedule of Rate Books".

Data Book:-

The process of working out the cost or rate per unit of each item is called as Data. In preparation of Data. The rates of materials and labour are obtained from current standard

scheduled of rates and while the quantities of materials and labour required for one unit of item are taken from Standard Data Book.

Bill of Quantities (BOQ):-

It is a statement of the various items of work giving the description, quantities and unit of rates. It is prepared in a tabular form similar to the 'Abstract of Estimates Cost' of the detailed estimate, but the rate and amount columns are left blank (unfilled). When prices, that is, the rates and amounts are filled up and totalled, this gives the estimated cost.

It is primarily meant for inviting tender, and supplied to the contractor to fill up the rates and amounts columns. On receipt of the tenders the rates and amounts are compared and decision about entrusting the work is finalised.

Conveyance Statement

Lead Statement –

Thelead statementwill give the total cost of materials per unit item including first cost, conveyance, loading – unloading, stacking charges etc.

The distance between the source of availability of material and construction site is known as Lead and is calculated in km. The conveyance cost of material depends on lead.

Conveyance Charges –

The charges required for the transportation or conveyance of materials from the source to the site is termed as conveyance charges and it depends on lead (distance).

MODULE II

ANALYSIS OF RATES

Analysis of Rates

The determination of rate per unit of quantities of work done the cost of quantities of materials, the cost of labour and other miscellaneous expenses required for the completion is known as analysis of rates. As per CPWD works charges is 1%, contractors profit and overhead is 15%.

1. Earthwork

1.1. Earthwork in surface excavation not exceeding 30cm in depth not exceeding 1.5m in width as well as 10m² on plan, getting out and disposal of excavated earth upto 15m and lift upto 1.5m as directed by engineer in charge

Sl No	Description	Qnty	unit	Rate	Amount
	Details of cost for 100m²				
	Labour:-				
	Beldar	6.60	day	56	2508.4
	Coolie	5.6	day	36	2060.8
					4569.20
	Total				
					45.69
	Add 1% works charge				
					4614.1-
	Total				

Add 15% contractor profit & overhead charge		791.2
	Total	5700.15
cost of 100 sqm		5700.15
cost of 1 sqm		57.0

1.2. Earthwork in rough excavation, banking excavated earth in layers not exceeding 20mm in depth breaking lumps watering each layers with help of Iron Rollers wooden or steel hammer and rolling every third and top most layer with power rollers in embankment for road, flood embankment, marginal bank and guide bank or filling up ground depressions lead upto 15m and lift upto 1.5m.

ALL KINDS OF SOIL

SI no	Description	qty	unit	Rate	Amount
	Details of cost for 10 m3				
	Labours :-				
	Beldar	5.90	day	368	2171.2
	Coolie	3.60	day	368	1324.8
	Besti	0.40	day	407	162.8
	chowkidar	0.005	day	358	2.04

Hire charges of diesel roller	[illegible]	day	[illegible]	[illegible]
Sundries	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL				[illegible]
Add 1% of water charge				[illegible]
TOTAL				[illegible]
Add CP & OH @ 15%				[illegible]
TOTAL				[illegible]
cost of 1m³				[illegible]

1-5 Earthwork in excavation by mechanical means (hydraulic excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width ... including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of excavated soil as directed within a lead of 50 m (All kinds of soil).

Sl No	Description	Qnty	Unit	Rate	Amount
	Details of cost per 10m³				
1	Machinery:				
	Hydraulic excavator with driver & fuel	[illegible]	day	4500	2.68.125
	Tractor and dumper/tipper [illegible]	[illegible]	day	6000	[illegible]
2	Labour:				
	Mate	[illegible]	day	[illegible]	[illegible]
	Beldar	[illegible]	day	[illegible]	[illegible]
	TOTAL				[illegible]
	Add 1% water charge				[illegible]
	TOTAL				[illegible]
	Add 15% CP & OH				[illegible]
	TOTAL				[illegible]
	cost of 1m³				[illegible]

II

Cement concrete

To have the quantity of dry ingredients in a concrete mix as plastic mix the ladies are available in schedule of rate booklet. But in case of non availability it can be calculated as follows

From the ratio of mix required we can estimate the amount of wet ingredients there will be a reduction in volume of finished concrete when the dry ingredients are mixed together. Hence the total vol of dry material is greater than required. This increase in vol. is taken as 50-55% of actual vol is some later usually 52% is taken

for 10 m³ pcc we need to take dry ingredient for a total vol of 15.2 m³. and for 1m³ – 1.52 m³ of material

Eg: PCC 1:4:8

Sum of parts = 1+4+8 = 13

Quantity of cement = $\frac{1}{13} \times 1.52$ (density of cement = 1440)

= 183.04 kg/m³

= 183.04 × 10⁻³ × 1440

= 0.173 tonne.

Quantity of sand = $\frac{4}{13} \times 1.52 = 0.47$ m³

Quantity of CA = $\frac{8}{13} \times 1.52 = 0.94$ m³

M5	1:5:10
M7.5	1:4:8
M10	1:3:6
M15	1:2:4
M20	1:1.5:3
M25	1:1:2

Eg: PCC 1:5:10

Sum of parts = 1+5+10 = 16

Quantity of cement = $\frac{1}{16} \times 1.52 = 0.095$ m³

= 0.136 tonne = 0.14 tonne

Quantity of sand = $\frac{5}{16} \times 1.52 = 0.476$ m³

Quantity of CA = $\frac{10}{16} \times 1.52 = 0.95$ m³

PCC : 1 : 4 : 8

Quantity of CA = 0.94 m³

Color 0.94 m³ CA . 0.7 m³ for 40mm nominal size,

- considering 7.5 % for void voids in 40mm nominal size

rel quantity = 0.7 - 0.7 × 7.5/100 = 0.65 m³

Balance 0.24 m³ for 20mm nominal size aggregate .

II. 1. Cement concrete 1:4:8 using graded stone 40mm nominal size including all charges of costs, conveyance, watering, curing etc in m³.

SI No	Description	Qty	Unit	Rate	Amount
	Materials for 1 m³ :-				
	Stone aggregate 40mm nominal size	0.65	m³	1250	812.5
	Stone aggregate 20mm nominal size	0.24	m³	1300	312
	Carriage of stone aggregate 40 mm	0.65	m³	137.4	89.31
	Carriage of stone aggregate 20 mm	0.24	m³	126.41	30.33
	Sand	0.47	m³	1200	564
	Carriage of sand	0.47	m³	192.50	81.07
	Portland cement	017	tonne	5700	969
	Carriage of cement	0.17	tonne	68.94	11.71
	Labour :-				
	Mason	0.2	day	467	46.7
	Beldar	1.63	day	368	599.84
	Bhisti	0.7	day	407	284.9

hire charges of concrete mixture	0.07	day	800	56
vibrator	0.07	day	700	56
sundries		₹5		50
TOTAL				5052.86
Add 1% tools charge				50.52
TOTAL				4502.99
Add 15% CP & OHC				650.44
TOTAL				4603.43
cost for 1 m³				4603.43

8.2 Providing and laying c.c 1:5:10 excluding the cost of centring and shuttering using 40mm nominal size all works upto plinth level - m³.

Sl No	Description	Qty	Unit	Rate	amount
1	Material for 1 m³ :-				
	stone aggregate 40mm nominal size	0.65	m³	1250	812.5
	stone aggregate 20mm nominal size	0.25	m³	1580	325
	carriage of stone aggregate 40mm	0.65	m³	137.4	89.31
	carriage of stone aggregate 20mm	0.25	m³	106.41	51.00
	sand	0.48	m³	1200	576
	carriage of sand	0.48	m³	132.50	62.8
	Portland cement	0.14	tonne	5000	778
	carriage of cement	0.14	tonne	65.94	9.55
2	Labour :-				
	Mason	0.1	day	467	46.7
	Beldar	1.63	day	365.34	595.54
	Bhisti	0.7	day		

PCC 1:4:8

Quantity of CA = 0.94 m³

Out of 0.94 m³ CA, 0.7 m³ for 40mm nominal size.

- considering 7.5% for net voids in 40mm nominal size

net quantity = $0.7 - 0.7 \times 7.5/100 = 0.65 m^3$

Balance 0.24 m³ for 20mm nominal size aggregate.

5.1. Cement concrete 1:4:8 using graded stone 40mm nominal size including all charges of costs, conveyance, watering, curing etc in m³

S.No	Description	Qty	Unit	Rate	Amount
	Materials for 1 m³ :-				
	Stone aggregate 40mm nominal size	0.65	m³	1250	812.5
	Stone aggregate 20mm nominal size	0.24	m³	1300	312
	carriage of stone aggregate 40mm	0.65	m³	137.4	89.31
	carriage of stone aggregate 20mm	0.24	m³	127.41	30.53
	Sand	0.47	m³	1200	564
	carriage of sand	0.47	m³	172.50	81.07
	Portland cement	0.17	tonne	5700	969
	carriage of cement	0.17	tonne	68.94	11.71
	Labour :-				
	Mason	0.1	day	467	46.7
	Beldar	1.63	day	368	599.84
	Bhisti	0.7	day	407	284.9

Hire charges of concrete mixture	0.07	day	800	56
Vibrator	0.07	day	800	56
Sundries		LS		50
TOTAL				5962.86
Add 1% water charge				59.62
TOTAL				6002.94
Add 15% CP & OH				900.44
TOTAL				6903.45
Cost for 1 m³				6903.45

II.2 Providing and laying CC 1:5:10 excluding the cost of centering and shuttering using 40mm nominal size all works upto plinth level - m³

Sl. No	Description	Qty	Unit	Rate	Amount
1	Material for 1 m³ :-				
	stone aggregate 40mm nominal size	0.65	m³	1250	812.5
	stone aggregate 20mm nominal size	0.25	m³	1300	325
	carriage of stone aggregate 40mm	0.65	m³	137.4	89.31
	carriage of stone aggregate 20mm	0.25	m³	206.41	51.60
	sand	0.48	m³	1200	576
	carriage of sand	0.48	m³	172.50	82.8
	Portland cement	0.14	tonne	5700	798
	carriage of cement	0.14	tonne	68.94	9.65
2	Labour :-				
	Mason	0.1	day	467	46.7
	Beldar	1.63	day	334 544.84	544.84
	Bhisti	0.7	day	407	284.9

Time charges of concrete mixture	0.01	day	600	56
Vibrator	0.01	day	800	56
Sundries		LS		50
			TOTAL	4818.3
Add 17 water charge				818.83
			TOTAL	5637.13
add 15% of OHC				548.47
cost of 1m³ / TOTAL				6185.60
				≅ 6186/-

4Q. Workout the quantity of given materials required for 1:1.5:3 concrete and analyse the unit rate using the details given below

Sl no	Description	Qnty	unit	Rate	unit
	20mm nominal size broken stone	?	m³	1300	m³
	sand	?	m³	1200	m³
	cement	?	tonne	5400	tonne
	Mason	0.2	nos	500	each
	Man	1	nos	450	each
	women	3.5	nos	450	each
	Man for lifting mortar	0.2	nos	450	each

Ans: 1:1.5:3

Sum of the parts = 1+1.5+3 = 5.5

Quantity of cement = $1/5.5 \times 1.52 \times 10^{-3} \times 1440 = 0.398$ t ≈ 0.4

Quantity of sand = $1.5/5.5 \times 1.52 = 0.414$ m³ ≈ 0.42 to m³

Quantity of CA = $3/5.5 \times 1.52 = 0.829$ m³ ≈ 0.83 m³

Less void ~ Net CA

Sl No	Description	Qty	Unit	Rate	Amount
1	Materials :				
	50 mm broken stone	0.83	m^3	1300	1079
	Sand	0.42	m^3	1200	504
	Cement	0.4	tonne	5700	2280
2	Labour :-				
	Mason	0.2	nos	500	100
	Man	1	nos	450	450
	women	3.5	nos	450	1575
	Man for Lifting material	0.2	nos	450	90
3	Sundries		LS		50
	TOTAL				6128
	Add 1% profit charge				61.28
	TOTAL				6189.28
	Add 15% overhead				928.392
	TOTAL				7117.672
	cost of 1 m^3 precast				7117.672/-

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Workout the unit rate for per work in 1:6 cement sand mortar for 10 m^3 of broken stone 12.5 m^3 at the rate 800 per m^3 River sand 4.2 m^3 at the rate 1200/m^3, cement 1000 kg at a rate Rs 8000/tonne, 12.5 mason at a rate Rs 350/each, 10.5 man at a rate Rs 550/each and 11 coolies at a rate 550/each.

cement = $1000 \times 10^{-3} \times 1440 = 1$ tonne

Sl	Description	Qty	Unit	Rate	Amount
	Material for 10 m^3				
1	Broken stone	12.5	m^3	800	10000
	Sand	4.2	m^3	1200	5040

	Cement	1	tonne	8000	8000
2	Labours :-				
	Mason	12.5	nos	750	9375
	Man	10.5	nos	650	6825
	Women	11	nos	550	6050
3	Sundries		LS		500
	TOTAL				45790
4	Add 1% water charge				457.9
	TOTAL				46247.9
5.	Add 15% CP and OHC				6937.185
	TOTAL				53185.085
	unit rate of PCC per m^3				53185/-

III Brick Work

Materials required : Brick
cement } mortar
sand

Nominal size of a brick, = 20cm × 10cm × 10cm

Volume of 1 brick = 0.002 m^3

∴ No. of brick for 1 m^3 = $1/0.002$ = 500 nos

Std size 19×9×9 (without mortar)

Mortar requirement :-

Quantity of mortar = 1 − [500 × .19 × .09 × 0.09]
= 0.23 m^3

For frog filling, handling, wastages etc 15% extra mortar.

∴ Required = 0.23 × 1.15 = 0.26 m^3

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Dry volume of mortar = 0.26 x 1.25 (25% extra)
= 0.328 m³

For 10 m³ of brickwork, no of bricks = 5000 #
quantity of mortar = 2.2 m³

5.1 First class brickwork in foundation and plinth with 20 x 10 x 10 cm nominal size brick with cement - sand mortar 1:6. For 10 m³ of 1st class brick at a rate of, 4500 / 1000 nos, cement @ 8000/tonne, sand @1200/m³, mason 7 nos @ 365 each, Beldar @ 365 each 7 nos, Bhisti 2 nos @ 405 each] Analyse the unit rate of brick work

Sum of part = 14 C = 7
Dry cement = 1/7 x 2.2 = 0.457 m³ = 0.658
" sand = 6/7 x 2.2 = 2.74

Sl No	Description	qty	unit	rate	Amount
	Details of cost for 10 m³				
1	Materials				
	1st class brick	5000	nos	4500/1000	22500
	cement	0.658	tonne	8000	5264
	sand	2.74	m³	1200	3288
2	Labour :-				
	Mason	7	nos	365	2555
	Beldar	7	nos	365	2555
	Bhisti				
3	Sundries	2	nos	405	810
	TOTAL		LS		37072
	add 1 % cooler charge				370.72
	TOTAL				37442.72
	add 15 % CP & OHC				5616.41
	TOTAL				43059.13
	cost for 10 m³ 1st class brick work				43059.13
	cost for 1st class brick work per m³				4305.91

IN : Random rubble masonry

for 10 m³.

Materials :-

1. Stone for RR masonry - 12.5 m³
   Coursed rubble masonry - 12.5 m³
   ashlar masonry - 12.5 m³
2. Mortar requirement :
   for RR masonry - 4.2 m³
   for coursed rubble masonry - 4 m³
   for ashlar masonry - 2.5 m³

A-1. Random rubble stone masonry in super structure in 1:6 cement sand mortar for 10 m³ (Stone including through & bed stone and wastage 12.5 m³ @ 1200/m³), cement @ 6200/T Sand @ 1200/m³, mason 10# 360/-, Beldar 10 # @ 260/-, Bhisti 1 # 405/- Mortar = 1:6 Scaffolding(s) 325/-

- Total part = 1+6 = 7
- Qty of cement = 1/7 × 4.2 = 0.6 m³ = 0.864 MT
- Qty of sand = 6/7 × 4.2 = 3.6 m³

S.No	Description	Qty	unit	Rate	Amount
	Details of cost for 10m³				
1.	Materials :-				
-	stone including through bed stone and wastage	12.5	m³	1200	15000
-	cement	0.86	T	8000	6880
-	sand	3.6	m³	1200	4320
2	Labour :-				
-	Mason	12	nos	368	4416
-	Beldar	10	nos	368	3680
-	Bisti	1.5	no's	405	607.5
3.	Scaffolding		LS		325
					TOTAL

	Total				[illegible]
	Add 1% water charge				[illegible]
	Total				[illegible]
	add 15% CP and CGTE				[illegible]
	Total				[illegible]
	cost for 100m² of masonry				[illegible]
	cost for 1 m² masonry				[illegible]

V Plastering

Materials for 12mm thick plastering wall mortar for 100m²

12mm thick - 100m²

- Volume of wet mix mortar = 100×0.012 = 1.2 m³
- adding 30% extra to fill up joints, uneven surface etc
  Qty of mortar = 1.2×1.3 = 1.56 m³
- dry volume of mortar add 25% extra
  = 1.56×1.25 = 1.95 m³ ≈ 2m³

Cement concrete floor

The quantity of cement concrete in floor may be calculated by multiplying area of floor by thickness of the floor and the quantity of each material may be found out on the same principles as for cement concrete.

For 25mm CC floor for 100m²,

Qty of cement concrete = 100 × 0.025 = 2.5m³

add 10% extra for unevenness of cc floor

Qty of CC = 2.5×1.1 = 2.75m³

Dry volume add 50% = 4.125m³

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Conveyance and conveyance statement

Carriage of materials

Various materials required for the construction of roads bridges and buildings are transported to the site of work from the factory or quarry the mode of transport depends upon the geological conditions of the area given where the material is to be transported Trucks, trains, bullock carts etc may be the mode of transport.

TRUCKS

The trucks may be of different capacity as 5 tonnes, 8 tonnes, 8 tonnes etc the cost of transporting materials depends upon the following factors

- cost of owning or hire charges of the truck
- loading capacity of the vehicle
- speed of the vehicle
- load or distance of transport
- no of trips per day of 8 hrs working
- Labour cost for loading and unloading
- the consumption of high speed diesel oil or petrol oil per km
- distance of parking place of the vehicle.

Unless otherwise stated the carriage rate include loading unloading and stacking. The speed for truck is less for short lead and gradually increases for greater distance lead

For a lead of 1 km the avg speed is 15 km/h, and for 2 km lead it is 17 km/h. Max for each additional lead of 1 km an increase of avg speed of half km/h is allowed

For parking usually 6 km is allowed

The no of trips in a 8 hrs working day is calculated by the formula

$$N = \frac{8}{\left(\frac{2L}{S}\right)+1}$$

Where L = lead in km

S = speed in kmph

+1 = 1hr is allowed for loading and unloading ie ½ hr each

Knowing the no of trips the total distance can both away (in a day) in km = 2NL + 6

The consumption of fuel may be taken as 5 km/litre

Mobile oil : consumption is 100 km/litre

Size beldars or coolie is required at the rate of Rs 350/day

Hire charges of the truck in Rs/day.

Then the total cost and the quantity of materials that can be transported per day may be calculated and the rate of transport per unit of materials may be determined.

Capacity of truck per day : Lime, moorum, building rubbish - 8 m³

, Sand, stone aggregate < 40mm nominal size - 7.36 m³

, Bricks 3000 nos, Kutcha tiles 5000 nos, steel 9 tonne, timber 7 tonne, excavated rock - 8 m³

Tar or bitumen - 8 tonne.

MODULE - 3

Different methods for building estimate

Long wall - short wall method.

① Calculate the length of individual wall

② Length of long wall - Centre line distance of long wall + one breadth of wall.

Length of short wall - Centre line distance of short walls - one breadth of wall

The length of long wall usually decreases from earthwork to brickwork in superstructure & the length of short wall increases from earthwork to brickwork in superstructure. These lengths are multiplied with breadth & height to get the desired quantity.

Estimation of a single room building as per the plan

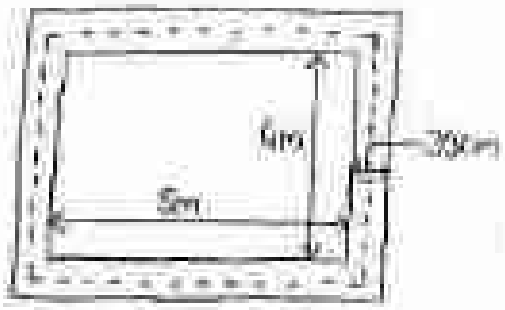
Q1. Estimate the quantity for following items of work.

i) Earthwork in excavation in foundation

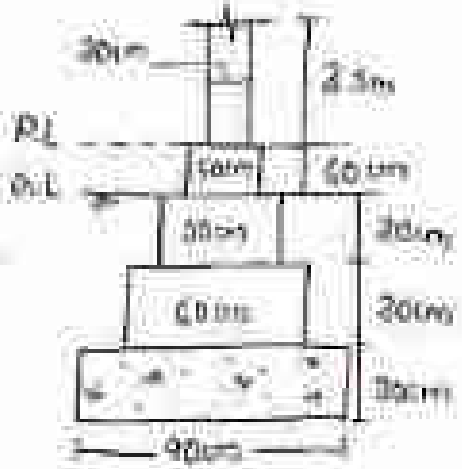
ii) PCC in foundation

iii) 1st class brickwork in foundation & plinth.

iv) 1st floor brick work in superstructure



Plan



Section

Length of long wall = 5 + 0.15 + 0.15 = 5.3m

Center line distance of long wall = 5 + 0.15 + 0.15 = 5.3m

Center line distance of short wall = 4 + 0.15 + 0.15 = 4.3m

Sl. No.	Item Description	No	Length (m)	Breadth (m)	Height (m)	Quantity	Remarks
1.	Brick work Superstructure						
	* Long wall	2	5.3m	0.3	0.9	10.08 m^3	L_{av} = 5.3+0.9 = 5.2 m
	* Short wall	2	3.4	0.3	0.9	5.508 m^3	L_{av} = 4.3-0.3 = 4.0 m
					Total Qty	15.55 m^3	

2.	PCC in foundation						
	a Long wall	2	6.2	0.9	0.3	3.348 m³	
	b Short wall	2	3.4	0.9	0.3	1.836 m³	
					Total Qty	5.184 m³	
3.	1st class brickwork in foundation and plinth						
	a Long wall :						
	① 1st Footing	2	5.9	0.6	0.3	2.124 m³	$L_{1st} = 5.3 + 0.6 = 5.9$
	② 2nd Footing	2	5.5	0.5	0.3	1.74 m³	$L_{2nd} = 5.3 + 0.5 = 5.5$
	③ Plinth	2	5.7	0.4	0.4	2.736 m³	$L_p = 5.3 + 0.4 = 5.7$
	b Short wall :						
	① 1st Footing	2	3.7	0.6	0.3	1.332 m³	$L_{1st} = 4.3 - 0.6 = 3.7$
	② 2nd Footing	2	3.5	0.5	0.3	1.14 m³	$L_{2nd} = 4.3 - 0.8 = 3.5$
	③ Plinth	2	3.9	0.4	0.4	1.872 m³	$L_p = 4.3 - 0.4 = 3.9$
					Total Qty	10.944 m³	
4.	1st class brickwork in superstructure						
	a Long wall	2	5.6	0.3	3.5	11.76 m³	$L_{LW} = 5.3 + 0.3 = 5.6$
	b Short wall	2	4	0.3	3.5	8.4 m³	$L_{SW} = 4.3 - 0.3 = 4$
					Total Qty	20.16 m³	

Estimation of two bedroom building

Q. Estimate the quantity of following items

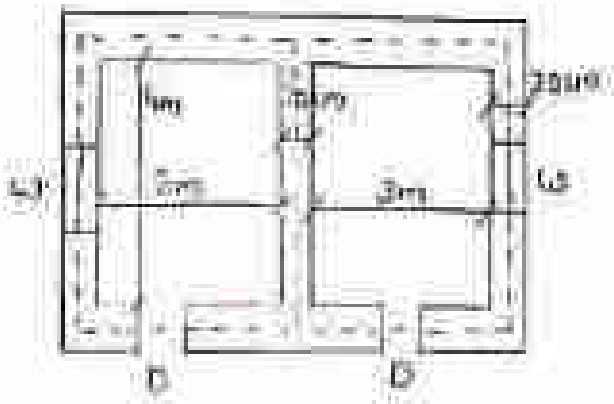
i) Earthwork excavation in foundation

ii) Lime concrete in foundation

iii) 1st class brickwork in foundation & plinth.

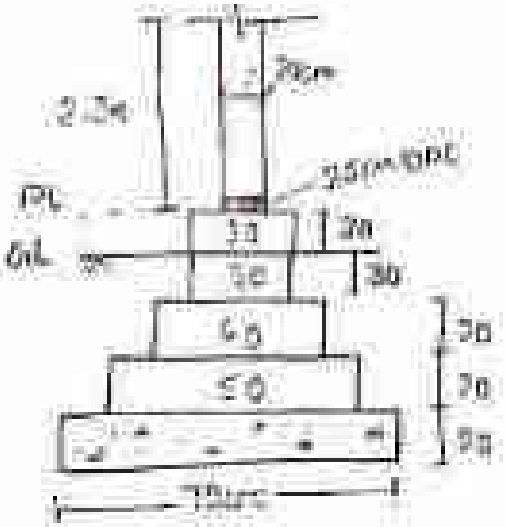
iv) 2.5cm thick DPC

v) 1st class brickwork in superstructure.



D = 1.2 x 2.1m

W = 1 x 1.2m



Centre line distance of long wall = 0.1 + 4 + 0.2 + 3 + 0.1 = 5.4m

Centre line distance of short wall = 0.1 + 6 + 0.1 = 6.2 m

No.	Description	No.	Length (m)	Breadth (m)	Height (m)	Quantity	Remarks
1	Foundation excavation in foundations:						
	a. Long wall	2	7.1	0.7	0.9	8.95 m³	$L_{lw} = 6.4 + 0.7 = 7.1$
	b. Short wall	3	3.5	0.7	0.9	6.62 m³	$L_{sw} = 4.2 - 0.7 = 3.5$
					Total Qty	15.57 m³	
2	Lime concrete in foundations:						
	a. Long wall	2	7.1	0.7	0.2	1.99 m³	
	b. Short wall	3	3.5	0.7	0.2	1.47 m³	
					Total Qty	3.46 m³	
3	1st class brickwork in foundations & plinth:						
	a. Long wall:						
	① 1st footing	2	6.9	0.5	0.2	1.38 m³	$L_{1st} = 6.4 + 0.5 = 6.9$
	② 2nd footing	2	6.8	0.4	0.2	1.09 m³	$L_{2nd} = 6.4 + 0.4 = 6.8$
	③ 3rd footing	2	6.7	0.3	0.3	1.21 m³	$L_{3rd} = 6.4 + 0.3 = 6.7$
	④ Plinth	2	6.7	0.3	0.3	1.21 m³	$L_p = 6.4 + 0.3 = 6.7$
	b. Short wall:						
	① 1st footing	3	3.7	0.5	0.2	1.11 m³	$L_{1st} = 4.2 - 0.5 = 3.7$
	② 2nd footing	3	3.8	0.4	0.2	0.91 m³	$L_{2nd} = 4.2 - 0.4 = 3.8$
	③ 3rd footing	3	3.9	0.3	0.3	1.05 m³	$L_{3rd} = 4.2 - 0.3 =$

		3	3.9	0.2	0.3	1.05	L_p 4.2 - 0.3 = 3.9
					Total Qty	9.01 m³	
4.	2.5cm thick DPC :						
	Long wall	2	6.6	0.2	—	2.64 m³	L_{lw} = 6.4 + 0.2 = 6.6m
	Short wall	3	4	0.2	—	2.4 m³	L_{sw} = 4.2 - 0.2 = 4m
					Total Qty	5.04 m³	
	Deductions :						
	Door	2	1.2	0.2	—	- 0.48	
					Net Qty	4.56 m³	
5.	1st class brickwork in superstructure						
	Long wall	2	6.6	0.2	3.3	8.71 m³	L_{lw} = 6.4 + 0.2 = 6.6m
	Short wall	3	4	0.2	3.3	7.92 m³	L_{sw} = 4 - 2(0.2) = 4m
					Total Qty	16.63 m³	
	Deductions :						
	Door	2	1.2	0.2	2.1	- 1.01	
	Windows	2	1	0.2	1.2	0.48	
						- 1.49	
					Net Qty	15.14 m³	

Centre Line Method

Step 1: Calculate the total centre line length of the wall in building & multiply the same by breadth & depth of respective item to

get the total quantity.

Step 2: For a building having cross or partition wall the total centre line length get reduced by half breadth of respective item for each junction ($n \times \frac{1}{2} b$)

Step 3: For different section of walls in a building (30cm, 20cm etc.) the centreline length for each type of wall shall be worked out separately.

Step 4: In case of a building having different types of wall suppose the outer or main wall are of 'a' type & inner cross walls are of 'b' type. The total centreline length of 'a' wall taken first & the length of 'b' type wall taken next separately.

* No deduction of any kind made for 'a' type wall but taken 'b' type width are taken for each joint half of the width from the corresponding section of main wall with which it joints at the same level shall be deducted.

↓

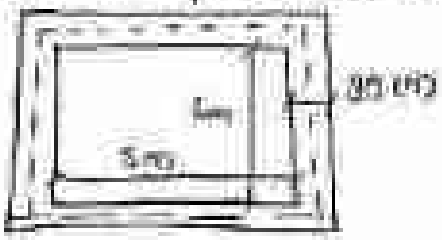
Q3 Estimate the quantity for following items of work.

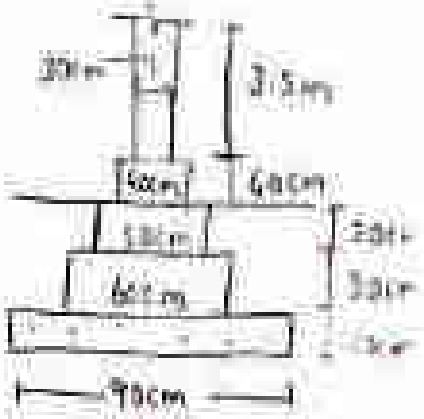
i) Earthwork in excavation in foundation

ii) PCC in foundation

iii) 1st class brickwork in foundations & plinth.

iv) 1st class brickwork in superstructure.





Centre line distance of walls = (3.15 + 3 + 3.15) x 2

1(0.15+4+0.15) x 2 = 17.2m

No. of junctions = 0

Sl. No.	Item description	No	Length	Breadth	Height	Quantity	Formula
1.	Earthwork excavation in foundation	–	19.2	0.9	0.9	15.55 m³	
2.	PCC in foundation	–	19.2	0.9	0.3	5.18 m³	
3.	1st class brickwork in foundation & plinth:	–					
	1st footing	–	19.2	0.4	0.3	3.46 m³	
	2nd footing	–	19.2	0.3	0.3	2.88 m³	
	Plinth	–	19.2	0.4	0.4	4.61 m³	
					Total Qty	10.95 m³	
4.	1st class brickwork in superstructure	–	19.2	0.3	3.5	20.16 m³	
					Total Qty		

Q4. Estimate the quantity of following items.

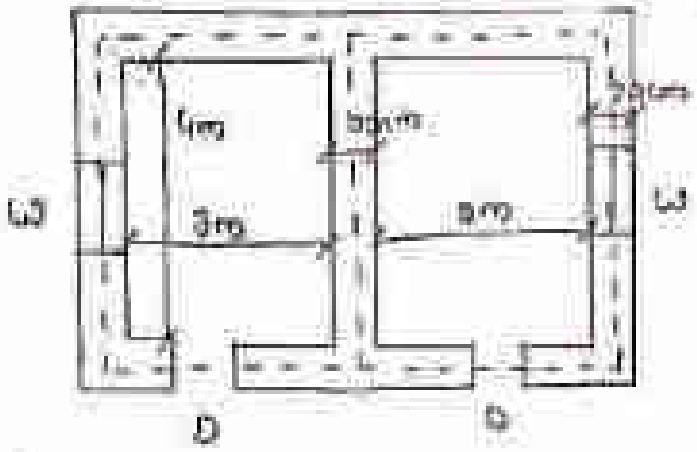
i) Earthwork excavation in Foundation

ii) Lime concrete in foundation.

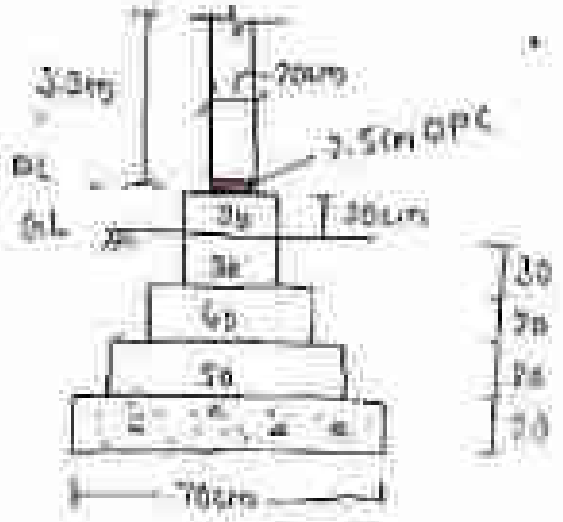
iii) 1st class brickwork in foundation & plinth.

iv) 2.5cm thick DPC.

v) 1st class brickwork in superstructure



D = 1.9 x 2 Lm
La = 1x1.9 m



Centre line distance of main wall = (6.1 + 3.1 + 3.1) x 2
+ (6.1 + 6 + 0.3) x 2 = 25.4m

No. of junctions (2e + 2e) = 8

SE No.	Item description	No	Lengths	Breadth	Height	Quantity	Remarks
1.	Earthwork Excavation in foundations	-	24.7	0.7	0.9	15.56m³	$L_m = 25.4 - (2 \times \frac{1}{2} 0.7)$ = 25.4 - 0.7 = 24.7
2.	Lime concrete in foundations	-	24.7	0.7	0.2	3.46m³	
3.	1st class brickwork in foundations: 1st footing	-	24.9	0.5	0.2	2.49m³	$L_{1st} = 25.4 - (2 \times \frac{1}{2} 0.5)$ = 24.9

	2nd footing	-	25	0.4	0.9	2 m³	L_{2nd} = 25.4 - $(\frac{1}{2}$ x 2x0. = 25
	3rd footing	-	25.1	0.3	0.3	2.26m³	L_{3rd} = 25.4 - $(\frac{1}{2}$ x 2x0. = 25.1
	Plinth	-	25.1	0.3	0.5	3.39m³	L_p = 25.1
					Total Qty	9.01 m³	
4.	2.0cm thick DPC	-	25.2	0.2	—	5.05m³	L = 25.4 - $(\frac{1}{2}$ x2 = 25.2
	Deductions:						
	Doors	2	1.2	0.2	-	- 0.48	
					Total Qty	4.56m³	
5.	1st floor brickwork in superstructure	-	25.2	0.2	3.5	14.63	L = 25.2
	Deductions:						
	Doors	2	1.2	0.2	2.1	-1.21	
	Windows	2	1	0.2	1.2	-0.48	
					Total Qty	13.16m³	

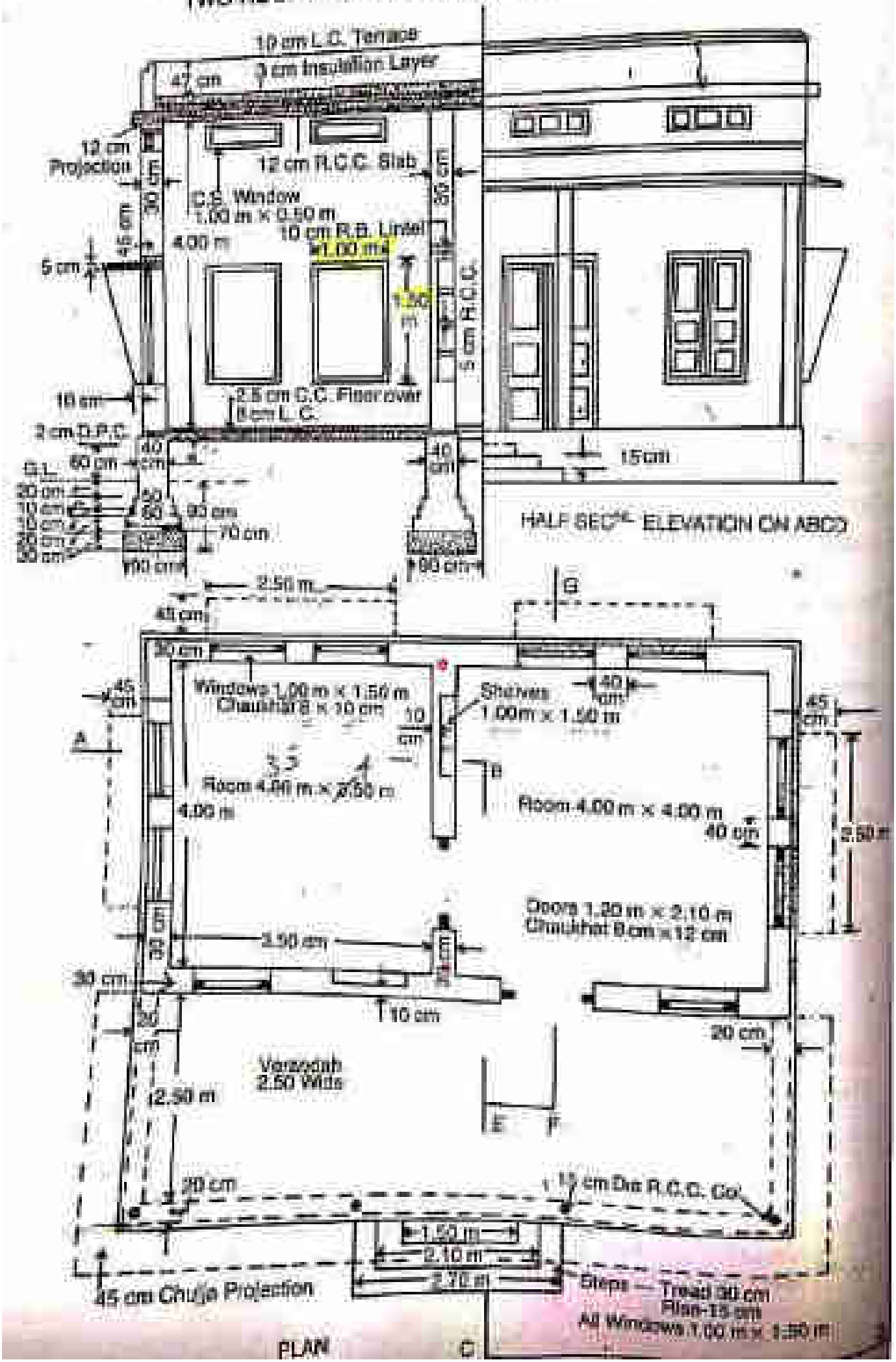
25. Prepare a detailed estimate & abstract of RCC building from the given plan, elevation & sectional elevation.

Centre line distance of main wall (30cm wall)

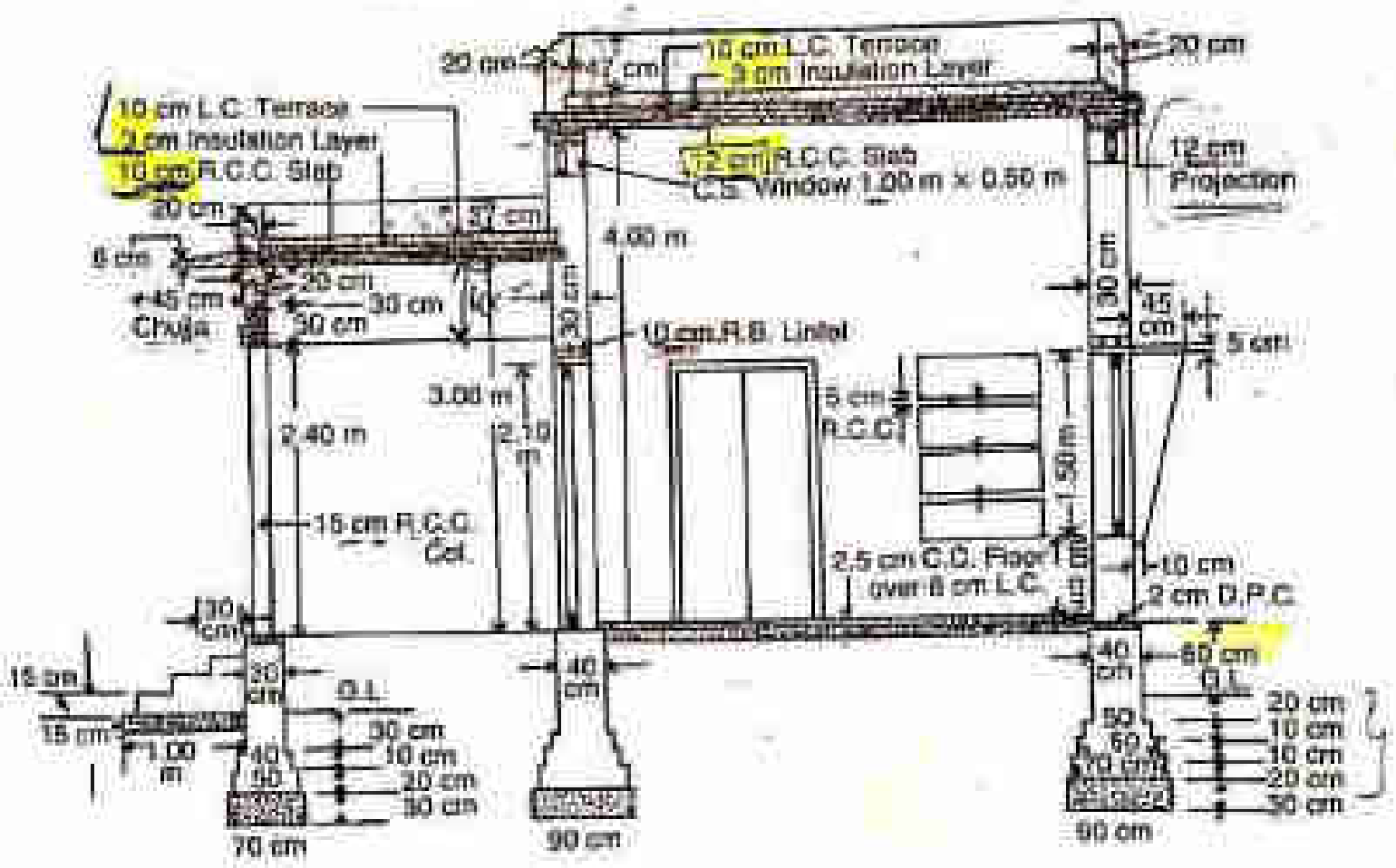
$= (6.15 + 3.5 + 0.3 + 4 + 0.15) \times 2$

$+ (6.15 + 4 + 0.15) \times 3 = 29.1$m

TWO-ROOM BUILDING WITH FRONT VERANDAH



CROSS-SECTION OF TWO-ROOMED BUILDING



SECTION ELEVATION ON CEFG

Centre line distance of (20cm) verandah wall

$= (0.15 + 2.5 + 0.1) \times 2 + (0.1 + 0.1 + 3.5 + 0.3 + \frac{4}{10.1} + \frac{10.1}{10.1})$

$= 13.7\,m$

No. of junction (30x30) = 2

No. of junctions (20x30) = 2

No. of junctions (30x30) = 0

S.N.	Item description	No.	Length (m)	Breadth (m)	Height (m)	Quantity	Remarks
1	Earthwork excavation						
	* Main wall (150cm)	-	28.2	0.9	0.9	22.84	$L_m = 29.1 - (2 \times \frac{1}{2} \times 0.9)$ $= 28.2\,m$
	* Verandah (30cm)	-	12.8	0.7	0.9	8.64	$L_v = 13.7 - (2 \times \frac{1}{2} \times 0.7) - (0.3 \times 2 \times \frac{1}{2} \times 0.7)$ $= 12.8$
	* Step	-	2.4	1	0.15	0.405	
					Total Qty	31.885 m^3	
2.	PCC in foundation						
	* Main wall	-	28.2	0.9	0.3	7.614	
	* Verandah	-	12.8	0.7	0.3	2.688	$L_v = 13.7 - (2 \times \frac{1}{2} \times 0.7) - (3 \times$ $= 12.8$
	* Step	-	2.4	1	0.15	0.405	
					Total Qty	10.707 m^3	
3.	1st class brick work in foundation & plinth						
	* Main wall: 1st floor	-	28.2	0.7	0.9	3.95	$L_m = 29.1 - (2 \times \frac{1}{2} \times 0.9)$

2nd Footing	-	28.5	0.6	0.1	1.77	$L_{2nd} = 29.1 - (2 \times \frac{1}{2} \times 0.6)$ $= 28.5$
3rd Footing	-	28.6	0.5	0.1	1.43	$L_{3rd} = 29.1 - (2 \times \frac{1}{2} \times 0.5)$ $= 28.6$
4th Footing	-	28.7	0.4	0.2	2.296	$L_{4th} = 29.1 - (2 \times \frac{1}{2} \times 0.4)$ $= 28.7$
Plinth	-	28.7	0.4	0.6	6.888	$L_p = 29.1 - (2 \times \frac{1}{2} \times 0.4)$ $= 28.7$
• Verandah:						
1st Footing	-	13	0.5	0.2	1.3	$L_{1st} = 13.7 - (2 \times \frac{1}{2} \times 0.7)$ $= 13$
2nd Footing	-	13.1	0.4	0.1	0.524	$L_{2nd} = 13.7 - (2 \times \frac{1}{2} \times 0.6)$ $= 13.1$
3rd Packing	-	13.2	0.3	0.1	0.396	$L_{3rd(1)} = 13.7 - (2 \times \frac{1}{2} \times 0.5)$ $= 13.2$
		13.3	0.3	0.2	0.798	$L_{3rd(2)} = 13.7 - (2 \times \frac{1}{2} \times 0.4)$ $= 13.3$
Plinth	-	13.3	0.3	0.4	2.394	$L_p = 13.7 - (2 \times \frac{1}{2} \times 0.4)$ $= 13.3$
• Step 1		3.7	0.9	0.15	0.865	
Step 2		2.1	0.6	0.15	0.189	
			0.3	0.15	0.068	

					Total Qty	22.335 m³	
4.	2cm thick DPC	-	28.8	0.3	-	8.64	L = 29.1 - (2 × 1/5 × 0.3) = 28.8m
	Deductions:	2	1.2	0.3	-	0.72	(width of DPC = 30cm)
					Total Qty	7.92 m²	
5.	1st class backwash in superstructure						
"	30 cm wall	-	28.8m	0.3	4	20.56	L = 29.1 - (2 × 1/5 × 0.3") = 28.8m
*	Backwash above lintel in verandah	-	13.4	0.2	0.3	0.804	L = 13.7 - (2 × 1/5 × 0.3) = 13.4m
*	Backwash in parapet above roof	-	95.2m	0.2	0.6 (extra 0.3 thick)	8.024	L_m = (0.2×0.1 (corn) + 3.5 + 4 + 0.3 + 0.1 + 0.2)×2 + (6.4 + 0.1 + 4 + 0.1) ×2 = 95.2
*	Parapet above verandah	-	13.4m	0.2	0.4 (2×0.2)	1.072	L = 13.7 - 0.3 = 13.4
					Total Qty	29.46m³	
*	Deductions:						
	Doors	2	1.2	0.3	2.1	1.512	
	Windows	10	1	0.3	1.5	4.5	
	Cross windows	12	1	0.3	0.5	1.8	

	Sunshade	2	1	0.2	1.8	0.36	
	Lintel	-	28.8	0.3	0.1	0.864	L = 29.1 - (2 × 1/2 × 0.3) = 28.8
						0.276	
					Total qty	30.184 m³	
c.	RCC work :						
	• Roof slab for 30cm		8.64	6.84	0.12	5.018	L = 0.3 + 3.5 + 0.3 + 4 + 0.3 + 0.12 + 0.12 = 8.64 B = 0.12 + 0.3 + 6 + 0.3 + 0.12 12 cm thick RCC slab
	• Roof slab for verandah		8.4	2.85	0.1	2.394	L = 0.2 + 0.1 + 0.3 + 0.3 + 4 + 0.1 + 0.2 = 8.4 B = 0.2 + 2.5 + 0.15 = 2.85 Assume 15cm insulation to the wall
	• Lintel						
	• 30 cm wall		28.8	0.3	0.1	0.864	
	• Verandah		14	0.2	0.3	0.84	L = 13.7 - (2 × 1/2 × 0.3) + 0.3 + 0.3 = 14m (30cm insulation to the wall)
	• For glass window	12	1.2	0.6	0.1 (Thick)	0.432	L = 0.1 + 1 + 0.1 + 1.2 Assume 10cm thickness divided in

	RCC pillar					each side
	RCC pillar	4			$\frac{\pi}{4}d^2h \times 4$	$11 + 2.6 + 0.8 = 14.4$
					$\frac{\pi}{4} \times 0.45^2 \times 14.4 \times 2.4$	(term insulation to the place (assume))
					$= 0.19$	
	Chajja projection for verandah					
	Total		9.3	0.15	0.05	0.0348
	Side	2	2.5	0.45	0.05	0.2812
	Sunshade for windows					
→	Top	4	2.5	0.6	0.05	0.25
→	Bottom	4	2.5	0.15	0.05	0.075
→	Sides	4x2	1.5	0.225	0.05	0.135
	Shelf slab	2x3	1	0.2	0.05	0.05
					Total qty	10.85 kg/m³

$L = 0.45 + 0.2 + 0.1 + 3.5 + 10.3 + 4 + 0.1 + 0.2 + 0.45 = 19.3$

$L = 0.2 + 2.5 + 0.1 = 2.8$

(Assume term insertion to the wall)

$b = 0.45 + 0.05 = 0.5m$

(Term insertion to the wall)

$b = 0.1 + 0.05$

$b = \frac{0.5 + 0.15}{2} = 0.325$

7. Steel reinforcement — 1 % total RCC work = $\frac{1 \times 10.85}{100}$

$= 0.1085 m^3$

$= 0.1085 \times 7850$

$= 8.517 \times 10^2$

$= 851.7 kg = 0.85 T$

Density of steel = 7850 kg/m³

100 kg = 1Q

1000 kg = 1T

5. Wood work :							
a. Frame							
→ Door		2	5.46	0.12	0.09	0.1048	L = 0.08 + 2.1 + 1.5 + 2.1 + 0.03 (Assume 80mm projection to the floor)
→ Windows		10	5	0.1	0.08	0.4	L = 1 + 1.5 + 1 + 1.5 = 5
→ Cross window		12	3	0.08	0.06	0.2304	L = 1 + 0.5 + 1 + 0.5 = 3 Assume frame size 80 x 80mm
					Total Qty	0.7352 m³	
b Shutters							
→ Door		2	1.07	—	2.025	4.28	L = [1.2 - [(0.08) x 2]] + [0.015 x 2] Assume 15mm as beading H = 2.1 - 0.08 - 0.015 + 0.015 = 2.12
→ Windows		10	0.37	—	1.37	11.919	L = 1 - (0.08 x 2) + (0.015 x 2) = 0.87 H = 1.5 - (0.08 x 2) + 0.015 + 0.015 = 1.37
→ Cross window		12	0.87	—	0.87	3.86	L = 1 - (0.08 x 2) + 0.015 + 0.015 = 0.87

9.	Flooring					
	Room:					
	Room1	-	3.5	4	-	14
	Room2	-	4	4	-	16
	Verandah all opening including total space	-	8.5	2.75	-	23.375
	Deca	2	1.2	0.3		0.72
	Deductions:					
	Column area	6	$\frac{\pi}{4} d^2 = \frac{\pi}{4} \times 0.15^2$		=	0.0706
					Total Qty	54.0244 m^2
10.	10 cm lime concrete to roof leveling complete with surface finishing:					(Measured in Sqm)
a	Main cast	-	8	4.2	-	33.6
b	Verandah	-	8	2.5	-	20
					Total Qty	53.6 m^2
11.	12mm thick plastering using cement mortar 1:6 :					
a	Inside plastering					
	Room1	2	3.5	-	4	28
	"	"	4	-	4	32

L = 0.1+3.5+0.3+4.4 +8

B = 0.1+4+0.1 = 4.2

L = 8

b = 2.5

→	Room 2	4	4	-	9	69	
→	Verandah		8.4	-	3	25.2	L = 0.3+3.5+0.3+4 +0.3 = 8.4
							H = 2.4+0.3+0.3+3
→	Top of Pillar (Verandah from above column level)		8	-	0.6	4.8	L = 0.1+3.5+0.3+4 +0.1 = 8
-	Side	2	2.5	-	0.6	3	
→	Jamb, sill & soffit of shelf	2	5	-	0.9	9	L = 1.5+1.5+1+1 = 5
					Total	159 m²	
	Deductions:						
	Door	2	1.7		2.1	-5.04	
	Window	2	1		1.5	-3	
					Total Qty	150.96 m²	
o	Outside plastering						
→	Room						
-	Back plinth including 10cm below ground level		8.5	-	0.75	6.375	 L = 0.05+0.3+3.5 +0.3+4+0.3+0.05 = 8.5 H = 0.6+0.1+0.05 = 0.75
-	Side	2	4.5	-	0.75	6.9	 L = 0.3+4+0.3 = 4.6

- Back wall		8.4	—	4	33.6	L = 0.3 + 3.5 + 0.3 + 4 + 0.3 = 8.4
- Side wall	2	4.6	—	4	36.8	L = 0.3 + 4 + 0.3 = 4.6
→ Veranda's						
- Plinth including 10 cm G.L (Front)		8.5	—	0.7	5.95	L = 0.05 + 0.3 + 8.5 + 0.3 + 4 + 0.3 + 0.05 = 8.5 H = 0.4 + 0.1 = 0.7
- Plinth including 10 cm G.L (side)	2	2.75	—	0.7	3.85	L = 0.3 + 2.5 + 0.05 = 2.75 H = 0.6 + 0.1
→ Above pillas Outer face						
- Front		8.4	—	0.6	5.04	
- Back Side	2	2.7	—	0.6	3.24	
→ Wall above Veranda roof		8.4		0.77	6.468	L = 0.3 + 3.5 + 0.3 + 4 + 0.3 = 8.4 H = 4 - (3 + 0.1 + 0.03 + 0.1) = 0.77
→ Parapet						
- Room:						
Inner wall		23.6		0.47	11.092	L = (3.5 + 0.3 + 4) 2 + (4.2) = 23.6
Outer wall		25		0.6	15.6	H = 0.47 + 0.03 + 0.1 = 0.6
Top of the wall		25	0.2		5.2	
- Verandah's:						
Inner wall		13		0.27	3.51	L = 0.3 + 3.5 + 0.3 + 4 + 0.1 + (3.5 + 0.3) = 13
Outer wall		13.8		0.4	5.52	H = 0.27 + 0.03 + 0.1 = 0.4
Top of the wall		13.8	0.2		2.76	
				Total	181.905	

	Deductions:					
	Windows	8	1		1.5	12
	Cross windows	12	1		0.5	6
					Total Qty	123.905 m²
13	Ceiling Plastering					
	Room 1	1	3.8	4	44	14
	Room 2	1	4	4	16	16
	Verandah	1	8	2.5		20
					Total Qty	50 m²
12	White washing					
	For internal & ceiling		158.96	1.30	= 206.648m²	
14	Colour washing					
	For outside wall:					
→	Total quantity of outside plastering					130.905
→	Chajja					
	Front verandah	—	9.8	—	0.96	8.928
	Side verandah	2	2.7	—	0.96	5.184
→	Sunshade					
	Top	4	2.5	—	0.95	9.5
	Bottom	4	2.5	—	0.25	2.5
	Side	8	1.5	—	0.375	6.0

Edge of sticks	8	1.5	—	0.05	0.4	
→ Pillar	4			2.75	4.5938	$4 \times 2 \times 11 \times \frac{0.15}{2}$ sq.
→ Cubes projection of roof slab		24	—	0.36	9.84	0.12 / 0.12 / 0.12
				Total Qty	181.1 m²	

Rates of different items of work.

1. Earthwork excavation

Ordinary soil	Hard soil
Rs. 200 per m³	Rs. 290 per m³

2. R.C.C

1:2:4 for foundation - Rs. 6400 per m³

3. Lime concrete in foundation - Rs. 2500 per m³.

4. 1st class brickwork in foundation - Rs. 4000 per m³

5. 1st class brickwork in superstructure - Rs. 5000 per m³

6. Cement concrete 1:2:4 using 20mm aggregate for RCC work - Rs. 6900 Rs. 6100 per m³.

7. Steel work - Rs. 80 /kg

8. Wood work, Frame (Teak) - Rs. 25000 /m³

shutter - Rs. 8000 /m³

9. Plastering :

Inside plastering - 200 /m²

Outside " - 210/m²

Ceiling - 250/m²

10. Flooring :

Concrete Flooring - 150/m²

Mosaic Flooring - 800/m²

Tile Flooring - 1200/m²

11. Inside painting - Rs. 60 per m²

Outside painting - Rs. 180 per m²

12. Lime concrete in roof terracing - Rs 230 per m³

13. DPC - Rs. 150 /m²

Abstract

Item No.	Description	Quantity	Unit	Rate	Amount
1.	Earthwork excavation :				
	Ordinary soil	31.885	m³	200	6377
2.	PCC in foundation	16.737	m³	5400	87979.8
3.	1st class brickwork in foundation	22.338	m³	4000	89352
4.	2cm thick DPC	7.99	m²	150	1198
5.	1st class brickwork in superstructure	30.184	m³	5000	150920

6.	RCC work	10.854	m^3	6100	66209.4
7.	Steel work	851.7	kg	80	68136
8.	Wood work:				
	Frame	0.7357	m^3	25000	18380
	Shutter	20.109	m^2	8000	160872
9.	Concrete flooring	34.0244	m^2	150	5103.66
10.	Line concrete in roof bearing	53.6	m^2	250	13400
11.	Plastering:				
	Inside	150.96	m^2	200	30192
	Outside	133.905	m^2	210	28120.05
	Ceiling	50	m^2	250	12500
12.	Inside painting	900.96	m^2	160	32153.6
	Outside painting	181.1	m^2	180	32598
				Total	776371.51

Bar bending schedule

Bar bending schedule is prepared for estimating steel for reinforcement. This is a list of reinforcement bar in a tabular form & the following details are generally given for a bar bending schedule in a RCC work.

1. Bar mark for the position of bar
2. Diameter of bar in mm
3. Shape & bending dimensions
4. Length of bar
5. No. of same type of bar
6. Total length
7. Weight
8. Total weight

Bar bending schedule Formula

Bar mark	Dia. of bar mm	Shape & bending dimension	Length of bar (m)	No. of bars (operation)	Total length	Weight	Total weight

Size & weight of mild steel

Size (mm)	5	6	8	10	12	16	20	22	25	28	32	36	40	45
Weight kg/Rm	0.16	0.22	0.39	0.62	0.89	1.58	2.47	2.98	3.85	4.83	6.31	7.99	9.86	12.48

End anchorage

- Semi circular hook

Length of hook = 9D

D-diameter of bar in mm

∴ Total length = L + 2 × 9D

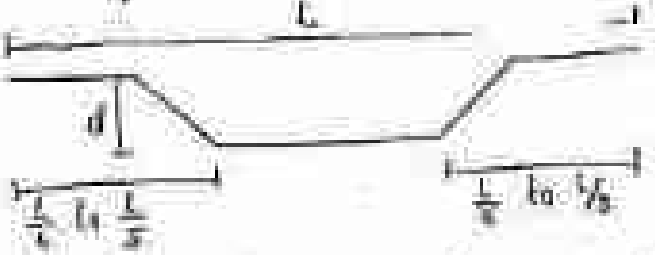
Overlapping length = 40D

D-dia in mm.

- Rectangular hook

Length of hook = 6D

- Straight bars.
- Bent-up bars or cranked bars (To resist hogging in support) (-ve BM)



- If position of bent-up bars not shown in the drawing then the position of crank may be considered as $\frac{1}{6}$th to $\frac{1}{5}$th of effective spa

of the beam

- If a bar is cranked at both ends at 45° then total length of bar
  = L + [2 x 0.42d]

  d- depth covered by the crank.

- If a bar is cranked at both ends at 30° then total length of bar
  = L + (2 x 0.27d)

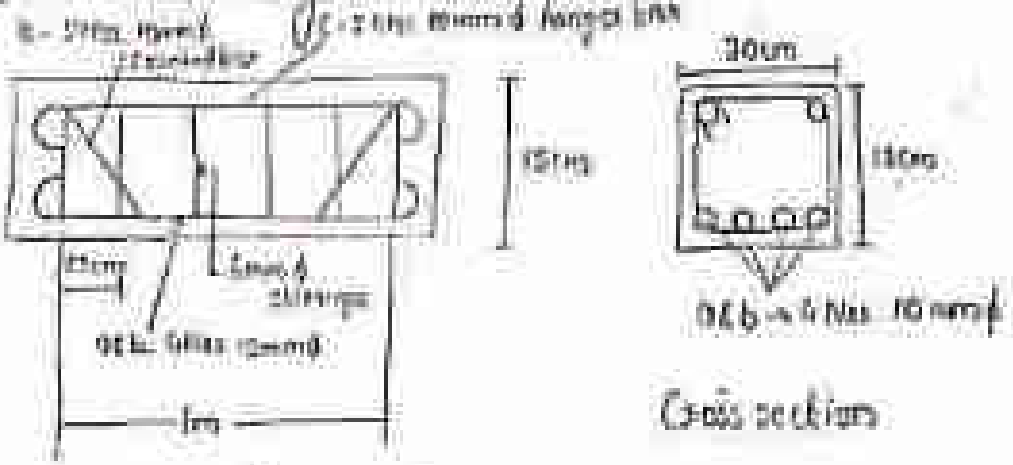
  d- depth covered by the crank.

- Stirrup

  Extra length for stirrup = 24D

  D- diameter of bar in mm

Q7. Prepare a schedule of bar for the RCC lintel shown in figure assuming bearing of the lintel 15cm on the walls at each sides. Assume nominal cover 25mm & angle of bend 45°.



Longitudinal cross section

Bar mark	No. of bar mm	Shape & bending dimension	Length of one bar (m)	No. of same type bar	Total length	Weight	Total weight
a-a c-c	10mm		1.43	4	5.72	0.62	3.546 kg

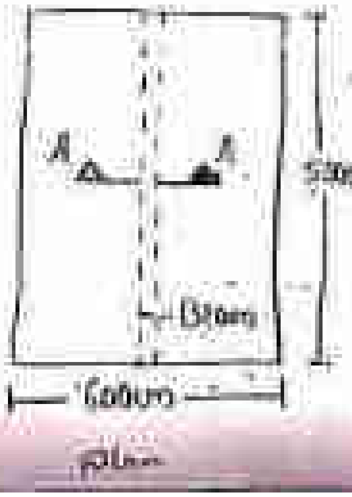
mark	dia	Shape & bending dimension	Length of one bar (m)	No. of bars	Total length	Unit weight	Total weight	
b-b	10mm		1.516	2	3.032	0.62	1.877 kg	L = 1.3 − (0.025×2) + (0.42d×2) + 2×9D = 1.3 − 0.05 + (2×9D) + (0.42×(15−2.5×2)) = 1.516
Stirrups	6mm		0.796	6	4.776	0.22	1.05 kg	L = [(30 − (2.5×2)) − (0.6×2)]×2 + [(15 − (2.5×2)) − (0.6×2)]×2 + 24×0.6 = 0.796
							Total quantity = 6.673 kg ≈ 6.5 kg	

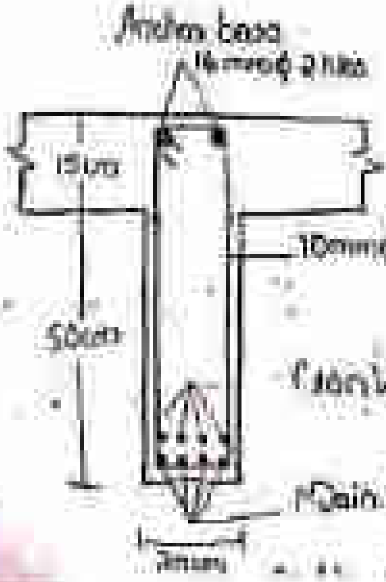
98. A room 600cm long × 500cm wide has a flat-roof. there is one T beam in the centre (c/s below the slab 30×50cm) & the slab is 15cm thick. Estimate the quantity of iron bars required for reinforcement (for T beam only) for the data given below:

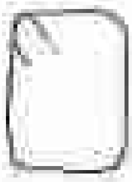
Main bars - 8 Nos, 25mm dia in two rows of 4 each (All 4 being bottom bars straight & others bent)

Stirrups - 10mm ϕ @ 15cm centre to centre throughout

Anchor bars - 2 Nos, 16mm ϕ (Assume a clear cover of 25mm dia all over & bars are bent at 45°)





Bar mark	Dia in mm	Shape & bending dimension	Length of bar	No. of same type bar	Total length	Weight	Total weight	
T	16		5.338	2	10.676	1.58	16.55	L = 500 (25×2) + (9×1.6)×2 = 5.33 m
b_1	25		5.4	4	21.6	3.85	83.16	L = 500 − (2.5×2) + (9×2.5)×2 = 5.4 m
b_2	25		5.862	4	23.448	3.85	90.27	L = 500 − (2.5×2) + (2×9×2.5) + (2×0.42×(50 − 2.5 − 1.6 − 2.5)) = 5.862 m
Stirrups	10		1.86	35	65.1	0.62	40.36	No. of stirrups = $\frac{500}{15}$ + 1 = 34.33; L = {30 − (2.5×2) − (1.2)}×2 + [0.65 − (2.5×2) − (1.2)]×2 + 24×1 =
					Total quantity = 230.34 kg			

Note :

Where there are 2 or more rows of bars the bars shall be vertically in line & the min vertical distance b/w the bars shall be 15mm

Clear cover :

Beam - 25mm

Column - 40mm

Slab - 15 mm

Q.9. Prepare a bar bending schedule & quantities of RCC & reinforcement of a simply supported beam of length 8.5m, depth 30cm & width 30cm reinforced with 3 Nos. of 20mm diameter at bottom as straight bar, 2 Nos. of 20mm diameter cranked at 45°, 2 Nos. 16mm ϕ at

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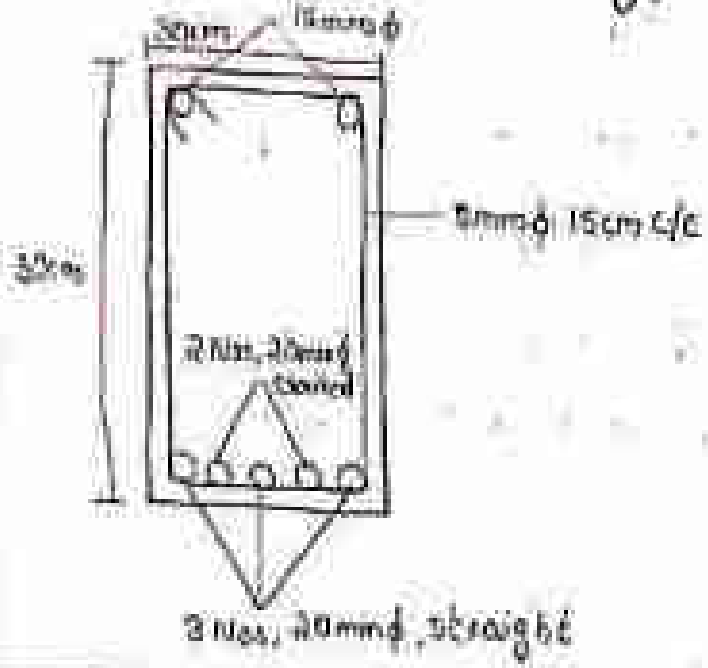
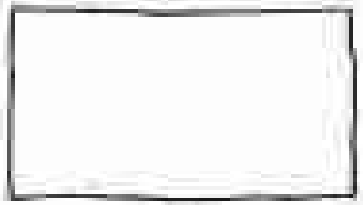
Top of beam & 8mm ϕ 2 legged stirrups at 15cm c/c.





Bar mark	Dia of bar (mm)	Shape & bending dimensions	Length of bar (m)	No. of same type bars	Total length	Weight	Total weight	
b (bottom straight)	20		6.81	3	20.43	2.47	50.46	L = 6.5 − (0.025×2 cover) + (9 × 0.02 × 2) = 6.81
b (bottom bent-up bar)	20		7.18	2	14.36	2.47	35.46	L = 6.5 − (0.025×2) + (9×0.02×2) + (0.42 × (0.5 − (2 × 0.025)) × 2) = 7.18 d = 0.3 − (2×0.025)
T (top bar)	16		6.76	2	13.48	1.58	21.29	L = 6.5 − (0.025 × 2) + (2×9×0.016) = 6.76
8ϕ stirrups	8		1.53 kg	45	68.85	0.39	26.85	L = [0.3 − (2×0.025) − (2×0.008)] ×2 + [0.5 − (2×0.025) − (2×0.008)] ×2 + (24 × 0.008) = 1.52 No. of stirrups = 6.5/0.15 + 1 = 44.33

Total quantity = 134.06 kg

Quantity of RCC = [illegible]

= 6.3×0.3×0.5 = 0.945 m³

9.10. Prepare a detailed estimate of a RCC roof slab 3m clear span & 6m long from the given drawings. RCC work including centering & shuttering & steel reinforcement in detail shall be taken separately. Also prepare a schedule of bars. Assume side cover 4cm.

Length = 6 + 0.15 + 0.15 = 6.3m

Width = 3 + 0.15 + 0.15 = 3.3m

Quantity of RCC = 6.3×3.3×0.12 = 9.49 m³

Bar mark	Dia. of bar (mm)	Shape & bending dimension	Length of bar	No. of same bars	Total length	Weight	Total weight	
Main bars (straight)	12		3.44 5.04	27	92.88	0.89	82.66	L = 3.3 − (0.04×2) + (2×9×0.012) = 3.44; No. of main straight bars = (6.3 − (2×0.04))/0.20 = 26.9
Main bars (cranked)	12		3.44	26	89.46	0.89	80.06	No. of cranked bars = (6.3 − (2×0.04))/0.24 = 25; L = 3.3 − (0.04×2) + (2×9×0.012) + (2×0.42×(0.12−0.08)) = 3.6
Distribution bars (bottom)	6		6.33	19	120.27	0.22	26.46	L = 6.3 − (0.04×2) + (2×9×0.006) = 6.33; No. of bars = (3.3 − (2×0.04))/0.18 = 17.8
Distribution bars (Top)	6		6.33	3×2	37.98	0.22	8.35	

Total quantity = [illegible]

Estimation of Earthwork For Road construction

Volume of earthwork shall be measured in cubic metres without any allowance for shrinkage in earth. The volume of earthwork shall be calculated by multiplying the length, breadth & depth or height measured from the ground from which the soil has been taken out.

Lead & lift

Lead shall be a horizontal straight distance through which the earth can be carried out or transported from the sources to the place of spreading.

The unit of lead is 50m for a distance upto 300m & shall be measured as a separate item for

1. @ 0 to 250 m
2. 250m to 300 m

The unit of lead is 100m for a distance exceeding 500m upto 5 km shall be measured as a separate item with the following stages.

1. Lead exceeding 300m & not exceeding 1000 m.
2. 1000 to 1500 m
3. 1500 to 2000 m

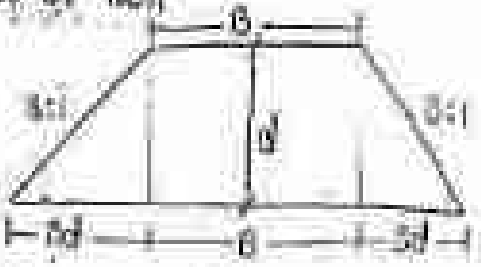
Such separate stages shall be provided for a distance upto 3 km.

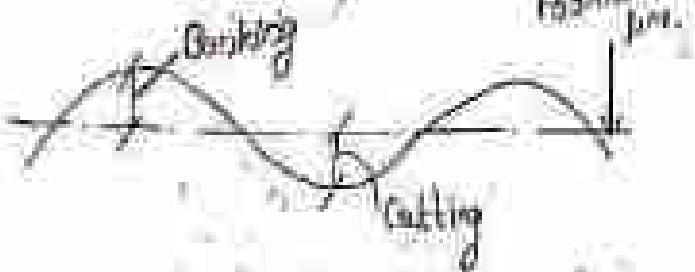
When the lead exceeds 5 km it will be measured in units of 1 km

Lift :

Lift shall be measured from ground level, excavation upto 1.5m

depth below ground level & depositing excavated material on the ground should be included in the item of earthwork for various kinds of soil





The depth of earthwork either in banking or cutting at any place along the road center is the difference b/w ground level & formation level but the top width for banking or bottom width for cutting remains same for a length. The side slope is measured in the form of horizontal : vertical.

Volume of earthwork

Volume of earthwork = Sectional area x Length

$$V = [Bd + sd^2] \times L$$

Case 1

Volume of earthwork when the ground is levelled or L the formation level of the road has no gradient. Then volume of earthwork

$= [Bd + sd^2] L$

Case 2

Volume of earthwork when the ground is in longitudinal slope or the formation level has a uniform gradient for a length L. quantity of earthwork may be calculated by any one of following

* Formula of mid-section method.
* Formula of trapezoidal or average end area or mean sectional area method

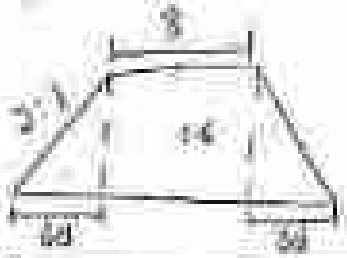
6 Trapezoidal method - according to Simpson's first rule

7. Mid section Formula

In this Formula, the mean depth is calculated first by average in the depths of two consecutive sections From the mean depth the area of mid-section is to be worked out & volume of earthwork to be computed by multiplying the area of mid-section by the distan btw the two original sections

Station/ Chainage	Depth/ height of station as Difference of GL & FL	Mean depth or height (obs)	Area of central portion ($5 \times d_m$)	Area of sides ($\frac{1}{2} s d_m^2$)	Total area ($b d_m + s d_m^2$) (A_m)	Distance btw Sections (L)	Quantity ($A_m L$)	
							Embankment	Cutting

9 11. Estimate the quantity of earthwork for an embankment 120m long & 8m wide at crest & whose side slopes is 2 to 1. The central hgt of From grnd at every 30m interval are 0.60 m, 1.2 m, 1.6, 2 & 0.7m Calculate the earthwork using mid section Formula.



Station/ Chainage	Depth/ height	Mean depth	Area of central portion	Area of sides	Total area	Distance btw Sections	Quantity	
							Embankment	Cutting
0	0.6	—	—	—	—	—		
1	1.2	0.9	7.2	1.62	8.82	30	264.6	
2	1.6	1.4	11.2	3.92	15.12	30	453.6	

3	1.9	1.8	14.4	6.48	20.88	30	[illegible]	
4	1.3	1.65	13.2	5.445	18.645	30	559.35	
							Total Qty =	1903.95 m³

2. Average end area or mean sectional area method

This method is based on the assumption that the mid area of a pyramid is have the avg. area of the ends & the end sections are in parallel planes if A_1 & A_2 are areas of the ends & L is the length bet'n the two sections, the volume is given by

$V = L \times \left(\frac{A_1 + A_2}{2}\right)$ or $V = L \times A_m$ A_m - mean sectional area.

Station/ Chainage (l)	Depth of Central section (d)	Area of Central section (Bxd)	Area of Sides ($2xd^2$)	Total sectional area ($Bd + 2d^2$)	Total mean sectional area ($\sum A_m$)	Distance L	Quantity	
							Embankment	Cutting

Q19. Same as above question:

Station/ Chainage	Depth of Central section	Area of Central section	Area of Sides	Total sectional area	Total mean sectional area	Distance L	Quantity	
							Embankment	Cutting
0	0.6	6.8	0.72	5.52	—	—		
1	1.9	9.6	7.22	12.68	9	30	270	
2	1.6	12.8	5.12	17.92	15.2	30	456	
3	2	16	8	24	20.96	30	628.8	
4	1.3	10.4	3.38	13.78	18.89	30	566.7	
							Total qty =	1921.5 m³

3. Prismoidal method

This formula is based on the assumptions that A_1 & A_2 are the areas at the ends & A_m is the area of mid section parallel to ends & L is the length b/w two end. Then, volume

$$V = \frac{L}{6}[A_1 + A_2 + 4A_m]$$

Prismoidal formula to estimate volume of earthwork having more than 3 cross sections at regular intervals.

$$V = \frac{I}{3}[A_1 + A_n + 4 \times \text{Σ even areas} + 2 \times \text{Σ odd areas}]$$

Q1. Refer problem number 11.

Solution.

At 0, $A_0 = Bd + sd^2 = 8 \times 0.6 + 2 \times 0.6^2 = 5.52\ m^2$ ①

At 1, $A_1 = 8 \times 1.2 + 2 \times 1.8^2 = 12.48\ m^2$ ②

At 2, $A_2 = 8 \times 1.6 + 2 \times 1.6^2 = 17.12 m^2$ ③

At 3, $A_3 = 8 \times 2 + 2 \times 2^2 = 24 m^2$ ④

At 4, $A_4 = 8 \times 1.8 + 2 \times 1.3^2 = 13.78\ m^2$ ⑤

$$\therefore V = \frac{I}{3}\left[\begin{matrix}A_0 + A_4 \\ A_0 + A_4\end{matrix} + 4 \times \text{Σ even area} + 2 \times \text{Σ odd area}\right]$$

$$= \frac{30}{3}\left[5.52 + 13.78 + 2(17.92) + 4(12.48 + 24)\right] = 2010.6\ m^3$$

Quantity as obtained by method 3 is more accurate & this is more by 5% & less by 0.77% as compared to methods 1 & 2 respectively considering base code of earthwork method 1 & 2 are in general use. But method 2 should be preferred as the result is more close to method 3.

sufficiently close intervals.

Example-3 Prepare an estimate for the portion of a road from chainage 14 to 22 from the data given below. Draw also the longitudinal and typical cross-sections for cutting and banking. Turfing with grass sods shall be provided for the sides of the embankment @ Rs. 2.00 per sq m. The rate of earthwork in cutting is Rs. 8.50 per cu m and embankment is Rs. 7.50 per cu m. The formation width of the proposed road is 12m. side slopes: $1\frac{1}{2}$: 1 in cutting and 2 : 1, in banking

Chainage (30m)	14	15	16	17	18	19	20	21	22
R.L. of Ground	108.60	109.25	109.40	108.85	108.50	107.25	106.80	107.15	107.20

The road formation is proposed at uniform falling gradient 1 in 200 passing through G.L. at chainage 14. Length of one chain = 30 m.

Solution : Depths of cuttings and bankings are denoted by –ve and +ve signs respectively. Depth of cutting or banking = Difference between G.L. and F.L. For a gradient 1 in 200 change of level per chain of 30 m $= \frac{30}{200} = 0.15$.

Chainage (30m)	14	15	16	17	18	19	20	21	22
R.L. of Ground	108.60	109.25	109.40	108.85	108.50	107.25	106.80	107.15	107.20
R.L. of Formation	108.60	108.45	108.30	108.15	108.00	107.85	107.70	107.55	107.40
Depth of earthwork (diff. of G.L. & F.L.)	0	–0.80	–1.10	–0.70	–0.50	0.60	0.90	0.40	0.20

Quantities of earthwork and area of turfing are calculated adopting mid-section formula in a table as shown below, B = 12m ; S = 1.5 Cutting and S = 2 Banking.

Chainage	Depth or height Diff of G.L. and F.L. m	Mean depth or height dm m	Area of Central portion Bdm sq m	Area of sides Sdm^2 sq m	Total area Bdm + Sdm^2 sq m	Length Between Chainage L m	Quantity $L(Bdm + Sdm^2)$ Cutting cu m	Quantity $L(Bdm + Sdm^2)$ Banking cu m	Area of both sides Turfing $2L \times dm\sqrt{1+S^2}$ sq m
14	0	—	—	—	—	—	—	—	—
15	–0.80	–0.40	4.80	0.24	5.04	30	151.20	—	—
16	–1.10	–0.95	11.40	1.35	12.75	30	382.50	—	—
17	–0.70	–0.90	10.80	1.22	12.02	30	360.60	—	—
18	–0.50	–0.60	7.20	0.54	7.74	30	232.20	—	—
Zero	0	–0.25	3.00	0.09	3.09	14	43.26	—	—
19	0.60	0.30	3.60	0.18	3.78	16	—	60.48	21.47
20	0.90	0.75	9.00	1.23	10.23	30	—	306.90	108.62
21	0.40	0.65	7.80	0.85	8.65	30	—	259.50	87.20
22	0.20	0.30	3.60	0.18	3.78	30	—	113.40	40.25
						Total =	1169.70 cu m	740.28 cu m	249.54 sq m

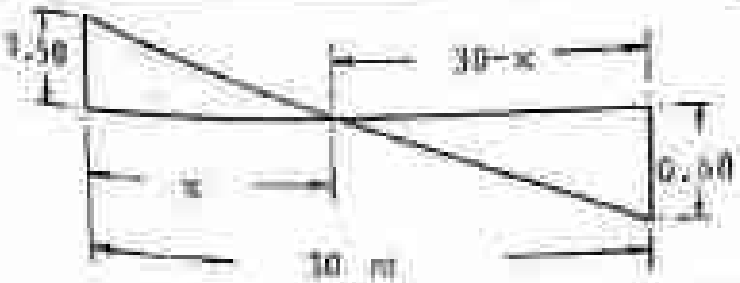


FIG. 18-8

Let the distance from 16 chainage up to portion of cutting = X

$\therefore \frac{X}{0.50} = \frac{30-X}{0.60}$ or, $0.6X = 15 - 0.50X$

or $1.1X = 15 \quad \therefore X = \frac{15}{1.1} = 13.63$ m say 14 m

∴ Length of banking portion = 30-14 = 16 m.

Estimate of metalled road

Q 15. Calculate the quantity of metal required for a 3.7m wide macadam road for 1 km length for 1 layer of 8cm compacted thickness

Note:

Metalling of road usually consist of 3 layers of coats i.e the soling coat, inter coat & top coat. The metal may be stone ballast, brick ballast, kankar etc. The inter coat & top coat are made with 12cm thick layer loose compacted to 8cm. The soling coat may be of brick flat on brick on edge or of stone boulders or of some type as for the inter or top coat if the sub soil is good. The top or covering coat may be of cement concrete or bituminous.

Ans: Quantity of metal (loose) = $1000 \times 3.7 \times 0.12 = 444\ m^3$

(Volume of loose metal get reduced ⅓ on compaction)

Q 16. Calculate the quantity of materials stone grit & binder as paint required for 1st coat of painting for 1 km length of 3.7m wide bituminous road.

1st coat painting:

1.35 ml metal per square meter

Quantity of stone grit 20 mm size = $1000 \times 3.7 \times \frac{1.35}{100}$

$= 49.95\ m^3$

(@ 1.35 m^3 % for 1 sqm)

Binder as road tar or asphalt = $1000 \times 3.7 \times \frac{220}{100}$

$= 8140\ kg$

(@ 220 kg % for 1 sqm)

2nd coat of painting:

Quantity of stone grit 12mm size = $1000 \times 3.7 \times \frac{0.75}{100}$

= 27.75 m²

(@ 0.75 ml % for 1 sqm)

Binder asphalt = $1000 \times 3.7 \times \frac{120}{100}$

= 444.0 kg

(@ 120 kg % for 1 sqm)

Q11. Calculate the quantity of cement concrete for cement concreting 1 km length of 3.70m wide road for 8cm thick layer. Also calculate cost at the rate of Rs. 375/m³.

Quantity of cement concrete = $1000 \times 3.7 \times 0.08$

= 296 m³

Cost = 296×375 = 111000 Rs/-

Q12. Estimate the quantity of soling in stone 15cm size for a road of carriage way width 6.20m & a length of 1.9 km & for cement concrete above soling 12cm thick.

Quantity of soling = $1700 \times 4.20 \times 0.15$

= 736 m³

Quantity of cement concrete = $1700 \times 4.2 \times 0.12$

= 604.8 m³

RCC retaining wall

Q13. Prepare a detailed estimate of a RCC retaining wall of 30m in length whose c/s is given in figure. Steel bars in reinforcement shall have to be taken separately. Assume suitable rates.

eparately. Assume suitable rates.

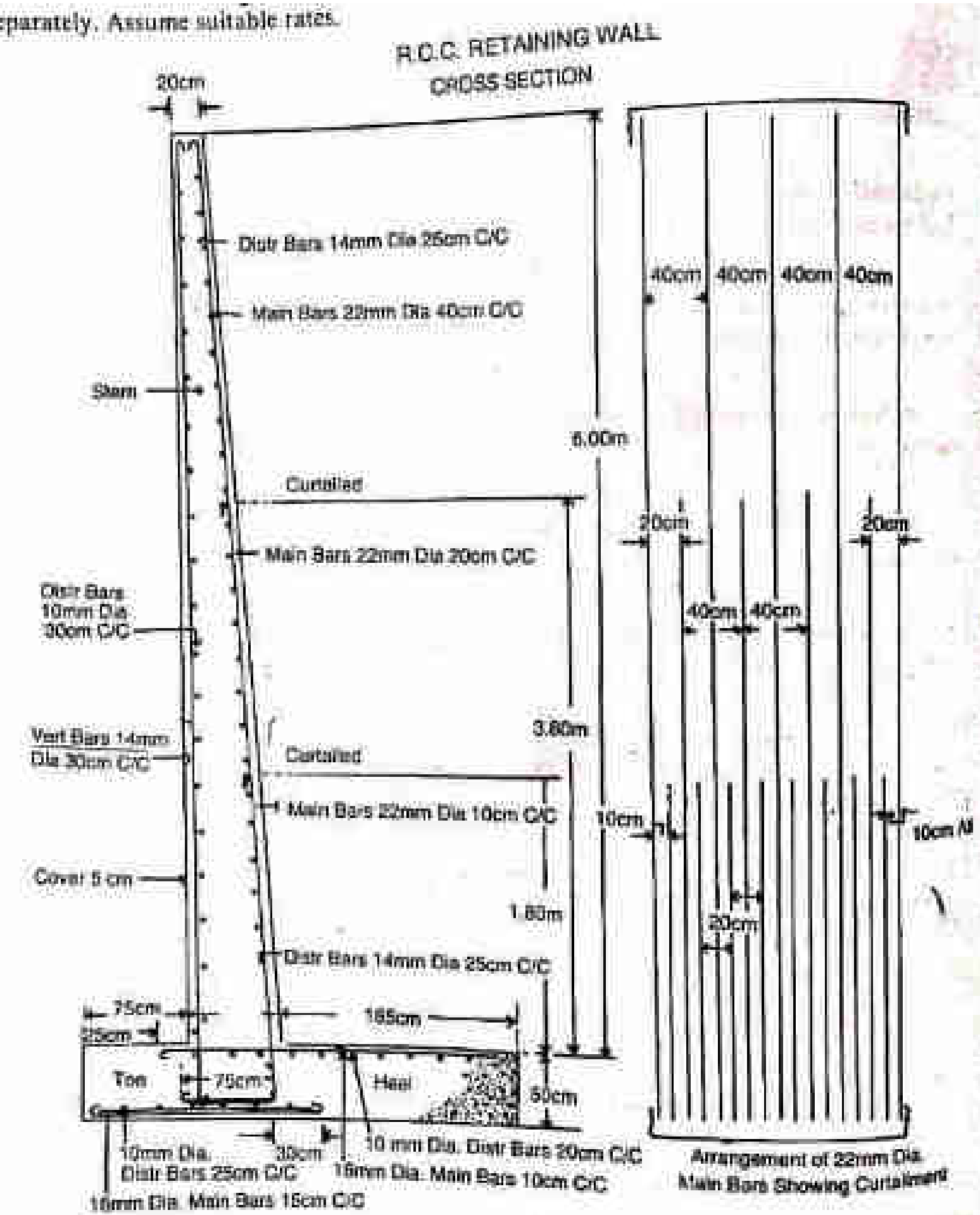
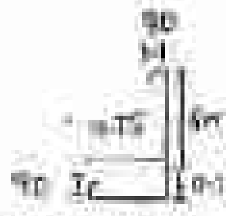


Fig. 5.9

Item No.	Description	No.	Length	Breadth	Height	Quantity	Remarks
1	RCC work						
a	Base slab	-	30	3	0.5	45	B = 1.65 + 0.6 + 0.75
b	Stem	-	30	0.4	6	72	B = (0.2 + 0.6)/2
					Total qty = 117 m³		
2.	Steel bars including bending & in reinforcement:						Assume bottom cover as 7cm
a	Stem :- Right side						
a)	22mm dia. main bars @ 400mm c/c (full height) No. = (30 - (2×0.05))/0.4 + 1 ≈ 76	76	7.53			572.28	L = 6 + 0.5 + 0.75 + (2×9×0.022) - 0.07 - 0.05 = 7.53; Q = 76 × 7.53
b)	22mm dia main bars @ 200mm c/c (3.8 m height) No. = (30 - (2×0.05) - (2×0.2))/0.4 + 1 ≈ 75	75	5.33			399.75	L = 7.53 - (6 - 3.8) = 5.33
c)	22mm dia. main bars @ 100mm c/c (1.8m height) No. = (30 - (2×0.05) - (2×0.1))/0.2 + 1 ≈ 150	150	3.33			499.5	L = 7.53 - (6 - 1.8)
							Q = 1471.53 × 2.98
				Total quantity of 22mm dia bars = 4385 kg			

16mm dia distribution bars @ 25cm c/c No. = (6.5 − 0.05 − 0.07) / 0.25 + 1 = 27	27	31.77			857.79	For overlapping length = 40 Ø L = 30 − (2×0.05) + (2×40×0.016) overlap + 6×9×0.016 hook Assuming 2 joints 
16mm dia vertical bars left side of stem @ 30cm c/c No. = (30 − (2×0.05)) / 0.3 + 1 = 101	101	5.63			569.63	L = 6.5 − 0.05 − 0.07 + (3×9×0.016) G = 1527.42 × 1.58
			Total of 16mm dia bars = 1848.77 kg			
10mm dia distribution bars @ 30cm c/c at left side No. = (6.5 − 0.05 − 0.07) / 0.3 + 1 = 23	23	31.24			718.52	L = 30 − (2×0.05) + (2×40×0.01) + (6×9×0.01)
Base slab: 10mm dia distribution bars @ top (heel) @ 20cm c/c No. = (1.45 + 0.6 + 0.25 − 0.05) / 0.2 + 1 = 13	13	31.24			406.12	L = 30 − (2×0.05) + (2×40×0.01) + (6×9×0.01)
10mm dia distribution bars @ toe (bottom) @ 25cm c/c No. = (0.75 + 0.4 + 0.5 − 0.05) / 0.25 + 1 = 7	7	31.24			218.68	G = 1343.32 × 0.62
			Total of 10mm dia bars = 832.85 kg			

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12mm dia main bar @ top (head) @ 150 c/c No = $\frac{30-(2\times0.05)}{0.1}$ + 1 = 300	300	2.71		892	L = 1.65+0.5+0.2 −0.05 + (2×9×0.016)
16 mm dia main bar @ bottom (bottom) @ 150 c/c No = $\frac{30-(2\times0.05)}{0.15}$ + 1 = 200	200	1.89		378	L = 0.15+0.6+0.3 −0.05 + (2×9×0.016) Q = $\frac{1200}{1000}$ × 1.58
			Total of 12mm dia bars =		1896 kg

Sanitary & water supply works

- Sanitary works usually consist of providing Flush type latrines & connecting with sewer lines of septic tank.
- For estimating the numbers of different fittings are found & rates are taken per number for supply & fixing in position.
- The latrine seat with a flushing pipe etc are usually taken as one set & rate per set for the complete work is taken in the estimate
- Wash hand basin, bath tubs, urinals etc are also estimated per number for the complete work.
- The fittings of mica valve cocal gully trap, master trap etc are also estimated number wise.
- The pipe lines of different materials of different diameters are estimated on running meter basis for the complete work supplying & fixing in position including excavation, refilling

joining etc shall be together with cement concrete including as per specification.

- Fittings as bends, junctions etc are not measured separately.
- Masonry manholes & inspection chambers are estimated per number for different sizes fitted with CI manhole for the complete work.

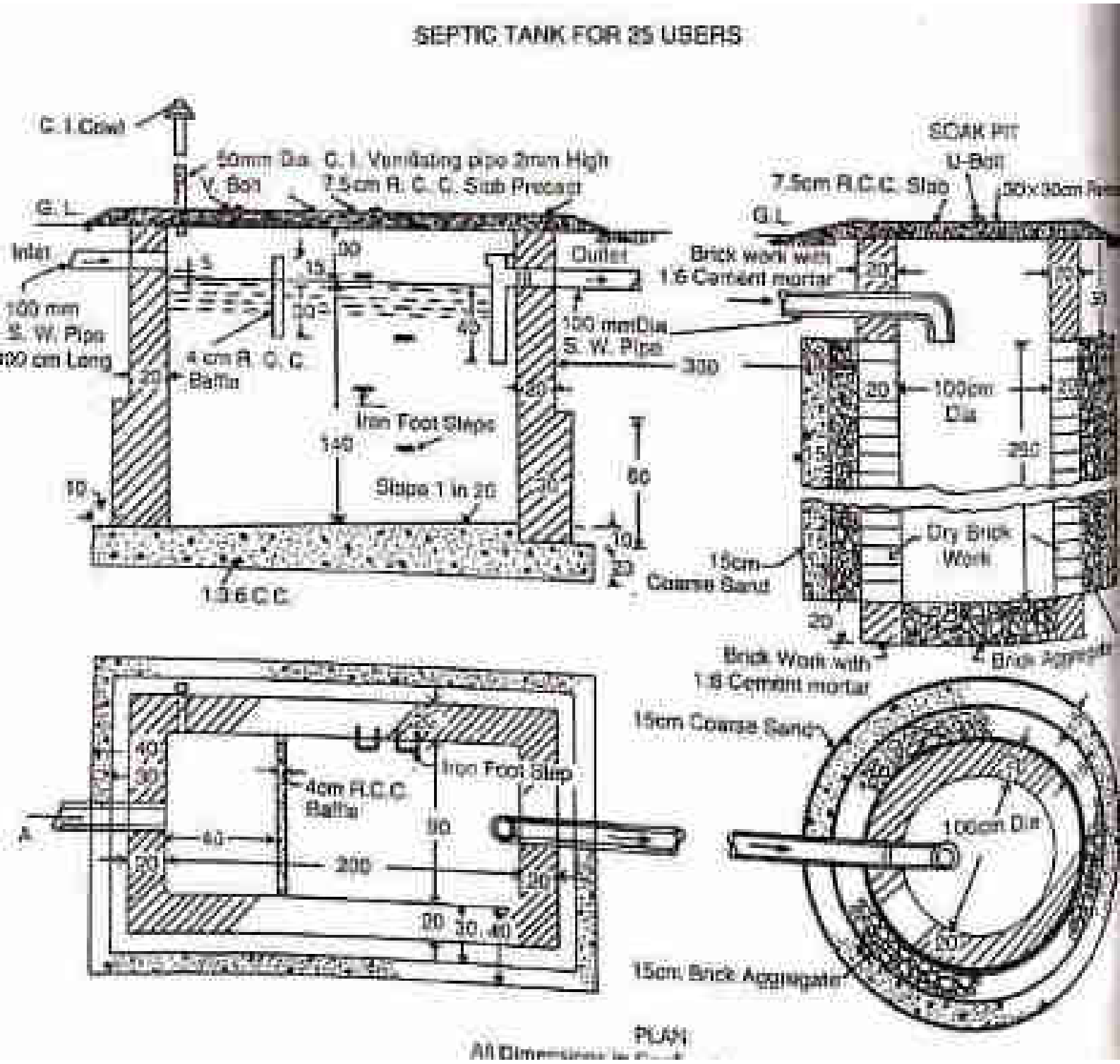
Septic tank

- Septic tank is usually consist of brickwall in cement mortar not less than 20cm
- The foundation of floor are of cement concrete 1:3:6 or 1:2:4.
- Both the inside walls & floor are plastered with a minimum thickness of 12mm thick cement mortar 1:3.
- Floor should be given a slope of 1 in 20m for the convinience of collection & removal of sludge.
- Septic tank may also be built with stone masonry, precast or cast insitu cement concrete of 1:2:4 proportion.
- The cover of the septic tank is of RCC slab with suitable circular openings with cast iron manhole cover for cleaning & inspection.
- For small septic tank precast RCC slab if steps may be provided one or two pieces may be removed for cleaning & refilled.

Estimate of septic tank for 25 users

Q.20 Prepare a detailed estimate of septic tank with soak pit for 25 users from the given drawing.

SEPTIC TANK FOR 25 USERS



Item No.	Description	No.	Length	Breadth	Height	Quantity	Remarks
1.	Earthwork excavation						L = 200 + (2×60)
a	Septic tank	-	5.8	1.7	1.95	9.28	H = 80 + 40 + 20 + $(\frac{0+10}{2})$
b	Soak pit upto 3m height	-	$\frac{\pi}{4} \times 2^2$		3	9.42	d = 1 + 0.4 + 0.3 + 0.3 =
c	Soak pit base section	-	$\frac{\pi}{4} \times 1.4^2$		0.2	0.3	d = 100 + 40 = 1.4m (Backfilling 0.10)
					Total Qty =	19 m³	
7.	Cement render 1:3:6						 5.8
•	Floor & foundation						
a	Foundation	-	5.8	1.7	0.2	0.95	
b	Floor	-	2	0.9	0.05	0.09	H = $\frac{0+10}{2}$
					Total qty =	1.04m³	
8.	1st class brickwork in in 1:4 cement mortar in septic tank.						
a	1st step						
	Long wall	2	5.6	0.3	0.4	0.94	
	Short wall	2	0.9	0.3	0.4	0.32	
b	2nd step.						
	Long wall	2	5.4	0.2	1.15	1.1	H = 140 + 60 + 60 + 30 = 1.15m
c	Short wall	2	0.9	0.2	1.15	0.414	
					Total qty =	2.77 m³	

	Upper portion	1	3.77	0.2	0.5	0.38	
	Lower portion	1	3.77	0.2	0.2	0.15	
					Total qty	0.53 m^3	$(L=0.9+1.2)=3.77$
5.	2nd class qty brick work in soak pit	-	3.77	0.2	2.5	1.88 m^3	
6.	precast RCC work 1:2:4 mix						
•	Roof slab for septic tank	-	2.4	1.3	0.075	0.234	(wall to wall 2ay(b)) outer
•	Roof cover slab of soak pit	-	$\frac{\pi}{4}\times1.6^2$		0.075	0.115	$\frac{\pi}{4}\times1.6^2$
•	Baffle wall in septic tank	-	1.1	0.08	0.45	0.0198	$L=0.9+0.1+0.1=1.1$ (Insertion to the wall to hold it)
					Total qty	0.368 m^3	
7.	12mm cement plaster inside of septic tank						
•	Long wall	2	2	-	1.7	6.8	H=1.4+0.3 (only inner face)
•	Short wall	2	0.9	-	1.7	3.06	
					Total qty	9.86 m^2	
8.	20mm cement plastering in floor of septic tank	1	2	0.9	-	1.8 m^2	
9.	15cm size brick aggregate						
•	Outer side of soak pit	-	$\frac{\pi}{4}\times(1.7^2-1.4^2)$	2.5		1.826 ≈ 1.83	$\pi\times1.55\times0.15\times2.5=1.83$

	iii) bottom of soak pit		$\frac{\pi}{4} \times 1^2 \times 0.2$		0.16	H = 0.2
				Total qty	1.09 m³ ≈ 2m³	
10	Coarse sand under side of soak pit		$\frac{\pi}{4} \times (3^2 - 1.7^2) \times 0.5$		3.15 m³	
11	Iron foot steps 15mm dia bars	4			4	
12.	100mm dia. P.V.C. pipe.					
	i. Inlet coal from flushing to septic tank		3		3	
	ii. Outlet coal from septic tank to soak pit		3.3		3.3	L = 3.1 + 0.2
				Total Qty =	6.3	
13.	3.40 Tee	1			1	Septic tank
14.	3.40 Bend	1			1	(At soak pit inlet)
15.	50mm dia. Cast iron vent pipe		2		2	
16.	50mm dia CI bend	1			1	

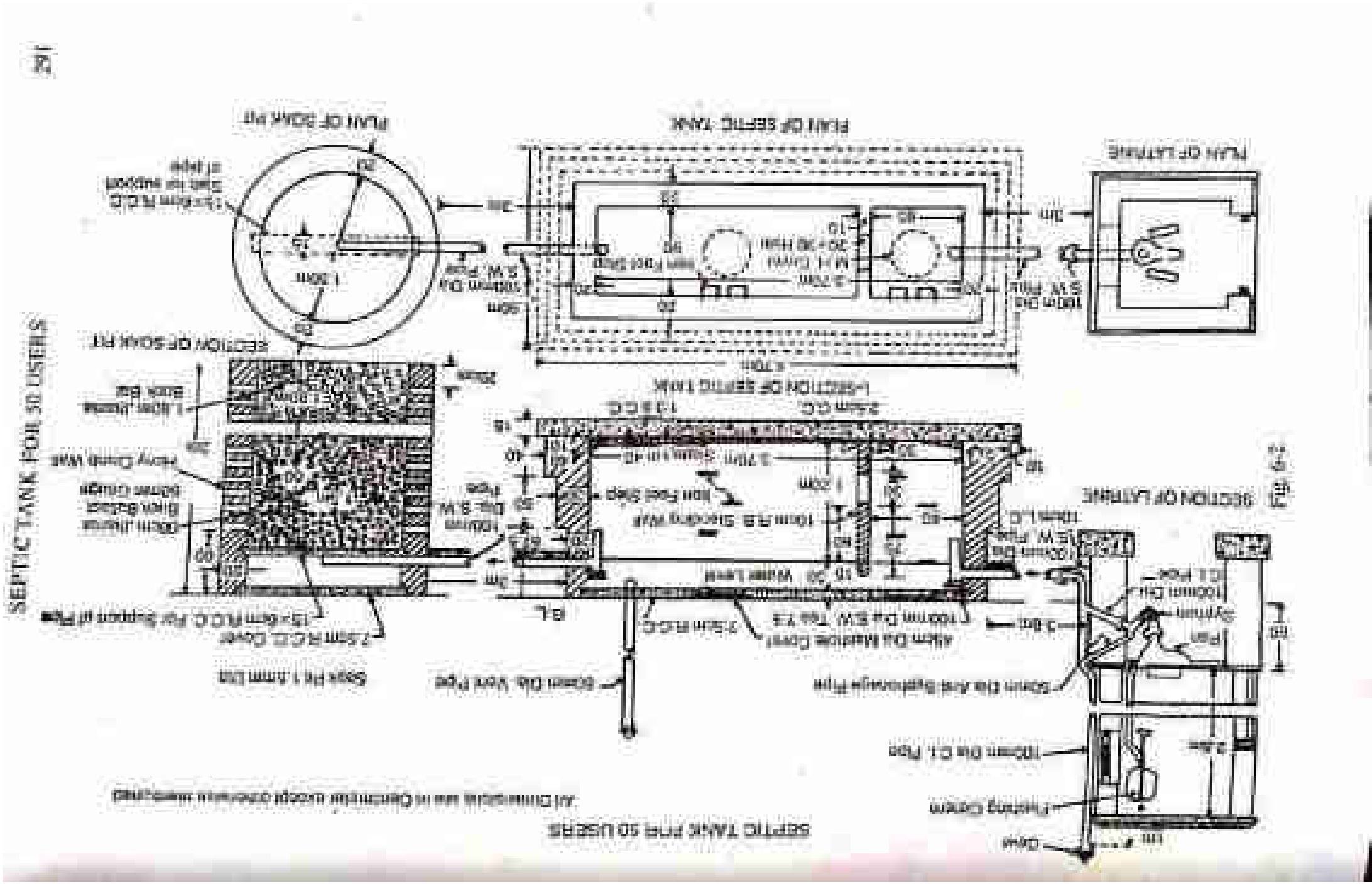
Abstract

Item no.	Description	Quantity	Unit	Rate	Amount
1.	Earthwork excavation	19	m^3	885	16815
2.	Coarse concrete	1.04	m^3	6000	6240
3.	1st class brickwork	9.77	m^3	3000	13830
4.	2nd class brickwork	0.53	m^3	4540	9385
5.	2nd class clay brick	1.88	m^3	2000	3760

6.	Precast RCC tank	0.36	m^3	12000	4416
7.	12mm cement plaster	9.86	m^2	3000 /sqm	2958
8.	75mm cement plastering	1.8	m^3	500	900
9.	1st size brick flat soling	2		3000	6000
10.	Coarse sand outside side of soak pit	2.18		1100	2398
11.	Iron foot steps	4		20	80
12.	100mm dia. C.I pipe	6.2		27	170.1
13.	C.I Tee	1		15	15
14.	C.I Bend	1		8	8
15.	50mm dia cast iron ventilating pipe	2		15	30
16.	5cm dia CI cowl	1		10	10
				Total amount =	60033.1/-

Estimation of septic tank for 50 users

Q) Prepare a detailed estimate of a septic tank with soak pit for 50 users together with sanitary fitting of one seat of latrine from the given drawings.



Septic tank shall be 37 [illegible] mortar over cement concrete 1:3:6 foundation & base with RB partition wall & RCC slab cover inside of tank including floor shall be 20mm cement plastered 1:2 mortar mixed with water proofing material. Soak pit shall be of 1st class brick masonry with 1:6 cement mortar. Estimate for water arrangement should also be made with a 250 l GI overhead tank connecting flushing cistern of WC & a water trap. Assume that there is a pipe water supply within 10m of the building.

S.N.	Description	No.	Length	Breadth	Height	Quantity	Remarks
1.	Earthwork excavation						
a	Septic tank	-	6.7	1.9	1.795	15.4	
a	Soak pit	-	$\frac{\pi}{4} \times 1.9^2 \times 3$			8.51	$\frac{\pi}{4} d^2 h$
					Total qty =	23.91 m^3	
2.	Cement concrete 1:3:6						
a	Foundation		9.7	1.9	0.15	1.54	
b	Floor (slope)		3.7	0.9	0-05	0.17	$H = \frac{0.15+0}{2}$
					Total qty =	1.71 m^3	
3.	1st class brickwork 1:4 cement mortar in septic tank						
a	1st step						
	Long wall	2	6.5	0.4	0.4	1.44	
	Short wall	2	0.9	0.4	0.4		
						0.29	

• 2nd step						
Long wall	2	4.3	0.3	0.5	1.29	
Short wall	2	0.9	0.3	0.5	0.27	
• 3rd step						
Long wall	2	4.1	0.2	0.635	1.11	
Short wall	2	0.9	0.2	0.675	0.24	
				Total qty =	4.64 m³	
4. 2nd class brickwork in C.M. (1:6) in soak pit	1	$\frac{\pi}{4} \times 2 (1.8^2 - 1.5^2)$			3.30 m³	
5. Plain R.C. work in partition wall in C.M. (1:3:6) in septic tank including curing and complete work	1	6.9	0.1	1.35	0.932 m³	
6. RCC work						L.S.T. = 0.14 + 0.1
• Slab cover for septic tank	-	3.9	1.3	0.015	3.51	
• Slab cover of tank pit	-	$\frac{\pi}{4} \times (1.7)^2 \times 0.015$			0.17	
• RCC slab for support of pipe	-	1.7	0.15	0.06	0.015	
				Total qty =	0.87 m³	
7. 20mm cement plaster with water proofing material (septic tank)						
• long wall	2	8.7	–	1.5	11.1	
• Short wall	2	4.9	–	1.3	9.7	

	... both sides	2	0.9	-	1.33	3.99	
a	Partition walls top	1	0.9	-	0.1	0.09	
					Total qty	16.33 m^2	
8.	Jhama brick ballast inside soak pit	-	$\frac{\pi}{4} \times 1.5^2 \times 0.6$			1.06 m^3	
9.	Jhama brick bat inside soak pit	-	$\frac{\pi}{4} \times 1.5^2 \times 1.8$			3.18 m^3	
10.	45cm dia manhole cover over septic tank	2	-	-	-	2	
11.	Iron foot steps	7	-	-	-	7	
12.	W.C Indian pattern 580m white glazed earthenware with syphon & with 12.5 l C.I flushing cistern with brackets & 32mm dia G.I telescopic flush pipe painted 2 coats & with chain pull rods complete supply & fixing	1	-	-	—	1 set	Flushing cistern telescopic pipe pull rods etc. can may also be taken as separate items.
13.	S.W pipe 100mm dia laid over 10cm C.C						
•	Connecting latrine with septic tank	1	3	-	-	3	
•	Connecting septic tank with soak pit	1	4	—	-	4	L = 3 + 0.05 + 0.2 + 0.75
					Total	7	
14.	S.W Tee 100mm dia inlet & outlet septic tank	2	-	-		2	

15. CI heavy soil pipe 100mm dia connecting latrine seat, vent pipe including fixing with lead jointing	1	5	-	-	5m	
16. CI heavy soil pipe 50mm dia complete with lead jointing						
• Connecting latrine with soil pipe	1	0.6	-	-	0.6	
• Vent pipe for septic tank	1	3	-	-	3	
			Total = 3.6m			
17. CI cowl 100mm dia in latrine	1	-	-	-	1	
18. CI cowl 50mm dia for septic tank vent pipe	1	-	-	-	1	
19. 350L GI Tank of 20 BWG sheets with 45cm dia raised hinged cover with locking arrangement & fitted with 15mm dia brass ballcock supplying & fixing in position complete	1	-	-	-	1	
20. 15mm dia GI pipe with fittings including digging, laying, clamping complete						
• Connecting GI tank with water ...	1	15	-	-	15	L = 10 + 0.6 + 2.3 + 1 + 0.6 extra = 15m

	e. Connecting flushing cistern from G.I tank	1	2	-	-	2	
	• Connecting water tap from G.I tank	1	6.5	-	-	6.5	Tap on outside wall
					Total =	31.5m	
31.	15mm dia brass stop cock (one for G.I tank & one for flushing cistern) supplying & fixing	2	-	-	-	2	
32.	15mm dia brass bib cock supplying & fixing	1	-	-	-	1	
33.	Brass ferrule 15mm dia supplying & fixing	1	-	-	-	1	
34.	CC floor 1:2:4 fencing chicken	1	3.7	0.9	-	3.33m³	

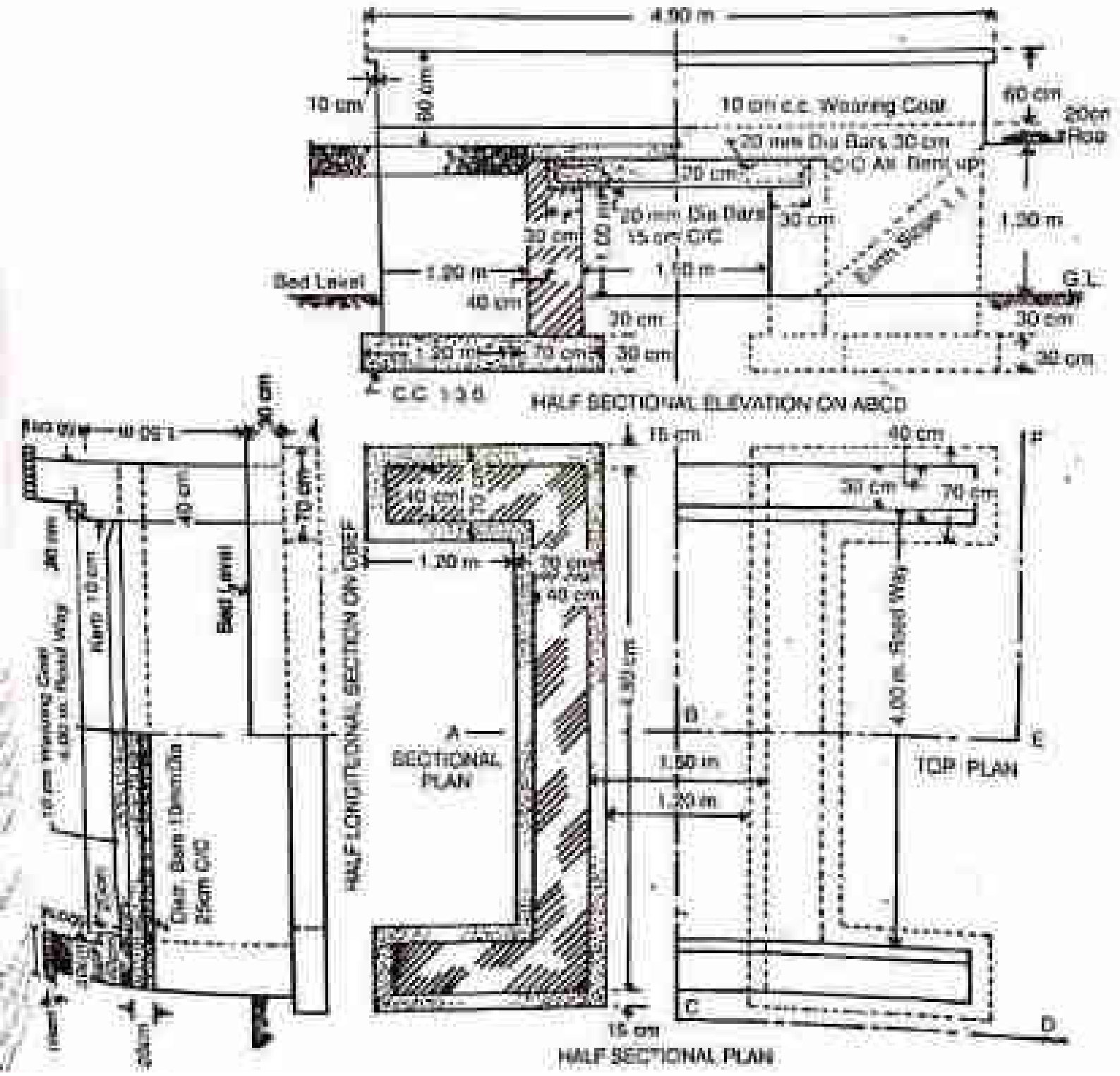
Culvert

Q22. Estimation of RCC slab culvert

Item No.	Description	No.	Length	Breadth	Height	Quantity	Remarks
1.	Earthwork excavation in foundation						
	a. Abutments	2	5.1	0.7	0.6	3.44 4.28	L = 0.15+4.8+0.15
	b. Wing walls	4	1.8	0.7	0.6	2.02	
					Total abt =	6.3m³	

Assume suitable rates.

R.C.C. SLAB CULVERT 1.50 m SPAN with standard modular bricks



2	Concrete mix 1:2:4 in foundation						
a	Abutments	2	5.1	0.7	0.3	2.14	
b	Wing walls	4	1.2	0.7	0.3	1.01	
					Total qty	3.15 m³	
3.	1st class brickwork						
a	Abutments	2	6.3	0.8	1.2	5.76	H = 0.3+1+0.2
b	Wing walls	4	1.2	0.6	1.2	2.88	
c	Parapets cycle kerb	2	6.7	0.4	0.2	0.19	L = 6.7 = 0.1 - 0.1
d	Parapets above kerb	2	6.7	0.3	0.5	1.01	H = 0.8 - 0.1
e	Parapet coping	2	6.9	0.6-0.4	0.1	0.34	
					Total qty	11.9m³	
	Deductions:						
a	Bearing of RCC in abutment	2	6.8	0.2	0.2	0.37	
					Total qty	10.63m³	
4.	RCC work 1:2:4 in slab		6.8	long 2.1	0.2	2.016	0 = 1.5 | 0.3 | 0.3
5.	Steel bars						
a	20mm dia bars						
→	Main straight bar beam c/c	17	7.28			60.46	No. = $\frac{6.8}{0.3}$ + 1
→	Cranked bars (d = 0.3 - cm max)	16	2.45			39.68	L = 2.1 - (2×0.04) + 2.8×0.07 = 2.29
							L = 2.1 - (2×0.04) + (2×2×0.07) + 0.2×0.04

•	Dist. bars 10mm dia 250mm c/c (bottom)	9	4.9			44.1	$No = \frac{2.1}{0.25} + 1$ $L = 4.9 - (2 \times 0.04) + (9 \times 2 \times$ [illegible]
•	Dist. bars 10mm dia 250mm c/c (top)	3	4.9			14.7	[illegible] = 2.136 = 0.525 $No = \frac{0.525}{0.25} + 1 = 3$
				Total qty of 20mm dia bars = 197.9 kg			
				Total qty of 10mm dia bars = 36.45 kg			
6.	Wearing coat (Cement concrete 1:2:4)		6	2.3	0.1	[illegible] 0.92 m^3	B = 1.5 + 0.4 + 0.4
7.	Cement pointing 1:3 to walls.						
•	Face wall from 10cm below G.L. upto bottom of coping.	2	4.7		2.1	19.74	L = 4.9 − 0.1 − 0.1 H = 0.1 + [illegible] 0.2 + 1.3 + 0.5 = 2.1
•	Inner side of parapet excluding coping.	2	4.7		0.8	7.52	H = 0.5 + 0.1 + 0.2
•	Coping (Inner edge, top, outer edge, outer bottom)	2	4.9		0.7	6.86	H = 0.1 + 0.1 + 0.4 + 0.1
•	Ends of parapet upto kerb	4	—	0.4	0.2	0.32	
•	Ends of parapet above kerb	4	—	0.3	0.5	0.6	
•	Ends of coping (edge & underside)	4	—	0.4	0.2	0.32	H = 0.1 + 0.1
					Total qty = 35.36 m^2		

Deductions					
• Rectangular opening	2	1.5	–	1.8	5.4
• Triangular portion below each slope	2	$\frac{1}{2}bh = \frac{1}{2} \times 1.2 \times 1.3$			1.56
				Total ded^{n} =	29.96m^2

MODULE IV

VALUATION

Value

- Value means it's worth or utility
- It varies time to time and depends largely on the supply of that particular type of property and the extend of the demand for it
- Value depends mainly on its
    - Utility
    - Scarcity
    - Events

Cost

It means the original cost of the construction and can be known after accounting all the day to day expenditure from the very planning stage to the construction is completed.

Price

This is an amount worked out by adding the cost of production, interest on investment, reward to the producer for his labour and risk.

Valuation

Valuation is the technique of estimating or determining the fair price or value of a property such as a building, a factory, other engineering structures of various types, lands etc.

- By valuation the present value of a property is determined
- Present value of a property is decided by its selling price or income or rent it may fetch.

Purpose of Valuation

i. ***Buying or Selling Property*** – When it is required to buy or sell a property, its valuation is required.

ii. ***Taxation*** – To assess the tax of property its valuation is required. Taxes may be Wealth tax, Property tax, Municipal tax etc.

iii. ***Rent Fixation*** – In order to determine the rent of the property, valuation is required. Rent is usually fixed on certain percentage of the amount of valuation (6 to 10% of valuation).

iv. ***Security of Loans or Mortgage*** – When loans are taken against the security of property its valuation is required.

v. ***Compulsory acquisition*** – Whenever a property is acquired by law compensation is paid to the owner. To determine the amount of compensation valuation of the property is required.

vi. Valuation of a property is also required for ***Insurance, Betterment Charges, and speculations*** etc.

- **Gross Income –** Gross income is the total income and includes all receipts from various sources, the outgoings and operational and collection charges are not deducted.

- **Net Income or Net Return** – This is the savings or the amounts left after deducting all outgoings, operational and collection expenses from the gross income or total receipt.

Net Income = Gross Income – outgoings

- **Outgoings –** Outgoings or the expenses which are required to be incurred to maintain the revenue of the building. The various types of outgoings are as follows:-
  1. Taxes – These includes Municipal Tax, Property Tax etc, which are to be paid by the owner of the property annually.
  2. Repairs – The repairs are required to be carried out every year to maintain a property in condition. Usually 10 to 15% of the gross income or gross rent is allowed for repairs.
  3. Management and collection charges – These include the expenses on Rent collector, Watchman, Liftman, Pump attendant, sweeper etc. About to 5 to 10% of the gross rent/income may be taken on these accountant.
  4. Sinking Fund – A certain amount of the gross rent/income is set aside annually as sinking fund to accumulate the total cost of construction when the life of the building is over.
  5. Miscellaneous – These include electrical charges for running lift, pump, for lighting common places and similar other charges which are borne by the owner.

- **Scrap Value –** Scrap value is the value of dismantled materials. The scrap value of a building may be about 10% of its total cost of construction. The cost of dismantling and

removal of the rubbish material is deducted from the total receipt from the sale of the usable materials to get the scrap value.

- **Salvage Value –** It is the value at the end of the utility period without being dismantled.

E.g.):- A machine after the completion of its useful span of life or when it become uneconomic, may be sold or one may purchase the same for use for some other purpose , the sale value of the machine is the salvage value.

  - Normally the scarp value and salvage value of a property or asset has got some positive figure, but it may also be zero or negative. For Example the scrap value of a RCC structure will be negative as dismantling and removal will be costly.

- **Market Value –** The market value of a property is the amount which can be obtained at any particular time from the open market if the property is put for sale.
  - Market value will differ from time to time according to demand and supply
  - Market value also changes from time to time for various miscellaneous reasons such as changes in industry, changes on fashions, means of transport, cost of materials and labour

- **Book Value –** The book value is the amount shown in the account book after allowing necessary depreciations.
  - The book value of a property at a particular year is the original cost minus the amount of depreciation up to the previous year.

Difference between Market Value and Book Value

Market Value	Book Value
1. The value is fixed by purchaser. **2.** The value may be higher during the subsequent years due to the increase of price index. **3.** The value may be constant for a period. **4.** This is applicable to any type of property. **5.** Market value is considered for valuation.	**1.** The value is fixed by the rate of depreciation. **2.** The value cannot be higher during the subsequent year even due to the increase of price index. **3.** The value cannot be constant, rather there is gradual fall. **4.** This is not applicable in case of land, metal articles like gold, copper etc. **5.** Book value is considered for accounts book of a company.

- **Ratable value** - Ratable value is the net annual value of a property, which is obtained after deducting the amount of yearly repairs from the gross income.
- **Assessed value** - Assessed value is the value of a property recorded in the register of a municipality in order to determine the amount of municipal taxes to be collected from the owner of the property.
- **Distress value or forced sale value** - In case a property is sold at a lower price than the market value at that time, it is said to have distress value.
    - Such distress value may be due to any one of the following reasons: (i) Financial difficulties of the seller (ii) Court decree (iii) Insufficient knowledge of the seller (iv) Quarrel among partners (v) Panic due to war or riots or civil commotion
- **Replacement value** – It is the present value of a property portions thereof if these have to be replaced at the current market rates
- **Potential value** – When a property is capable of fetching more return due to its alternative use or by advantageous planning or providing some development works, such inherent value of a property is known as potential value
- **Monopoly value** – In case land is scarce little remaining for sale or certain properties possess special advantages with respect to adjoining property due to its location, frontage, size, shape etc. the owner may demand fancy price: Such value of a property is known as monopoly value
- **Sentimental value** – When a property is sold or purchased at a higher value than the market value due to playing of sentiments in the mind of the owner or purchaser, this is known as sentimental value.
- **Speculative value** – Speculation in agricultural land, ripe for building development, will cause

  value to raise, even before roads are made and services installed. Speculators purchase such properties at a low price as far as possible known as speculative value and sell it again at profit at short duration without spending any further amount towards its development.
    - Construct a national highway in undeveloped area will cause a rise in value.

- **Accommodation value** – The value of the surrounding agricultural land of a city which is expanding considerably will be more if the land is converted in to accommodation land after obtaining approval from the competent authority. Beside this owners from the adjoining

plot of land may offer more price for accommodation purpose or utilize the said land most beneficially and as such price will be more than the market value for ordinary land and is known as accommodation value.

- **Reversionary value** – Reversion means right in possession for the property at the end of the term granted to the tenant or lessee. Present value of an amount deferred for a certain period at a fixed rate of interest is known as reversion value.
- **Occupation value** – When the purchasers are attracted to own the property for occupying for their personal uses which is regarded as necessity and no satisfactory substitutes exist then this is known as occupation value
- **Free hold property and lease hold property**

  - **A freehold property** means that the owner is in absolute possession of the property, and the owner can utilize the same in any manner, he likes, subject to the rules and regulations of Government and local authorities. He may use the property by himself, he may grant leases or tenancies for a short period or any period.
  - **Lease hold property** – It indicates the physical possession of the property and the use of it may be allowed by the original owner as per lease document. The person who takes lease is known as lessee or lease holder and the owner who grants lease is known as lessor.

    - The man types of lease are:-

Building Lease – The owner (lessor) of a free hold land leases out his plot of land to somebody to construct a building, on payment of a yearly ground rent by the leaseholder. The leaseholder constructs the building and maintains it at his own cost and earns some rent from the building. The net income to the leaseholder will be net rent minus the ground rent he pays to the lessor. As the lease holder has to invest sufficient money in constructing the building, such lease is granted for long period for 99 to 999 years. At the end of the lease period the lessor has got the right on his land together with the structure on land.

Occupation Lease – In this case the building or the structure is built by the owner (free holder) and the built up property is given on lease for the purpose of occupation for a specified period on payment of certain amount of annual rent. The occupation lease may be for residential, office, factory, shop etc.

Comparison between free hold and lease hold property

Free holder	Lease holder
• A free holder is absolute owner of his property • A free holder does not require any payment in the nature of rent • He may sell, rent or lease , develop the property without consent of any other private person	• A lease holder possess an occupational right for a specific period of duration and after that he has no longer any right for that property • He requires to pay periodic payment regularly to hold the possession of property • He cannot sell, rent or lease , develop the property without consent of leaser

- **Annuity** – Annuity is the annual periodic payment for repayments of the capital amount invested by a party. These annual payments are either paid at the end of the year or at the beginning of the year, usually for a specified number of years
  - If the amount of annuity is paid for a definite number periods or years, it is known as **annuity certain**.
  - If the amount of amount of annuity is paid at the beginning of each period of year and the payment continued for a definite periods, it is known as **annuity due**
  - If the payments of annuity begins at some future date after a number of years, this is known as **deferred annuity**
  - If the payments of annuity continue for indefinite period, it is known as **Perpetual annuity.**
- **Capital Cost –** Capital cost is the total cost of construction including land, or the original total amount required to possess a property.
- **Capitalized value –** The capitalized value of a property is the amount of money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property.

Capitalized value = net annual income x Year's purchase

- **Years purchase -** Years purchase is defined as the capital sum required to be invested in order to receive a net annual income as an annuity of Rs 1/- at certain rate of interest.

Year's purchase = 100/ (Rate of interest) = 1/ i

i – rate of interest in decimal

E.g.)- For 5% interest , Y.P = 100/5 = 1/0.05 = 20

- In case a property whose period of utility is limited to a number of years a certain amount is required to be set aside on the form of sinking fund, to accumulate the amount of original cost at the end of utility period of the property, in that cases years purchase will be reduced in such a way that income of the property will provide both for interest on the capital and for accumulation of sinking fund to replace the capital. Hence Years purchase will be

$$\mathbf{Y.P} = \frac{\mathbf{1}}{\mathbf{(i+s)}} = \frac{\mathbf{1}}{\mathbf{I_p + I_c}}$$

I_p = rate of interest on capital , in decimal

I_c= Coefficient of sinking fund = $\frac{\mathbf{i}}{\mathbf{(1+i)^n - 1}}$

Here, i is the rate of interest on sinking fund in decimal

- **Sinking Fund** - It is an amount which has to set aside at fixed intervals of time out of the gross income so that at the end of the useful life of the building or property, the fund should accumulate to the initial cost of the property.

$$\mathbf{I = S \times I_c}$$

I - annual investment required

Ic – Coefficient of annual sinking fund

S – Total amount of the sinking fund

$$\mathbf{I} = \frac{\mathbf{S \times i}}{\mathbf{(1+i)^n - 1}}$$

DEPRECIATION

It is the loss in the value of the property due to its use, life, wear and tear, decay and obsolescence

Types of depreciation

- Physical depreciation – It may be due to wear and tear from operation or due to action of time and elements
- Functional depreciation – It may be due to inadequacy or due to obsolescence
- Obsolescence – The value of property or structure will become less due to change in fashions, in designs, in structure, inadequacy to present or growing needs necessity for replacement due to new inventions etc. Obsolescence may be
    - Internal obsolescence due to change in type of construction, change in utility demand etc.
    - External obsolescence due to specific detrimental influences such as due to construction of factories, proximity of public building, traffic noises etc.

Methods of calculating depreciation

- Straight line method
- Constant percentage method OR Declining balance method
- Sinking fund method
- Quantity survey method

1. Straight line method

In this method, the property is assumed to loss value by a constant amount every year and thus a fixed amount of original cost written off every year so that at the end of the utility period when the asset is worn out only scrap value remains.

$$\textit{Annual depreciation, } D = \frac{(C - S_C)}{N}$$

Where C - Original cost

Sc – Scrap value

n- life in years

Total Depreciation in N years = D x N

Depreciated cost after N years = Original Cost – Depreciated cost = C - (DxN)

2. Constant percentage method/ Declining balance method

In this method the property is assumed to loss value annually at a constant percentage of its book value .

The value of the property after N years

$$V = C\,(1-p)^{N}$$

Where, C - Original cost

P - Percentage rate of annual depreciation for the constant percentage method expressed in decimal

After n year, the value of the property = scrap value

$$Sc = C\,(1-p)^{n}$$

where

Sc – Scrap value

n- life in years

$$p = 1 - \left(\frac{Sc}{C}\right)^{\frac{1}{n}}$$

3. Sinking fund method

In this method the depreciation is assumed to be annual sinking fund plus the interest of accumulated sinking fund till that year.

Rate of depreciation = xy %

where x= annual sinking fund to be provided for Rs 1/- in n year

$$\mathbf{x = \frac{i}{(1+i)^{n} - 1}}$$

i - is the rate of interest expressed in decimal at which sinking fund amount is required to be invested

n – life in years

y = an amount Rs.1/- per annum in 'N' years

$$\boldsymbol{y = \frac{(1+i)^{N} - 1}{i}}$$

Total Depreciation = C x (xy%)

4. Quantity survey method

In this method, the property is studied in details and extend of physical deterioration worked out in order to calculate depreciation.

DIFFERENT METHODS OF VALUATION

1. Rental method of valuation
2. Direct comparison method of valuation
3. Valuation based on profit
4. Valuation based on cost
5. Development method of valuation
6. Land and building development method of valuation

1. Rental method of valuation

In this method, the net income by way of rent is found out by deducting all outgoings from the gross rent. A suitable rate of interest as prevailing in the market is assumed and years purchase is calculated. The net income multiplied by the years purchase gives the capitalized value or valuation of the property.

Value of property = Net rent x Y.P

Net rent = Gross rent – Out goings

2. Direct comparison method of valuation

This method may be adopted when the rental value is not available from the property concerned, but there are evidences of sale price of properties as a whole. In this method value of the property is estimated by direct comparison with capitalized value of few adjoining properties.

3. Valuation based on profit

- This is very much similar to the rental method of valuation and is the most applicable in case of valuation of hotels, cinema shops etc.
- In this method net profit is worked out after deducting all possible outgoings including interest and also remuneration of labour rendered by owner.
- This net profit is calculated and multiplied by years purchase to determine the capitalized value.

4. Valuation based on cost

In this method the actual cost incurred in constructing the building or in possessing the property is taken as basis to determine the value of property. In such cases necessary depreciation should be allowed and the points of obsolescence should also be considered.

5. Development method of valuation

This method of valuation is used for the properties which are in the underdeveloped stage or partly developed and partly undeveloped stage. If a large place of land is required to be divided in to plots after providing for roads, parks, etc., this method of valuation is to be adopted. In such cases, the probable selling price of the divided plots, the area required for roads, parks, etc. and other expenditures for development should be known.

If a building is required to be renovated by making additions, alterations or improvements, the development method of valuation may be used. The valuation of the property may be worked out from the anticipated future net come which it may fetch after its renovation. The net income multiplied by the Y.P. will give anticipated capitalized value. The total expenditure required to be incurred in renovation should be worked out, and the original cost of the property together with the new expenditure should be compared with anticipated value and decided if the investment in renovation is justified.

- An undeveloped or under developed property is bought, develop and then offered for sale
- The valuation in that case would depend on the initial investment, development cost and expected profit
- The method is based on

    a) Development of building estates
    b) Hypothetical building schemes

a) Development of building estates

- In this method an estate is developed with all essential amenities and sold in small plots
- When a city continues to expand ,then the land is known as ripe for building

Valuation by development of building estates = Present value – total outgoings

Procedure for valuation

1)Find out the net area of land

i.e. Net area = Total area - area of land required for essential amenities like roads, paths, water supply etc may be considered as 30% of the total area

2) Calculate gross income

= Net area of land available for sale by plotting x Average sale price

3) From the gross income find out present value. Since all the plots are not sold at a time the gross income is differed by the half of the period that is likely to be elapsed before all the plots are sold.

- If a period of 4 years is required to sell all the plots the gross income will be multiplied by the present value of Rs 1/- in 2 years at the rate of 8%
- If a period of 6 years is required to sell all the plots the gross income will be multiplied by the present value of Rs 1/- in 3 years at the rate of 8%

4) From the present value deduct the following outgoings

- Cost of development
- Payment for the easement rights
- Engineering and supervision charges
- Stamp cost and incidental charges
- Development profit

b) Hypothetical building schemes

In this system value of a vacant plot of land is estimated by capitalizing the assumed rent that can be obtained from a building if erected on the land after developing the same and then deducting the cost of development and building

Procedure for valuation

1) From the total area of the land, find out the **permissible covered area** which is **= total area – 1/3rd of land**, as required for compulsory open space under municipal bylaws
2) Find out **rentable area,** which is **= total covered area- 20 % for area** of walls and wastes etc
3) Calculate the **net rent per month** which is **= gross rent – outgoings** (unless mentioned consider total outgoings be 30% of gross rent)
4) Find out years purchase for perpetual (since land) with interest on capital at the current bank deposit rate (should minimum 10%) and for redemption of capital (say 6%)

5) Capitalize the net rent by multiplying the y.p deferred for the development and construction period.

6) Consider the current plinth area rate and find out the cost of the building from the total covered area. For storeyed buildings (for full development) the covered area shall be worked out for all the stories.

7) Work out the development cost of land (if required)

8) Find the total cost of building and development cost of land

9) Deduct the total cost of building (including planning, sanctioning) and development from the deferred rental value of the building to find the cost of land

Disadvantage:-

This is not suitable method of valuation of land because the cost of land depends on the magnitude of development of land

6. Land and building development method of valuation / Initial cost based valuation

- The basic principle of valuation by this method is to determine the individual market value of land and simultaneously individual depreciated value of building.
- Adding these 2 values is the valuation of the property

Method of Valuation of land

(1) Comparative method- The simplest and most direct method of valuation is direct comparison.

- Various transactions of nearby lands are properly studied and then a fair rate of land under consideration is decided.
- Useful only in case of an active market where there are large number of statistics available for comparison.
- The element of time plays a vital role in this method.
- This method is based on two main factors

- Sales price
- Similar neighborhood lands

- Other factors considered for analysis
  - Location
  - Size
  - Shape
  - Frontage and depth
  - Level
  - Nature of soil
  - Restriction on development

(2) Belting method of valuation

- Value of a plot of land has a great bearing on its road frontage
- Frontage land has a great value than the back land
- So in order to find out a more realistic value of land, the entire plot is divided into a number of convenient strips by lines parallel to the centre line of the land
- Each such strips of land is known as belts

(3) Abstractive Method of valuation

The abstractive method becomes useful when no information is available regarding land transaction in the nearby area or in other words, the value of land where sales are not occurring frequently can be worked out by the application of this method.

Following three distinct steps are involved in this method:

- A nearby properly fetching rent is considered and its capitalized value is worked out by multiplying its net income by year's purchase (Say S).
- The estimated cost of the building is worked out and then, after making due allowance for the depreciation, a figure representing the cost of the building alone at present is obtained, (Say T).
- The difference D= (S- T) gives the value of the land and if A is the area of land, the cost per unit area = D/A.

Valuation of Building

- Cost from detailed items
- Estimate from plinth area
- Estimate from unit rate
- Cubic rate estimate
- Estimated cost from accounts

RENT

Rent may be defined as an annual periodic payment for the use of land or buildings. Rent depends on demand.

Forms of rent:-

1. Standard rent – It is the legal permissible rent that can be charged to a tenant.

2. Ground rent – It is the form of rent that is paid by a person for the use of a plot of vacant land belonging to another.

3. Fair rent – The rent payable by a tenant under existing rules of the rent control act is known as fair rent.

4. Nominal rent – It is token rent, of very small amount per annum mentioned in lease document in order to establish the relation between a landlord and a tenant or lessee.

5. Rack rent – Where the rent reserved under an occupation lease represents full rental value land and building or full annual value of property it is known as Rack rent.

6. Head rent – Where the rent reserved under lease is less than the prevailing rent for the similar property, it is known as head rent.

7. Contractual rent – The rent agreed by bargaining by a landlord and tenant is known as contractual rent.

8. Improved rent – When the original lease holder sub lets the property under lease at a higher rent than the original rate rent of the lease is known as improved rent.

9. Profit rent – The difference between improved rent and head rent is known as profit rent.

10. Virtual or sitting rent – It is the term applied tom the true annual cost of premises to a lessee. It is the rent paid plus the annual equivalent of any capital sums he may have expended on the premises from time to time.

11. Lease rent – This is a certain periodical payment fixed in the lease document to be paid by the lessee to enjoy the possession of the property from the owner.

FIXATION OF RENT

The rent of building is fixed on the basis of certain percentage of annual interest on the capital cost and all possible annual expenditure on outgoings. It is the reverse method of rental method of valuation.

Gross rent = Net rent + outgoings

Dividing the gross rent by 12, rent per month can be calculated.

- ✓ If the interest rate is not given, take 6% on the cost of construction and 4% on the cost of land

Fixation and calculation of rent of government buildings

The basis for calculation of standard rent is to allow a certain percentage of interest on the capital cost and to add the annual expenditure on repairs, maintenance and taxes. The capital cost includes the cost of construction of buildings, the cost of sanitary and water supply works, the cost of electric installations, etc. The cost of land is not included in the capital cost.

Method 1:- According to this method the annual standard rent is taken as 6% per annum of the total capital cost.

Method 2:- According to this method the annual standard rent is taken as 6% per annum of the total capital cost and in addition the expenditure on annual and special maintenance and repairs, and municipal and other taxes are added. For annual repairs, 1 ½ % of the cost of building, 1% of water supply works, 1% of the cost of sanitary works and 1 ½ % of the cost of electric installations are allowed per annum.

Method 3 – According to this method allotment for accommodation for residence for a government employee is provided according to 1/10 of basic pay.

Plinth area required for residential buildings

Government residential buildings are planned according to the salary of the official for whom the building is meant. Normally, government officials pay a rent of $1/10^{th}$ of their salary therefore the capital investment should be on the basis of this rent, considering the rental value as 6% on the capital cost.

Method of valuation

(a) Rental method

Value of property = Net rent × Y.P.

1- The gross rent according to a property is ₹ 20,000 per annum allowing 10% on account for repair, maintenance & management of the property. Estimate the rental value of the property at the rate 10% assume the rent to be realized for a very long period.

Sol:- $i = 10\% = 0.1$

Gross rent = 20,000/-

Outgoings :-

10% for repair, maintenance & management of the property $= 20,000 \times \frac{10}{100} = 2000/-$

Net rent = 20,000 − 2000 = 18,000/-.

$Y.P = \frac{1}{i} = \frac{1}{0.1} = 10$

Value of property = Net rent × Y.P = 18,000 × 10 = ₹ 80,000

2- A lease hold prop is to produce a net annual income ₹ 12,000/- for the next 30 yrs, The owner expects a ret of 8% on his capital & also sets apart a sinking fund installment to accumulate at 6% annually replace the capital Determine the value of property

Sol:- Net income = ₹ 12,000/-

n = 30 yrs

$i_p = 8\% = 0.08$.

$i = 6\% = 0.06$.

$$i_e = \frac{i}{(1+i)^n - 1} = \frac{0.06}{(1.06)^{30} - 1} = 0.0126$$

$$Y.P = \frac{1}{i_p + i_e} = \frac{1}{0.08 + 0.0126} = 10.79$$

∴ Value of property = net inc. × Y.P

= 12000 × 10.79

= 1,29,521/-

ii) Direct comparison method

1. The owner has decided to sell his vacant property with a 30 yrs old single storeyed building having a total plinth area 110 sq.m. The cost of land is 20,000/- as compared with the adjoining areas. There is no comparable instance of letting value available in the locality but the present plinth area rate to construct such a new building has been determined from current sale price which is ₹ 5500/- per sq.m. What should be the same price of the prop. having a total life of 80 yrs? Also the rate of annual sinking fund interest is 5%.

Ans: Present cost of the building = 110 × 5500 = 6,05,000/- (Given new rate)

$i = 0.05 = 5\%$. $n = 80$ yrs.

$$\frac{i}{(i+1)^n - 1} = \frac{0.05}{(1.05)^{80} - 1} = 1.0296 \times 10^{-3}$$

$n = 30$ yrs.

Rate of depreciation = $\frac{100}{30}\%$

Hence $y = (1+i)^n - 1 = (1.07)^{30} - 1 = 66.12\%$

∴ Depreciation value = 0.0013698 x 60 x 99 = 0.0868 = 6.8%

(2)

∴ Depreciated cost = 30,000

Value of building after depreciation = Total 60500 x 0.06

= 4138/-

Depreciated cost of building after 30 yrs.

= 60500 - 4138

= 56362/-

Value of property = Value of land + Value of building

= 30,000 + 56362 = 86362/-

(iii) Valuation based on profit

Ex:1 Work out the valuation of a cinema hall with the following data. Cost of land for lifetime period of the house = 1,20,000/- Gross income per year = ₹ 7,50,000/- Expenses incurred per year.

(i) to run the cinema including staff salary, electric charges, municipal taxes, license fee, stationary & printing etc. is 30% of Gross Inc.

(ii) for repairs & maintenance of machinery, plants, equipments, furniture etc. at the rate of 5% of capital cost of which = 9,50,000/-

(iii) SF for the machinery as in (2) whose life is 25 yrs at the rate 4% after allowing 10% scrap value.

(iv) Insurance premium = 10,000/- per yr. Assume it will last for 40 yrs at the rate 4% of redemption of capital

at 4% (Annual) repair of the house at the rate 2% on gross income.

Kulagbon 2: capital - Raw'y 5.9

Ans: Value of land for 60 yrs = 1,20,000/-

Gross income/profit = 7,50,000/-

Outgoings :-

1) 30% for staff salary, electric charges, tax etc.

$= 7,50,000 \times \frac{30}{100} = 2,25,000/-$

2) 5% of capital cost of 9,50,000/- for repair & maintenance $= \frac{5}{100} \times 950,000/- = 47,500/-$

3) S.F installment for the machinery after deducting scrap value $\left\{9,50,000 - \frac{10}{100} \times 95,0,000 = 8,55,000/- \right\} = \frac{5,55,000 \times 0.04}{(1+0.04)^{25}-1}$

$i = 4\% \; ; \; n = 25$ yrs $= 20,530/-$

4) Insurance premium $= 10,000/-$

5) Annual repair of the house

$= 2\% \times 750,000 = 15000/-$

$\therefore$ Total outgoings $= 3,18,030/-$

$\therefore$ Net income/profit = Gross profit − outgoings

$= 7,50,000/- - 3,18,030$

$= 4,31,970/-$

$i_p = 8\% = 0.08$ $\quad n = 50$ yrs

$i = 4\% = 0.04$

$i_c = \frac{i}{(1+i)^n - 1} = \frac{0.04}{(1.04)^{50}-1} = 0.0042$

$Y.P = \frac{1}{i_p + i_c} = \frac{1}{0.08 + 0.0042} = 11.88$

= 1,31,130 × 0.69

= Rs 90,390/-

Total valuation = cost of land + Value of structure

= 1,20,000 + 90,390 = Rs 2,10,390/-

(2nd) Valuation based on cost

(v) Development method of valuation

a) Development of building estates

1. Work out the cost of a plot of land measuring 60,000 sq m which is now ripe for building development. The present market rate for small building plots is ₹ 50/- per sq m. The cost of development for roadways, water supply, sewer system, electricity & all other exp works is ₹ 10/- per sq m. Assume the last plot will be sold after 4 yrs from the date of purchase.

Sol: Total area of land = 60,000 m²

Avg. sale price = ₹ 50/- per sq m

Cost of development = ₹ 10/- per sq m

Net area = 60,000 − 30% of 60,000

= 42000 sq m

∴ Gross income = Net area × Avg. sale

= 2100000/-

Present value $P = \frac{1}{(1+i)^n} = \frac{1}{(1+0.09)^3} = 0.7513$

Present value of gross income = 21,00,000 × 0.7513

Outgoings

① Cost for development = 4 × 60,000 = 2,40,000/-

② Present value for cost of development = 2,40,000 × 0.8573 = 205,752/-

③ Engg. & Supervision = 5% of the present value of development cost = $205752 \times \frac{5}{100} = 10,287/-$

④ Stamp cost = $\frac{10}{100} \times 18,00,330 = 18,00,33/-$

⑤ Development profit = $15\% \times 18,00330 = \frac{15}{100} \times 18,00330$

= 27,00495/-

∴ Total outgoings = 6,66121/-

∴ Cost of land = Gross value − Total outgoings

= 21,00,000 − 6,66,121

= 14,33,879/-

Value of land per sq.m = $\frac{14,33,879}{60,000}$ = 23.9/- per sq.m.

b) Hypothetical building scheme:

1. A an developed plot of open land measuring 240 sq.m. is situated in a residential area containing a no of 2 storeyed tenanted houses. Determine the value of land by hypothetical building scheme method. Assume the construction period to be 2 yrs & plinth area rate ₹ 10,900/- per sq.m for a 2 storeyed house. Assuming a fair rent ₹ 20/- per sq.m.

Total area = 240 m²

(4)

Permissible covered area = 240 − 1/3 × 240 = 160 sq m

Covered area for stranged building = 2 × 160 = 320 sq m

Rentable area = 320 − 20/100 × 320 = 256 sq m

Gross annual income = 256 × 24 = 6144

Net annual income = 6144 − 30/100 × 6144 = 4301/-

Net annual income = 4301 × 12 = 51612/-

Y.P = 1/i = 1/0.1 = 10 (Procedure 4)

Y.P differed for 2 yrs = 10 × 1/(1+i)^n

= 10 × 1/(1+0.1)^2 = 8.26

Value of property = Net annual income × Y.P

= 51612 × 8.26 = 426315/-

Construction cost of building = Plinth area × plinth area rate

= 160 × 1900 = 304000/-

∴ Value of land = Value of property − cost of building

= 426315 − 304000 = 122315/-

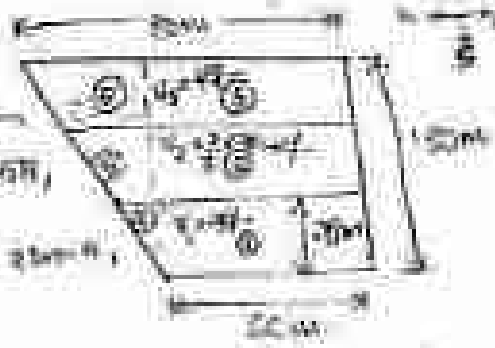
Belting method

2. A property consists of a south facing plot of land having scale - east & north sides are in duel dimensions which measure 60 m, 180 m & 80 m resp. It consists of an old 2 storey building having a total cubical content of 2840 m³. Assuming prime cost of construction of the building ₹ 500 / cubic metre & allowing 10% old materials value scrap [illegible] building, [illegible]

Value of ① land = 90/-

" ② land = $\frac{2}{3}$ × 90 = 60/-

" ③ land = $\frac{1}{2}$ × 90 = 45/-



B_1 = 225m

B_2 = 175 × 225 = 3375m²

B_3 = 117.5m

Value of ④ plot = $\frac{3}{4}$ × 90 = 67.5/-

" ⑤ plot = $\frac{3}{4}V_2$ = $\frac{3}{4}$ × 60

= 45/-

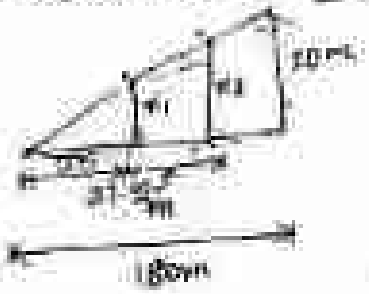
" ⑥ plot = $\frac{5}{6}V_3$ = $\frac{5}{6}$ × 45

= 37.75/-

A_1 = 60 × 25 = 1500 m²

A_2 = 37.5 × 60 = 2250 m²

A_3 = 60 × 117.5 = 7050 m²



$x_1 = \frac{20}{180} \times 25 = 2.78$ m

$x_2 = \frac{20}{180} \times (37.5) = 6.944$m = 7m

$A_4 = \frac{1}{2} \times 2.78 \times 25 = 34.75$ m²

$A_5 = \frac{1}{2}(2.78 + 7) \times 37.5 = 189.375$ m²

$A_6 = \frac{1}{2}(7 + 20) \times 117.5 = 1586.25$ m²

Cost of ① plot = 1500 × 90 = 13,5000/-

" ② " = 2250 × 60 = 13,5000/-

" ③ " = 7050 × 45 = 317250/-

" ④ " = 34.75 × 67.5 = 2,345.625/-

" ⑤ " = 189.375 × 45 = 8251.875/-

" ⑥ " = 1586.25 × 33.75 = 53535.94/-

Cost of land = 6,51,384/-

= Present cost of construction of building = 2816 × 500
= ₹420000/-

Old materials value = $\frac{10}{100}$ × 420000 = ₹42000/-

Value of property = cost of land + cost of building (materials etc)
= 651375 + 42000 = ₹693375/-

Fixation of Rent

1- A building costing ₹ 7,00,000/- has been constructed on a leasehold land measuring 100 sq.m recently in a big city. Remaining rate of land in the neighbourhood is ₹ 150/m², determine the net rent of the property if the expenditure on account including sinking fund is ₹ 24,000 per annum. Workout also the gross rent of the property per month.

Sol: Net rent = 6% cost of construction + 4% cost of land

= $\frac{6}{100}$ × 7,00,000 + $\frac{4}{100}$ × (100 × 150)

= ₹42600/-

Cost of land = 100 × 150 = 15000/-

Gross rent = Net rent + outgoings
= 42600 + 24000
= 66600/-

Gross Rent per month = ₹ 5550/- (66600/12)

a m a piece of land + costing ₹ 20,000/- a building has been newly constructed as a total cost of ₹ 80,000 including sanitary & water supply arrangements. The building consists of 4 flats. The annual expenses 5% return on cost of construction & 5% return on cost of land. Calculate the standard rent for each flat of the building assuming life of the building as 60 yrs & SF will be evaluated on 4% interest.

ADD Annual repairing cost @ 1% of cost of construction and office outgoings including taxes @ 32% of the net return on the building.

Sol: Cost of land = ₹ 20,000/-

Cost of construction = ₹ 80,000/-

Net rent = 8% of construction cost + 5% of cost of land

$= \frac{8}{100} \times 80,000 + \frac{5}{100} \times 20,000$

$= 6400 + 1000 = ₹ 7400/-$

Gross rent = 100 : 80,000 :: 132 : x

$x = \frac{80,000 \times 132}{100} = ₹ 1,05,600/-$

Sinking fund $= \frac{Si}{(1+i)^n - 1}$

Scrap value = 10% of 80,000

$= \frac{10}{100} \times 80,000 = ₹ 8000/-$

$n = 60$ yrs

$i = 4\% = 0.04$

$\therefore I = \frac{7400 \times 0.04}{(1.04)^{60} - 1} = ₹ 30.53/-$

8% of construction cost = 8 × 1600 = 12800/-

$= \frac{1}{100} \times 80,000 = ₹\ 800/-$

Tax = 30% of net return = $\frac{30}{100} \times 6400 = 1920/-$

Total outgoings = 800 + 1920 + 80 302.53

= 3022.53/-

∴ Gross rent = Net rent + Outgoings

= 7400 + 3022.53

= 10422.53/-

∴ Gross rent per each flat per year

$= \frac{10422.53}{4} = 2605.63/-$

21/10/16

Ex:- A govt. employee having a pay of ₹ 700/- per month occupying a quarter having a plinth area of 120 m² The prevailing rate per m² of plinth area is ₹ 400/- Calculate & suggest suit of monthly house rent liable by the employee.

Soln: Cost of area of

Capital cost of building = 120 × 400 = 48,000/-

① Standard rent based on the 6% interest on capital cost (overall all % basis) = $4800 \times \frac{6}{100}$

= 2880/- per annum

Rent per month = $\frac{2880}{12}$ = 240/-

② Rent based on 10% of pay = $700 \times \frac{10}{100}$ = 70/-

Charged rent = Min of 440/4 ... = 210/- per month.

2. Calculate the std. rent of the govt. residential building of ₹ 75,000/-. Data given are:

① cost of sanitary & water supply works = 10% of the building cost.

② Cost of electric installation = 8% of the building cost

③ Cost of internal roads & compound work = 15% per 10,000 per annum.

④ Municipal & all other taxes = 300/- per annum. (shouldn't be added with capital cost)

Ans: Building cost = 75,000/-

Outgoings = $\frac{10}{100} \times 75,000 + \frac{8}{100} \times 75000 + 10,000$

= 23500/-

∴ Capital cost = 75,000 + 23500 = 98500/-

Overall % basis

Std. rent on 6% interest on the capital cost

= $\frac{6}{100} \times 98500$ = 5910/- + municipal taxes

= 5910 + 300 = 6210/- per annum

Std rent/month = $\frac{6210}{12}$ = 517.5/-

Individual % basis.

i) Interest on capital cost @ 6% = $98500 \times \frac{6}{100}$ = 5910/-

· Annual repair charges.

i) Buildings, roads & compound wall (75000 + 10000 = 85,000)

1½ 7500 ... (7)

(d) Sanitary and water supply work @ 1·5% 12·75

= 7500 × $\frac{1}{100}$ = 75/-

(e) Electric installation @ 1·5% = 6000 × $\frac{1 \cdot 5}{100}$ = 90/-   (→ 8% of building cost)

Municipal tax = 300/-

∴ Total rent/annum = 7650/-

∴ Rent per month = $\frac{7650}{12}$ = 637·5/-

∴ Chargable rent = 517·5/-

5. Find the plinth area reqd & suggest the amt of monthly house rent payable for the residential accomodation for an assistant engg engineer drawing a salary of 25,000/- per month. Consider the cost of construction ₹18,000/- per m².

Ans : Cost of construction = 18,000/- per m².

Std. rent on 10% of pay = $\frac{10}{100}$ × 25,000

(Monthly rent at 10% of salary) = 2500/- per month

= 2500 × 12 = 30000 per annum

Let x be the plinth area.

∴ Building cost = 18,000 × x = 18,000 x

6% of building cost = $\frac{6}{100}$ × 18,000 x

= 1080 x

$\therefore$ 1% of pay = 6% of building cost

$\Rightarrow$ $1080x = 30{,}000$

$\rightarrow x = 27.78\ m^2$

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE409

Course Name: QUANTITY SURVEYING AND VALUATION

Max. Marks: 100 Duration: 3 Hours

(Any missing data may suitably assumed)

PART A

Answer any two full questions, each carries 10 marks. Marks

1 a) Briefly explain the detailed specification of Earthwork excavation for foundation in ordinary soil (6)

b) Write the unit of measurement of (i) Carpentry fittings (ii) Pointing of Brick wall (4)

2 Work out the unit rate for P.C.C work in 1:6 Cement sand mortar For 10 m^3 (Broken stone 12.5 m^3 @800/ m^3, river sand 4.2 m^3 @1200/ m^3. Cement 1000kg @ Rs 8000/ ton, 12.5 mason @ Rs. 750/Each, 10.5 man @ Rs. 650 /Each and 11 woman @ Rs. 550/ Each). (10)

3 (a) Calculate the amount required for carriage of 1500no's brick to be brought from a source of 12km away from the site. The vehicle access to the construction site is 60m away. (6)

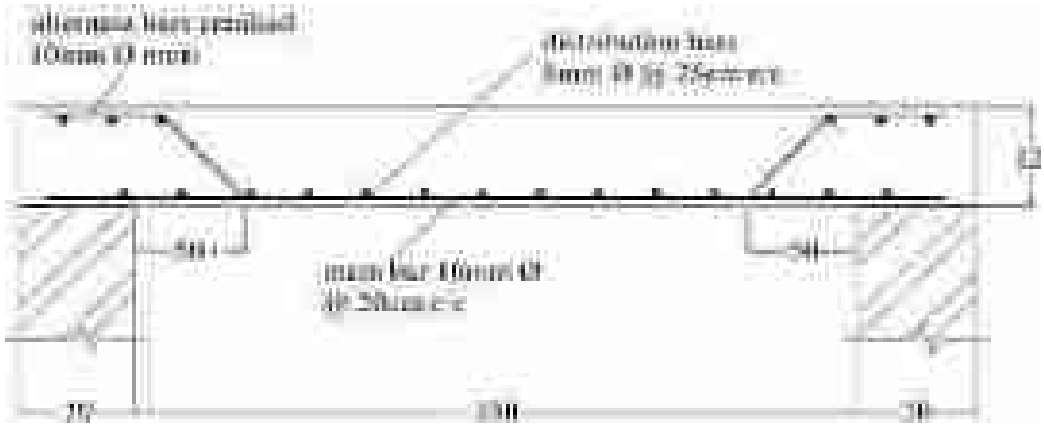
CPWD data are as follows for mechanical transport of 1000nos of bricks at 1km@Rs.209.80; 2km@Rs.237.86; 5km@Rs.318.22; beyond 5km upto 10km per km @Rs.23.15; beyond 10km upto 20km per km @ Rs.19.0 ; and for transport of 1000nos of brick by manual labour Rs.216.40/- for first 50meters and Rs.47.12/- for every additional 50metre or part thereof. (All rate given are inclusive of profit & overhead)

(b) What is mean by overhead charges? Give the percentage adopted for the contractor's profit and overhead in CPWD DSR 2016 rate analysis. (4)

PART B

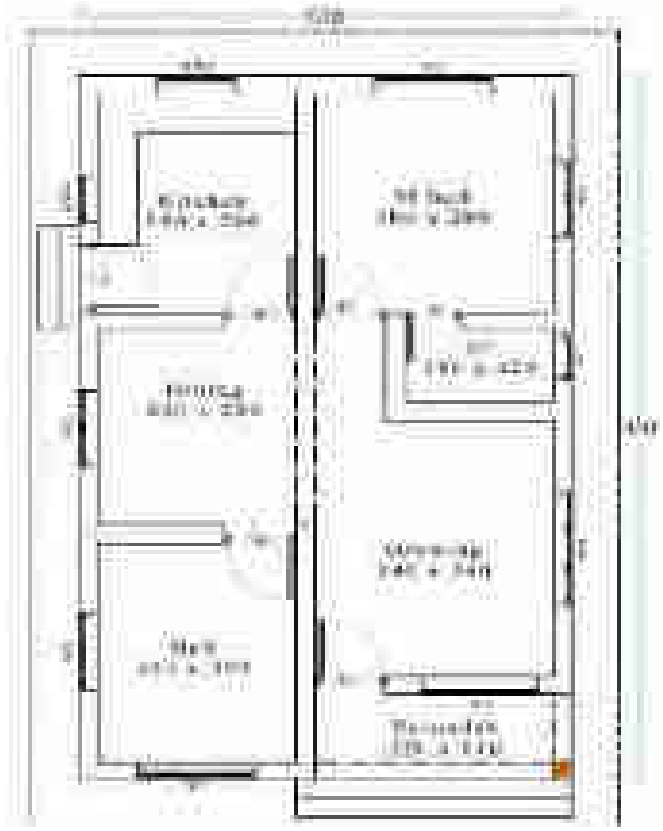
Answer any two full questions, each carries 25 marks.

4 a) Calculate the quantity of RCC and Prepare a bar bending schedule of the slab of size 330cm x 550cm (internal dimensions) shown in the figure. (All dimensions are in Centimetres) (20)



b) Calculate the quantity of Earth work, PCC and Brick work of a soak pit of internal diameter 1.5m and depth of 2.0m. Wall thickness 20cm and PCC thickness 15cm. (5)

5 Prepare detailed estimate for the following items of work for the construction of residential building (25)



Prepare detailed estimate for the following items of work for the construction of residential building

(a) RRM for foundation (75cm x 75cm) and basement50cm x 50cm , Wall thickness 20cm

(b) Quantity of earth filling inside the plinth

(c) RCC works for slab (12cm thick), lintel (15cm thick), and sun shade (60cm projection).

(d) Painting for walls, doors(D1-100x210; D2 80x210) and windows (W2-100x150; W3-150x150;KW1-50x100;KW2-100x100); V(90x60).

All dimensions are in centimetres. Any missing data may be suitably assumed.

6 a) Prepare a detailed estimate of brick work for a hexagonal building of internal side length 3.00m. wall thickness 40cm. All five sides are provided with window of size 110cm x 150cm and one side with a door of size 120cm x 210cm. Height of the wall 3.50. A all round lintel of 15cm thick was provided. (5)

b) Estimate the quantity of earthwork for a portion of a district road for 400m length with following data. Formation width 10m side slopes in banking 2:1 , side slope in cutting 1.5:1, downward gradient is 1in200, formation level at chainage 0 in 150.000 (20)

Chainage	0	40	80	120	160	200	240	280	320	360	400
RL	149.0	148.90	148.50	148.80	148.60	148.70	149.20	149.40	149.30	149.0	148.60

PART C

Answer any two full questions, each carries 15 marks.

7 a) Discuss about different methods for finding valuation (5)

b) A building is situated by the side of a main road of Mumbai city on a land of 500 sq m .The built up portion is 20m x 15 m. (10)
The building is first class type and provided with water supply, sanitary and electrical fittings, and the age of the building is 30 years. Workout the valuation of the property.

8 a) Discuss about the different types of values and the term obsolescence (7)

b) An old building has been purchased by a person at a cost of Rs. 30,000 excluding the cost of the land. Calculate the amount of annual sinking fund at 4% interest assuming the future life of the building as 20 years and the scrap value of the building as 10% of the cost of purchase. (8)

9 a) Discuss the importance of valuation in civil engineering. (7)

b) A three storied building is standing on a plot of land measuring 800 sq m. The plinth area of each storey is 400 sq m .The is on RCC framed structure and the future life may taken as 70 years , The building fetches a gross rent of Rs 1500 per month , work out the capitalized value of the property on the basis of 6% net yield .For sinking fund 3% compound interest may be assumed . Cost of the land may be taken as Rs 40 per sq m . The other data may assumed suitably (8)

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Scheme of Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE409

Course Name: QUANTITY SURVEYING AND VLUATION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 10 marks.

Marks

1 (a) Specification in detail (6)

(b) Carpentery - No (2 marks) (4)

Pointing- Sq meter (2 Marks)

2 1. TABLE PREPRATION (3 MARKS) (10

2. FOR INCLUDING WATER CHARGES (1.5 MARKS))

3. FOR INCLUDING CONTRACTORS PROFIT (1.5 MARKS)

4. FOR CALCULATION ACCURACY (4 MARKS)

3 (a) Calculation for conveyance vehicle -3marks (6)

Calculation for head load – 3marks

b) OVERHEAD COST- Establishment (office staff) ; stationary, printing, postage etc.,; Travelling expense; Telephone; Rent and taxes; Supervision (salary of engineers, overseers, etc) ;Amenities of labour etc.. (2 marks) (4)

15% (2 marks)

PART B

Answer any two full questions, each carries 25 marks.

4 a) ()

Sl No	Quantity (kg)	Remark	Particulars	No	Length (m)	Total length (m)	Wt/m run (kg/m)	**Mark Distribution**
1	37.9	No = ((5.9-0.05)/0.4) +1 = **16**Q l = L-2ec+2hkl = 3.7-(2×0.025) + (2×9×0.01) = **3.83m** = 16×3.83 = 61.28m @ 0.62kg/m = **37.9kg**	Main bar 10mm ø @ 20cm c/c (straight bar)	16	3.83	61.28	0.62	5 Marks (Format 20%; No. of bar 25%, Total length 25%, final quantity 30%)

2	36.503	No = (5.9-0.05)/0.4 = **15 bars** l = L-2ec+2hkl +d = 3.7-(2×0.025) + (2×9×0.01) + 0.095 = **3.925m** = 15×3.925 = 58.875m @ 0.62 kg/m = **36.503kg**	Main bar 10mm ø bent up bar	15	3.925	58.875	0.62	5 Marks (Format 20%; No. of bar 25%, Total length 25%, final quantity 30%)
3	37.44 14.04	No of bars on bottom side= (365/25) +1 = **say 16 bars** No of bars on top side = (L-2ec-1d)/spacing = {(2×70)-(2×2.5)-(12-5)}/25 = 128/25 = **say 6 bars** l = L-2ec+2hkl = 5.9- (2×0.025) + (2×9×0.008) = **say 6m** Total length = (16+6) × 6 = 132 Steel = 132×0.39 = **51.48 kg**	Distribution bars 8mm ø @ 25cm c/c a) Bottom b) TopZ	16 2×3	6 6	96 36	0.39 0.39	5 Marks (Format 20%; No. of bar 25%, Total length 25%, final quantity 30%)
	Say 126kg		Total steel					2 Marks
Note : 5% wastage may be added. Whether added or not give full credit								

5 Total Center line length = 55.50m (5 marks) (25)

No. of Junctions = 12 or14 (depends on the center line layout)

Considering the No. of junction as 12

a) RR Masonry for foundation = 28.70m3

RR Masonry for Basement = 13.13m3 (5 Marks)

b) Earth filling = 18m3 (5 Marks)

c) RCC work for roof slab=7.0m3 ,Lintel=1.63m3 Sunshade=1.50m3 (5 Marks)

d) Painting for walls Gross area =289m2, Deduction=41.85m2 (Including Veranda brick work of height 2.10m); Net quantity= 247.15m2 (5 Marks)

Note : Full credit can be awarded if the variation in the above quantity due to the adoption No. of junctions as 14

6 a) Gross Total of Brick Work = 27.13 m3 (2 Marks) (5)

Deduction (Opening & Lintel) = 5.473m3 (2 Marks)

Net Total = 21.66m3 (1 Mark)

b) (20)

Chainage	Depth		Mean Depth		Area Central		Slope Area		Total Area		Length	Quantity (m3)	
	cutting	Filling	Filling	cutting	cutting (BD)	Filling (BD)	Cut (Sd^2) S=1.5	Fill (Sd^2) S=2.0	Cut (BD+Sd^2)	Fill (BD+Sd2)		**Cutting**	**Filling**
0		1											
40		0.9	0.95			9.5		1.62		11.12	40		444.8
80		1.1	1			10		2.42		12.42	40		496.8
120		0.6	0.85			8.5		0.72		9.22	40		368.8
160		0.6	0.6			6		0.72		6.72	40		268.8
200		0.3	0.45			4.5		0.18		4.68	40		187.2
217.14		0	0.15			1.5		0		1.5	17.14		25.71
240	0.4			0.2	2		0.24		2.24		22.86	51.2064	
280	0.8			0.6	6		0.96		6.96		40	278.4	
320	0.9			0.85	8.5		1.215		9.715		40	388.6	
360	0.8			0.85	8.5		0.96		9.46		40	378.4	
400	0.6			0.7	7		0.54		7.54		40	301.6	
												1398.206	**1792.11**

PART C

Answer any two full questions, each carries 15 marks.

7 a) 1. Rental Method (5)

2. Direct Comparison

3. Valuation based on profit

4. Valuation based on cost

5. Development Method

b) Construction cost - (3 Marks) , Depreciation – (3 Marks), Valuation of the building – (4 Marks) (10)

8 a) Any 4 type of values 4 mark (7)

Obsiscence 3 mark

b) The total amount of Sinking fund to be accumulated at the end of 20 yrs. (8)

S = 30000 x 90/100 = Rs. 27000

Annual Instalment of sinking fund, I=Si/((1+i)^n-1)= (27000×0.04)/((1+0.04)^20-1)=27000×0.0336=Rs.907.20

9 a) Any five points (7)

b) Capitalised value – 5 Marks, Sinking Fund – 3 Marks (8)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CE409

Course Name: QUANTITY SURVEYING AND VALUATION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 10 marks. Marks

1 a) List different type of estimates (4)

b) Work out the quantity of given materials required for 1:1.5:3 concrete and analyse the unit rate using the details given below: (6)

Description	**Quantity**	**unit**	**Rate Rs.**	**unit**
20mm (nominal size) broken stone	**?**	m^3	1300.00	m^3
Sand	**?**	m^3	1200.00	m^3
Cement	**?**	Tonne	5700	Tonne
Mason	0.200	Nos	500.00	Each
Man	1.000	Nos	450.00	Each
Women	3.500	Nos	450.00	Each
Man for lifting materials	0.200	Nos	450.00	Each

2 a) List the essential documents to be accompanied with the detailed estimate (6)

b) What is mean by overhead charges? Give the percentage adopted for the contractor's profit and overhead in CPWD DSR 2016 rate analysis. (4)

3 Write the detailed specification for brickwork in cement mortar 1:5. (10)

PART B

Answer any two full questions, each carries 25 marks.

4 Prepare detailed estimate for the following items of work for the construction of residential building **(25)**

(a) RRM for foundation (75cm x 75cm) and basement50cm x 50cm , Wall thickness 20cm

(b) Quantity of earth filling inside the plinth

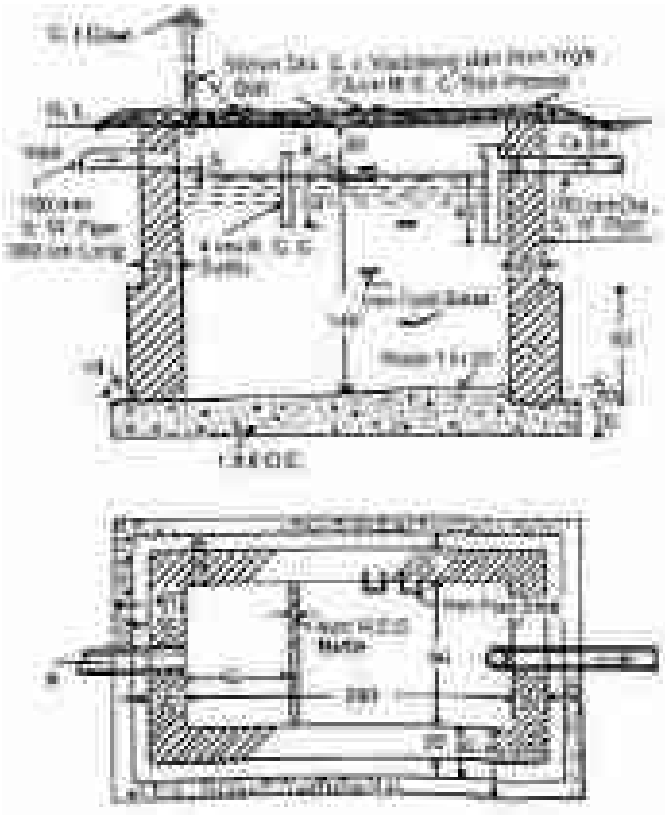
(c) RCC works for slab (12cm thick), lintel (15cm thick), and sun shade (60cm projection).

(d) Painting for walls, doors(D1-100x210; D2 80x210) and windows (W2-100x150; W3-150x150;KW1-50x100;KW2-100x100); V(90x60).

All dimensions are in centimetres. Any missing data may be suitably assumed.

5 Prepare a bar bending schedule and quantities of RCC and reinforcement of a simply supported beam of length 6.5 m , depth 50 cm, and width 30 cm reinforced with 3 Nos of 20 mm dia at bottom as straight bar, 2 Nos of 20 mm dia cranked at 45^{o} , 2 Nos 16 Φ at top of beam and 8 mm Φ 2 legged stirrups @ 15 cm c/c (25)

6 Prepare a detailed estimate of a Septic tank from the given drawings. (25)



PART C

Answer any two full questions, each carries 15 marks.

7 a) Explain valuation and its purpose? (5)

b) What are the methods for calculating depreciation? (10)

8 a) Discuss about different methods for finding valuation of a building (8)

b) The cost of construction of a new building according to present market rate is Rs. 80,000/- having a life of 70 years. But if the building is 15 years old determine the depreciation amount which should be deducted from the cost of the new building at 6% compound interest. (7)

9 a) A building is constructed at a cost of Rs.2,50,000 on a land purchased at Rs. 50,000. The owner of the property expects a return of 9% on the cost of construction and 8% on the cost of land. The building is estimated to have a future life of 60years at the end of which it requires Rs.3,25,000 for constructing a new building in its place. Determine the standard rent of the property given: (9)

i. Rate of interest for sinking fund at 6%

ii. Annual repairs at 1.5% of cost of the construction

iii. All other outgoings 28% of the net income of the property

Scrap value at the end of the useful life of the building as 10%.

b) Define salvage value, Scrap value, capitalised value and obsolescence (6)

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DRAFT SCHEME

Scheme of Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CE409
Course Name: TRANSPORTATION ENGINEERING - II

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 10 marks.

			Marks
1	(a)	Any four type – ***1 marks x 4no's***	(4)
	(b)	Analysis ***(3 marks)*** ; fill blanks***(3 marks)***	(6)
2	(a)	Report of work (Description of site, objective of wok, necessity of work, time of execution etc.....), Specification(General and detailed, drawings, calculation and design, analysis of rate (if not from the standard source), contract conditions ***(Any FIVE relevant document name-give full marks)***	(6)
	(b)	OVERHEAD COST- Establishment (office staff) ; stationary, printing, postage etc.,; Travelling expense; Telephone; Rent and taxes; Supervision (salary of engineers, overseers, etc) ;Amenities of labour etc.. ***(2 marks)*** 15% ***(2 marks)***	(4)
3	(a)	Explanation Materials required, quality , mixing, laying, maintaining levels,no vertical joints, stoppage of work after days work , curing point wise 1 mark	(10)

PART B

Answer any two full questions, each carries 25 marks.

4 Quantities each item 5 marks each

5 Concrete quantity 5 marks |BBS table 3 marks each bar type 4 marks each – total steel quantity 5

6 Any 5 items 4 marks each, presentation, format 5 marks

PART C

Answer any two full questions, each carries 15 marks.

7	a	5 purpose	5
	b	4 methods each 2.5 marks each-constant rate, constant percentage, sinking fund+any one	10

8 a explain the methods-2 each 8

b Sinking fund coefficient for 70 years $I_c = \frac{i}{(1+i)^n-1} = \frac{0.06}{(1+0.06)^{70}-1} = 0.001$ 7

An amount of Re.1 per annum in n years $=\frac{(1+i)^n-1}{i}$

An amount of Re.1 after 15 years $=\frac{(1+i)^{15}-1}{0.06} = 23.25$

Therefore, Rate of Depreciation in 15 years = 0.001 x 23.25 = 0.02325 or 2.352%

Total depreciation in 15 years on Rs. 80,000 = 80000 x 2.325/100 = Rs. 1860.

9 a. **Net return per annum** 9

On building cost@9% = Rs.2,50,000 x 0.09 = Rs. 22,500/-

On the cost of land @8% = Rs. 50,000 x 0.08 = Rs. 4000/-

Total net return per annum = Rs. 26,500/-

Outgoings

scrap value considered @ 10% of cost of building = 2,50,000 x 0.10 = Rs. 25,000/-

Sinking fund = 3,25,000 – 25,000 = Rs. 3,00,000/-

Annual sinking fund required for 60 years

$$I - \frac{SF}{(1+i)^n-1} - \frac{300000 \times 0.06}{(1+0.06)^{60}-1} - 570$$

Annual repairs @1.5% of construction cost = Rs. 2,50,000 x 0.015 = Rs. 3750

Other outgoings 28% of net return = 0.28 x 26,500 = Rs. 7420

Total outgoings = Rs. 11,740

Standard rent = net return + outgoings

= 26,500 + 11,740

Standard rent per annum = Rs. 38,240/-

Standard rent per month = Rs. 3186.67/-

b. Each definition 1.5 marks each 6

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