ATME College of Engineering

SUB: Estimation and Contract Management

SUB CODE: BCV702

TECHNICAL TERMS

- Estimate
- Quantity Survey
- Specifications
- Rates
- Site Plan
- Line Plan
- Index Plan
- Detailed Plan
- Centre Line Plan
- Supplementary Estimate
- Administrative Approval
- Technical Sanction
- Competent Authority
- Ordinary Measurement Book

TECHNICAL TERMS

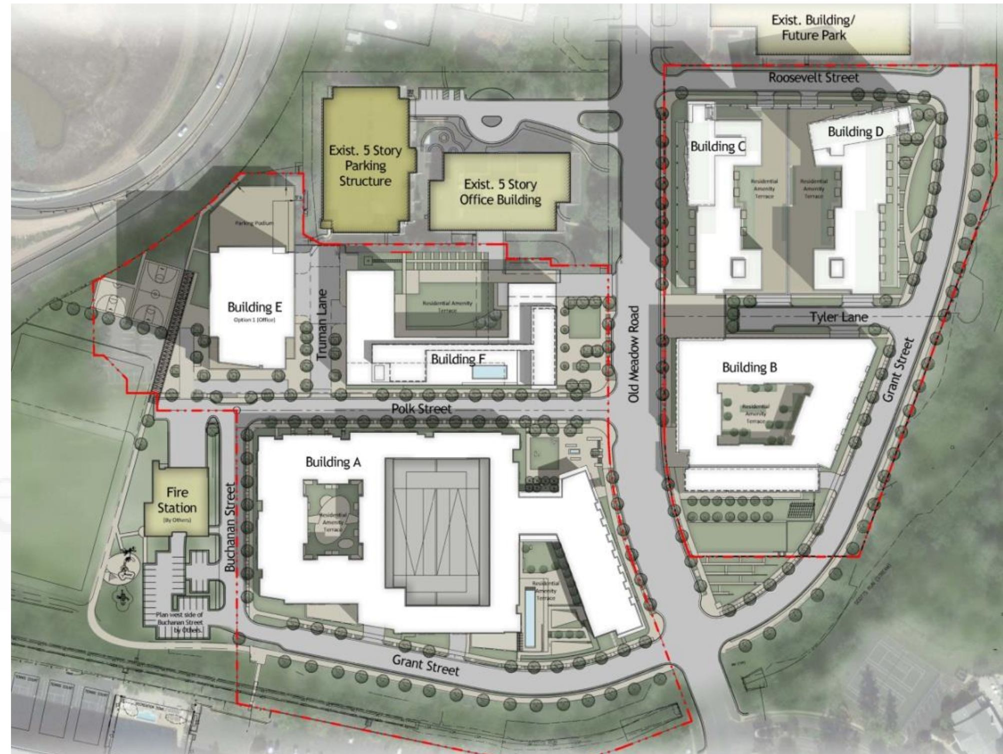
1. **ESTIMATE**: An estimate is the anticipated or probable cost of work and is usually prepared before the construction is taken up. It is indeed calculations or computations of various items of an engineering work.

2. **QUANTITY SURVEY**: It is the schedule of all items of work in a building. These quantities are calculated from the drawing of the building. Thus quantity survey gives quantities of work done in case of each items, when priced gives the total cost. In short, quantity survey means calculations of quantities of materials required to complete the work concerned

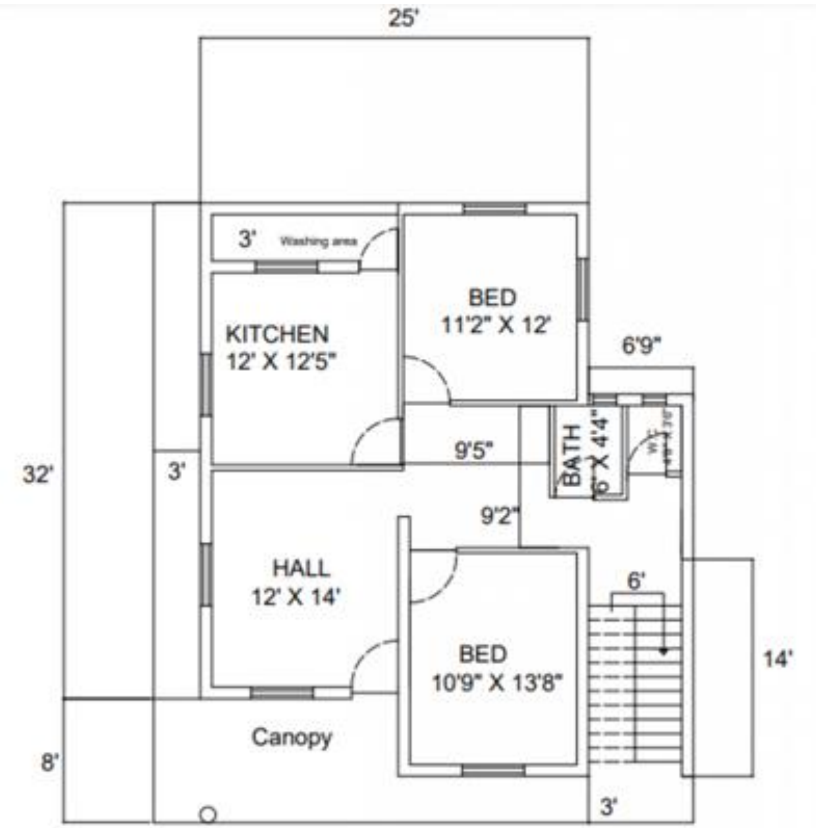
3. **SPECIFICATIONS:** Detailed specifications gives the nature, quality and class of work, materials to be used in the various parts of work , quality of the material, their proportions, method of preparation, workmanship and description of execution of work are required.

4. **RATES:** The rates of various items of works, materials to be used in the construction and the wages of different categories of labor (skilled and unskilled) should be available for preparing an estimate. The cost of transportation charges should also be known. As far as possible sanctioned “Schedule of Rates” shall be followed or the rates may be worked out by the “Analysis of Rates” method.

5. **<u>SITE PLAN</u>**: It is the plan drawn for a particular construction showing its position with respect to approaching roads, main bazars, markets and other permanent features in a populated area. It shows the location of the area under construction with respect to the other areas and on it generally the names of the owners of areas or property holders adjoining to it are also denoted. North line is also clearly marked on it.



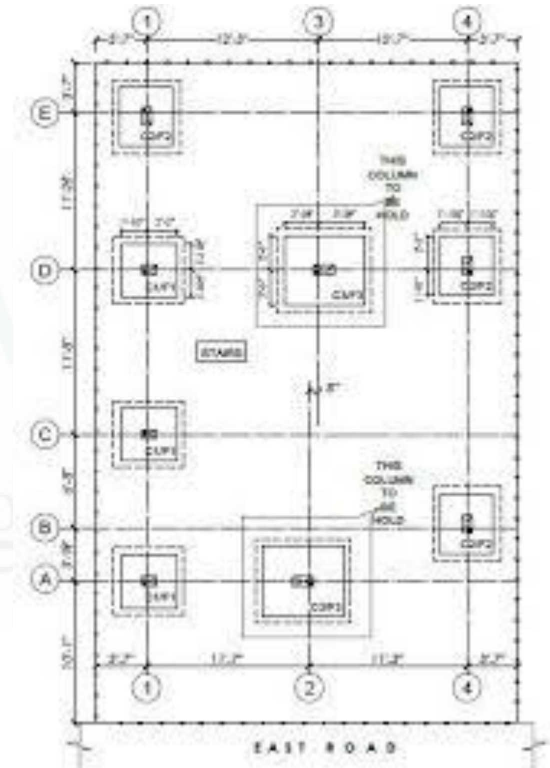
6. LINE PLAN: Line plan can be defined as the plan of a particular construction simply showing main features with the help of the single lines of different portions of the constructions. Details of constructions are not generally shown on this plan. This inside and outside dimensions shown on this plan should necessarily be corresponding to actual dimensions.



7. <u>INDEX PLAN</u>: This is the plan of a particular colony showing the positions of different houses in single lines their number if any position of roads, schools, market, hospitals and other features etc. this plan is generally fixed on the entrance, or at exit or in the central place of the colony, for the guidance of the inhabitants and outsiders.

8. <u>DETAILED PLAN</u>: This plan indicates a plan of a construction drawn to a definite scale, showing all detailed information required for its execution. Various sections and elevations are clearly drawn on this plan.

9. **CENTRE LINE PLAN**: This is actually a layout plan drawn to facilitate the laying out of foundation lines and other features. It is generally fixed on the entrance or at exit in the central place of the colony for the guidance of the inhabitants and outsiders.



10. **SUPPLEMANTARY ESTIMATE:** When some additions are done in the original work, a fresh detailed estimate is prepared to supplement the original work. This estimate is called supplementary estimate. It is also accompanied by all the papers as required in thru detailed estimate.

11. **ADMINISTRATIVE APPROVAL:** For any project required by the department an approval so sanction of the competent authority with respect to the cost and work is necessary at the first instance. Thus administrative approval denotes the formal acceptance by the administrative department concerned of the proposals for incurring expenditure.

12. **TECHNICAL SANCTION:** It means the sanction and order by the competent authority of the department for the detailed estimate design calculations quantities of work rates and cost of work.

13.**COMPETENT AUTHORITY:** An officer or any other authority in the department to whom relevant powers are delegated by the government (Financial Department).

14.**ORDINARY MEASUREMENT BOOK:** It is measured book in which entries regarding the work done or supplies made and services performed are recorded for the purpose of making payments to the contractors or the labor. Entries in the M.B are generally recorded by the sectional officers or by any other officers deputed for the purpose

15. **<u>LUMPSUM ITEMS</u>:** Sometimes while preparing estimate for the certain small items like front architecture or decoration work of a building it is not possible to workout detailed quantities so far such lump sum items a lump sum rate is provided.

16. **<u>PLINTH AREA</u>:** The built up covered area of a building measured at floor level of any storey is called plinth area.

- Estimating is the technique of calculating or computing the various quantities and the expected Expenditure to be incurred on a particular work or project.
- In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirement are necessary for preparing an estimate.

➢ Drawings like plan, elevation and sections of important points.

➢ Detailed specifications about workmanship & properties of materials etc.

➢ Standard schedule of rates of the current year.

UNITS OF MEASUREMENTS

- The units of measurements are mainly categorized for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:

❑ Single units work like doors, windows, trusses etc., is expressed in numbers.

❑ Works consists linear measurements involve length like cornice, fencing, hand rail, bands of specified width etc., are expressed in running meters (RM).

❑ Works consists a real surface measurements involve area like plastering, white washing, partitions of specified thickness etc., and are expressed in square meters (m2)

❑ Works consists cubical contents which involve volume like earth work, cement concrete, Masonry etc are expressed in Cubic metres.

Sl. No.	Particulas of item	Units of Measurement	Units of payment
I	**Earth work:**		
	1. Earth work in Excavation	cum	Per%cum
	2. Earthwork in fillingin foundation trenches	cum	Per%cum
	3. Earth work in filling in plinth	cum	Per%cum
II	**Concrete:**		
	1. Lime concretre in foundation	cum	percum
	2. Cement concrete in Lintels	cum	percum
	3. R.C.C in slab	cum	percum
	4. C.C. or R.C.C. Chujja, Sunshade	cum	percum
	5. L.C. in roof terracing (thickness specified)	sqm	persqm
	6. Cement concrete bed	cum	per cum
	7. R.C. Sunshade (Specified Width & Hight	cum	1rm
III	**Damp ProofCource (D.P.C)** (Thickness should be mentioned)	sqm	persqm
IV	**Brick work:**		
	1. Brickwork in foundation	cum	percum
	2. Brick work in plinth	cum	percum
	3. Brick work in super structure	cum	percum
	4. Thin partition walls	sqm	percum
	5. Brick work in arches	cum	percum
	6. Reinforced brick work (R.B.Work)	cum	percum

V	**Stone Work:**		
	Stone masonry	cum	percum
VI	**Wood work:**		
	1. Door sand windows frames or chowkhats, rafters beams	cum	percum
	2. Shutters of doors and windows (thickness specified)	sqm	persqm
	3. Doors and windows fittings (like hinges, tower bolts, sliding bolts, handles)	Number	per number
VII	**Steel work**		
	1. Steel reinforcement bars etc in R.C.C. and R.B.work. quintal	Quintal	per quintal
	2. Bending, binding of steel Reinforcement	Quintal	per quintal
	3. Rivets, bolts, & nuts, Anchor bolts, Lewis bolts, Holding down bolts.	Quintal	per quintal
	4. Iron hold fasts	Quintal	per quintal
	5. Iron railing (height and types specified)	Quintal	per quintal
	6. Iron grills	sqm	per sqm

VIII	**Roofing**		
	1. R.C.C. and R.B.Slab roof (excluding steel)	cum	per cum
	2. L.C. roof over and inclusive of tiles or brick or stone slab etc (thickness specified)	sqm	per sqm
	3. Centering and shuttering form work	sqm	per sqm
	4. A.C.Sheet roofing	sqm	per sqm
IX	**Plastering, points&finishing**		
	1. Plastering-Cement or Lime Mortar (thickness and proportion specified)	sqm	per sqm
	2. Pointing	sqm	per sqm
	3. White washing, colour washing, cement wash (number of coats specified)	sqm	per sqm
	4. Distempering (number of coats specified)	sqm	per sqm
	5. Painting, varnishing (number of coats specified)	sqm	per sqm
X	**Flooring**		
	1. 25mm cement concrete over 75mm lime concrete floor (including L.C.)	sqm	per sqm
	2. 25mm or 40mm C.C. floor	sqm	per sqm
	3. Doors and window sills (C.C. or cement mortar plain)	sqm	per sqm
XI	**Rain water pipe /Plain pipe**	1RM	per RM
XII	**Steel wooden trusses**	1No	per 1No
XIII	**Glass pannels(supply)**	sqm	per sqm
XIV	**Fixing of glass panels or cleaning**	No	per no.

RULES FOR MEASUREMENT

❖ The rules for measurement of each item are invariably described in IS- 1200. However some of the general rules are listed below:

1. Measurement shall be made for finished item of work and description of each item shall include materials, transport, labor, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.
2. In booking, the order shall be in sequence of length, breadth and height or thickness.
3. All works shall be measured subject to the following tolerances.

- Linear measurement shall be measured to the nearest 0.01m.
- Areas shall be measured to the nearest 0.01 sq.m.
- Cubic contents shall be worked-out to the nearest 0.01 cum

REQUIREMENTS OF ESTIMATION & COSTING

1. Estimate gives an idea of the cost of the work & hence its feasibility can be determined i.e. whether the project could be taken up with in the funds available or not.
2. Estimate gives an idea of time required for the completion of the work.
3. Estimate is required to invite the tenders and Quotations and to arrange contract.
4. Estimate is also required to control the expenditure during the execution of work.
5. Estimate decides whether the proposed plan matches the funds available or not.

PROCEDURE OF ESTIMATING
OR
METHOD OF ESTIMATING

- Estimating involves the following operations

1. Preparing detailed Estimate.
2. Calculating the rate of each unit of work
3. Preparing abstract of estimate

DATA REQUIRED TO PREPARE AN ESTIMATE

1. Drawings i.e. plans, elevations, sections etc.
2. Specifications.
3. Rates.

- **DRAWINGS**: If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, it is very essential before preparing an estimate.

- **SPECIFICATIONS**

a) General Specifications: This gives the nature, quality, class and work and materials in general terms to be used in various parts of wok. It helps no form a general idea of building.

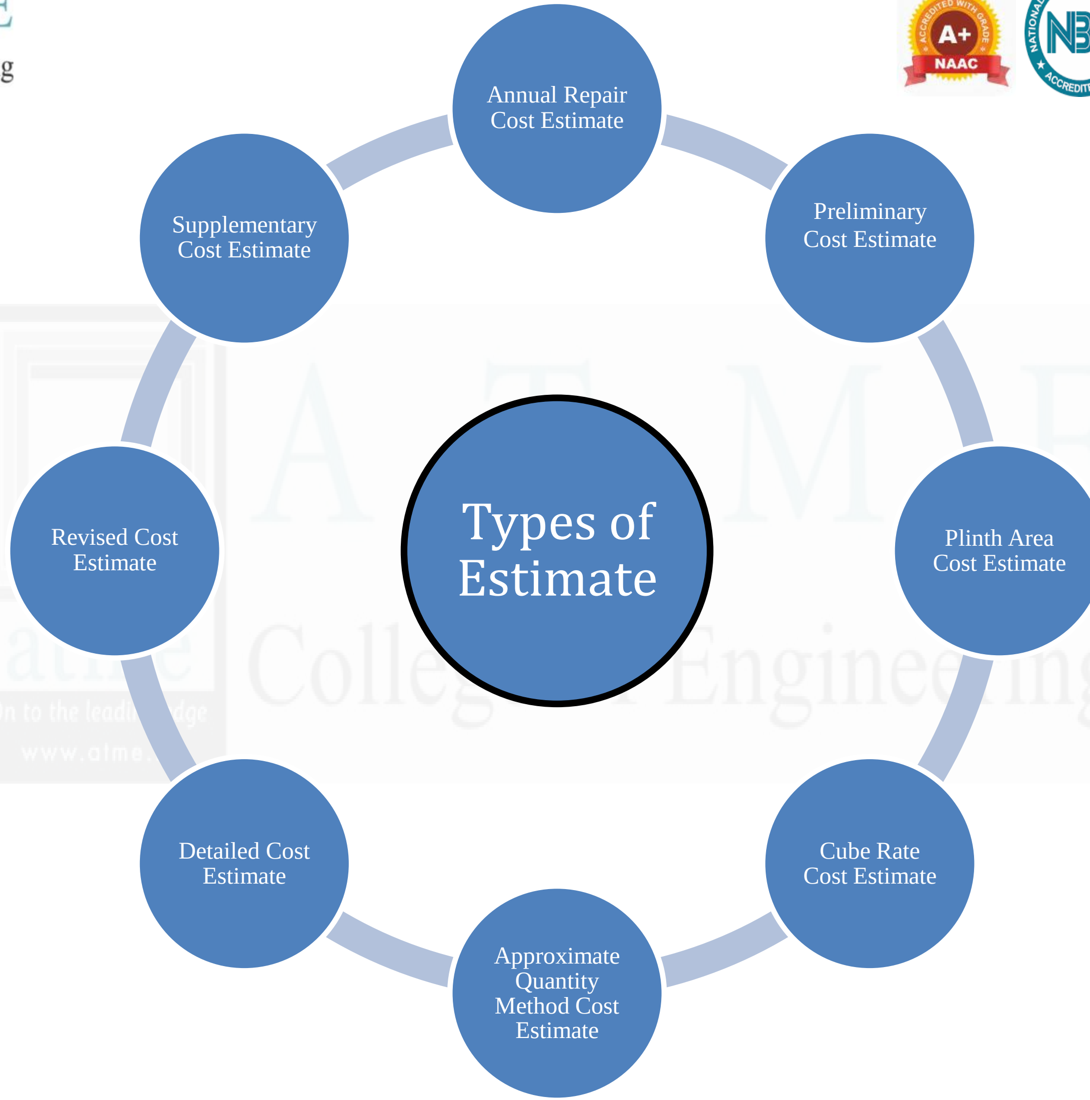
b) Detailed Specifications: These gives the detailed description of the various items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

- **RATES:** For preparing the estimate the unit rates of each item of work are required.

1. For arriving at the unit rates of each item.
2. The rates of various materials to be used in the construction.
3. The cost of transport materials.
4. The wages of labor, skilled or unskilled of masons, carpenters, Amador, etc.,

TYPES OF ESTIMATE

- A cost estimate is predicted expenditure of a project which is generally prepared before the project is taken up. It is prepared in different types based on the requirement of project.
- The construction cost estimates can be prepared either in a detailed manner by taking into consideration item by item or can be calculated approximately without going much into the details.


Types of Estimate
Annual Repair Cost Estimate
Preliminary Cost Estimate
Plinth Area Cost Estimate
Cube Rate Cost Estimate
Approximate Quantity Method Cost Estimate
Detailed Cost Estimate
Revised Cost Estimate
Supplementary Cost Estimate

Preliminary Cost Estimate

- The preliminary cost estimate is also called an **abstract cost estimate or approximate cost estimate or budget estimate.**
- This estimate is generally prepared in initial stages to know the approximate cost of the project. By this estimate, the competent sanctioning authority can decide the financial position and policy for the administration section.
- Preliminary estimates are prepared with reference to the cost of similar type projects in a practical manner.
- In this estimate, the approximate cost of each important item of work is displayed individually to know the necessity and utility of each item of work.
- The items of work include the cost of lands, cost of roads, electrification, water supply costs, cost of each building, etc.

Plinth Area Cost Estimate

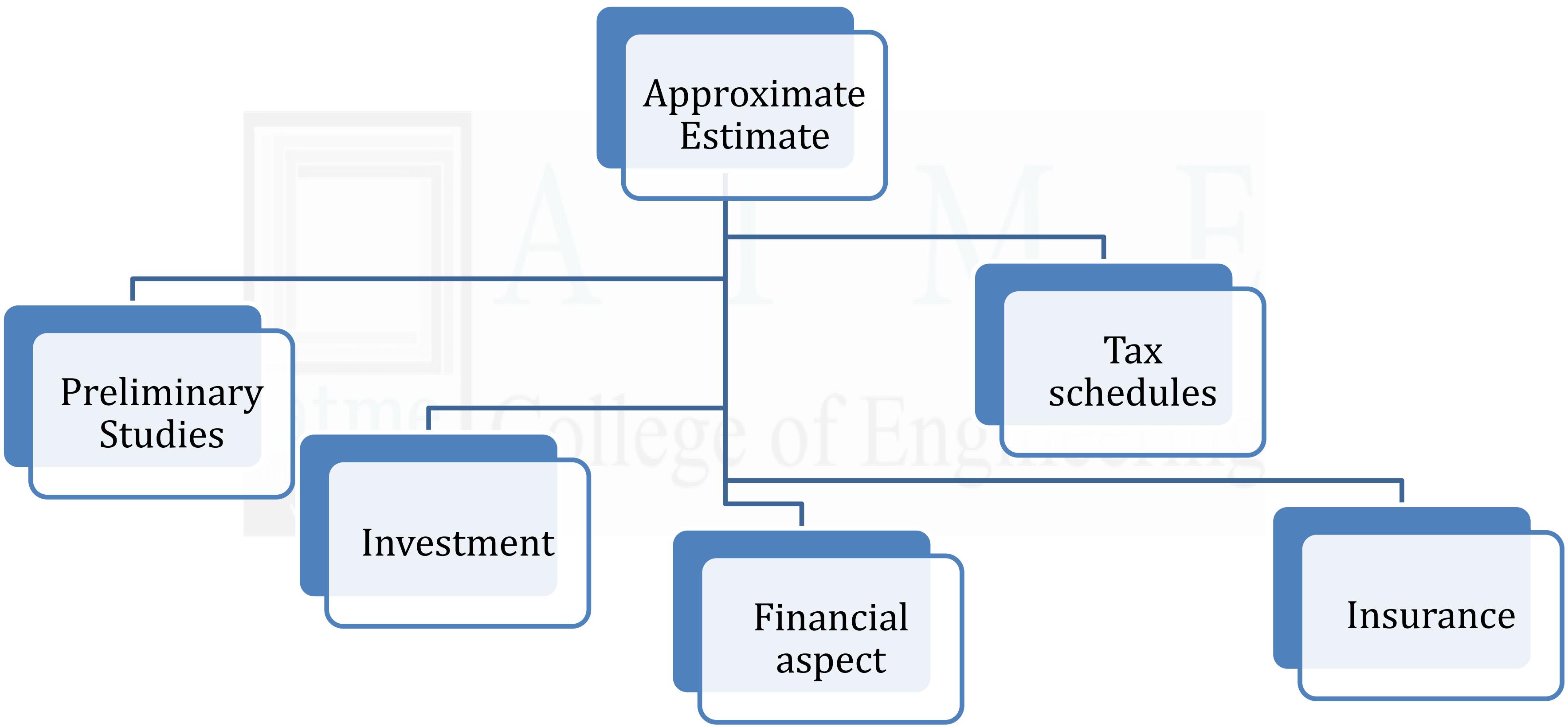
- Plinth area cost estimate is prepared on the basis of plinth area of building which is the area covered by external dimensions of building at the floor level and plinth area rate of building which is the cost of similar building with specifications in that locality.
- Plinth area estimate is obtained by multiplying plinth area of building with plinth area rate. For example if we require plinth area estimate of 100 sq.m in a particular locality and plinth area rate of a building in same locality is 2000 per sq.m then plinth area estimate is 100 X 2000 = 200000.
- Open areas, courtyards, etc. are not included in the plinth area. If the building is multi-storied, the plinth area estimate is prepared separately for each floor level.

Cube Rate Cost Estimate

- Cube rate cost estimate of a building is obtained by multiplying plinth area with the height of building. Height of building should be considered from floor level to the top of the roof level. It is more suitable for multi storied buildings.
- This method of estimation is accurate than plinth area method. The rate per cubic meter is taken into consideration based on the costs of similar type of buildings situated in that location. Foundation, plinth and parapet above the roof level are not considered in this type of estimate.

Approximate Quantity Method Cost Estimate

- In approximate quantity method cost estimate, the total wall length of the structure is measured and this length is multiplied by the rate per running meter which gives the cost of the building.
- The rate per running meter is calculated separately for the foundation and superstructure.
- In case of foundation, rate per running meter is decided by considering quantities such as excavation cost, brick work cost up to plinth.
- While in case of superstructure quantities like brickwork for wall, wood works, floor finishing etc. are considered for deciding rate per running meter.


Approximate Estimate
Preliminary Studies
Investment
Financial aspect
Tax schedules
Insurance

Detailed Cost Estimate

- Detailed cost estimate is prepared when competent administrative authority approved the preliminary estimates.
- This is very accurate type of estimate. Quantities of items of work are measured and the cost of each item of work is calculated separately.
- The rates of different items are provided according to the current workable rates and total estimated cost is calculated.
- 3 to 5 % of estimated cost is added to this for contingencies as miscellaneous expenditure.

The detailed Estimated should consist following details and documents:

- Report
- General Specifications
- Detailed Specifications
- Drawings/plans – layout plans, elevation, sectional views, detailed drawings etc.
- Designs and calculations – In case of buildings design of foundations, beams, slab etc.
- Schedule of rates

Important Factors

- Availability of local labour
- Availability of materials
- Location of site
- Transportation of materials
- Quantity of materials

Revised
Cost Estimate

- Revised cost estimate is a detailed estimate and it is prepared when the original sanctioned estimate value is exceeded by 5% or more.
- The increase may be due to sudden increase in cost of materials, cost of transportation etc. The reason behind the revision of estimate should be mentioned on the last page of revised estimate.

Supplementary Cost Estimate

- Supplementary cost estimate is a detailed estimate and it is prepared freshly when there is a requirement of additional works during the progress of original work.
- The estimate sheet should consists of cost of original estimate as well as the total cost of work including supplementary cost of work for which sanction is required.

Annual Repair Cost Estimate

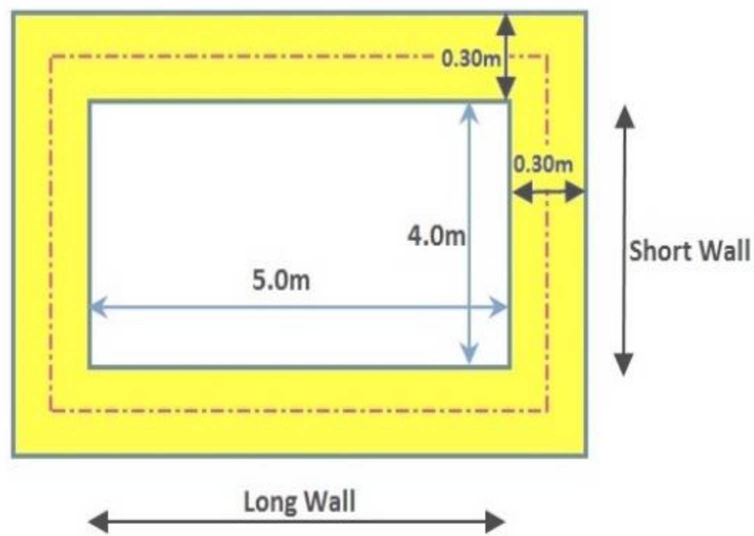
- The annual repair cost estimate is also called as **annual maintenance estimate** which is prepared to know the maintenance costs of the building which will keep the structure in safe condition.
- Whitewashing, painting, minor repairs, etc. are taken into consideration while preparing annual repair estimate for a building.

Estimation of building

- Short wall and long wall method
- Centre line method.

Long Wall and Short Wall Method of Estimation

- For the calculating quantity of various construction item, long wall and short wall method is used.
- For measuring the long wall and short wall the external out-to-out length of walls running in the longitudinal direction generally is considered as "long wall" while the in-to-in internal length of walls running in the transverse direction is called as "short wall" or "cross wall".
- For calculating quantity multiply the length into the breadth and height of the wall.



Length of Long Wall = Center to Center Length of wall + Half Breadth on One Side + Half Breadth on the Other Side

Length of Short Wall = Centre to Centre Length – One breadth

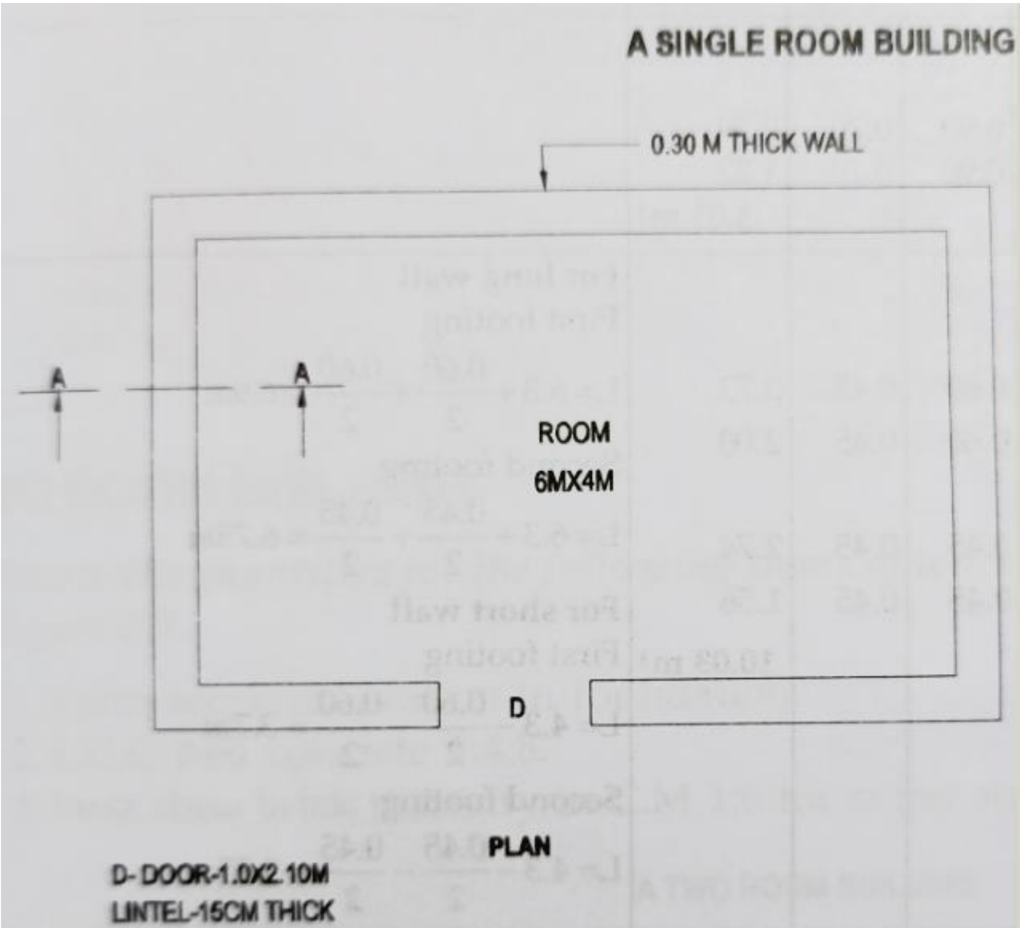
Center Line Method

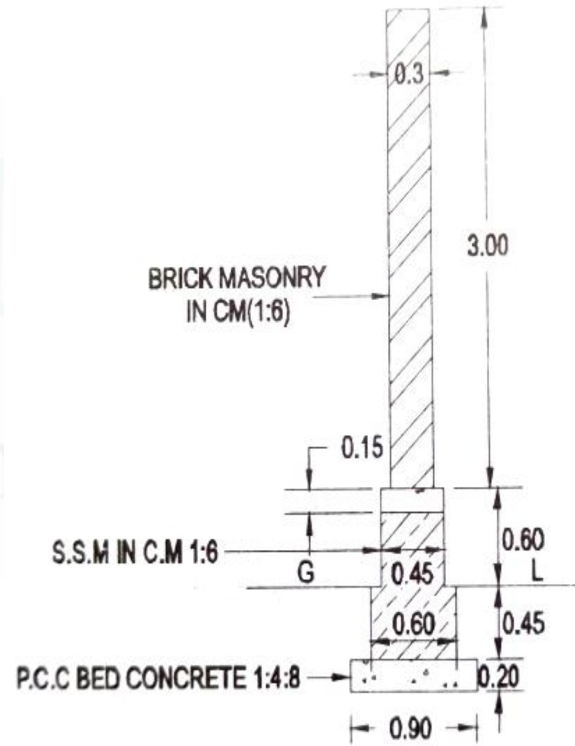
- Centre line method is adopted for walls of similar cross sections.
- In centre line method, total centre line length of all the walls is first measured, provided walls are of same type, long and short having same cross section and same type of footings.
- After the calculation of centre line length, it is multiplied with the breadth and depth correspondingly to find the total quantity.
- Using centre line method provides an edge with higher work pace; however, extra attention must be paid at junctions, meeting points of partition or cross walls, etc.

PROBLEM 1

- Estimate the quantities for the following items of work for a single room building:

1. Earthwork excavation in foundation
2. P.C.C bed concrete 1:4:8
3. S.S.M in C.M 1:6
4. Burnt brick masonry in C.M 1:6





SECTION ON AA

All dimensions are in metre

Long wall & Short wall method

(a) Centre to Centre of long wall

= (Wall thickness/2) + Inner to Inner distance of wall + (Wall thickness/2)

= (0.3/2) + 6 + (0.3/2) = 6.3

(b) Centre to Centre of short wall

= (Wall thickness/2) + Inner to Inner distance of wall + (Wall thickness/2)

= (0.3/2) + 4+ (0.3/2) = 4.3

CALCULATIONS

Sl no	Particulars of Item	No	Length	Breadth	Depth	Quantity	Remarks

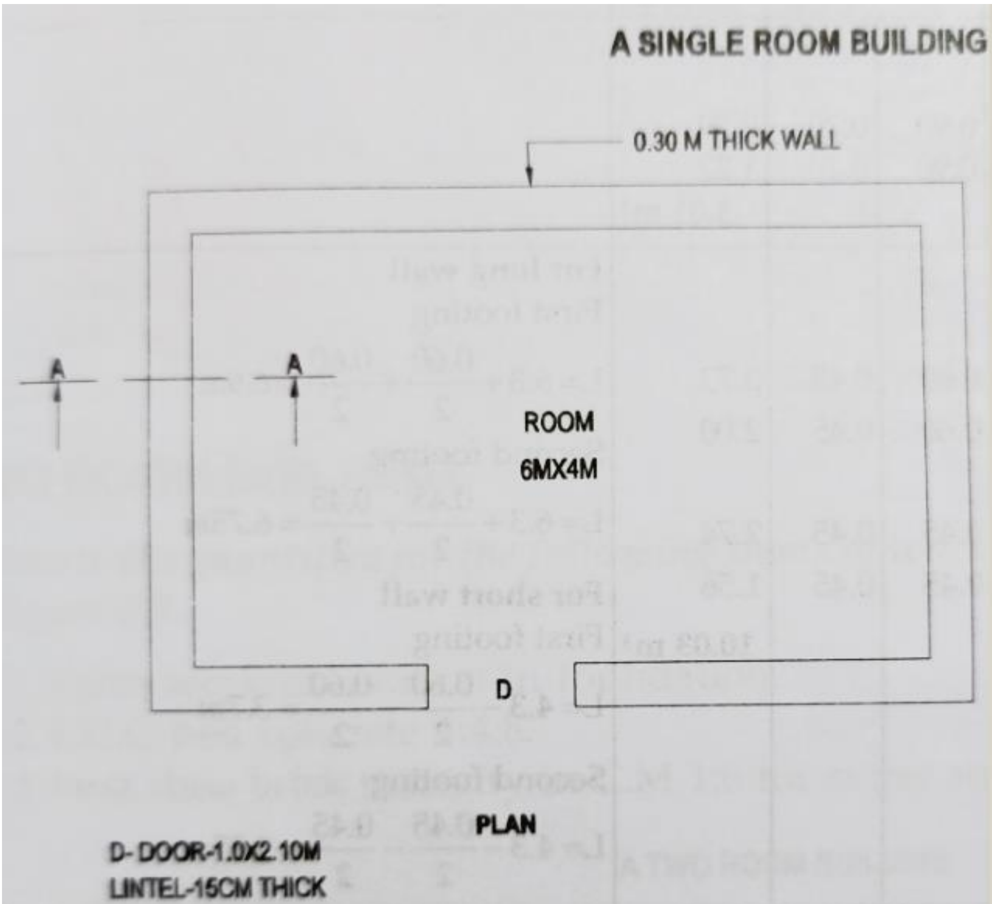
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
1	Earth work Excavation						For Long Wall 6.3 + (0.9/2) + (0.9/2)
	(a) Long Wall	2	7.2	0.9	0.65	8.42	= 7.2 m
	(b) Short wall	2	3.4	0.9	0.65	3.98	For short wall = 4.3 - 0.9 = 3.4 m
	=					**12.40 m^3**	

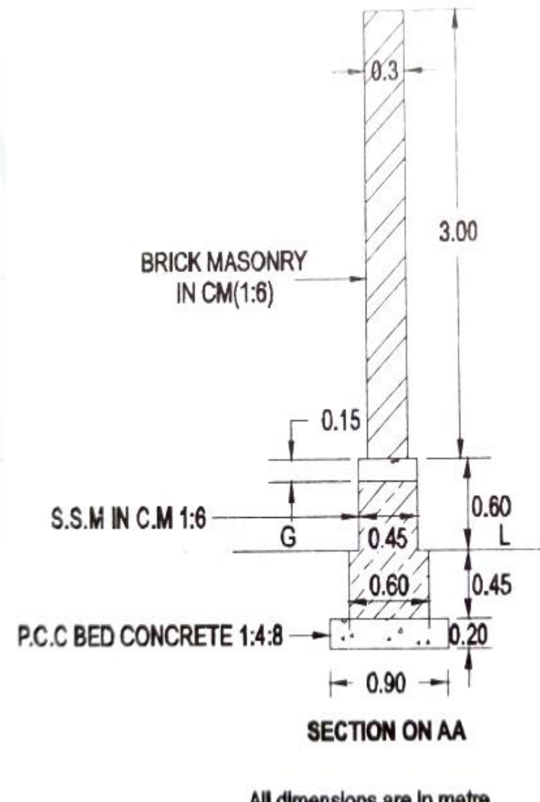
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
2	P.C.C bed Concrete (1:4:8)						**For Long Wall** 6.3 + (0.9/2) + (0.9/2)
	(a) Long Wall	2	7.2	0.9	0.20	2.59	= 7.2 m
	(b) Short wall	2	3.4	0.9	0.20	1.22	**For short wall** = 4.3 - 0.9 = 3.4 m
	=					**3.81 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
3	S.S.M in CM 1:6						**For Long Wall**
	First footing						**First footing**
	(a) Long Wall	2	6.9	0.60	0.45	3.73	L = 6.3 + (0.6/2) + (0.6/2) = 6.9 m
	(b) Short wall	2	3.7	0.60	0.45	2.00	**Second footing** L = 6.3 + (0.45/2) + (0.45/2) = 6.75 m
	Second footing						
	(a) Long Wall	2	6.75	0.45	0.45	2.74	**For short wall**
	(b) Short wall	2	3.85	0.45	0.45	1.56	**First footing** L = 4.3 - (0.6) = 3.7 m **Second footing** L = 4.3 - (0.45) = 3.85 m
=						**10.03 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
4	Burnt brick masonry in CM 1:6						For Long Wall L = 6.3 + (0.3/2) + (0.3/2) = 6.6 m
	(a) Long Wall	2	6.6	0.30	3.0	11.88	For short wall
	(b) Short wall	2	4	0.30	3.0	7.20	L = 4.3 - (0.3) = 4.0 m
	Total					**19.08 m^3**	
	Deduction						For Lintel
	For Door	1	1	0.3	2.1	0.63	L = Opening size + bearing
	For Lintel	1	1.30	0.3	0.15	0.059	L = 1 + 0.15 + 0.15 = 1.30 m
			=			**18.39 m^3**	

Centre line method





Centre line method

- **Total length of centre line**

$= (2 \times 6.3) + (2 \times 4.3)$

$= 12.6 + 8.6$

$= 21.2$ m

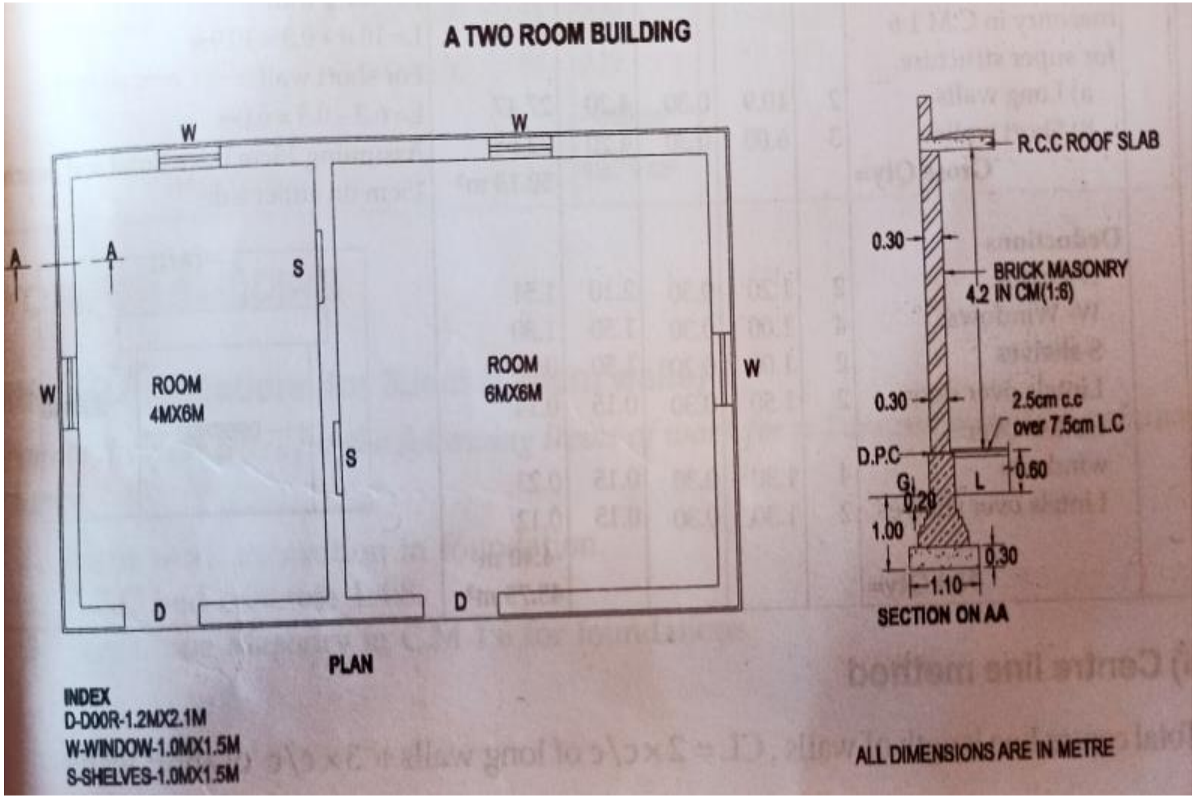
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity	Remarks
1	Earth work excavation	1	21.2	0.90	0.65	12.40 m^3	
2	P.C.C bed concrete 1:4:8	1	21.2	0.90	0.20	3.81 m^3	
3	S.S.M in C.M 1:6						
	First footing	1	21.2	0.60	0.45	5.72	
	Second footing	1	21.2	0.45	0.45	4.29	
	Total=					10.01 m^3	
4	Burnt brick masonry in C.M						
	1:6	1	21.2	0.30	3	19.08 m^3	
	Deduction for Door	1	1	0.30	2.1	0.63 m^3	
	Deduction for Lintel	1	1.3	0.30	0.15	0.059 m^3	
	Total =					18.39 m^3	

PROBLEM 2

- Estimate the quantities for the following items of work for a two room building shown in fig.

1. Earthwork excavation in foundation
2. P.C.C bed concrete 1:4:8
3. First class brick masonry in C.M 1:6 for super structure

Long wall & Short wall method



Long wall & Short wall method

(a) Centre to Centre of long wall

= 0.15 + 4 +0.15 + 0.15 + 6 + 0.15

= 10. 6

(b) Centre to Centre of short wall

= 0.15 + 6 + 0.16

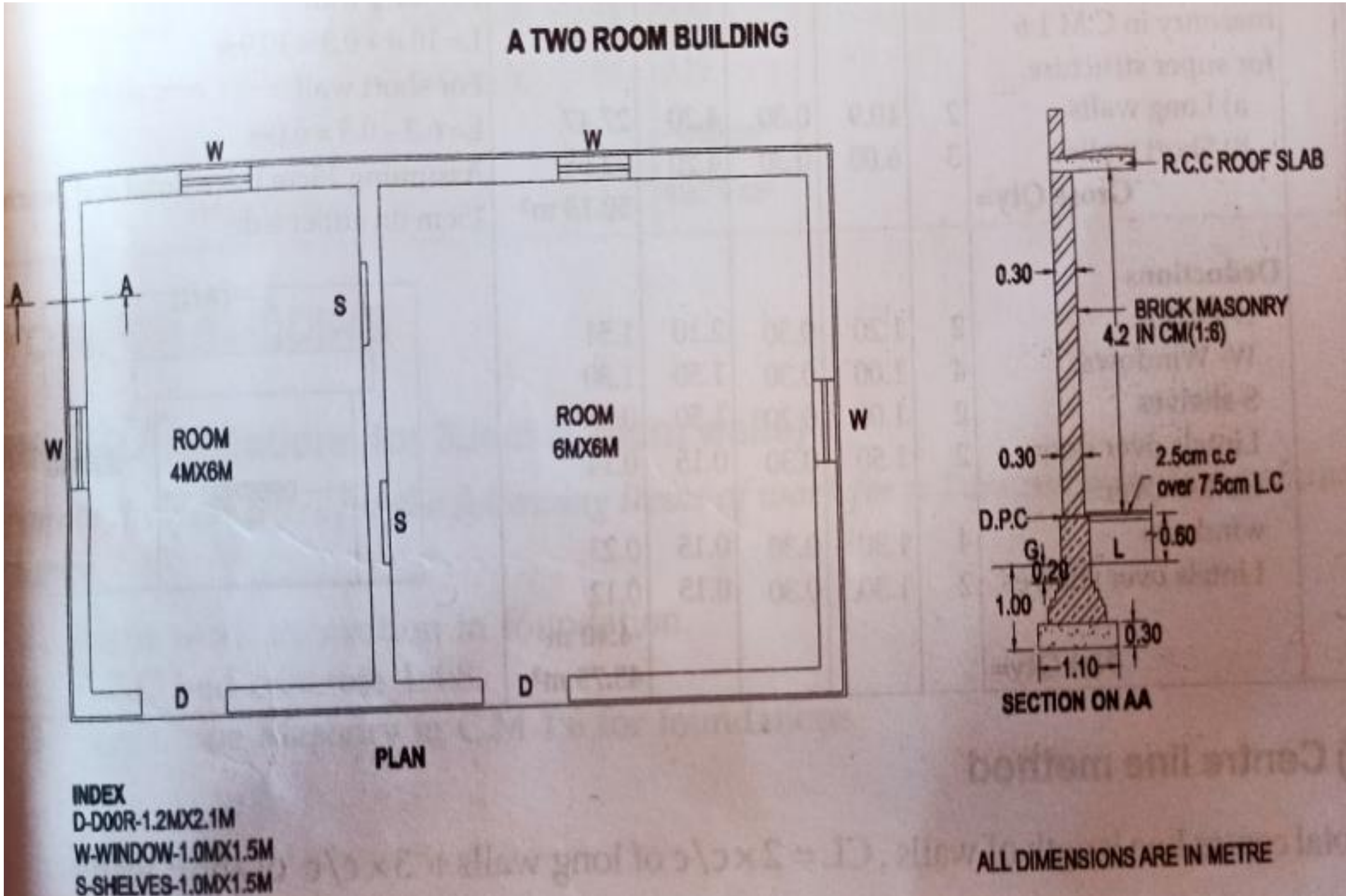
= 6.3

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
1	Earth work Excavation (a) Long Wall (b) Short wall	 2 3	 11.7 5.20	 1.10 1.10	 1.00 1.00	 25.74 17.16	For Long Wall 10.6 + 1.1 = 11.7 m For short wall = 6.3 – 1.1 = 5.20 m
=						**42.90 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
2	P.C.C bed Concrete (1:4:8)						For Long Wall 10.6 + 1.1
	(a) Long Wall	2	11.7	1.1	0.30	7.722	= 11.7 m
	(b) Short wall	3	5.20	1.1	0.30	5.18	For short wall = 6.3 – 1.1 = 5.20 m
=						**12.87 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
3	First class brick						For Long Wall
	masonry in CM 1:6						10.6 + 0.3 = 10.9 m
	for super structure						For short wall
	(a) Long Wall	2	10.9	0.30	4.2	27.47	= 6.3 – 0.3 = 6.0 m
	(b) Short wall	3	6	0.30	4.2	22.68	
	Total					**50.15 m^3**	
	Deductions						
	For Door	2	1.20	0.3	2.1	1.51	For Lintel
	For Windows	4	1	0.3	1.5	1.8	L = Opening size + bearing
	S – Shelves	2	1	0.2	1.5	0.6	L = 1 + 0.15 + 0.15 = 1.30 m
	Lintels over Doors	2	1.5	0.3	0.15	0.14	
	Lintels over windows	4	1.3	0.3	0.15	0.23	
	Lintels over shelves	2	1.3	0.3	0.15	0.12	
						-4.4 m^3	
	=					**45.75 m^3**	

Centre line method



Centre line method

- **Total length of centre line**

  $= (2 \times 10.6) + (3 \times 6.3)$

  $= 21.2 + 18.9$

  $= 40.1$ m
- Number of junctions as per drawing (T – Junctions) , N = 2 No's
- Length, L = Total Centre length – N × (Breadth/2)

Sl No.	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity	Remarks
1	Earth work excavation	1	39.0	1.10	1	**42.90 m³**	L = 40.1 – ((2×1.1)/2) = 39.0 m
2	P.C.C bed concrete 1:4:8	1	39.0	1.10	0.30	**12.87 m³**	L = 40.1 – ((2×1.1)/2) = 39.0 m
3	First class brick masonry in CM 1:6 for super structure	1	39.8	0.30	4.2		L = 40.1 – ((2×0.3)/2) = 39.8
	Total					**50.15 m³**	
	Deductions						
	For Door	2	1.20	0.3	2.1	1.51	For Lintel
	For Windows	4	1	0.3	1.5	1.8	L = Opening size + bearing
	S – Shelves	2	1	0.2	1.5	0.6	L = 1 + 0.15 + 0.15 = 1.30 m
	Lintels over Doors	2	1.5	0.3	0.15	0.14	
	Lintels over windows	4	1.3	0.3	0.15	0.23	
	Lintels over shelves	2	1.3	0.3	0.15	0.12	
						-4.4 m³	
						45.75 m³	

PROBLEM 3

- The dimensions of a residential building is shown in fig with the following details:

1. Foundation concrete : bed width = 0.8m , depth = 0.2m
2. Foundation S.S Masonry, width = 0.5m, depth = 0.8m
3. Basement: width = 0.4m, depth = 0.15m
4. Plinth concrete, D.P.C (1:2:4) : width = 0.4m, depth = 0.15m
5. External walls are 30cm & partition walls are 20cm thick
6. All-round lintel (1:2:4) : depth = 0.15m

7. Height of roof from plinth = 3.5m

8. Roof: R.C.C roof slab of 10cm thick

9. R.C.C Chejja: 0.6m width projected outside the wall

10. Flooring: Mosaic tile flooring is provided

11. Parapet wall: 0.75m height, 10cm thick parapet wall constructed over the R.C.C roof

12. 10 cm (Average) thick waterproof course over the R.C.C roof provided.

- Work out the various quantities of item of work and prepare an abstract estimate cost of a building using prevailing rates in your locality.

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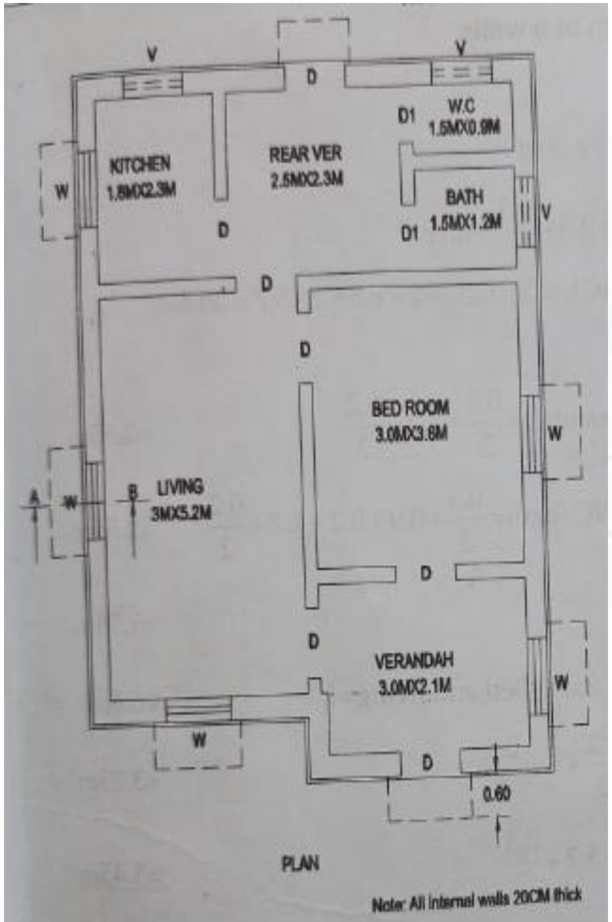
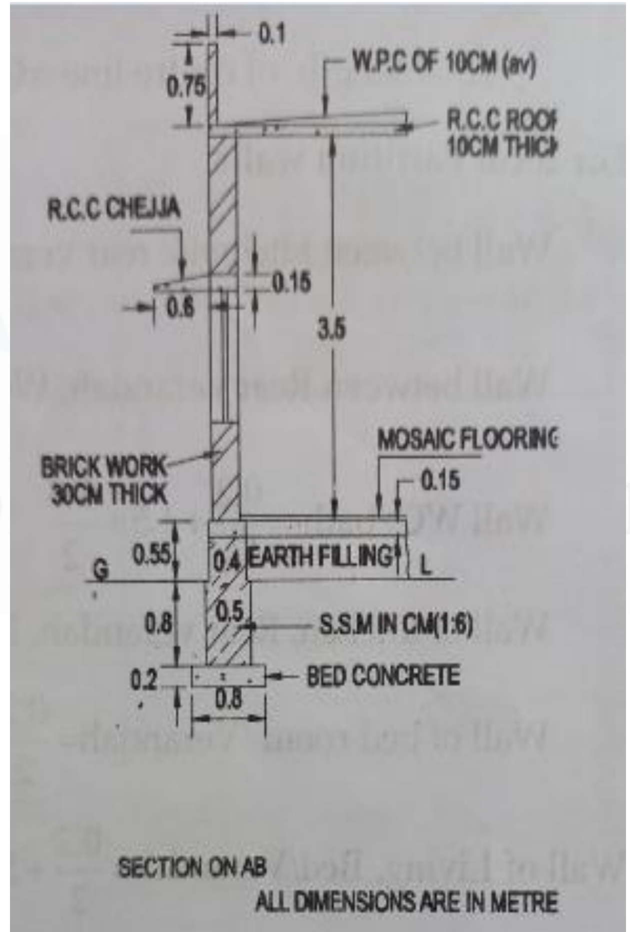
RESIDENTIAL BUILDING PLAN





SCHEDULE OF OPENING

D - 0.9MX2.1M
D1 - 0.75MX2.0M
W - 1.0MX1.2M
V - 0.9MX0.6M

To find the centre to centre length of a walls

- **For 30cm wall – Main walls**

➢ L1 = (0.3/2) + 3.0 + 0.2 + 3.0 + (0.3/2) = 6.5m

➢ L2 = (0.3/2) + 2.1 + 0.2 + 3.6 + 0.2 + 2.3 + (0.3/2) = 8.7m

Total length of centre line = (2×L1) + (2×L2)

= (2×6.5) + (2×8.7)

= **30.4 m**

- **For 20cm Partition walls**

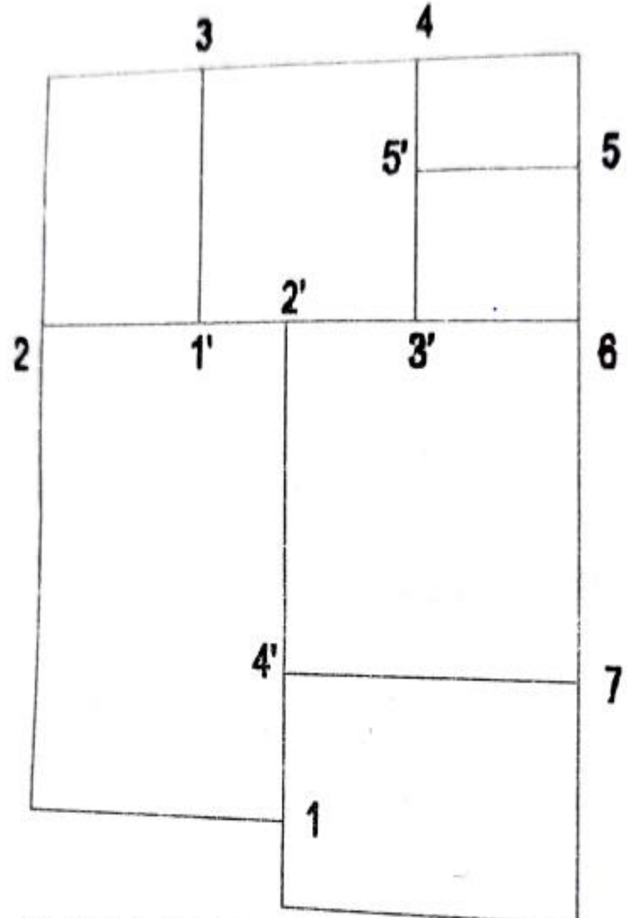
1. Wall b/w kitchen & rear verandah = (0.3/2) + 2.3 + (0.3/2) = 2.55m
2. Wall b/w rear verandah, W.C/bath = (0.3/2) + 0.9 + 0.2 + 1.2 + (0.2/2) = 2.55m
3. Wall WC/bath = (0.2/2) + 1.5 + (0.3/2) = 1.75m
4. Wall of kitchen, rear verandah, Bath/Bed and living

   = (0.3/2) + 3.0 + 0.2 + 3.0 + (0.3/2) = 6.5m
5. Wall of bed room/verandah = (0.2/2) + 3 + (0.3/2) = 3.25m
6. Wall of living, bed/Verandah = (0.2/2) + 5.2 + (0.3/2) = 5.45

Total length of centre line = **22.05m**

- **Number of Junctions**

1. 30cm to 30cm wall = Nil
2. 20cm to 30cm wall = 7 No’s
3. 20cm to 20cm wall = 5 No’s



CENTRE LINE DIAGRAM SHOWING NUMBER OF JUNCTIONS

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
1	Earth work Excavation						
	(a) For 30cm Wall	1	30.4	0.80	1.00	24.32	
	(b) For 20cm wall	1	17.25	0.80	1.00	13.80	Length of 20cm wall L = 22.05 – 7× (0.8/2) - 5× (0.8/2) = 17.25m
	=					**38.12 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
2	P.C.C bed concrete (1:4:8)						
	(a) For 30cm Wall	1	30.4	0.80	0.20	4.86	
	(b) For 20cm wall	1	17.25	0.80	0.20	2.76	Length of 20cm wall L = 22.05 – 7× (0.8/2) - 5× (0.8/2) = 17.25m
	=					**7.62 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
3	S.S.M in CM 1:6						
	(i) First foundation course (Below G.L)						
	(a) 30cm wall	1	30.4	0.50	0.80	12.16	
	(b) 20cm wall	1	19.05	0.50	0.80	7.62	First footing – 20cm wall L = 22.05 – 7× (0.5/2) - 5× (0.5/2) = 19.05m
	(ii) For basement course						
	(a) 30cm wall						
	(b) 20cm wall	1	30.4	0.40	0.40	4.86	Second footing – 20cm wall
		1	19.65	0.40	0.40	3.14	L = 22.05 – 7× (0.4/2) - 5× (0.4/2) = 19.65m
	=					**27.78 m^3**	

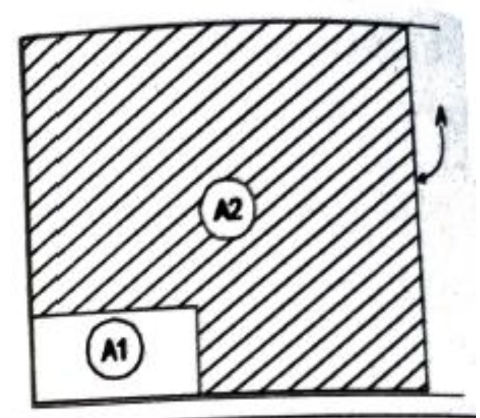
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
4	Plinth concrete 1:2:4						
	(a) 30cm wall	1	30.4	0.40	0.15	1.824	
	(b) 20cm wall	1	19.65	0.40	0.15	1.179	20cm wall L = 22.05 – 7× (0.4/2) - 5× (0.4/2) = 19.65m
	=					**3.00 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
5	Earth filling						
	(a) Foundation trenches					7.62 m^3	Q = (1/5) × Excavation Quantity = (38.12/5) L = c/c distance – (0.4/2) – (0.4/2)
	(b) For plinth						
	1. Living	1	2.85	5.05	0.55	7.92	
	2. Kitchen	1	1.65	2.15	0.55	1.95	**Living**
	3. Rear Verandah	1	2.30	2.15	0.55	2.72	L = 3.25 – (0.4/2) - (0.4/2) = 2.85m
	4. W.C	1	1.35	0.75	0.55	0.56	B = 5.45 – (0.4/2) – (0.4/2) = 5.05m
	5. Bath	1	1.35	1.00	0.55	0.74	
	6. Bedroom	1	2.85	3.4	0.55	5.33	
	7. Verandah	1	2.85	1.95	0.55	3.06	
		=				**29.90 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
6	Brick masonry in C.M 1:6						Length of 20 cm wall B1 = 0.3m, B2 = 0.2m L = 22.05 – (7× (0.3/2)) - (5× (0.2/2)) = 20.5 m
	(a) 30cm walls	1	30.4	0.30	3.50	31.92	
	(b) 20cm walls	1	20.5	0.20	3.50	14.35	Length of parapet wall,
	(c) Parapet walls	1	31.2	0.10	0.75	2.34	L1 = 6.8 –(0.1/2) – (0.1/2) = 6.7 L2 = 9.0 – (0.1/2) – (0.1/2) = 8.9 L = (2×6.7) + (2×8.9) = 31.2m
=						**48.61 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
6	Deduction for openings						
	(a) Openings for 30 cm wall						
	1. Doors - D	2	0.9	0.3	2.10	1.13	
	2. Windows – W	5	1	0.3	1.20	1.80	
	3. Ventilator – V	3	0.9	0.3	0.6	0.49	
	(b) Openings for 20 cm wall						
	1. Doors, D	5	0.9	0.2	2.1	1.89	
	2. Doors, D1	2	0.75	0.2	2	0.49	
	=					**5.91 m3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
6	Deduction for Lintels						
	1. All round lintel	1	30.4	0.30	0.15	1.37	
	2. Lintels over internal walls:						
	For D	5	1.20	0.20	0.15	0.18	
	For D1	2	1.05	0.20	0.15	0.063	
= 48.61 – 7.523 = 41.09 **m^3**						**41.09 m^3**	

<table>
<tr><th>Sl no</th><th>Particulars of Item</th><th>No</th><th>Length m</th><th>Breadth m</th><th>Depth m</th><th>Quantity m^3</th><th>Remarks</th></tr>
<tr><td>7</td><td>R. C.C works 1:2:4
(a) Roof Slab</td><td colspan="6">Q=Area of roof slab x Thickness area
Area of roof $A_2 = A - A_1$
$A = 6.80 \times 9.0 = 61.20 sqm$
$A_1 = 3.30 \times 0.70 = 2.31 sqm$
$A_2 = 61.2 - 2.31 = 58.89 sqm$
$Q = 58.89 \times 0.10 = 5.889 cum$
</td></tr>
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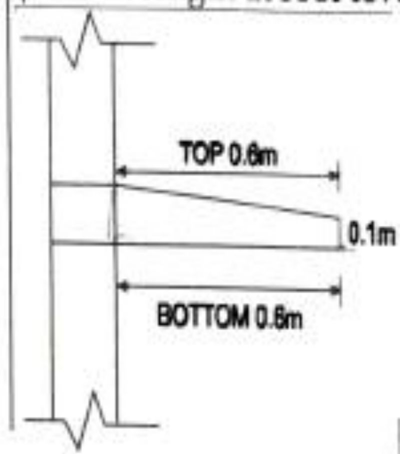
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
7	R.C.C Works 1:2:4						
	1. All round lintel	1	30.4	0.30	0.15	1.37	
	2. Lintels over internal walls:						
	(i) D	5	1.20	0.20	0.15	0.18	
	(ii) D1	2	1.05	0.20	0.15	0.063	
	3. RC.C Chejja						For Chejja
	(i) over door (Front & Rear)	2	1.20	0.60	0.125	0.180	L = 0.9 + 0.15 + 0.15 = 1.2 B = 0.6 (Projected Length)
	(ii) Over Window	5	1.20	0.60	0.125	0.45	Depth = Average thickness **= (0.15 + 0.10)/2 = 0.125m**
	= 5.889 + (1.37+0.18+0.063+0.180+0.45)					**8.132 m^3**	

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3	Remarks
8	Steel Reinforcement (Assuming 1.5%)	Q = (1.5/100) × 8.132 × 7850 = 957.54 Kgs = 0.957 MT R.C.C Volume = 8.132 cum Density of steel = 7850 Kg/cum					Normally assume 1.0 to 3.0% of R.C.C Volume for residential buildings
9	Weather Proof course	W.P.C area = Roof area – Parapet wall area = 58.89 – (**31.2×0.10**) = 55.77 sq.m					

10	Cement plastering in C.M 1:6						**Outer wall**
	a) External plastering						L=Out to out wall =2x6.8+2x9.0=31.60m
	i) External walls	1	31.6		4.35	137.46	D=3.5+0.10+0.75=4.35m
	ii) Parapet walls(Top)	1	31.2	0.10		3.12	**Parapet wall**
	Inside parapet wall	1	30.8		0.75	23.10	Inside length=6.6x2+8.8x2 =30.8m
	iii) Chejja plastering						(In to in length at roof level)
	1.Over doors-D						
	Top & bottom of chejja B=0.6+0.1+0.6=1.30	2	1.20	1.30		3.12	
	Sides of chejja	2x2	0.60		0.125	0.30	
	2.Over windows -W						
	Top & bottom of chejja	5	1.20	1.30		7.80	
	Sides of chejja	2x5	0.60		0.125	0.75	
	Gross total (a) =					175.65m²	



b) Internal plastering						
1.Walls						
Kitchen	1	8.2		3.5	28.70	Area=Perimeter x height
Rear verandah	1	9.6		3.5	33.60	A=2(L+B) x D
W.C	1	4.8		3.5	16.80	L=2(1.8+2.3) =8.20m
Bath	1	5.4		3.5	18.90	L=2(2.5+2.3) =9.6m
Bed room	1	13.2		3.5	46.20	L=2(1.5+0.9) =4.8m
Verandah	1	10.2		3.5	35.70	L=2(1.5+1.2) =5.4m
Living	1	16.4		3.5	57.40	L=2(3.0+3.6) =13.2m
2.Ceiling plastering						L=2(3.0+2.1) =10.2m
Kitchen	1	1.8	2.3		4.14	L=2(3.0+5.2) =16.4m
Rear verandah	1	2.5	2.3		5.75	
W.C	1	1.5	0.9		1.35	
Bath	1	1.5	1.2		1.80	
Bed room	1	3.0	3.6		10.80	
Verandah	1	3.0	2.1		6.30	
Living	1	3.0	5.2		15.60	
Gross total (b) =					**283.04 m²**	
Deductions for openings						Deductions for openings: 50% deduction done for openings. (one time for two measurements, i.e. external & internal) .
D	7	0.9		2.1	13.23	external & internals).
D1	2	0.75		2.0	3.00	
W	5	1.0		1.2	6.00	
V	3	0.9		0.6	1.62	
Total deductions=					**23.85 m²**	**Net qty=Gross (a) +Gross (b) - Deductions**
Net quantity=					**434.84 m²**	

11	External wall painting. Gross quantity= Deductions D W V Net quantity=	 0.5x2 0.5x5 0.5x3	 0.90 1.00 0.90		 2.10 1.20 0.60	175.65 m² 1.89 3.00 0.81 -5.70 m² 169.95 m²	Gross quantity same as external plastering
12	Internal walls painting. Gross quantity= Deductions D(External) D D1 W V Net quantity=	 0.5x2 5 2 0.5x5 0.5x3	 0.90 0.90 0.75 1.00 0.90		 2.10 2.10 2.00 1.20 0.60	283.04m² 1.89 9.45 3.00 3.00 0.81 -18.15 m² 264.89 m²	Gross quantity same as internal plastering (ceiling+walls)
13	Enamel painting to doors, windows and ventilators D D1 W V	Painting area = $Nos. \times P.A.C \times 2sides \times Opening\ size$ $P.A.C = Painting\ Area\ Co-efficient$ $7 \times 1.30 \times 2 \times 0.90 \times 2.10 = 34.40sqm$ $2 \times 1.30 \times 2 \times 0.75 \times 2.00 = 7.8sqm$ $5 \times 1.0 \times 2 \times 1.00 \times 1.20 = 12sqm$ $3 \times 1.0 \times 2 \times 0.90 \times 0.60 = 3.24sqm$ Total quantity = 57.44sqm					**P.A.C** P.A.C=1.30 for fully paneled door P.A.C=1.0 for partly paneled and partly glazed windows, ventilators.

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Estimates of different R.C.C Structures

- The concrete work excluding centering and shuttering is measured in cubic metre and paid separately.
- The centering and shuttering or formwork is measured in square metre and paid separately.
- Steel reinforcement including cutting, bending, binding and placing in position is measured in quintal and paid separately.

Steel Reinforcements used in R.C.C

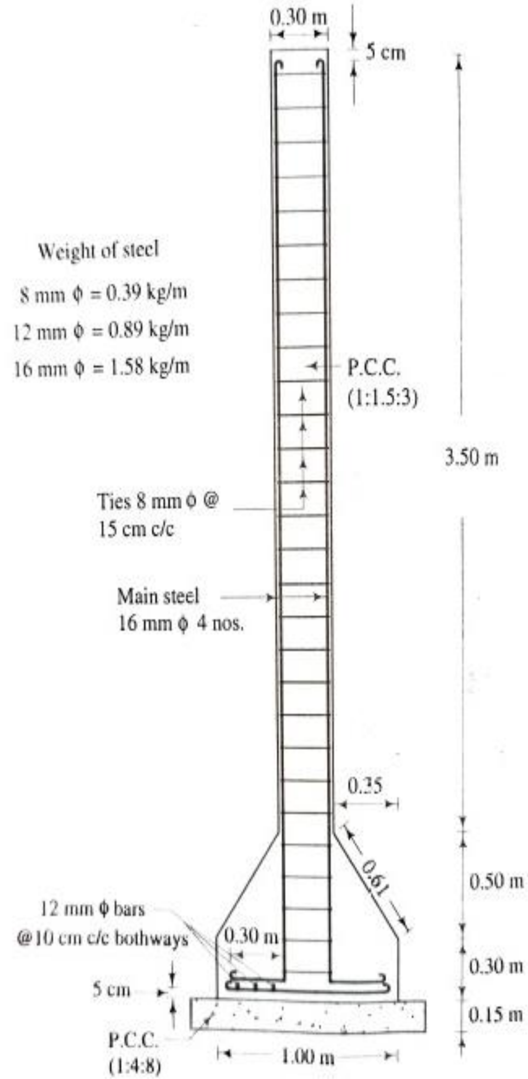
- Mild steel & Tor-steel (HYSD – High Yield strength deformed).
- In Conventional R.C.C the mild steel bars have been replaced by HYSD.

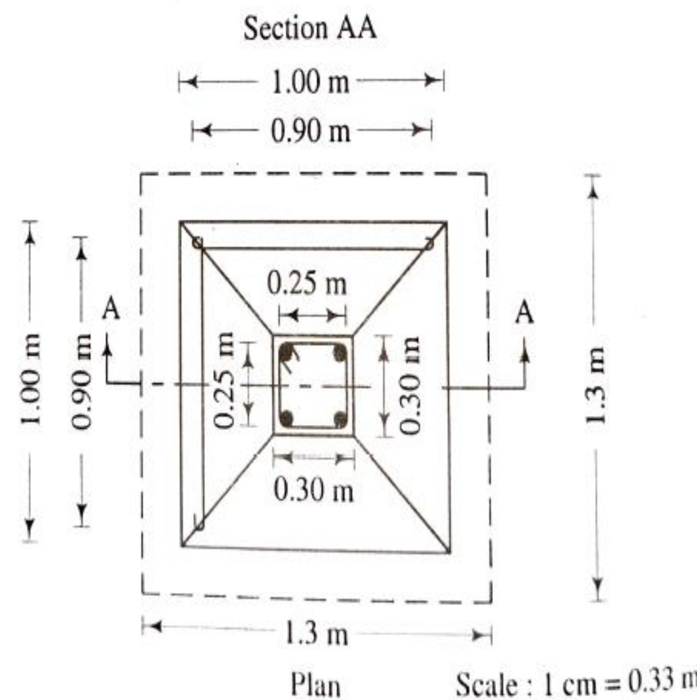
Diameter of bar in mm	Weight in kg per metre	Diameter of bar in mm	Weight in kg per metre
6	0.22	16	1.58
8	0.39	18	2
9	0.50	20	2.46
10	0.62	22	2.98
12	0.89	25	3.85

Problem – R.C.C Column & it's footing (1:1.5:3)

- Prepare a detailed estimate with abstract sheet of R.C.C column with footing as shown in Drawing.
- Also work out the following:

1. Percentage volume of reinforcement.
2. Prepare bar bending schedule.


0.30 m
5 cm
Weight of steel
8 mm ϕ = 0.39 kg/m
12 mm ϕ = 0.89 kg/m
16 mm ϕ = 1.58 kg/m
P.C.C.
(1:1.5:3)
3.50 m
Ties 8 mm ϕ @
15 cm c/c
Main steel
16 mm ϕ 4 nos.
0.25
0.61
0.50 m
12 mm ϕ bars
@10 cm c/c bothways
0.30 m
0.30 m
5 cm
0.15 m
P.C.C.
(1:4:8)
1.00 m


Section AA
1.00 m
0.90 m
0.25 m
A
A
0.25 m
0.30 m
1.00 m
0.90 m
1.3 m
0.30 m
1.3 m
Plan
Scale : 1 cm = 0.33 m

Measurements

No.	Item	No.	L	B	D	Qty.	Total
1.	**Cement concrete (1:1.5:3) i.e., M20 without reinforcement**						
	Base area of footing = A_1 = $1 \times 1 = 1\ m^2$ Column	1	3.50	0.30	0.30	0.32	
	Top area of footing = A_2 = 0.3×0.3 Footing without slope	1	1.00	1.00	0.30	0.30	
	= $0.09\ m^2$ Sloping part of footing	$\frac{0.5}{3}$	$(1+0.09+\sqrt{1\times0.09})$			0.23	
	$V = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1 \times A_2})$						0.85 cu m
2.	**P.C.C. (1:4:8) below column footing**	1	1.30	1.30	0.15	0.25	0.25 cu m

HYSD steel bars *Note:* 5 cm cover is provided on each side. *Column main steel:* *4 bars of 16 mm diameter:* $L = 3.5 + 0.5 + 0.3 + 0.3$ $+ 2 \times 9 \times 0.016$ (hook) $- 2 \times 0.05$ (cover) $- 2 \times 0.012$ (bottom bars) = 4.76 m	4	4.76 19.04	@	1.58 kg/m	30.08	

Footing: *12 mm diameter bars @ 10 cm c/c:* $L = 1.0 - 2 \times 0.05$ (cover) $+ 2 \times 9 \times 0.012$ (hook) $= 1.12$ m No. of bars $= \left(\frac{0.9}{0.1}\right) + 1 = 10$ For bothways nos. $= 2 \times 10 = 20$	20	$\frac{1.12}{22.40}$	@	0.89 kg/m	19.94	50.02 kg

Mild steel reinforcement

8 mm diameter lateral ties @ 15 cm c/c in column:

$l = b = 0.25 - 2 \times 0.008 = 0.234$ m

$L = 2\,(l + b) + 24d$ (hook)

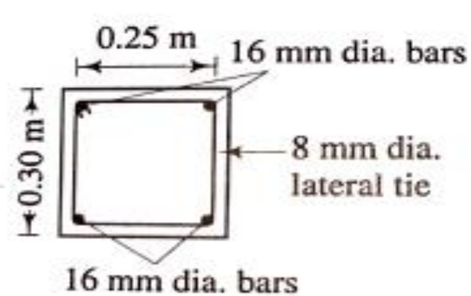
$= 2\,(0.234 + 0.234) + 24 \times 0.008$

$= 1.13$ m

Length of column $= 3.5 + 0.5 + 0.3 - 2 \times 0.05$ (cover) $= 4.2$ m

No. of bars $= \left(\dfrac{4.2}{0.15}\right) + 1 = 28.84$, say 29 nos.

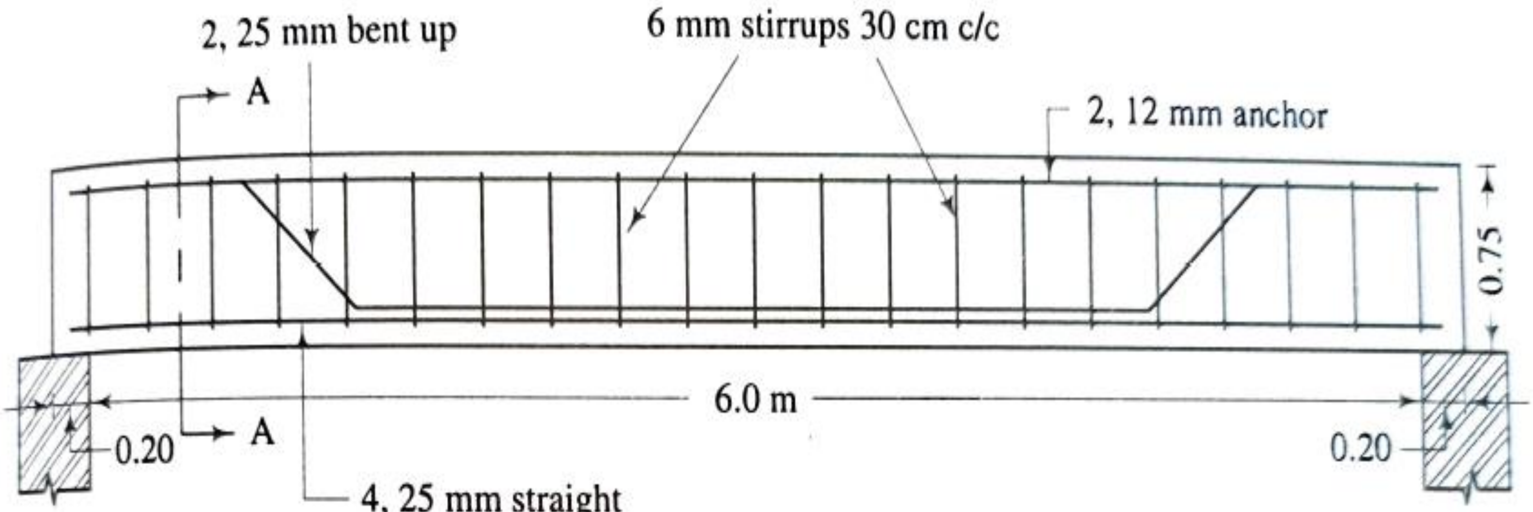
say 29 nos.	29	1.13 32.77	@	0.39 kg/m	12.78	12.78 kg

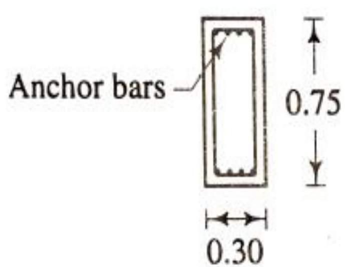


Problem – R.C.C Beam

- Prepare a detailed estimate with abstract sheet of R.C.C beam as shown in Drawing.
- Also work out the following:

1. Percentage volume of reinforcement.
2. Prepare bar bending schedule.



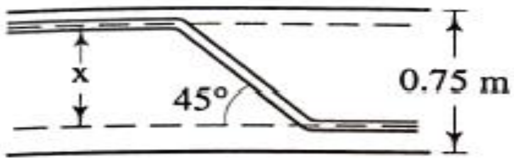


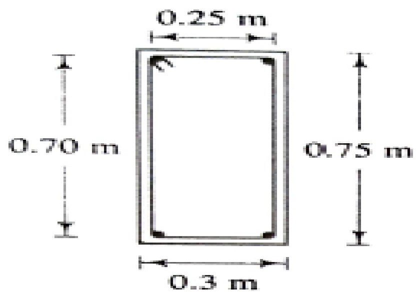
Section AA

Bar dia.	WT (kg/m)
6 mm	0.22
12 mm	0.89
25 mm	3.85

Item	No.	L	B	D	Qty.	Total
Cement concrete (1:1.5:3) i.e., M20 without reinforcement $L = 6.0 + 0.2 + 0.2 = 6.4$ m Beam	1	6.40	0.30	0.75	1.44	1.44 cu m

HYSD steel bars *4 straight bars of 25 mm diameter:* $L = 6.0 + 0.2 + 0.2 + 2 \times 9 \times 0.025$ (hook) $- 2 \times 0.025$ (cover) $= 6.8$ m	4	6.80 27.20	@	3.85 kg/m	104.72

2 bent-up bars of 25 mm diameter:  $x = 0.75 - 2 \times 0.025$ (cover) $- 2 \times 0.006$ (stirrups) $- 2 \times \frac{1}{2} \times 0.025 = 0.663$ m Extra length for one bent-up bar $= 0.45\,x = 0.30$ m $L = 6.8 + 2 \times 0.30 = 7.4$ m	2	7.40 14.80	@	3.85 kg/m	56.98	
2 Anchor bars of 12 mm diameter: $L = 6.0 + 0.2 + 0.2 + 0.3 + 2 \times 9 \times 0.012$ (hook) $- 2 \times 0.025$ (cover) $= 6.57$ m	2	6.57 13.14	@	0.89 kg/m	11.69	173.39 kg

Mild steel reinforcement  *6 mm diameter stirrups @ 30 cm c/c in beam:* $l = 0.75 - 2 \times 0.006 - 2 \times 0.025$ (cover) $= 0.69$ m $b = 0.30 - 2 \times 0.006 - 2 \times 0.025$ (cover) $= 0.24$ m hook length $= 24\,d = 24 \times 0.006 = 0.144 < 0.15$ (min. hook length) $L = 2\,(l + b) + 0.15 = 2\,(0.69 + 0.24) + 0.15 = 2.01$ m Length of beam $= 6.0 + 0.2 + 0.2 - 2 \times 0.025$ (cover) $= 6.35$ m No. of bars $= \left(\frac{6.35}{0.30}\right) + 1 = 22.17$, say 22 nos.	22	2.01 44.22	@	0.22 kg/m	9.73	9.73 kg

(ii) *Percentage volume of steel reinforcement in beam:*

Note: The weight of 1 cu m of steel is assumed as 7850 kg.

Volume of concrete = 1.44 cu m

Weight of steel = (173.39 + 9.73) = 183.12 kg.

$$\text{Percentage of steel} = \frac{183.12 \times 100}{7850 \times 1.44}$$

= Rs. 1.62, say **1.60 %.**

SUB: Estimation and contract Management

SUB CODE: BCV702

MODULE 2

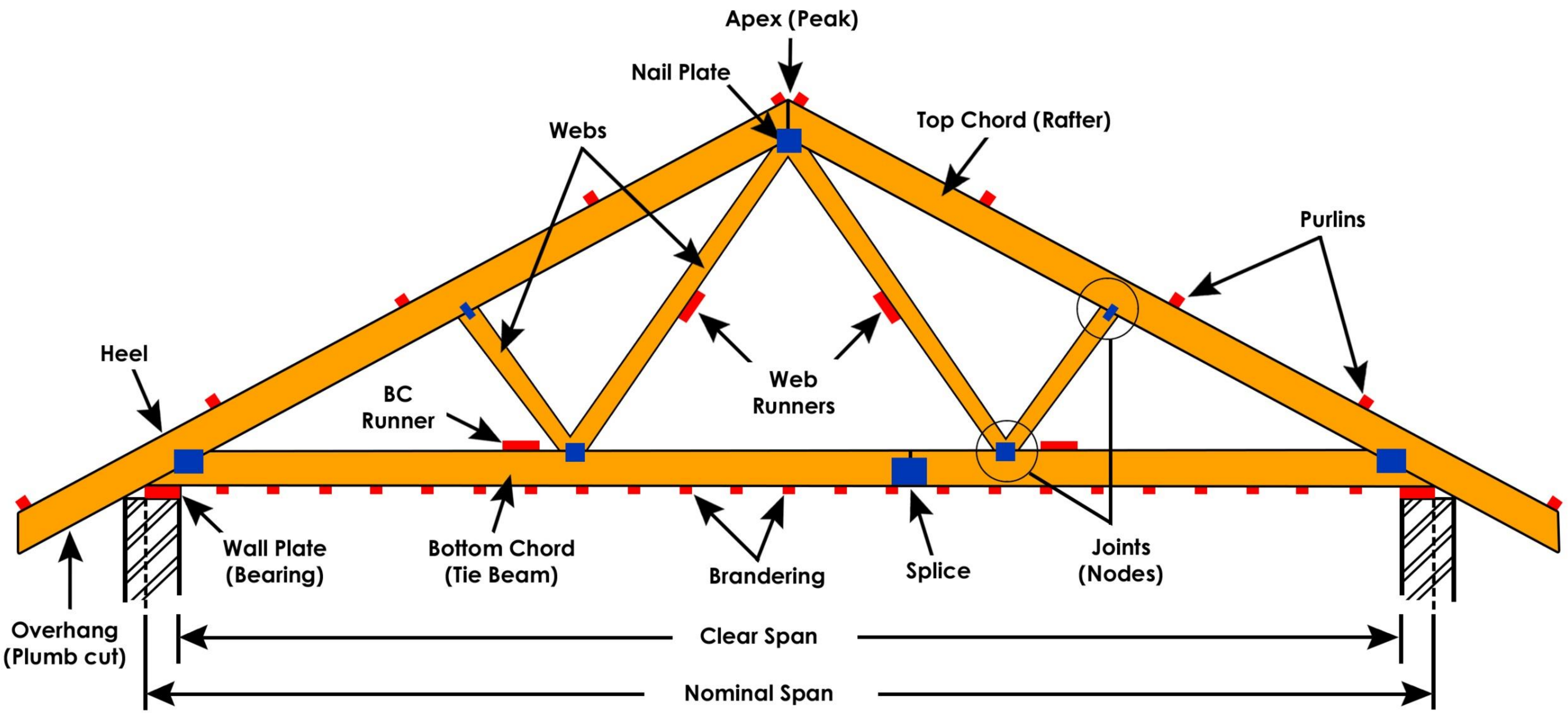
- Chapter 1: Estimation of flat, slopped RCC roofs, steel truss. Culverts (including box culvert, pipe culvert and RC slab culverts) manhole and septic tank. Measurement of Earth Work for Roads: Methods for computation of earthwork by mid-section formula, trapezoidal or average end area or mean sectional area formula, prismoidal formula.
- Chapter 2: Project Preparation: Preliminary Survey Report and Detailed Project Report

ATME College of Engineering

STEEL TRUSS

- Trusses are triangular frame works, consisting of essentially axially loaded members which are more efficient in resisting external loads since the cross section is nearly uniformly stressed.
- Trusses are used in roofs of single storey industrial buildings, long span floors and roofs of multistory buildings to resist gravity loads.
- Trusses are also used in walls and horizontal planes of industrial buildings to resist lateral loads and give lateral stability.

Components of steel truss



- **Apex –** Highest point where the sloping top chords meet.
- **Bearing –** Structural support of trusses (usually walls) normally with a timber wall plate.
- **Bottom Chords (BC)** – the lowest longitudinal member of a truss.
- **Cantilever –** part of structural member that extends beyond its support.
- **Cantilever Strut –** web that joins the bottom chord above the bearing point to the top chord of a cantilevered truss.
- **Chord –** main members that form the outline of the truss and subject to relatively large axial forces and bending moments.
- **Clear Span –** horizontal distance between interior edges of supports.
- **Heel –** point on a truss which top and bottom chord intersect.
- **Joint –** point of intersection of one or more web(s) with a chord.
- **Nail Plate –** galvanized steel plate punched to form a nail pattern integral with the plate and used to connect timber members.
- **Node (node point) –** point of intersection of two or more members that make up the panels of a truss.
- **Nominal Span –** horizontal distance between outside edges of the supports (wall plates) – usually the tie beam length.

PROBLEM

- Prepare a detailed estimate of the steel truss shown in fig. for work shop building. The effective span of the truss is 11m and trusses are placed at 3.5m c/c. Ends of the building are gable ends.

❑ The weight per m run of ISA angle:

- ISA 50x50x6mm – 4.5 kg/m
- ISA 65x65x6mm – 5.8 kg/m
- ISA 80x80x6mm – 7.3 kg/m
- ISA 80x80x8mm – 9.6 kg/m
- ISA 100x75x6mm – 8 kg/m

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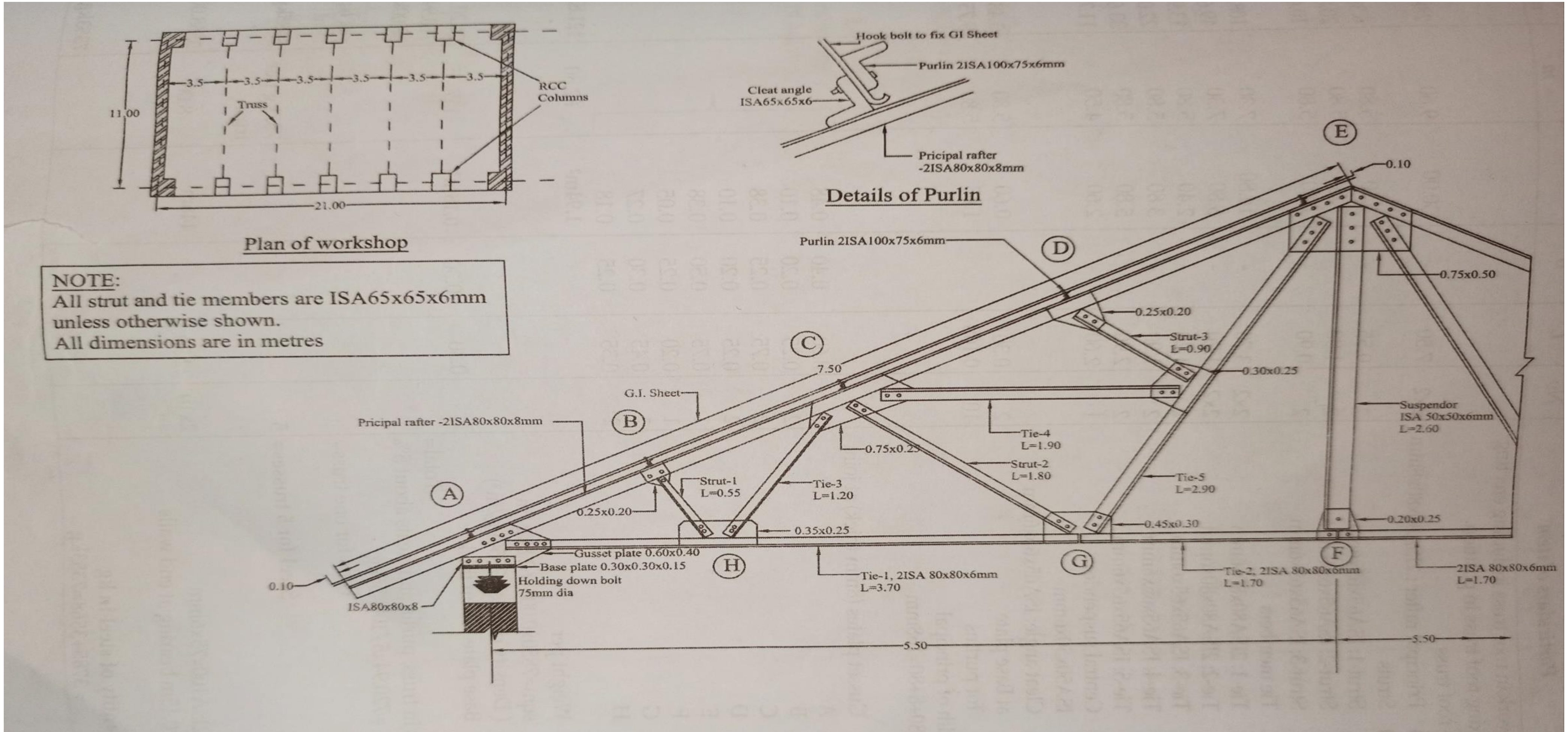


HALF ELEVATION OF STEEL ROOF TRUSS

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
Steel work in roof truss including erecting and fixing roof truss in position. In one roof truss **a) Principal rafter: 2ISA 80x80x8mm**	2x2	7.5		30	9.60	**288**

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
b) Struts						
Strut-1: ISA 65x65x6mm	2	0.55		1.1	5.8	**6.38**
Strut-2: ISA 65x65x6mm	2	1.80		3.6	5.8	**20.88**
Strut-3: ISA 65x65x6mm	2	0.9		1.8	5.8	**10.44**

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
c) Tie members						
Tie-1: 2ISA80x80x6mm	2x2	3.7		14.8	7.3	**108.04**
Tie-2: 2ISA80x80x6mm	2x2	1.7		6.8	7.3	**49.64**
Tie-3: ISA65x65x6mm	2	1.2		2.4	5.8	**13.92**
Tie-4: ISA65x65x6mm	2	1.9		3.8	5.8	**22.04**
Tie-5: ISA65x65x6mm	2	2.9		5.8	5.8	**33.64**

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
d) Central Suspendor:						
ISA 50x50x6mm	1	2.6		2.6	4.5	**11.7**
e) Cleat angle: ISA65x65x6mm						
At Base plate	2	0.3		0.6	5.8	**3.48**
For Purlins	10	0.168		1.68	5.8	**9.75**
L = Width of principal rafter = 80+8+80 = 168mm						

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
f) Gusset plates (8mm thick) at joint						
A	2	0.6	0.4			
B	2	0.25	0.2			
C	2	0.75	0.25			
D	2	0.25	0.2	1.94 sqm	7850x0.008 = 62.8 kg/sqm	**121.83**
E	1	0.75	0.5			
F	1	0.2	0.25			
G	2	0.45	0.3			
H	2	0.35	0.25			

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
g) Base plate 15mm thick	2	0.3	0.3	0.18 sqm` ``	7850x0.015 = 117.75 kg/sqm	**21.20**

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
Total						**720.94 kg**
Bolts in truss, purlin and cleats about 5% ([5/100]*720.94)						**36 kg**
Total for one truss						**756.94 kg**
Steel for 5 trusses (5*756.94)						**3785 kg**

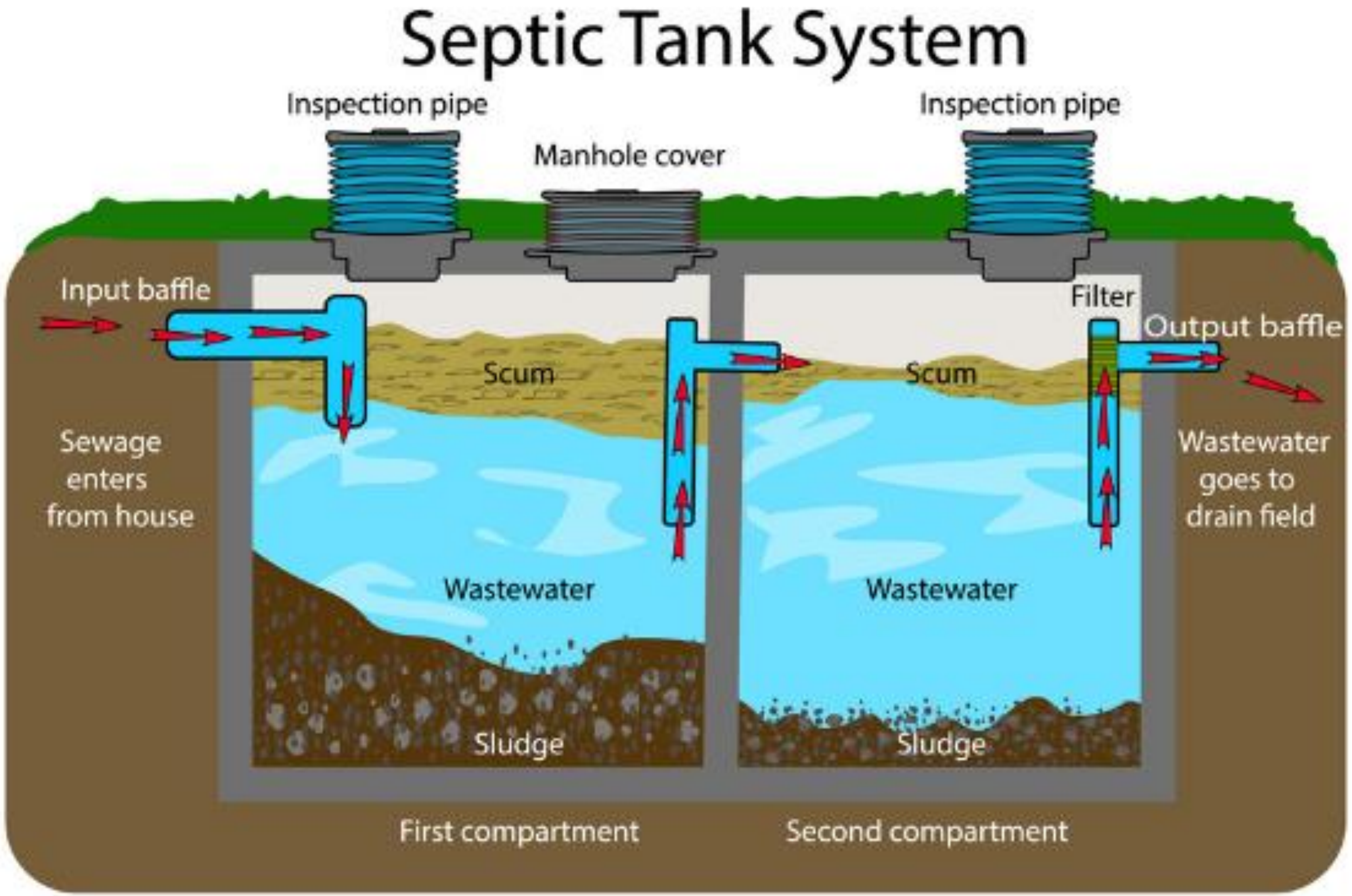
Particulars of item	No.	L	B	Qty	Weight per m	Total weight
Purlins: 2ISA 100x75x6mm 0.15m bearing at end walls	2*10	22.3		446	8	**3568**

Particulars of item	No.	L	B	Qty	Weight per m	Total weight
Total quantity of steel in kg (3785+3568)						**7353 kg**

SEPTIC TANK

- A **septic tank** is an underground chamber made of concrete, fiberglass, or plastic through which domestic wastewater (sewage) flows for basic treatment.
- Settling and anaerobic processes reduce solids and organics, but the treatment efficiency is only moderate (referred to as "primary treatment").
- Septic tank systems are a type of simple onsite sewage facility (OSSF). They can be used in areas that are not connected to a sewerage system, such as rural areas.
- The treated liquid effluent is commonly disposed in a septic drain field, which provides further treatment. Nonetheless, groundwater pollution may occur and can be a problem.

- The term "septic" refers to the anaerobic bacterial environment that develops in the tank that decomposes or mineralizes the waste discharged into the tank.
- Septic tanks can be coupled with other on site wastewater treatment units such as bio-filters or aerobic systems involving artificially forced aeration.
- The rate of accumulation of sludge—also called septage or fecal sludge—is faster than the rate of decomposition. Therefore, the accumulated fecal sludge must be periodically removed, which is commonly done with a vacuum truck.


Septic Tank System
Inspection pipe
Manhole cover
Inspection pipe
Input baffle
Filter
Output baffle
Scum
Scum
Sewage enters from house
Wastewater goes to drain field
Wastewater
Wastewater
Sludge
Sludge
First compartment
Second compartment

PROBLEM: 1

- Prepare a detailed estimate & abstract estimate of a septic tank as shown in fig.

a. Earthwork excavation in hard gravelly soil @ Rs.52/cum

b. Foundation bed concrete and floor concrete with CC 1:3:6 @ Rs.2200/cum

c. Roof covering slab and baffle wall with pre cast R.C.C Slab 1:2:4 @ Rs.220/sqm

d. I class brick masonry in CM 1:4 @ Rs.1700/cum

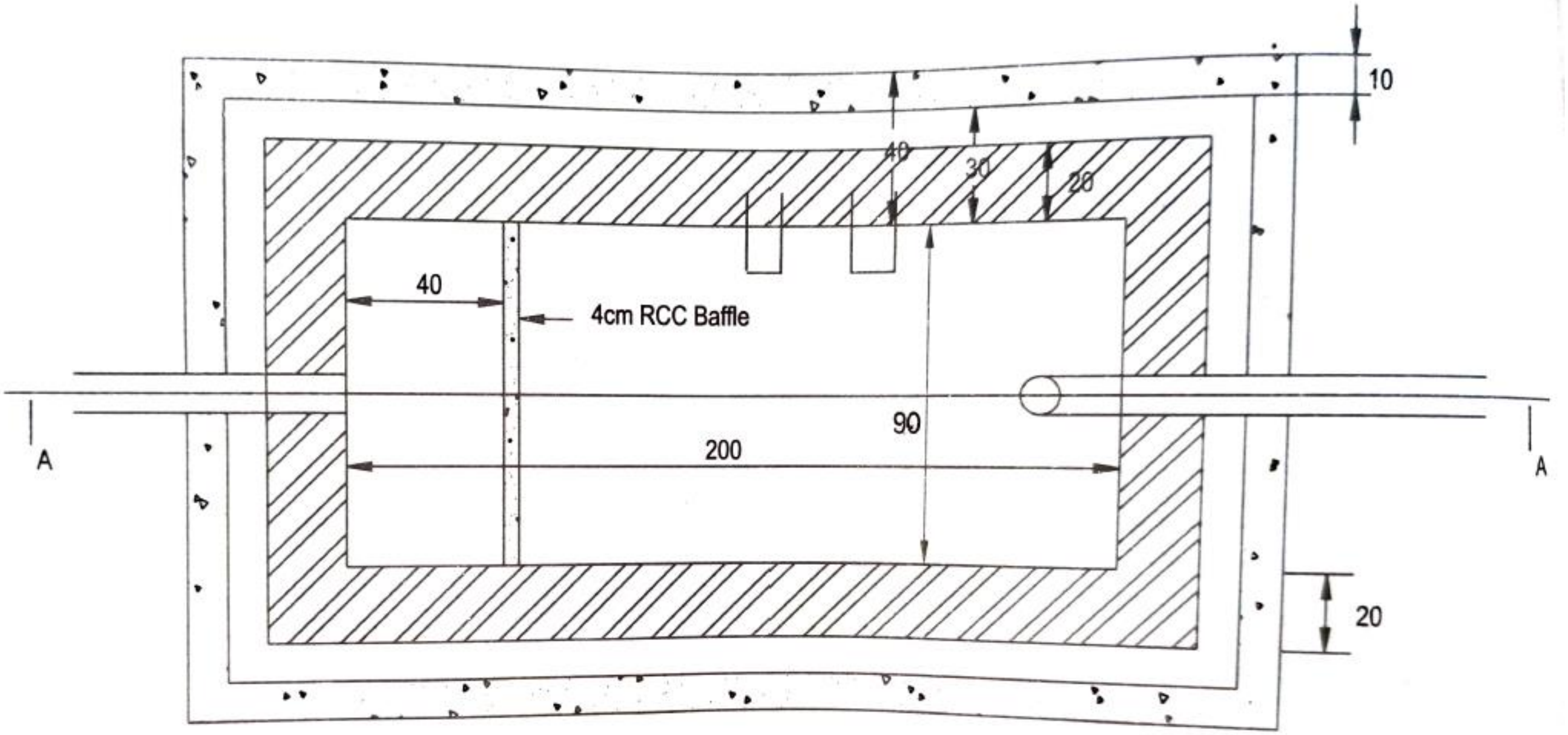
e. Plastering with CM 1:4 for the inside with waterproof compound @ Rs.75/sqm

f. 20mm cement plaster for flooring in CM 1:3 @ Rs.90/sqm

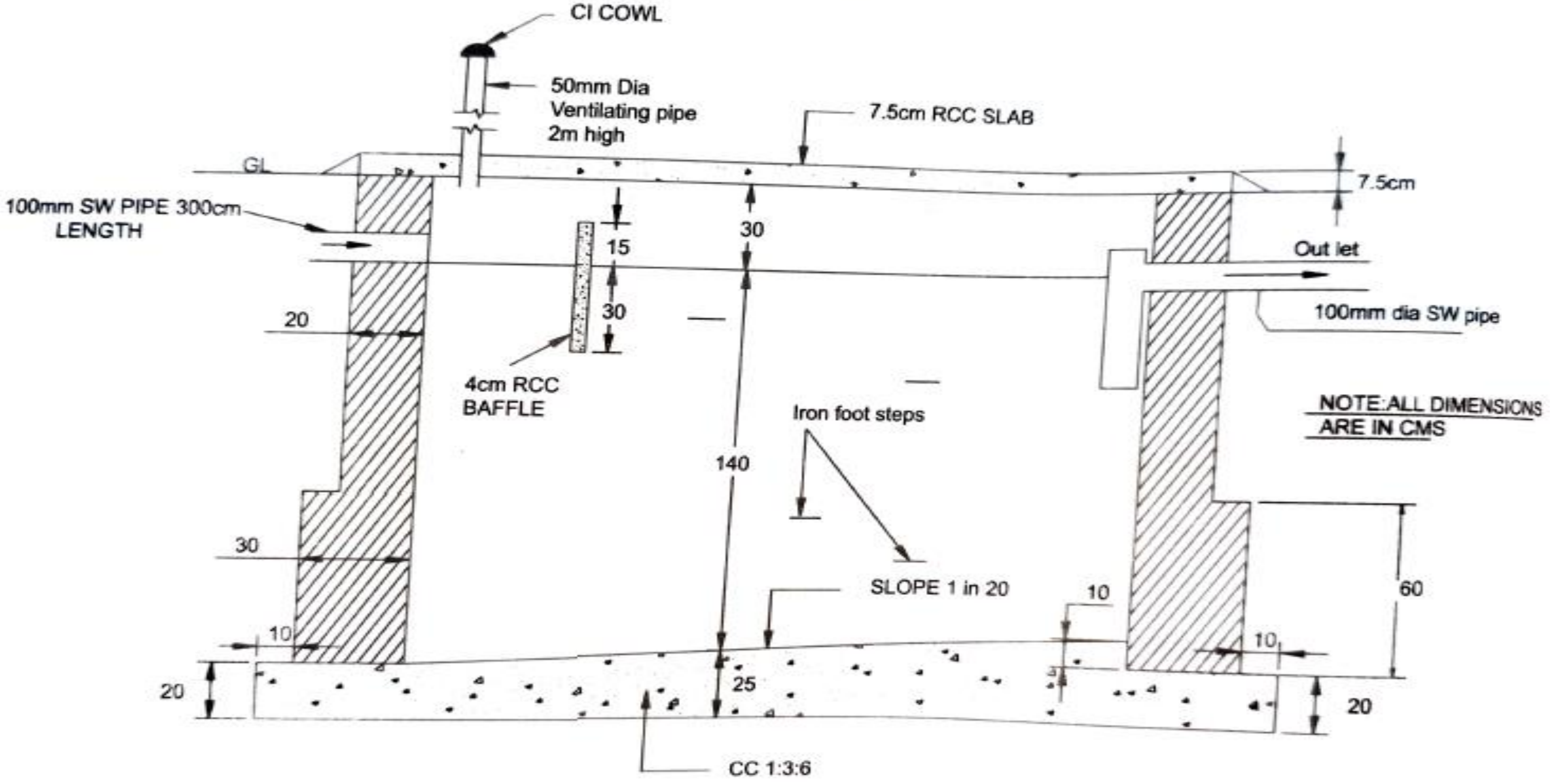
g. 100mm dia S.W. pipe and T for inlet & outlet @ Rs.30 each

h. 50mm dia C.I vent pipe with cowl for 2m height @ Rs.130/each

i. Iron foot steps of 16mm dia bars @ Rs.10 each


10
40
30
20
40
4cm RCC Baffle
90
200
A
A
20

A SEPTIC TANK



Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
1.	Earth work Excavation in hard gravelly soil	1.	2.80	1.70	1.95	9.28 m^3
2.	Foundation bed concrete with CC 1:3:6					
	➢For Foundation	1	2.80	1.70	0.2	0.95 m^3
	➢For Sloping Portion	1	2	0.90	0.05	0.09 m^3

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^2
3.	Roof covering slab and baffle wall with pre cast RCC slab 1:2:4					
	➢ Roof slab	1	2.40	1.30		3.12
	➢ Baffle wall (5 cm bearing on either side)	1	1.00		0.45	0.45
						= 3.57 sqm

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
4.	I class brick masonry in CM 1:4					
	➢Long walls					
	I step	2	2.60	0.30	0.60	**0.94**
	II step	2	2.40	0.20	1.15	**1.10**
	➢Short walls					
	I step	2	0.90	0.30	0.6	**0.32**
	II step	2	0.90	0.20	1.15	**0.41**
						= 2.77 m^3

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^2
5.	Plastering with CM 1:4 for inside With waterproof compound, Interior surface					
	➢ Long walls	2	2		1.75	**6.8**
	➢ Short walls	2	0.9		1.75	**3.06**
						= 9.86 m^2

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity
6.	20mm cement plaster for flooring in CM 1:3	1	2	0.90		**1.8 sq.m**
7.	100mm dia S.W pipe & T for inlet & outlet	1				**1 no.**
8.	50mm dia C.I vent pipe with cowl for 2m height	1				**1 no.**
9.	Iron foot steps of 16mm dia bars	1				**4 nos**

PROBLEM: 2

- Prepare a detailed estimate of a septic tank shown in fig for the details of items of work given below:

i. Earthwork is excavated in hard soil

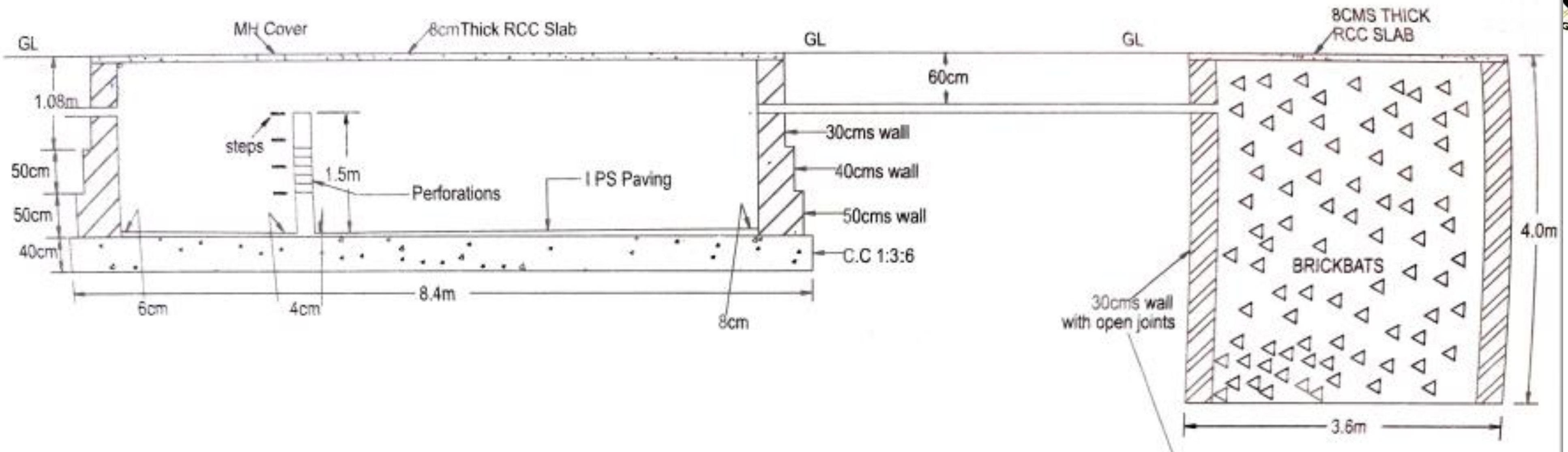
ii. Foundation and base with C.C 1:3:6

iii. Brickwork

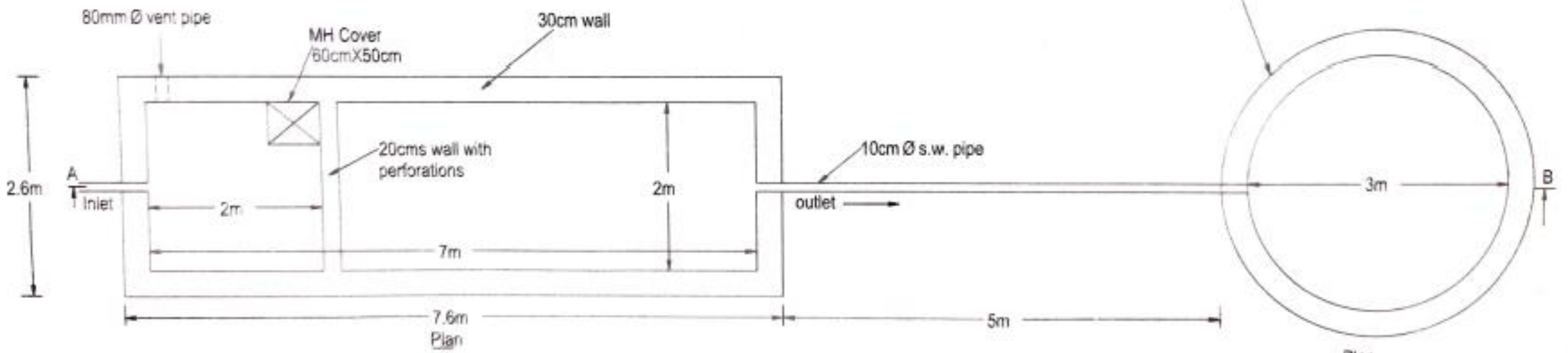
iv. R.C.C roof slab cover of 1:2:4

v. Plastering with C.M 1:4 with waterproof compound

A SEPTIC TANK



SECTION ON AB



SEPTIC TANK

SOAK PIT

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
1.	Earth work Excavation in hard soil					
	a) Septic tank	1	8.4	3.4	2.48	70.82 m^3
	b) Soak Pit $\frac{\pi \times d^2}{4} \times h = \frac{\pi \times 3.6^2}{4} \times 4 = 40.72\, m^3$					40.72 m^3
						111.54 m^3

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
2.	Foundation and base with CC 1:3:6	1	8.40	3.40	0.4	11.42 m^3

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
3.	I class brick masonry in CM 1:4					
	➢Long walls					
	I step	2	8	0.50	0.5	**4**
	II step	2	7.80	0.40	0.5	**3.12**
	III step	2	7.60	0.30	1	**4.56**
	➢Short walls					
	I step	2	2	0.5	0.5	**1**
	II step	2	2	0.4	0.5	**0.8**
	III step	2	2	0.3	1	**1**
						= 14.68 m^3

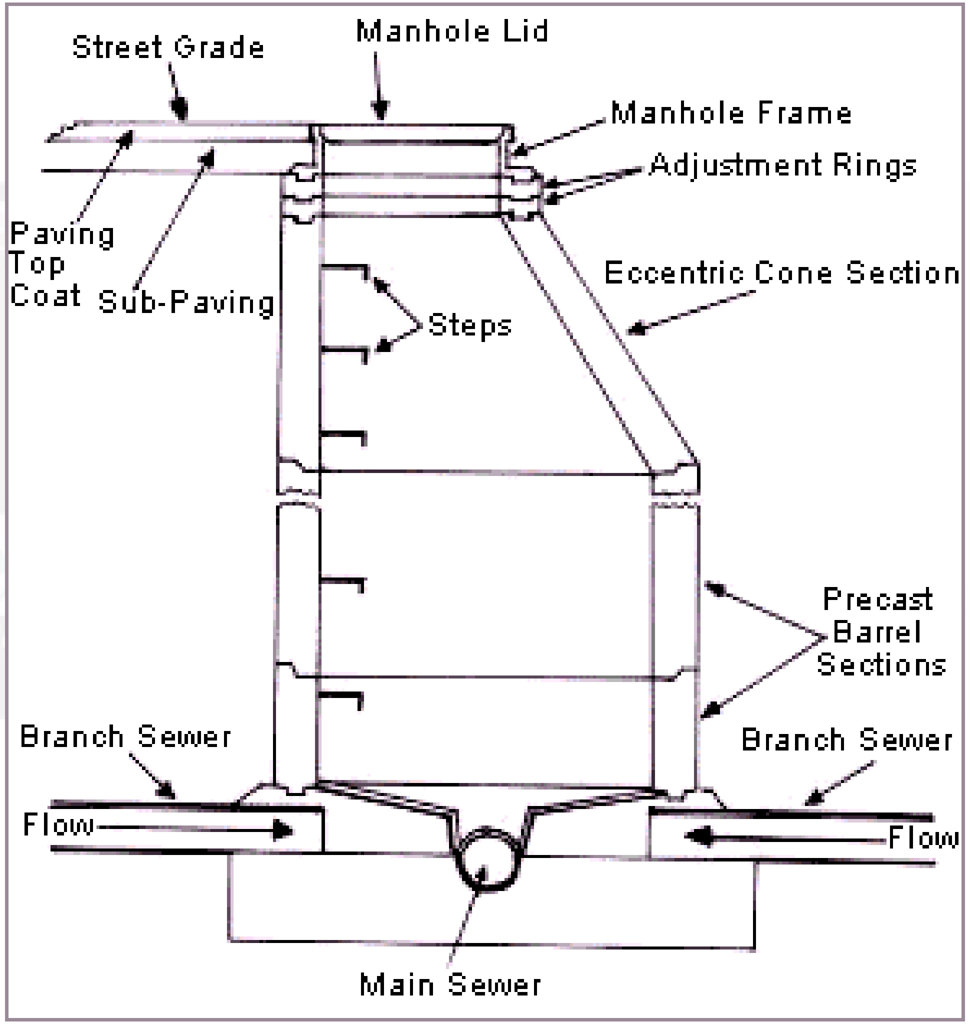
Sl no	Particulars of Item	No	Length M	Breadth m	Depth m	Quantity m^2
4.	Roof 1:2:4 roof slab cover					
	a) Septic tank	1	7.60	2.6	0.08	**1.58**
	b) Soak Pit	1	$\frac{\pi \times 3.6^2}{4} \times 0.08$			**0.81**
						2.39 cum
	Deduct					
	Manhole Cover	1	0.5	0.6	0.08	**-0.024 cum**
						-2.37 cum

Sl no	Particulars of Item	No	Length m	Breadth M	Depth m	Quantity m^2
5.	Plastering with CM 1:4 with waterproof compound, inside walls of septic tank					
	➢ Long walls	2	7		2	**28**
	➢ Short walls	2	2		2	**8**
	Deduct					
	Sides of the baffle wall	2	0.2		1.5	**-0.6**
						= 35.40 m^2

MANHOLE

- Manholes are provided for access into the sewer lines at the junction, at bends and also along the straight line for cleaning, inspection, flushing etc.
- Deep manholes should consists of a working chamber and an access shaft of small size

MANHOLE


Street Grade
Manhole Lid
Manhole Frame
Adjustment Rings
Paving
Top
Coat
Sub-Paving
Steps
Eccentric Cone Section
Precast
Barrel
Sections
Branch Sewer
Branch Sewer
Flow
Flow
Main Sewer

PROBLEM

- Estimate the quantities for the following items of the work for the manhole shown in fig.

a) Earthwork excavation for foundation

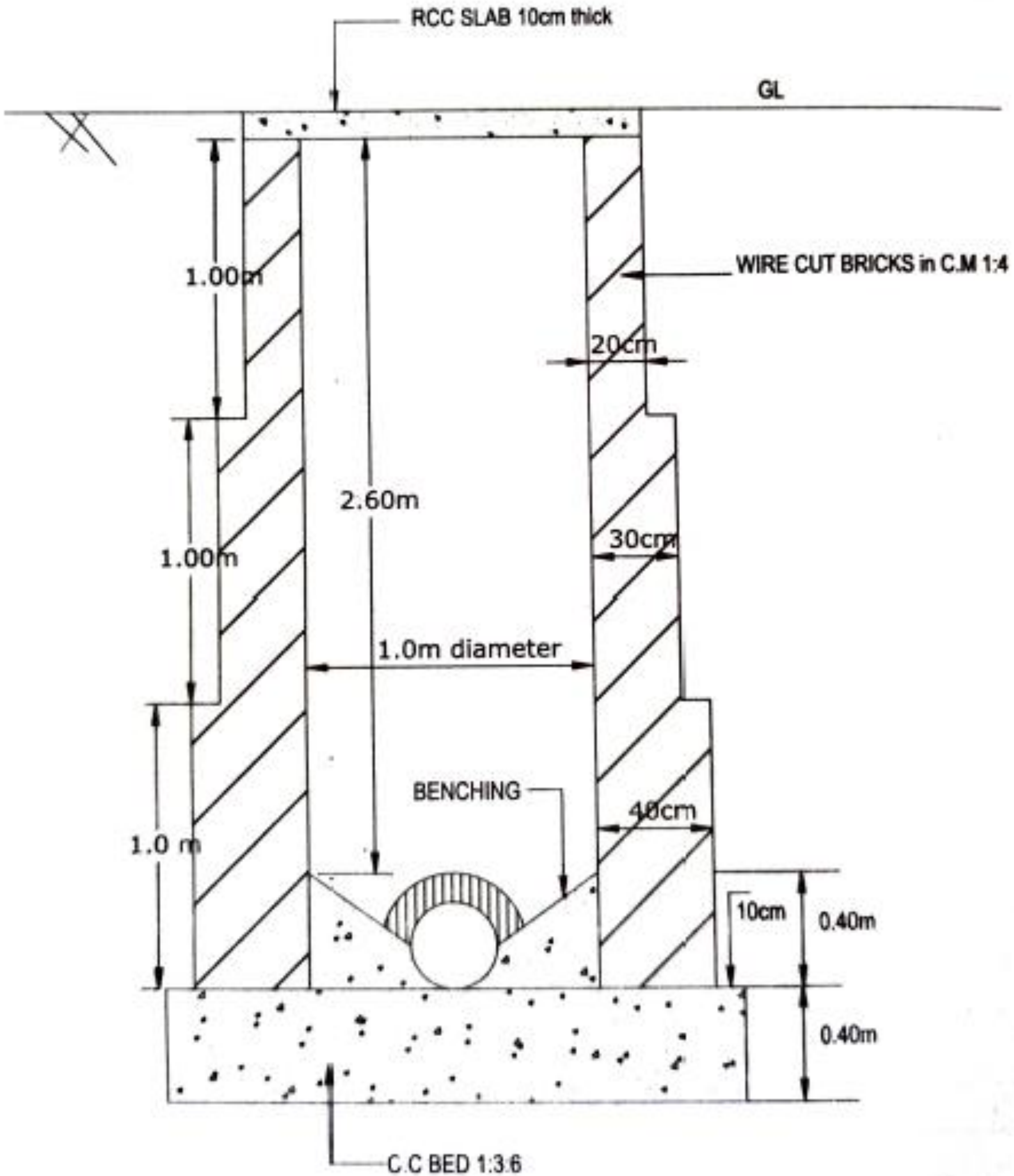
b) C.C Bed 1:3:6 for foundation

c) Wire cut bricks in C.M 1:4 for masonry

d) Cement pointing in C.M 1:6 for inner face

e) R.C.C 1:2:4 slab over the roof

MANHOLE



CROSS SETIONAL DETAILS

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
1.	Earth work Excavation for foundation	1	$\frac{\pi d^2}{4} \times h = \frac{\pi \times 2^2}{4} \times 3.5 =$			11 cum

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
2.	C.C 1:3:6 for foundation	1	$\frac{\pi d^2}{4} \times h =$	$\frac{\pi \times 2^2}{4}$	$\times 0.4 =$	**1.26 cum**

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
3.	Wire cut bricks in C.M 1:4 for masonry					
	I step					
	$L = \pi \times 1.4$	1	4.39	0.40	1	1.76
	II step					
	$L = \pi \times 1.3$	1	4.08	0.30	1	1.22
	III step					
	$L = \pi \times 1.2$	1	3.77	0.20	1	0.75
						= 3.73 cum

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
4.	Cement pointing in C.M for inner face	1	3.142		2.6	8.17 sqm

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
5.	R.C.C slab over the roof (1:2:4)	1	$\frac{\pi d^2}{4} \times h = \frac{\pi \times 1.4^2}{4} \times 0.1 =$			0.153 cum

PROBLEM: 2

- Estimate the quantities for the following items of work for man hole shown in fig:

a. Earthwork excavation in foundation

b. Cement concrete 1:3:6

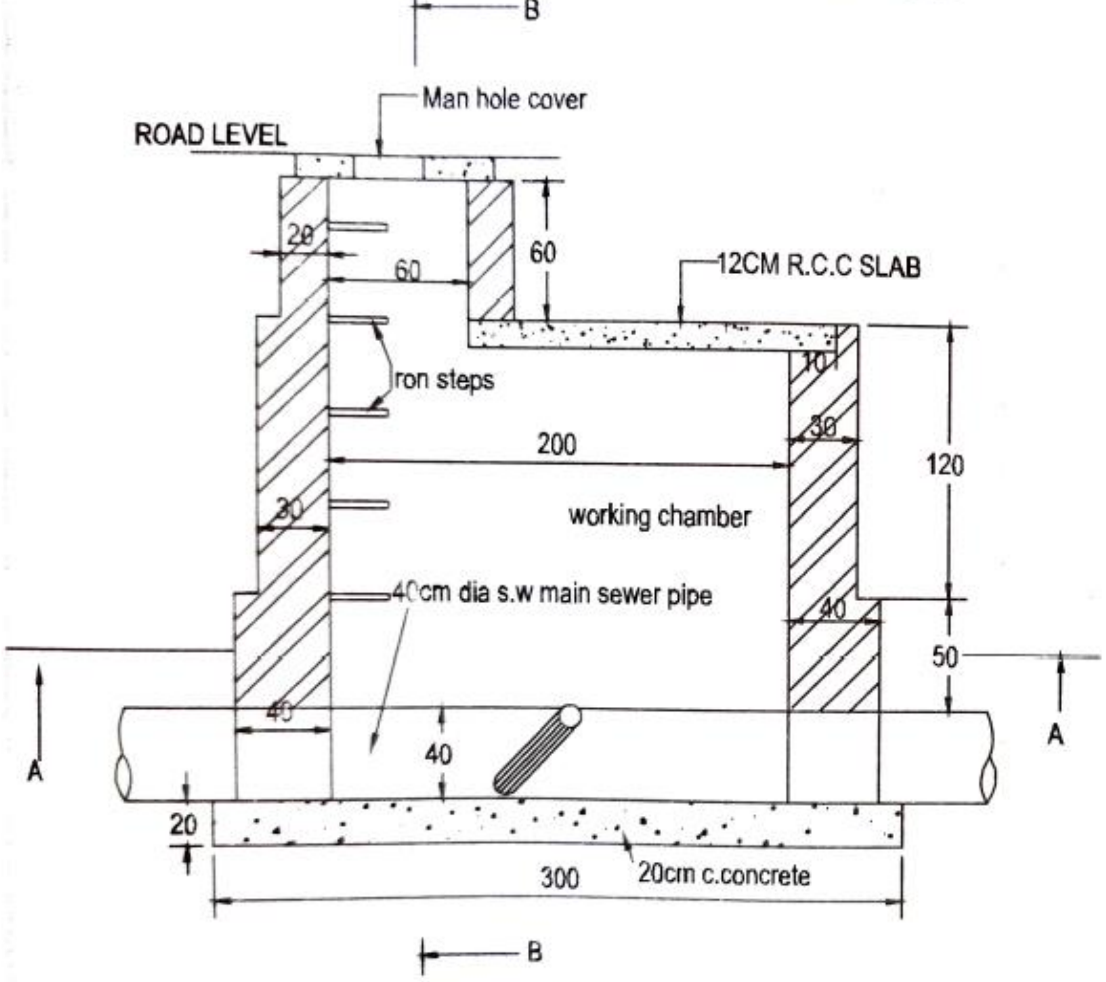
c. I class brick work in CM 1:6

d. Plastering in CM 1:2 for inner surface

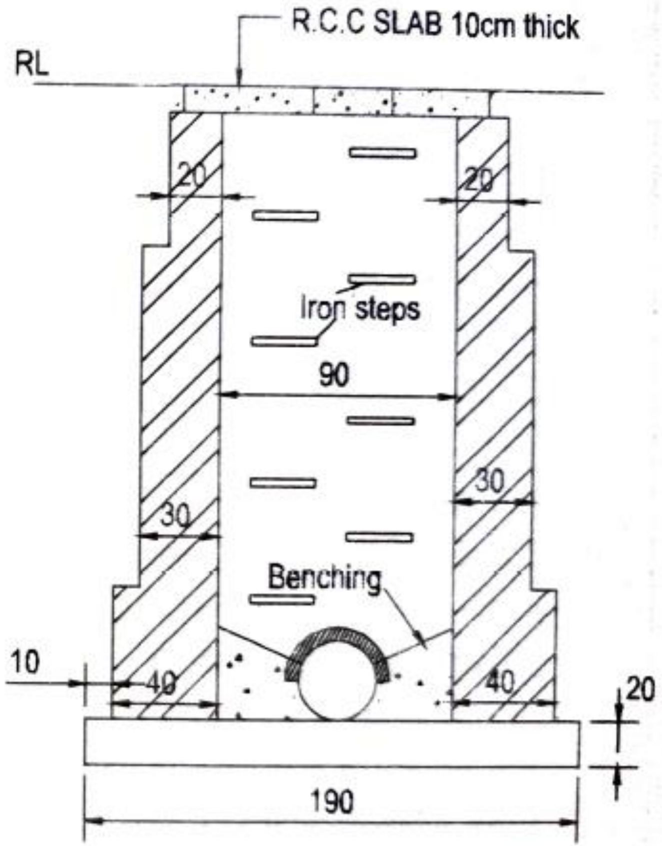
e. 20mm plastering for floor & chamber with CM 1:3

f. R.C.C slab over a roof as well as over the working chamber

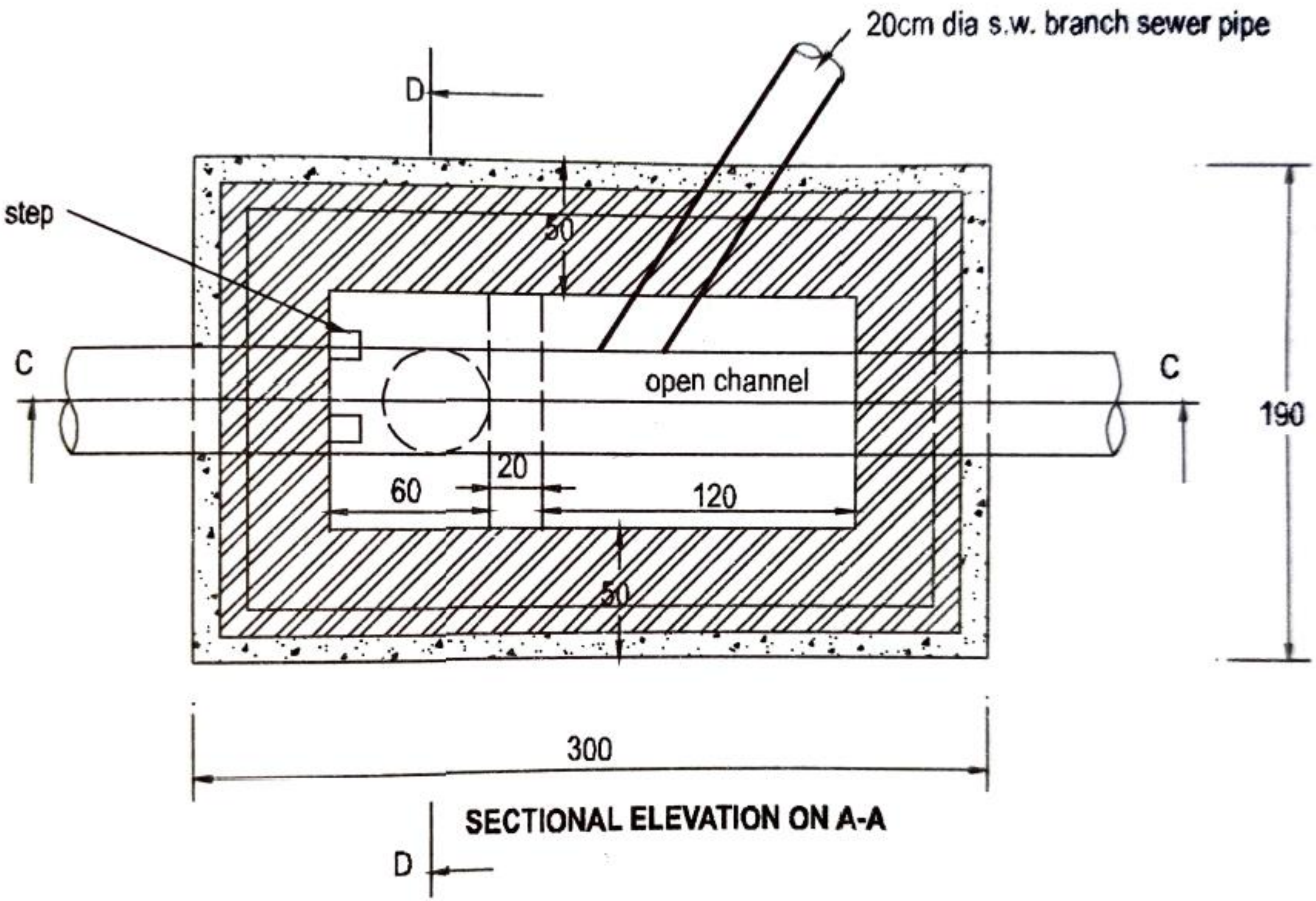
MAN HOLE



SECTIONAL ELEVATION ON C-C



SECTIONAL ELEVATION ON D-D



SECTIONAL ELEVATION ON A-A

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
1.	Earth work Excavation for foundation	1	3	1.90	3	17.10 cum

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
2.	Cement concrete 1:3:6	1	3	1.90	0.2	1.14 cum

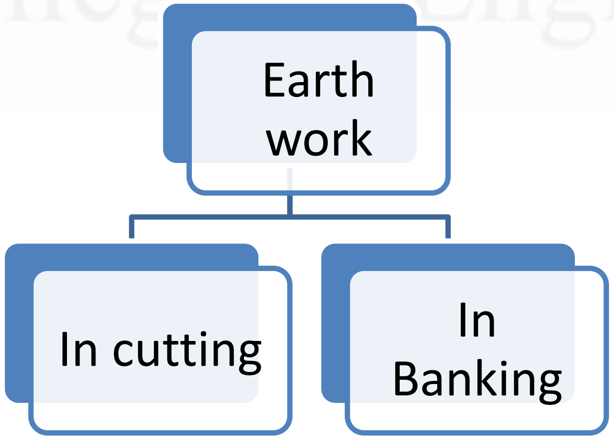
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
3.	I class brick work in C.M 1:6					
	Long walls					
	I step	2	2.8	0.4	0.9	2.02
	II step	2	2.6	0.3	1.2	1.87
	III step	2	1	0.2	0.6	0.24
	Short walls					
	I step	2	0.9	0.4	0.9	0.65
	II step	2	0.9	0.3	1.2	0.65
	III step	2	0.9	0.2	0.6	0.22
						= 5.65 cum

Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
4.	Plastering in C.M 1:2 for inner surface					
	a) Long walls upto R.C.C slab over working chamber					
	Long walls	2	2		1.7	6.8
	Short walls	2	0.9		1.7	3.06
	b) Above the RCC Slab					
	Long walls	2	0.9		0.6	1.08
	Short walls	2	0.6		0.6	0.72
						= 11.66 sqm

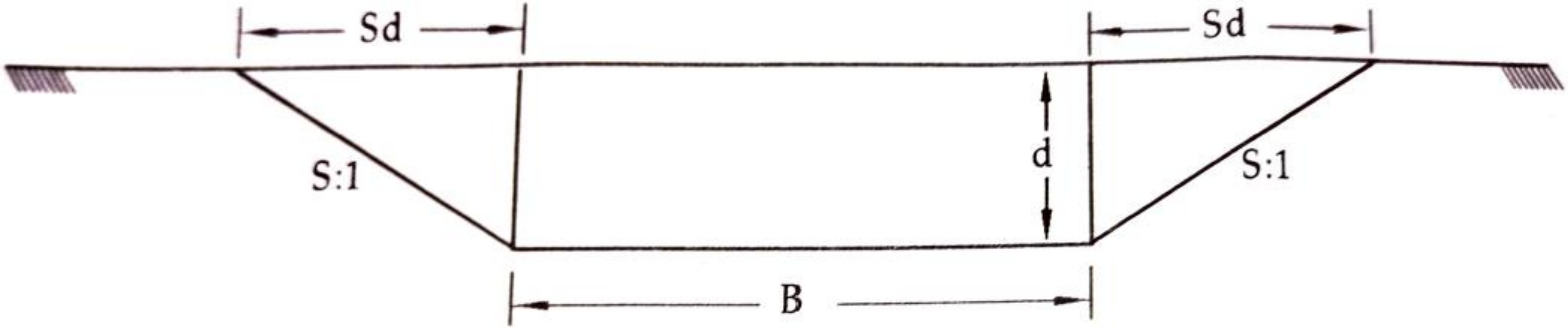
Sl no	Particulars of Item	No	Length m	Breadth m	Depth m	Quantity m^3
5.	20mm thick cement plastering					
	for flooring & channel					
	(addition for channel curvature)					
	B = 0.9+0.3 = 1.2	1	2	0.9		1.8 sqm
6.	Precast R.C.C slab over the roof					
	Over the working chamber	1	0.8	1.1	0.1	0.088
	(10cm bearing on either side)	1	1.5	1.1	0.12	0.198
						= 0.286 cum

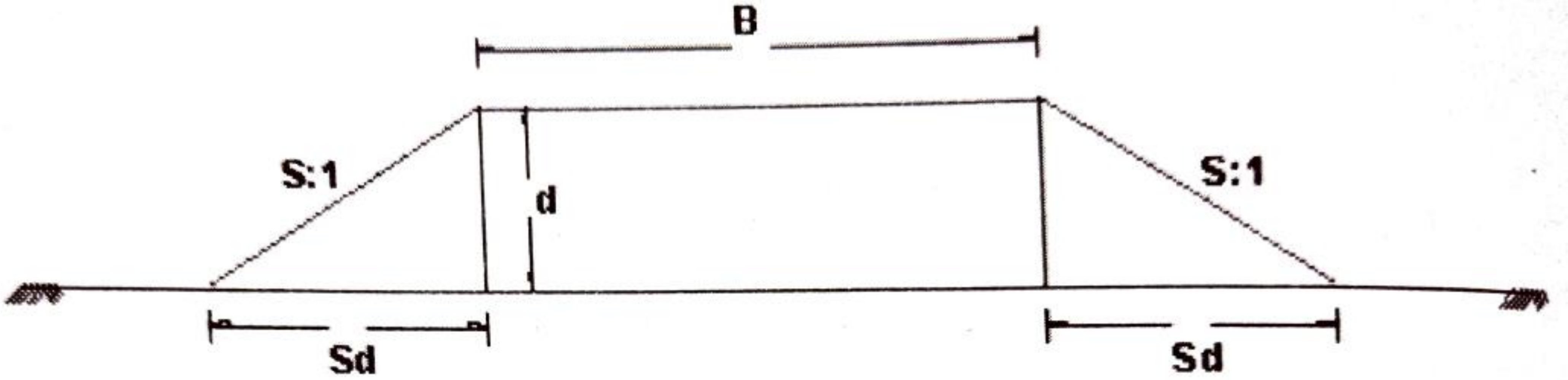
QUANTITY ESTIMATION FOR ROADS

- Estimation of earth work, is commonly required during construction works such as highways, railways, canals etc.
- Earthwork computations involve the calculation of volumes or quantities, the determination of final grades, balancing of cuts and fills.



- Cross section of earthwork of road is usually in the form of trapezium. Either it is banking or cutting.
- The total quantity of earthwork is given by sectional area multiplied by length of the road.
- Volume of earthwork shall be measured in cubic meters without any allowance for increase in bulk.


Sd
Sd
d
S:1
S:1
B


B
S:1
d
S:1
Sd
Sd

- Sectional area

= Area of rectangular portion + Area of two triangular portion

$$= Bd + 2\left(\frac{1}{2} sd \times d\right)$$

- Quantity of Earthwork

$$Q = (Bd + sd^2)L$$

METHODS

1. Mid sectional area method
2. Mean sectional area method
3. Prismoidal area method

Mid sectional area method

- If d_1 & d_2 are the heights of bank or depth of cuts at two ends portion, then mid height is found out as

$$d_m = \frac{d_1 + d_2}{2}$$

- The sectional area:

$$A = Bd_m + sd_m^2$$

- Quantity of Earthwork

$$Q = \left(Bd_m + sd_m^2\right)L$$

Mean sectional area method

$$A_1 = Bd_1 + sd_1^2$$

$$A_2 = Bd_2 + sd_2^2$$

$$A_m = \frac{A_1 + A_2}{2}$$

$$Q = A_m L$$

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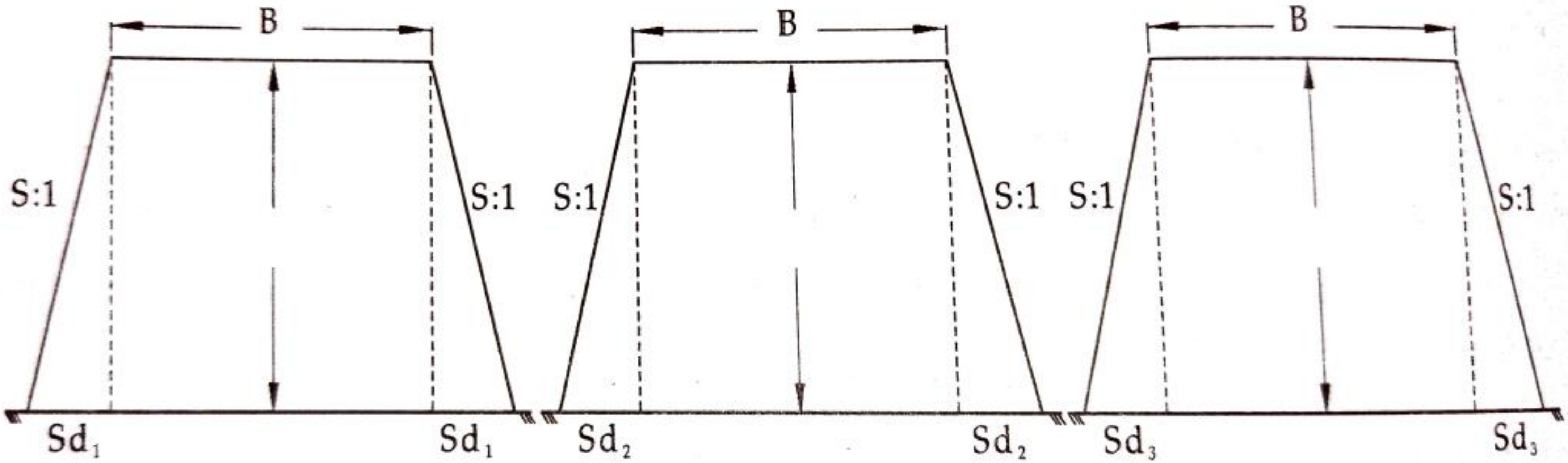
Prismoidal area method

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



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

$$A_1 = Bd_1 + sd_1^2 \qquad A_2 = Bd_2 + sd_2^2 \qquad A_m = Bd_m + sd_m^2$$

$$Q = \frac{L}{6}[Bd_1 + sd_1^2 + Bd_2 + sd_2^2 + 4(B[\frac{d_1 + d_2}{2}] + s[\frac{d_1 + d_2}{2}]^2)]$$

Series of Cross section

- Trapezoidal rule (Average end area rule)

$$Volume\ (Cutting\ or\ Filling) = \left(\frac{A_1 + A_n}{2} + A_2 + A_3 + \cdots + A_{n-1}\right) d$$

$$Volume\ (Cutting\ or\ Filling) = \left(\left\{\frac{Area\ of\ 1st\ section + Area\ of\ last\ section}{2}\right\} + [Sum\ of\ area\ of\ other\ sections]\right) \times Common\ distance$$

Series of Cross section

- **Prismoidal rule**

$$Volume = \frac{d}{3}((A_1 + A_n) + 4(A_2 + A_4 + \cdots + A_{n-1}) + 2(A_3 + A_5 + \cdots + A_{n-2})$$

$$Volume = \frac{Common\ distance}{3}((Area\ of\ 1st\ section + Area\ of\ last\ section) + 4(Sum\ of\ areas\ of\ even\ section) + 2(Sum\ of\ areas\ of\ odd\ section)$$

Problem

- Estimate the quantity of earthwork for a portion of road for 300m length from the following data. Formation width is 10m, side slopes in banking is 2:1 & side slopes in cutting is 1.5:1.

Distance	0	30	60	90	120	150	180	210	240	270	300
RL of Ground	101	100.9	100.5	100.7	100.8	100.6	100	99.8	99.2	99.1	98.5

- The formation level at the first chainage is 102.0. The road is in downward gradient of 1 in 150 upto distance of 120m. Afterward the gradient changes to 1 in 100.

- **Downward gradient of 1 in 150 upto 120m**

  Therefore for every 30m – {(1/150)*30} = 0.20m drop

- **After 120 m gradient changes to 1 in 100**

  Therefore for every 30m - {(1/100)*30} = 0.30m drop

Depth = RL of formation – RL of ground

Distance	0	30	60	90	120	150	180	210	240	270	300
RL of Ground	101	100.9	100.5	100.7	100.8	100.6	100	99.8	99.2	99.1	98.5
RL of formation	102	101.8	101.6	101.4	101.2	100.9	100.6	100.3	100	99.7	99.4
Depth	1	0.9	1.1	0.7	0.4	0.3	0.6	0.5	0.8	0.6	0.9

+ indicates banking, - indicates cutting

B = 10m, S = 2 for banking								
Sl No.	Distance	Depth	Mean d_m	$B \times d_m$	Sd_m^2	$Bd_m+Sd_m^2$	L	Quantity $(Bd_m+Sd_m^2) \times L$
1	0	1	-	-	-	-	-	-
2	30	0.9	0.95	9.5	1.81	11.31	30	339.3
3	60	1.1	1	10	2	12	30	360
4	90	0.7	0.9	9	1.62	10.62	30	318.6
5	120	0.4	0.55	5.5	0.61	6.11	30	183.3
6	150	0.3	0.35	3.5	0.24	3.75	30	112.5
7	180	0.6	0.45	4.5	0.41	4.91	30	147.3
8	210	0.5	0.55	5.5	0.61	6.11	30	183.3
9	240	0.8	0.65	6.5	0.85	7.35	30	220.5
10	270	0.6	0.7	7	0.98	7.98	30	239.4
11	300	0.9	0.75	7.5	1.13	8.63	30	258.9
Total quantity of earthwork in Banking =								**2363.10 cum**

Problem

- Estimate the cost of (i) Earthwork embankment and (ii) Turfing the slopes of the embankment for the portion of the road 300m long from the following data:

Formation levels	106.8	Down gradient 1 in 100					
RL of Ground	105.42	104.3	104.8	104	102.9	102	102.6
Distance in meters	0	50	100	150	200	250	300

- Formation – 10m, side slopes in embankment 2:1. Take the cost of earthwork as Rs. 80 per cum and cost of turfing at Rs. 40 per sqm.

- RL of formation at 0 distance = 106.80
- **Downward gradient of 1 in 100**

Therefore for every 50m – {(1/100)*50} = 0.50m drop

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Depth = RL of formation – RL of ground

Distance	0	50	100	150	200	250	300
RL of Ground	105.42	104.3	104.8	104	102.9	102	102.6
RL of formation	106.8	106.3	105.8	105.3	104.8	104.3	103.8
Depth in m Embankment	1.38	2	1	1.3	1.9	2.3	1.2

+ indicates banking, - indicates cutting

Earthwork Calculation

B = 10m, S = 2 for embankment								
Sl No.	**Distance**	**Depth**	**Mean d_m**	**$B \times d_m$**	**Sd_m^2**	**$Bd_m+Sd_m^2$**	**L**	**Quantity $(Bd_m+Sd_m^2) \times L$**
1	0	1.38	-	-	-	-	-	-
2	50	2	1.69	16.9	5.71	22.61	50	1130.5
3	100	1	1.5	15	4.5	19.5	50	975
4	150	1.3	1.15	11.5	2.65	14.15	50	707.5
5	200	1.9	1.6	16	5.12	21.12	50	1056
6	250	2.3	2.1	21	8.82	29.82	50	1491
7	300	1.2	1.75	17.5	6.13	23.63	50	1181.5
Total quantity of earthwork in embankment =								**6541.5 cum**

Sl No.	Distance	Mean d_m in m	Sloping breadth $d\sqrt{s^2+1}$	L	Area of both the side slopes $2Ld_m\sqrt{S^2+1}$
1	0				
2	50	1.69	3.77	50	377
3	100	1.5	3.35	50	335
4	150	1.15	2.56	50	256
5	200	1.6	3.57	50	357
6	250	2.1	4.68	50	468
7	300	1.75	3.9	50	390
Total Quantity of turfing =					**2183 sqm**

Abstract of estimated cost

Item No.	Particulars of Item	Quantity	Unit	Rate	Per	Amount
1	Earthwork embankment	6541.5	cum	80	cum	52332
2	Turfing the slopes of the embankment	2183	Sqm	40	Sqm	87320
Total =						610640
Add 3% for contingencies						18319.2
Add 2% for work charged establishments						12212.8
Grand Total =						641172

Problem

- Determine the quantities of earth work for the portion of a road between chainages 0 to 10 from the following data, lengths being measured with a standard 20m chain.

Chainages	0	1	2	3	4	5	6	7	8	9	10
GL above datum	231.1	231.2	230.9	231.2	230.8	230.7	230.6	230.4	229.1	229.5	229.7

- The formation level @ 0 chainage is 230.0 and the road is in rising gradient of 1 in 200. The width of formation is 8m and side slopes 1.5:1 in banking and 1:1 in cutting. The lateral slope of ground may be assumed as level.

- **RL of formation at 0 distance = 230.0**
- **Upward gradient, every 200m = 1m rise**

Therefore for every 20m – {(1/200)*20} = 0.10m rise

Depth = RL of formation – RL of ground

Chainages	0	1	2	3	4	5	6	7	8	9	10
G.L above datum	231.1	231.2	230.9	231.2	230.8	230.7	230.6	230.4	229.1	229.5	229.7
RL of formation	230	230.1	230.2	230.3	230.4	230.5	230.6	230.7	230.8	230.9	231
Depth	-1.1	-1.1	-0.7	-0.9	-0.4	-0.2	0	0.3	1.7	1.4	1.3

+ indicates banking, - indicates cutting

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B = 8m, S = 1.5 for banking, S = 1 for cutting									
Sl No	**Distance**	**Depth**	**Mean d_m**	**Bd_m**	**Sd_m^2**	**$Bd_m+Sd_m^2$**	**L**	**Quantity $(Bd_m+Sd_m^2)L$**	
								Banking	**Cutting**
1	0	1.1							
2	20	1.1	1.1	8.8	1.21	10.01	20		200.2
3	40	0.7	0.9	7.2	0.81	8.01	20		160.2
4	60	0.9	0.8	6.4	0.64	7.04	20		140.8
5	80	0.4	0.65	5.2	0.42	5.62	20		112.4
6	100	0.2	0.3	2.4	0.09	2.49	20		49.8
7	120	0	0.1	0.8	0.01	0.81	20		16.2
8	140	0.3	0.15	1.2	0.033	1.23	20	24.6	
9	160	1.7	1	8	1.5	9.5	20	190	
10	180	1.4	1.55	12.4	3.6	16	20	320	
11	200	1.3	1.35	10.8	2.73	13.53	20	270.6	
Total quantity of earthwork =								**805.2**	**679.4**

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PROBLEM

- Estimate the quantity of earthwork for a proposed road formation width of 10m and side slope is 3:1. The longitudinal profile of the ground is as follows. The ground is level transversely. The R.L of formation is 204 at chainage 180m, the formation has a longitudinal rising gradient of 1 in 60 from 0 to 300m chainage. Workout the volume of earthwork using Prismoidal formula method.

Distance	0	30	60	90	120	150	180	210	240	270	300
RL of Ground	198.6	199.7	200.5	201.6	202.4	203	204	202.5	201.4	201.8	199.5
RL of formation	Upward gradient 1 in 60						204	Upward gradient 1 in 60			

- **Upward gradient, every 60m = 1m rise**

Therefore for every 30m – {(1/60)*30} = 0.50m rise

Distance	**0**	**30**	**60**	**90**	**120**	**150**	**180**	**210**	**240**	**270**	**300**
RL of Ground	**198.6**	**199.7**	**200.5**	**201.6**	**202.4**	**203**	**204**	**202.5**	**201.4**	**201.8**	**199.5**
RL of formation	**201**	**201.5**	**202**	**202.5**	**203**	**203.5**	**204**	**204.5**	**205**	**205.5**	**206**
Depth of fill	**2.4**	**1.8**	**1.5**	**0.9**	**0.6**	**0.5**	**0**	**2**	**3.6**	**3.7**	**6.5**

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

$$A_1 = Bd_1 + sd_1^2 \qquad A_2 = Bd_2 + sd_2^2 \qquad A_m = Bd_m + sd_m^2$$

$$Q = \frac{L}{6}[Bd_1 + sd_1^2 + Bd_2 + sd_2^2 + 4(B[\frac{d_1 + d_2}{2}] + s[\frac{d_1 + d_2}{2}]^2)]$$

$$Q = L[B\left(\frac{d_1 + d_2}{2}\right) + s\left(\frac{{d_1}^2 + {d_2}^2 + d_1 d_2}{3}\right)]$$

B = 10m, S = 3

Chainage	depth	$\frac{d_1+d_2}{2}$	$B\left(\frac{d_1+d_2}{2}\right)$	d_1^2	d_2^2	$d_1 d_2$	(5+6+7)/3	S*Col8	Col4+ Col 9	L	Col10* L
1	2	3	4	5	6	7	8	9	10	11	12
0	2.4	-	-	-	-	-	-	-	-	-	-
30	1.8	2.1	21	5.76	3.24	4.32	4.44	13.32	34.32	30	1029.6
60	1.5	1.65	16.5	3.24	2.25	2.7	2.73	8.19	24.69	30	740.7
90	0.9	1.2	12	2.25	0.81	1.35	1.47	4.41	16.41	30	492.3
120	0.6	0.75	7.5	0.81	0.36	0.54	0.57	1.71	9.21	30	276.3
150	0.5	0.55	5.5	0.36	0.25	0.3	0.30	0.9	6.4	30	192
180	0	0.25	2.5	0.25	0	0	0.08	0.24	2.74	30	82.2
210	2	1	10	0	4	0	1.33	3.99	13.99	30	419.7
240	3.6	2.8	28	4	12.96	7.2	8.05	24.15	52.15	30	1564.5
270	3.7	3.65	36.5	12.96	13.69	13.32	13.32	39.96	76.46	30	2293.8
300	6.5	5.1	51	13.69	24.05	24.05	26.66	79.98	130.98	30	3929.4
Total Quantity =										**11050.5 cum**	

Preliminary Survey report

- A feasibility study report is an important document. That helps business owners and entrepreneurs as it assesses the viability of their proposed project.
- It includes a detailed analysis of all the potential risks. And the challenges associated with the project. As well as a review of the potential benefits and opportunities.
- The purpose of a feasibility study report. It is to help business owners make informed decisions.
- If the project completes as intended. The report should provide a clear and concise overview of all the relevant information.
- So that business owners can make an educated decision based on the facts.

Preliminary Survey report

- A project's preliminary report is a formal document that covers the particular tasks, occasions, and occurrences.
- The topics to explain the project's progress to that point (but not later than completion time).
- During project status meetings, the document gets distributed and discussed. To outline the objectives and deliverables.
- And the outcomes achieved as well as the ongoing activities. The document serves as the foundation for creating the project report's final version.

Detailed project report

- After the planning and the designing part of a project are completed, a **detailed project report** is prepared.
- A **detailed project report** is a very extensive and elaborative outline of a project, which includes essential information such as the resources and tasks to be carried out in order to make the project turn into a success.
- It can also be said that it is the final blueprint of a project after which the implementation and operational process can occur.
- In this comprehensive project report, the roles and responsibilities are highlighted along with the safety measures if any issue arises while carrying out the plan.

Contents of a detailed project report

- Brief information about the project
- Experience and skills of the people involved in the promotion of the project
- Details and practical results of the industrial concerns of the promoters of the project
- Project finance and sources of financing
- Government approvals
- Raw material requirement
- Details of the requisite securities to be given to various financial organizations
- Other important details of the proffered project idea include information about management teams for the project, details about the building, plant, machinery, etc.

Importance of a detailed project report

- **Managing the budget** - Managing the budget or expenditure is not an easy task, especially when you have to look at so many aspects of your project. Hence a DPR comes to your rescue and helps your plan and manage your budget in such a manner that you do not go over your set budget.
- **Minimizing risks** - Sometimes, despite giving great attention to details, risks, and issues arise during the implementation of the project. Hence it is crucial to identify and reduce these risks as much as possible so that the project is implemented without any hassles. It is reporting the risks to the project manager before the implementation that makes room for improvement.

Importance of a detailed project report

- **Project progress follow up** - One of the most important aspects of a **detailed project report** is to have a control on the project progress. Accordingly, one can keep track of the schedule of the project and eliminate the problems, if any.
- **Holdover the project** - Project reporting maintains hold of the higher authority, such as managers, over the project so that they can keep a check on progress and eliminate factors that cause a halt in the progress of the project. The performance of the team members and their quality of work is also checked.

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SUB: Estimation and contract Management

SUB CODE: BCV702

MODULE 3

- **Chapter 1**: Significance of Microsoft Excel or any other equivalent software in estimation.
- **Chapter 2**: Specifications: Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of item of works in buildings, specifications of aluminium and wooden partitions, false ceiling, aluminium and fiber doors and windows. Various types of claddings.

Significance of Microsoft Excel in estimation

- Microsoft Excel plays a critical role in estimation, particularly in fields such as project management, construction, finance, engineering, and business analysis.
- It provides a powerful and flexible platform for organizing data, performing calculations, analyzing trends, and making data-driven estimates.
- Its flexibility and range of built-in features make it an essential tool for anyone involved in estimation tasks, whether in project management, finance, construction, or other industries.
- By leveraging Excel's capabilities, professionals can improve the accuracy and efficiency of their estimates, make more informed decisions, and reduce risks associated with inaccurate predictions.

Key ways in which Excel is significant for estimation

1. Data Organization and Structuring

- **Tabular Format:** Excel allows users to structure data in rows and columns, which is ideal for organizing estimates, resources, costs, timelines, and other critical variables.
- **Data Filtering and Sorting:** Excel enables easy sorting and filtering of large datasets, which is essential for refining and reviewing estimation data.

2. Complex Calculations and Formulas

- **Mathematical Functions:** Excel offers a wide range of built-in mathematical functions (SUM, AVERAGE, MIN, MAX, etc.), making it simple to perform calculations for estimates, such as cost estimation, time estimation, and resource allocation.
- **Financial and Statistical Tools:** Excel provides advanced functions (e.g., NPV, IRR, regression analysis) for more sophisticated estimation techniques in financial forecasting, risk analysis, and trend prediction.

Key ways in which Excel is significant for estimation

3. Scenario Analysis and What-If Calculations

- **What-If Analysis:** Excel's "What-If" tools, such as Data Tables, Goal Seek, and Solver, help estimate different outcomes based on variable inputs. This is particularly useful when predicting costs, timelines, or resource requirements under different scenarios.
- **Sensitivity Analysis:** You can estimate how changes in variables affect outcomes by adjusting assumptions or inputs, enabling more accurate and robust forecasting.

4. Cost Estimation and Budgeting

- **Cost Estimation Models:** Excel is widely used in cost estimation, whether for construction projects, product development, or business operations. Templates can be set up to include direct and indirect costs, labor, materials, overheads, etc., allowing users to generate a comprehensive budget.
- **Variance Analysis:** Excel makes it easy to compare estimated costs to actual expenditures, track variances, and identify potential issues early in a project.

Key ways in which Excel is significant for estimation

5. **Time and Schedule Estimation**

- **Project Timelines:** Excel allows users to create Gantt charts, timelines, and other scheduling tools, which are essential for estimating the duration of tasks or projects.
- **Resource Allocation:** Excel can be used to track the allocation of resources (e.g., personnel, equipment) to different tasks, helping estimate time and effort requirements.

6. Risk Analysis and Probability

- **Monte Carlo Simulations:** For more complex estimation problems, Excel can be used to run Monte Carlo simulations, helping estimate probabilities and risks associated with uncertain variables. This is useful for estimating project timelines, costs, or financial outcomes under uncertainty.
- **Risk Modeling:** Excel's ability to perform sensitivity and risk analysis allows estimators to model different scenarios and assess the potential impact of uncertainties.

Key ways in which Excel is significant for estimation

7. Reporting and Visualization

- **Charts and Graphs:** Excel provides a variety of charting tools (e.g., bar charts, pie charts, scatter plots, histograms) to visually represent estimates, trends, and data distributions, making it easier to communicate the results to stakeholders.
- **Dashboards:** Customizable dashboards in Excel can provide at-a-glance views of key estimation metrics, making it easier to track progress, identify issues, and make informed decisions.

8. Collaboration and Sharing

- **Multiple Users and Cloud Integration:** With Microsoft 365 (formerly Office 365), Excel allows multiple users to collaborate on the same estimation model in real-time, which is valuable for team-based estimation work.
- **Data Import and Export:** Excel can easily import data from other sources (e.g., databases, CSV files, web data) and export estimates to different formats (e.g., PDFs, CSVs), making it versatile for sharing information.

Key ways in which Excel is significant for estimation

9. Templates and Standardization

- **Pre-built Templates:** Excel offers various templates for common estimation tasks, such as cost estimation, project management, and budgeting. These templates provide a starting point and help standardize estimation processes across teams or organizations.
- **Custom Templates:** Users can create their own custom templates to standardize estimation practices within their organization, improving efficiency and consistency.

10. Automation and Macros

- **Macros and VBA (Visual Basic for Applications):** Excel supports automation through macros and VBA scripting. This feature can be used to automate repetitive estimation tasks (such as data entry, report generation, or scenario testing), saving time and reducing the risk of human error.

Examples of Specific Estimation Use Cases in Excel

Construction Project Estimation: Excel can be used to calculate material quantities, labor costs, equipment rental, and overheads. Users can estimate total project costs based on different assumptions, then track actual vs. estimated costs.

Financial Forecasting: For businesses, Excel helps estimate future revenues, expenses, and profits based on historical data and market trends. It can also be used for budgeting, cash flow projections, and break-even analysis.

Manufacturing: In manufacturing, Excel can estimate production costs, determine the number of units needed, calculate labor costs, and optimize resource usage.

SPECIFICATION

- Specification is a statement of particulars for execution of any item of work.
- It describes the nature and the class of the work, materials to be used in the work, the workmanship and the tools and plants which are required to complete an engineering project in accordance with its drawing and details.
- Specifications are written by experts of a particular field.

Necessity of Specification

- A specification is a statement of particulars.
- An engineering specification contains the details about nature and class of the work, quality of the material to be used, workmanship and tools and plants required for the project.
- The drawings show the proportions and relative positions of the various components of the structure.

Necessity of Specification

- It is not possible to furnish the information on the drawings regarding the quality of materials to be used and the quality of workmanship to be achieved during construction, due to shortage of space.
- Thus details regarding materials and workmanship are conveyed in a separate contract document which is known as the specifications of the work.
- In general, the drawings showed what is to be done, whereas the specifications state how it is to be accomplished.

Importance of Specification

- The specification describes the quality and quantity of a materials, workmanship and equipment required for execution of the project and hence it directly affects the cost of the project. Moreover, it allows the contractor to make programs for their procurement beforehand.
- Specification provides specific guidelines for the workmanship and the method of doing work. Thus, it serves as a guideline for supervising staff to execute the work.
- Specifications enable the employer to check the quality of the materials and workmanship.
- The contractor bids the tender as per the specification and is paid as per the tendered price. Any change in specification changes the tender rate.

Legal Aspects of Specifications

- Specifications form a part of contract document, without which the contract document becomes invalid. On each page of the specifications both the parties *i.e.*, *owner and contractor should sign so that these specifications, where clear instructions, regarding the quality and procedure of works etc., are given will be binding on both the parties.*
- If any dispute arises between the parties, the specifications will help the arbitrator or the court to settle the dispute. If the contractor's work deviates from the specifications, he will be liable for penalty.

Legal Aspects of Specifications

- The specification also mentions the mode of measurements, quality and procedure of item, which is binding on both the parties to adhere to it. The contractor cannot ask for extra measurements or owner cannot give less measurements.
- The general character and the scope of the work in illustrated and defined by the specifications and signed by both parties. So it becomes a legal binding on both the parties to adhere strictly to the agree specifications.
- In the absence of complete specification, the contractor's obligation is limited to performance of only what is called for in such incomplete specifications. As such great care has to be taken in preparing specifications.

Types of Specifications

- General specification
- Detail specification

General Specification

- In general specifications nature and class of the work, names of materials, and the proportions that should be used in the various items of the work are described.
- Only a brief description of each and every item is given.
- It is useful for estimating the project without going through lengthy detailed specifications general information for the quantities of the materials nature and class of the work can be known from the general specifications, but they don't form a part of the contract document.

Detail Specification

- The detailed specifications describe the item of work in details, accurately and complete in all respects in relation to the drawings of the works.
- Detailed specification for a particular item specify the qualities, quantities and proportion of the materials and the method of preparation and execution and mode of measurements for that particular item of work in a project.
- The method and duration of protection of finished works as required are specified in the detailed specifications.
- The detailed specifications are arranged in the same sequence of order as the work carried out. The detailed specifications form an important part of contract document.

How to Write Specification

- **Description of materials**: The quality and size of materials required to do an item of work shall be fully described for checking up at site according to the clauses provided in the specifications. The proportion of mixing or treatment of materials if required before use shall be really described.
- **Workmanship**: The complete description of workmanship. The method of mixing and proportion, the method of laying, preparation of base or surface, compaction, finishing and curing etc. specially applicable to the item of work shall be stated in different clauses.

How to
Write Specification

- **Tools and Plant (T&P)**: The tools and plant to be engaged to carry out a work shall be described. The method of operation and by whom to be supplied shall be stated.
- **Protection of New Work**: The method of protection of new works against damage or the method of curing if required, the test of completed work if necessary shall be described in separate clauses.

How to
Write Specification

- **Expression**: While writing a specification endeavor shall be made to express the requirements of the specification clearly and in concise form avoiding repetition and unusual words. The style of the tense shall remain same throughout. As the specifications are legal documents, terms such as suitable, proper and words having more than one meaning shall be avoided. The sentience shall be short simple and concise because fewer words will involve less risk or legal difficulty.

How to Write Specification

- **Clauses of the specification**: As far as possible, the clauses shall be arranged in the order in which work shall be carried out. This does not mean to follow the works according to the order of arrangement, but it facilitates references. While framing the clauses for quality of materials, workmanship, tools and plants etc. practical possibilities should be realized. Correct and complete but not repeated information shall be given so that the owner and the contractor carryout the work following the specifications. Abbreviations which are familiar can be used.

General Specification of Building

- Buildings are classified in four categories depending superiority of their construction specifications: Class A (First class buildings) are having highest specification while class D (fourth class) are having lowest specifications.

General specifications for first class building

- **Foundation and plinth**: Foundation and plinth shall be of first class brick work in 1:6 cement mortar over 1:4:8 cement concrete.
- **Damp proof course**: DPC shall be of 25 mm thick cement concrete (1:1.5:3), mixed with one kg of Impermo (or any water proofing material) per bag of cement.
- **Superstructure**: Superstructure shall be of 1st class brickwork with 1:6 cement mortar. Lintels over doors and windows shall be of R.C.C.
- **Roofing**: Roof shall be of 100 mm thick R.C.C. (1:2:4) slab with 100 mm lime terracing above over RCC lab as required. Height of the room shall not be less than 3.5 m.

General specifications for first class building

- **Flooring**: Mosaic/Marble flooring shall be provided in all floors including staircase.
- **Finishing**: Inside and outside wall shall be finished with 12 mm cement mortar plaster (1:8). Inside shall be distempered over 2 coats of white wash. Outside shall be snow cement washed two coats over one coat of white wash.
- **Doors and windows**: Chaukhats shall be seasoned teak wood and shutters shall be 40 mm paneled glazed. All fittings shall be provided with iron grills. All wooden and grills shall be painted with enamel paint over one coat of priming.
- **Miscellaneous**: Rain water pipe shall be of cast iron. Building shall be provided with 1st class sanitary, water fittings and electrical installations.

Writing the Detailed Specifications for Construction Work

- **General provision**: These are also known as conditions of contract and they apply to the work as a whole. In this document, the conditions governing the contract are written.
- **Technical provisions**: These specifications describe the technical requirements of each type of constructions. The technical provisions contain detailed instructions regarding the desired quality of the final product

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Detailed Specifications: General Provision

- Conditions a relating to documents
- Conditions relating to the general obligations of the contractor
- Conditions a relating to labour and personnel
- Conditions a relating to the execution of the work
- Conditions a relating to measurements and payments
- Conditions a relating to default and non-completion
- Conditions a relating to settlement of dispute

Detailed Specifications: Technical Provision

- Specifications for materials and workmanship
- Specifications for performance
- Specifications for proprietary commodities

Detailed Specifications of Civil Engineering Materials

1. Detailed specification for first class brick

- The earth used for molding the bricks shall be free from organic matters salts and chemicals.
- They should not absorb water by more 15 % of their self-weight when immersed in water for one hour.
- The average compressive strength of the bricks shall be not less than 7.5 N/mm2.
- The dry weight of one brick shall not be less than 3 kg.

Detailed Specifications of Civil Engineering Materials

2. Detailed specification for cement

- Ordinary Portland cement or rapid hardening Portland cement confirming to IS: 269 – 1989 and IS:8041 – 1990 shall be used.
- Initial setting time shall not be less than 30 minutes and the final setting time shall not be greater than 10 hours.
- The average compressive strength, after 7 days curing, of 1:3 cement mortar cubes shall be not less than 33 N/mm2 (33 grade).

Detailed Specifications of Civil Engineering Materials

3. Detailed Specification for sand for mortar

- The sand used for mortar shall be clean, sharp, heavy and gritty. It should be free from clay, salt, mica and organic impurities.
- It shall not contain harmful chemicals in any form. Medium and fine sand are to be used in mortars.
- Coarse sand shall be sieved through 600 micron sieve and used in mortars for plastering works.

Detailed Specifications of Civil Engineering Materials

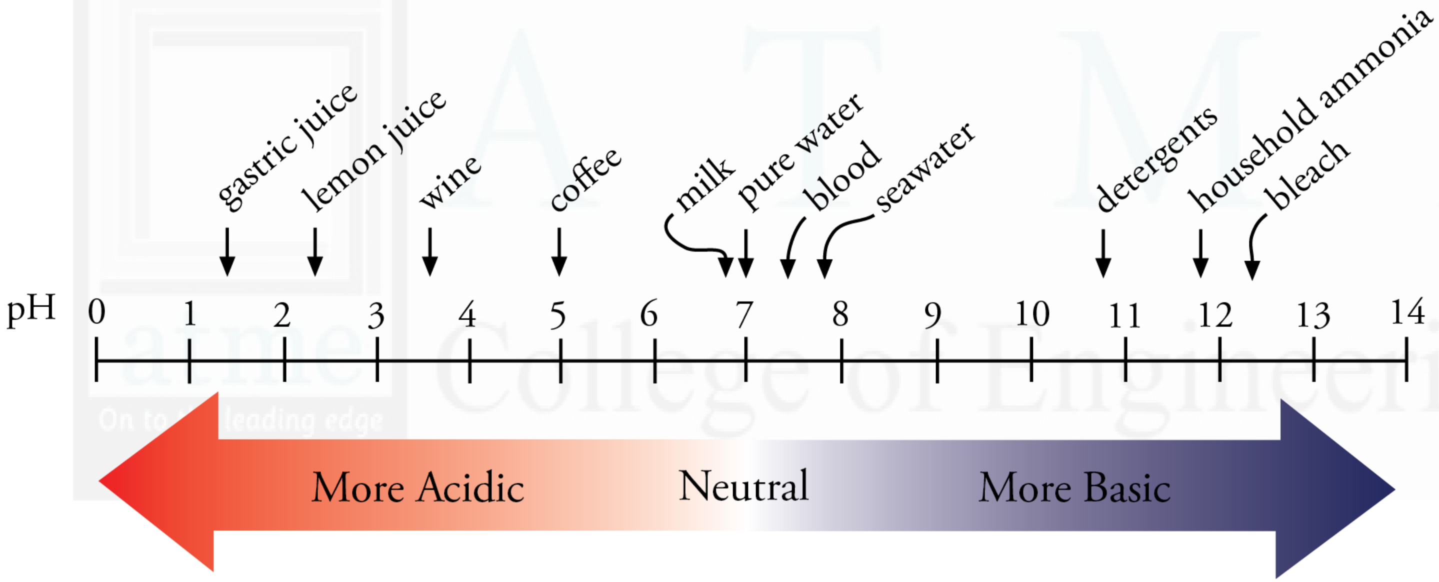
4. Detailed Specification for coarse aggregate

- The aggregate to be used in reinforced cement concrete shall be of blue granite stone, machine crushed and well graded with a nominal size of 20 mm.
- It shall be hard, dense, durable strong and free from flakes. The aggregate shall not contain harmful materials such as coal, mica clay, shells, organic impurities etc.
- The compressive strength, crushing value etc. of the aggregate shall be in accordance with the requirements of IS: 383 – 1970.

5. Detailed Specification for water for concrete

- Water used for mixing and curing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.
- Potable water may be used for mixing concrete. The suspended organic solid matter in the water shall not exceed 200 mg/l and inorganic solid matter shall not exceed 3000 kg/l, the pH value of water shall be not less than 6.
- Water used for curing should not produce any objectionable stain or unsightly deposit on the concrete surface. The presence of tannic acid or iron compounds in the water is objectionable.

pH VALUES



Acidic solutions have pH values less than 7.

Basic solutions have pH values greater than 7.

Detailed Specifications of Civil Engineering Materials

6. Detailed Specification for reinforcement

- The reinforcement shall be of high strength deformed steel bars confirming to IS: 1786 – 1985.
- It should be bendable, wieldable and have the modulus of elasticity not less than 200 kN/mm2. The yield strength of the steel used shall not be less than 415 N/mm2.
- All reinforcement bars shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coatings which may destroy or reduce bond.

Detailed Specifications of Civil Engineering Materials

7. Detailed Specification for wood for doors and windows

- The wood shall be teak, well-seasoned and dry. It should be free from cracks, knots, defects and disease.
- It should be sawn in the direction of grains so that the edges are perfectly straight and square.
- The dimensions of the frames/scantlings/planks shall be as prescribed in the drawings.
- Patching or plugging of any kind is not permitted.

Detailed Specifications of Common Construction Works

1. Detailed specification of for earth work excavation for foundation

- [Sequence: Leveling the surface; Dimensions; Shoring; Fencing; Dumping the soil; Water in foundation; Treatment of the bottom; Trench filling; Measurement]

a) Leveling the surface

- The whole area of construction is to be cleared of tees, grass, roots of trees etc., complete and leveled horizontally to enable easy marking of centre line of the building.

b) Dimensions

- The excavation shall be done in accordance with dimensions of trenches shown in the working drawings.

c) Shoring

- The sides of the trenches should be vertical and the bottom of the trenches should be flat. In the case of loose soils the sides of the trenches should be shored with steel sheets.

d) Fencing

- Suitable temporary fencing is to be provided around the site of excavation to avoid any accidental fall into the trenches.

e) Dumping the soil

- The excavated soil is to be dumped and heaped at a minimum distance of 1.5 metre away from the trenches so that it does not slide again into the trenches.

f) Water in Foundation

- Water, if any accumulated in the trench, should be pumped out without any extra payment and necessary precaution shall be taken to prevent surface water to enter into the trench.

g) Treatment of the bottom

- The bottom of the trench shall be watered and compacted by ramming before the foundation concrete is laid. Excessive excavations should not be adjusted by filling with loose excavated soils. Sand or plain concrete may be used for the adjustment of levels, that too with proper compaction.

h) Trench filling

- After the concrete has been laid and masonry has been constructed the remaining portion of the trench shall be filled up with earth free from rubbish and refuse materials, in layers of 15 cm and watered and well rammed.

i) Measurement

- The measurement of the excavation shall be taken in cu. m. as for rectangular trench bottom width of the concrete multiplied by the vertical depth of the foundation from the ground level and multiplied by the length of trench even though the contractor might have excavated with slopping side for his convenience.

2. Detailed specification of for lime concrete in foundation

- [Sequence: Lime; broken bricks; fine aggregate; proportioning; mixing; laying and compacting; curing; measurement]

a) Lime

- The lime used for the concrete shall be freshly burnt and slaked. It should be free from clayey particles and ashes. Unslaked stone particles should be removed by shifting.

b) Broken bricks

- The over burnt bricks and the pieces of well burnt bricks are to be broken to sizes ranging from 20 mm to 40 mm and stacked for easy measurement. The brick bats shall be free from dirt, dust, rubbish, leaf etc.

c) Fine aggregates

- Surki made from well burnt brick bats is to be used as fine aggregate. It should pass through I.S. sieve no.48 and free from dust and dirt.

d) Proportioning

- Lime, surki and broken bricks are to be mixed in the proportion of 1:2:5 by volume. The materials are to be measured loose without shaking or ramming.

e) Mixing

- The mixing shall be done only by mechanical mixer. The broken bats are to be soaked in clean water for at least 2 hours before mixing. The materials are first mixed to get uniform distribution and then water is gradually added. The mixing process is to be continued till all the brick bats are coated with mortar uniformly and a workable concrete is obtained.

f) Laying and compacting

- The concrete shall be laid to the required thickness, not more than 200 mm and a time, and compacted by ramming with rammers weighing 4.5 to 55 kg.

g) Curing

- The lime concrete, so laid, is to be kept wet for at least 7 days.

h) Measurement

- The measurement shall be taken in cu. m. for the finished concrete. The length and breadth shall be measured correct to 1 cm and depth correct to 05 cm.

3. Detailed specification of random rubble masonry in foundation and basement

- [Sequence: Materials; preparation of mortar; method of laying; curing; measurement]

a) Materials

- The stone shall be obtained from the approved queries. It shall be sound, free from cracks and decay and shall have a specific gravity of not less than 2.5. [Include detail specification for cement and sand]

b) Preparation of mortar

- The materials (cement and sand), with ratio 1:6, shall be first mixed dry thoroughly till uniform colour is obtained and then shall be mixed wet adding water slowly and gradually for at least turning three times to give uniform consistency.

c) Method of laying

- The stones are to be laid on broadest face which gives better opportunity to fill the spaces between stones by the mortar. The stones are laid layer by layer with sufficient mortar in between them for better binding. The outer face of the basement should be vertical and the joints are to be staggered. There shall be no gap, between the stones, unfilled by mortar.

d) Curing

- The masonry should be kept in we condition by sprinkling water thrice daily for at least 7 days after construction.

e) Measurement

- The measurement shall be taken in cu. m. for the finished concrete. The length and breadth shall be measured correct to 1 cm and depth correct to 0.5 cm.

4. Detailed specification for 1st class brickwork in super structure

- [Sequence: Materials; preparation of mortar; soaking of bricks; method of laying; curing; scaffolding; measurement]

a) Materials

- [Include detail specification for first class brick, cement, and sand]

b) Preparation of mortar

- The materials (cement and sand), with ratio 1:3, shall be first mixed dry thoroughly till uniform colour is obtained and then shall be mixed wet adding water slowly and gradually for at least turning three times to give uniform consistency.

c) Method of laying

- The stones are to be laid on broadest face which gives better opportunity to fill the spaces between stones by the mortar. The stones are laid layer by layer with sufficient mortar in between them for better binding. The outer face of the basement should be vertical and the joints are to be staggered. There shall be no gap, between the stones, unfilled by mortar.

d) Curing

- The masonry should be kept in we condition by sprinkling water thrice daily for at least 7 days after construction.

e) Measurement

- The measurement shall be taken in cu. m. for the finished concrete. The length and breadth shall be measured correct to 1 cm and depth correct to 0.5 cm.

5. Detailed specification for Reinforced Cement Concrete

- [Sequence: Materials; form work; proportioning; mixing of concrete; laying of concrete; curing; formwork; measurement]

a) Materials

- [Include detail specification for cement, sand, course aggregate, water and reinforcement]
- Reinforcement shall be hooked and bent (cold) and placed in position as per design and drawing and bound together tight with 20 S.W.G binding steel wire.

b) Centering and shuttering

- Centering and shuttering shall be made of timber and tight with necessary wedges and sufficiently strong and sable not to yield under laying of concrete. A coat of oil washing or a thin layer of paper shall be spread to have a smooth finished surface preventing adherence of concrete.

c) Proportioning

- Proportions of cement, sand and course aggregate shall be 1:2:4 for slab, beam and lintels and 1:1.5:3 for columns unless otherwise specified. The sand and course aggregate shall be measured by volume with boxed and cement by number of bags.

d) Mixing of concrete

- Concrete shall be mixed by concrete mixture. Cement, sand and course aggregate shall be put into the as per the required proportions for one batch. The total quantity shall not exceed the manufactures rated capacity. The machine shall be revolved to mix materials dry and then water shall be added up to the required quantity. After 2 minutes rotation for through mixing, the mixed concrete shall be discharged on a masonry platform or iron sheet.

e) Laying of concrete

- Concrete shall be laid gently in layers not exceeding 150 mm and compacted by wooden thapi or some mechanical vibrator until a dense concrete is obtained. While concreting, steel bars shall be given side band bottom covers of concrete by pacing the precast concrete blocks of 1:2 cement mortar 25x25 mm in section and thickness of specified cover. Concreting shall be laid continuously.

f) Curing of concrete

- Freshly laid concrete shall be protected from rain by suitable covering. After 24 hrs of laying of concrete the surface shall be cured by flowing with water of above 25
- mm depth or with covering by wet gunny bags. The curing shall be for a minimum period of 14 days or otherwise specified.

g) Removal of form work

- The centering and shuttering shall be removed after 14 days of casting. It shall be removed slowly and carefully so that no part is disturbed.

h) Measurement

- The measurement shall be taken in cu. m. The rate shall be for the complete work inclusive of form work and all tools and plants but excluding steel.

6. Detailed specification for damp proof course (D.P.C.)

- **[Sequence: Materials; preparation of mortar; Application of DPC; measurement]**

a) Materials

- Damp Poof Course shall be of plain cement concrete of 1:2:4 mix and 30 mm thickness. 12 mm size hard and dense stone chips shall be used as coarse aggregate and river sand of 5 mm nominal size shall be used as fine aggregate.
- The aggregate shall be clean and free from dust, dirt, mud, organic matter etc. The coarse aggregate is to be washed well before mixing. Fresh port land cement of I.S.I. approved brand of 43 grades is to be used as the binding material. Potable water, free from harmful salts, shall be only used for mixing the concrete.

b) Preparation of mortar

- The coarse aggregate and sand are to be measured separately by volume and mixed dry in a clean and stable platform to get a mixture of uniform colour. This mixture is stacked to a uniform height and the cement of required quantity is spread over the stack, turned over in dry state first, and with water twice to get a workable and uniform concrete.

c) Application of DPC

- The brickwork in basement is stopped at plinth level, cured will for 7 days, top surface cleaned well for dust by wire brushes. Form work is provided along the two sides of wall by wooden planks, to the required height. Gauge plates are to be provided at one metre interval, connecting the two side planks by nails, keeping at a clear distance equal to the width of wall at plinth level.

7. Detailed specification of plastering with cement mortar

- [Sequence: Materials; preparation of mortar; preparation of surface; application of mortar; curing; measurement]

a) Materials

- [Include detail specification for cement and sand]

b) Preparation of mortar

- [Ratio of cement to sand is 1:4 for inner wall and 1: 6 for outer wall or as specified.]
- Mortar for plastering shall be prepared at a time of such amount which can be used within the initial setting of cement.

c) Preparation of surface

- The joints of brick work shall be racked out a depth of 18 mm and the surface shall be brushed, cleaned, watered and kept wet for two days before plastering. In case of cement concrete surface, the face shall lightly roughen, cleaned, washed and wetted.

d) Application of mortar

- Plastering shall be started from the top and proceed towards the bottom. The plastered surface shall be made level and flush with wooden straight edges and rubbed thoroughly with wooden floats to ensure smooth and even surface.

e) Curing

- The work shall be kept well watered for at least 15 days.

f) Measurement

- The measurement shall be taken in sq. m. The rate shall be for the complete work inclusive of all tools and plants.

8. Detailed specification for form work and centering to R.C.C. Roofing

- [Sequence: Strutting; formwork; centering]

a) Strutting

- Props used for strutting shall be of casuarinas posts of 100 to 130 mm diameter. The props are to be vertical and rest on firm ground or on wooden sole plates of thickness not less than 40 mm. All props shall be provided with double wedges to facilitate tightening and loosening of shuttering. The horizontal spacing of props in both directions shall not exceed 750 mm. When the height of strutting exceeds 3.5 m, suitable horizontal bracings should be provided. Splicing of props shall be as per the approved drawings.

b) Form Work

- The formwork shall be of stiff and strong wood, easily workable with nails and light in weight. The form work shall be true to shape and size specified in the structural drawings and strong enough to with stand the forces caused by vibration of concrete and the incidental loads imposed on it during concreting.

c) Centering

- Well-seasoned wooden planks or steel sheets are to be used for the shuttering work. The joints shall be water tight to avoid leakage of cement slurry during compaction. The surfaces of planks and sheets which would come into contact with concrete shall be cleaned well and coated with oil of approved quality to the prevent adhesion of concrete.

9. Detailed specification for cement concrete flooring

a) Bottom Layer – 1:2:4 (25mm thick)

b) Top Layer – 1:3 (12mm thick)

c) Measurement

10. Detailed specification for mosaic tile flooring

- Base Course
- Mosaic Tiles
- Laying of Tiles
- Curing, Polishing and Finishing

11. Detailed specification for distempering

- The distemper shall be of the approved colour and quality. Water shall be added as prescribed by the manufacture, stirred well often during use, to maintain uniform colour and consistency.

12. Detailed specification for Pointing

- The joints of the brickwork shall be raked out to a depth of 20mm (3/4”) and the surface of the wall washed and cleaned 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 specification. The materials of mortar shall be first dry mixed by measuring with boxes to have the required proportion as specified (1:2 or 1:3 for cement sand mortar, 1:1 for lime surkhi mortar or kankar lime mortar), and then mixed by adding water slowly and gradually and thoroughly mixed.

13. Detailed specification for wood work for door and window frames

- Materials
- Joints
- Surface Treatment
- Gluing of Joints
- Fixing in position

Specifications of aluminium and wooden partitions

Aluminum Partitions: Aluminum is a lightweight, durable, and versatile material commonly used for partitioning spaces in commercial and residential settings. Aluminum partitions are known for their modern, sleek appearance and are often used in offices, retail spaces, and other high-traffic environments.

Material Composition:

- Frame: Primarily made from extruded aluminum, which is strong, lightweight, and corrosion-resistant.
- Panels: Can be made of glass, gypsum board, MDF (Medium Density Fiberboard), or other composite materials.

Thickness:

- **Frame:** Usually ranges from **1.2 mm to 3 mm** (depending on load-bearing needs).
- **Panels:** Typically **12 mm to 25 mm** thick, depending on the material used (e.g., gypsum board, glass, or composite).

Height & Width:

- **Standard Height:** Aluminum partitions are available in standard heights of **2.4 meters to 3 meters** but can be customized.
- **Standard Width:** Typically **800 mm to 1200 mm per panel**; can vary depending on the configuration.

Finishes:

- **Anodized Finish:** Provides corrosion resistance and a sleek, durable surface.
- **Powder-Coated Finish:** Available in a wide range of colors; offers aesthetic variety and enhanced resistance to wear and tear.
- **Brushed/Polished Aluminum:** Gives a modern, shiny finish.

Design Options:

- **Single or Double Glazed Panels:** If glass is used, it can be single-glazed or double-glazed for improved insulation and soundproofing.
- **Solid Panels:** For privacy, solid panels can be used (e.g., MDF, laminated boards, or gypsum).
- **Modular Systems:** Aluminum partitions often use modular systems that are easy to assemble, disassemble, and reconfigure.

Sound Insulation:

- Aluminum partitions can be designed with additional acoustic insulation within the panels to improve soundproofing properties.
- Acoustic glass or mineral-filled boards can be used to enhance sound absorption and noise control.

Strength and Durability:

- **Lightweight but strong:** Aluminum partitions are sturdy and resistant to corrosion, rust, and wear.
- **Maintenance:** Low maintenance due to the corrosion-resistant properties of aluminum.

Customization Options:

- **Transparent or Opaque Panels:** You can choose glass panels for visibility or opaque panels (e.g., MDF, gypsum) for privacy.
- **Movable Partitions:** Many aluminum partition systems offer movable or foldable options for flexible space management.

Wooden partitions: Wooden partitions are versatile and commonly used in interior design for both residential and commercial spaces. They serve as dividers, offering privacy, soundproofing, and aesthetic appeal.

1. Material

- **Wood Type**: The type of wood used impacts both the aesthetics and durability of the partition. Common types include:
  - **Pine**: Softwood, cost-effective, light color, easy to work with.
  - **Oak**: Hardwood, durable, strong, and aesthetically appealing.
  - **Teak**: Highly durable, often used in luxury or outdoor partitions.
  - **MDF (Medium-Density Fiberboard)**: Engineered wood, smooth finish, can be veneered or laminated.
  - **Plywood**: Versatile, available in different grades, can be finished or veneered.
- **Finish**: Can be natural (oiled or lacquered wood), stained, or painted, depending on the desired look and durability.

2. Dimensions

- **Height**: Typically ranges from 6 to 10 feet (1.8 to 3 meters), but custom heights are possible.
- **Width**: Standard partition panels are usually 3 to 6 feet wide (0.9 to 1.8 meters), but this can vary.
- **Thickness**: Usually between 0.5 to 1.5 inches (12 to 38 mm), with thicker partitions offering more stability and sound insulation.

3. Design Styles

- **Solid**: A full, solid wooden panel partition.
- **Lattice or Slatted**: Partitions with vertical or horizontal slats, allowing for light and air to pass through.
- **Framed**: Wooden partitions with a frame structure and optional insets of glass or panels.
- **Folding or Sliding**: Designed for space-saving and easy reconfiguration, often used for temporary partitions.
- **With Glass Inserts**: Wood panels integrated with glass, combining privacy with light flow.

4. Soundproofing

- **Thickness and Density**: Thicker and denser wood panels tend to offer better sound insulation.
- **Acoustic Treatments**: Wood partitions may include additional soundproofing materials like foam or mineral wool between the layers.

5. Installation Types

- **Freestanding**: No need for attachment to walls, portable and movable.
- **Fixed**: Attached to walls or floors, providing a more permanent solution.
- **Suspended**: Hanging partitions supported by the ceiling for a modern look.

6. Finishing Options

- **Lamination**: Decorative laminates for a smooth finish or high gloss.
- **Veneering**: Thin slices of high-quality wood adhered to cheaper material (e.g., MDF, plywood) to provide a premium wood finish.
- **Polished or Matted Finish**: Depending on the desired aesthetic.

7. Durability and Maintenance

- **Durability**: High-quality wood or engineered wood will last longer and resist damage like warping, cracking, or moisture absorption.
- **Maintenance**: Regular cleaning (dusting and polishing) is needed, especially for varnished or lacquered wood.

8. Applications

- **Residential**: Used in homes for room division, privacy screens, or decorative elements.
- **Commercial**: Dividing office spaces, waiting areas, or conference rooms.
- **Public Spaces**: Used in malls, libraries, or exhibition areas to separate areas while maintaining an open feel.

9. Cost

- Prices vary depending on wood quality, design complexity, and size. Softwoods like pine are generally cheaper than hardwoods like oak or teak.

10. Sustainability

- **Certified Woods**: Look for FSC (Forest Stewardship Council) certified wood to ensure the timber is sustainably sourced.
- **Recycled Wood**: Some partitions use reclaimed or recycled wood, which is more eco-friendly.

Specifications of false ceiling

False ceilings (also known as suspended ceilings or drop ceilings) are a popular feature in both residential and commercial spaces. They provide various benefits, such as improved acoustics, insulation, aesthetics, and easier concealment of wiring, pipes, and air-conditioning ducts.

1. Material

- **Gypsum Board**: Widely used for false ceilings due to its smooth finish and ability to be molded into various designs. It is fire-resistant, lightweight, and offers good sound insulation.
- **Mineral Fiber (Acoustic Tiles)**: Used primarily for commercial spaces due to its excellent sound absorption properties. These tiles are available in different finishes and textures.
- **PVC (Polyvinyl Chloride)**: Lightweight, waterproof, easy to install and clean. Often used in bathrooms and kitchens.
- **Wooden Panels**: Used for a more aesthetic, warm, and natural look. They are heavier and more expensive than other materials.
- **Aluminum**: Lightweight, fire-resistant, and durable. It's a common choice for commercial and industrial spaces.
- **Glass**: Used for aesthetic purposes in high-end spaces, offering a sleek and modern look, often combined with other materials.
- **Fabric**: Acoustic fabric panels are sometimes used in high-performance acoustic settings.
- **PVC Laminated Panels**: Waterproof, easy to maintain, and available in various colors and designs.

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2. Design Types

- **Grid System**: A metal frame with tiles suspended within. The tiles can be made of mineral fiber, gypsum, or other materials. This is the most common design.
- **Concealed Grid**: Similar to the grid system, but the frame is hidden, giving a more seamless and elegant look.
- **Plaster of Paris (POP)**: Molded plaster used to create intricate and artistic designs. It is popular for decorative ceilings with detailed patterns.
- **Tiled or Panel**: Standard tiles or panels that fit into a suspended grid system.
- **Open Cell**: A grid ceiling with large open spaces, often used in modern industrial spaces for an open, airy look.
- **Stretch Ceiling**: A flexible material (often PVC) stretched over a frame, creating a smooth and seamless ceiling surface, with options for backlighting or printed designs.

3. Dimensions

- **Standard Tile Size**: Common dimensions are 2’x2’ (60 cm x 60 cm) or 2’x4’ (60 cm x 120 cm). However, custom sizes are available.
- **Thickness**: Gypsum board is typically 9 to 12 mm thick. PVC panels usually range from 6 to 8 mm, while mineral fiber tiles are often about 15 mm thick.
- **Height of Suspension**: The distance between the existing ceiling and the false ceiling can range from 6 to 12 inches (150 to 300 mm), depending on the space and the type of systems used (e.g., for hiding ducts, cables, or pipes).

4. Load-Bearing Capacity

- **Light Fixtures**: False ceilings are often designed to support the weight of lights, fans, and other fixtures. The load-bearing capacity should be considered when installing lights, air conditioning vents, or speakers.
- **Heavy Items**: Some systems (like aluminum or gypsum) can bear heavier loads, but additional support may be required for particularly heavy items.

5. Fire Resistance

- **Gypsum**: Naturally fire-resistant due to its chemical properties.
- **Mineral Fiber**: Often fire-resistant but varies depending on the product.
- **PVC**: Not as fire-resistant, but fire-retardant versions are available.
- **Metal (Aluminum)**: Highly fire-resistant.
- **Plaster of Paris (POP)**: Fire-resistant and ideal for areas requiring high safety standards.

6. Acoustic Properties

- **Acoustic Tiles**: Used where sound absorption is critical, such as in offices, theaters, and auditoriums.
- **Gypsum Boards**: Can provide some sound insulation but may require additional treatment for better acoustic performance.
- **Mineral Fiber**: Excellent for soundproofing and noise reduction.
- **Fabric Panels**: Offer both acoustic control and aesthetic appeal.

7. Aesthetic Finishes

- **Texture**: Tiles can have a smooth, rough, perforated, or patterned texture. Customization is possible for unique designs.
- **Color**: False ceilings come in a wide variety of colors, often white or off-white for general use, but custom colors and finishes are available.
- **Lighting Integration**: False ceilings are often designed to accommodate recessed, cove, or ambient lighting. LED strips, downlights, and spotlights can be integrated for both functionality and ambiance.
- **Design Flexibility**: False ceilings allow for a wide range of creative and artistic designs, especially when using materials like POP, stretch ceilings, or customized tiles.

8. Installation

- **Suspension System**: The ceiling is usually supported by metal grids or hangers that are anchored to the original ceiling. The grid can be exposed or concealed.
- **Fixing Method**: The tiles or panels are fixed using clips, hooks, or adhesive depending on the type of material.
- **Time to Install**: Installation time depends on the complexity of the design. Simple grid systems with tiles may take less time compared to intricate designs with POP or stretch ceilings.

9. Sustainability

- **Eco-friendly Materials**: Materials like recycled mineral fiber, biodegradable tiles, or sustainably sourced wood panels are available for environmentally conscious design.
- **Energy Efficiency**: False ceilings with integrated insulation can improve a building's energy efficiency by helping regulate temperature and reducing heating/cooling costs.

10. Applications

- **Residential**: Living rooms, bedrooms, kitchens, and bathrooms.
- **Commercial**: Offices, conference rooms, malls, and hotels.
- **Industrial**: Factories, warehouses, and other large spaces.
- **Specialized Spaces**: Auditoriums, theaters, hospitals, and music rooms (for acoustics).

Aluminium Fiber Doors & Windows

1. Material Composition:

- **Aluminium Frame:** The door/window frames are made from high-quality aluminium, which is lightweight, corrosion-resistant, and durable.
- **Fiberglass (Fiber Reinforced Plastic - FRP):** The glazing or panels often incorporate fiberglass, which adds strength, thermal insulation, and resistance to weathering. This combination provides enhanced strength and insulation properties compared to traditional aluminium-only windows or doors.

2. Frame Design:

- **Profiles:** Aluminium frames are typically extruded and can have various designs depending on the aesthetic and strength requirements.
- **Section Size:** Frame thickness and width can vary, but common sizes range from 2mm to 3mm in thickness for the aluminium sections.
- **Color Options:** Powder-coated or anodized aluminium finishes are common, available in various colors (including standard colors like white, silver, black, and custom colors).
- **Sill and Threshold:** Aluminium sills for windows and thresholds for doors, with integrated drainage systems to prevent water accumulation.

Aluminium Fiber Doors & Windows

3. Glazing Options:

- **Glass Type:** Double or triple-glazed glass, sometimes with Low-E (low-emissivity) coatings for better thermal insulation and UV protection.
- **Fiber Panels:** Some systems feature fiber-based panels that can offer superior sound insulation and increased strength, and are lightweight compared to traditional glazing.
- **Thickness:** Typically, glass thickness ranges from 4mm to 12mm, depending on the application. Fiber panels might be 5mm to 20mm thick.

4. Insulation and Energy Efficiency:

- **Thermal Insulation:** Fiberglass panels are known for their excellent thermal insulation properties, which help keep the internal environment comfortable and reduce energy costs.
- **Acoustic Insulation:** The combination of aluminium and fiberglass can also provide good sound insulation, making it suitable for noisy environments.
- **Weatherproofing:** Rubber seals and gaskets are used to ensure airtight and watertight closure, reducing drafts and preventing rainwater from entering the room.

5. Strength and Durability:

- **Impact Resistance:** The addition of fiberglass increases the impact resistance of the door or window.
- **Corrosion Resistance:** Aluminium's natural resistance to corrosion is enhanced with powder coating or anodizing.
- **UV Protection:** Fiberglass is resistant to UV degradation, ensuring that the color and structural integrity of the panels do not deteriorate easily.

Aluminium Fiber Doors & Windows

6. Security Features:

- **Locking Mechanisms:** Multi-point locking systems are often used for enhanced security, with reinforced frame and glass designs.
- **Reinforced Frames:** Aluminium frames can be reinforced with steel inserts for added security, especially for doors.

7. Sizes and Configurations:

- **Custom Sizes:** Doors and windows can be custom-manufactured to fit specific dimensions, with sizes ranging from small to large openings.
- **Window Styles:** Sliding, casement, fixed, or tilt-and-turn configurations.
- **Door Styles:** Hinged, sliding, bi-fold, or French doors.

8. Maintenance:

- **Low Maintenance:** Aluminium frames require minimal maintenance, typically just cleaning with mild soap and water. Powder-coated finishes are highly durable and resistant to peeling or fading.
- **Fiberglass Durability:** The fiberglass panels or reinforcements are resistant to warping, rotting, and insect damage, making them a long-lasting option.

Aluminium Fiber Doors & Windows

9. Applications:

- **Residential:** Used in homes for energy-efficient, modern, and secure windows and doors.
- **Commercial:** Common in office buildings, retail spaces, and other commercial properties for their strength, aesthetics, and security features.
- **Special Applications:** Can be used in high-security areas, coastal regions, or places prone to extreme weather conditions due to their resistance to corrosion and impact.

10. Environmental Considerations:

- **Recyclability:** Both aluminium and fiberglass are recyclable, making them an eco-friendly option.
- **Energy Efficiency:** With their insulating properties, aluminium fiber doors and windows contribute to energy conservation, reducing heating and cooling costs.

SPECIFICATIONS OF CLADDINGS

Cladding refers to the materials or systems applied to the exterior surfaces of a building, serving both aesthetic and functional purposes such as weatherproofing, thermal insulation, and acoustic performance. The specifications for claddings typically include details related to material selection, installation procedures, and performance criteria.

Here are key aspects commonly included in the **specifications of claddings**:

1. Material Selection

- **Types of Materials**: Cladding can be made from a variety of materials, such as:
  - **Metal** (aluminum, steel, copper, zinc)
  - **Wood** (timber, engineered wood)
  - **Stone** (granite, limestone, slate)
  - **Brick** or **Masonry**
  - **Glass** (curtain walls, windows)
  - **Vinyl** or **Fiber Cement**
  - **Composite Materials** (such as high-pressure laminate panels, or aluminum composite materials (ACM))
  - **Ceramic Tiles**
- **Finish and Texture**: This can include painted, anodized, powder-coated, natural, or laminated finishes.
- **Durability Requirements**: Materials must be able to withstand local environmental conditions (e.g., moisture, UV exposure, thermal variations).
- **Fire Resistance**: Materials must comply with fire safety codes, which may include flame-retardant properties or the use of non-combustible materials.

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SPECIFICATIONS OF CLADDINGS

2. Structural Requirements

- **Weight and Load-Bearing Capacity**: Cladding materials should be specified with regard to their weight to ensure that the supporting structure can handle the load.
- **Wind Load Resistance**: Cladding must be designed to resist the forces imposed by wind. Specifications often require cladding to withstand specific wind speeds (e.g., up to 150 mph, depending on the location and type of structure).
- **Thermal Expansion**: Materials should have expansion rates that are suitable for temperature variations, with allowances for the natural expansion and contraction of materials.
- **Fastening Systems**: The type of fixings (screws, bolts, clips) and the spacing between them should be specified to ensure secure attachment to the building frame.

3. Aesthetic Considerations

- **Color**: Specification of the color palette for the cladding, which may be chosen to meet aesthetic goals or to harmonize with the surrounding environment.
- **Patterns and Profiles**: Certain cladding systems may have distinct textures, patterns, or profiles that affect their visual impact.
- **Integration with Building Design**: Cladding materials should be chosen to complement the building's architectural style (modern, traditional, industrial, etc.).

4. Performance Criteria

- **Thermal Insulation**: Cladding should meet specific thermal performance standards to enhance energy efficiency. This may involve specifying the R-value (thermal resistance) of the cladding system or specifying additional insulation layers.
- **Sound Insulation**: Cladding may also be required to have acoustic properties to reduce noise transmission, especially in urban environments.
- **Waterproofing and Moisture Control**: Cladding systems should be designed to prevent water penetration, with suitable drainage systems, weatherproofing, and vapor barriers.
- **Air Tightness**: Cladding should contribute to the overall airtightness of the building to reduce drafts and energy loss.

SPECIFICATIONS OF CLADDINGS

5. Sustainability and Environmental Considerations

- **Recyclability**: The materials should be recyclable or sourced from sustainable practices to align with environmental goals.
- **Energy Efficiency**: Some cladding systems integrate energy-saving features, such as reflective coatings or solar panels.
- **Emissions and VOCs**: Specify low-emitting materials that contribute to better indoor air quality and minimize environmental impact during manufacture.

6. Installation and Maintenance

- **Installation Method**: Detailed installation methods should be provided, including step-by-step instructions, fixing techniques, and safety measures.
- **Maintenance Requirements**: Cladding systems should be designed with low maintenance in mind, including resistance to fading, corrosion, or weathering. The specification might outline regular cleaning or coating intervals to maintain the appearance and functionality of the system.
- **Sealants and Gaskets**: Specify the types of sealants and gaskets used in joints and intersections to prevent water ingress and ensure a long-lasting seal.

7. Codes and Standards Compliance

- **Building Codes**: The cladding system should meet or exceed the relevant local building codes, including fire safety codes, wind load regulations, and other safety standards.
- **International Standards**: Compliance with recognized international standards such as ASTM, ISO, and EN for material quality and performance.
- **Fire and Safety Regulations**: Ensure cladding materials meet fire safety regulations, including flame spread ratings and smoke development.

8. Sustainability and Environmental Impact

- **Energy Efficiency**: Specify cladding systems that support energy efficiency, such as those with high insulation properties.
- **Life Cycle Impact**: Consider the life cycle of the cladding, from material extraction through to disposal or recycling.

SUB: Estimation and contract Management

SUB CODE: BCV702

MODULE 4

- **Chapter 1**: Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works or doors, windows and ventilators.

Rate Analysis

- The basis of arriving at a correct and reasonable rate per unit time of work following its specification is called “Analysis of rate”.

Rate analysis per unit item of work

- Cost of Materials
- Cost of labour
- Cost of equipment
- Cost of water charges
- Cost of profit

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Quantity for Rate Analysis

- For mass works
- For surface works
- For running meter works
- For unit quantity works

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Procedure for rate analysis

- First work out the quantity of materials required for particular item of work
- Allocate number of labours
- Workout cost of tools & plants
- Water charges & Profit
- Workout rate per unit

Factors affecting rate analysis

- Major factors
- Minor factors

Major factors

- Cost of materials
- Cost of labour

Minor factors

- Cost of tools & plant
- Cost due to magnitude of work
- Cost due to place of work
- Cost due to site conditions
- Cost due to specifications
- Overhead charges
- Contractors profit

PROBLEM 1

- Earthwork in excavation in trenches for foundation, not exceeding 1.5m width including dressing of sides and ramming of bottoms, lift upto 1.5m and lead upto 30m.

➢ **Take 10cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	Labour Mazdoor	3 ¼ Nos	290 Per day	942.5
			Water charges @ 1% of the total=	9.42
			Total= Profit and overhead @ 10% of the total= Grand total=	951.92 95.19 1047.11

Rate per cum = 1047.11/10 = 105

PROBLEM 2

- Earthwork in excavation in ordinary rock by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30 cm in depth, 1.5m in width as well as 10sqm on plan) including disposal of excavated earth, lead up to 50m and lift up to 1.5m.

➢ **Take 10 cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	Machinery ▪ Hydraulic Excavator (3D) with driver and fuel ▪ Hire and running charges of tipper	0.0625 day 0.0625 day	8000 per day 1700 per day	500 106.25
2	Labour Mazdoor (Rock excavator, Rock breaker, Hole driller, Belder, Coolies)	5 Nos	290 per day	1450
			Total =	2056.25
			Water charges @ 1% of the total=	20.56
			Total= Profit and overhead @ 10% of the total= Grand total=	2076.81 207.60 2284.41

Problem 3

- Filling in plinth with local sand under floors including ramming, consolidating and dressing complete

➢ **Take10 cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	Materials Fine sand	10cum	1300 per cum	13000
2	Labour Head Mason Mason	1/12 Nos 2 Nos	400 per day 290 per day	33.33 580
			Total =	13613.33
			Water charges @ 1% of the total=	136.13
			Total= Profit and overhead @ 10% of the total= Grand total=	13749.46 1374.95 15124.41

CEMENT CONCRETE

- **Calculation of materials**

- To determine the quantity of materials for 10 cum concrete is to divide 15.4 by the sum of the numerical of the proportion of the materials which gives the quantity of the cement in cum

- For 1:2:4 proportion

  Summation of proportion = 1+2+4 = 7

Therefore cement = 15.4/7 = 2.2 cum

Sand = 2.2*2 = 4.4 cum

Coarse aggregate = 2.2*4 = 8.8 cum

Note: 1 bag cement (50 kg) = 0.0347 cum

2.2 cum = 2.2/0.0347 = 63.4 bags

Quantity of materials for 10cum of concrete for different proportions (Variation 5% allowed)

Proportion	*Cement*	*Sand*	*Coarse aggregate*
1:1:2	$\frac{15.4}{4} = 3.90cum$ (112.4bags)	$3.90 \times 1 = 3.90cum$	$3.90 \times 2 = 7.8cum$
1:1½:3	$\frac{15.4}{5.5} = 2.80cum$ (80.7bags)	$2.80 \times 1.5 = 4.20cum$	$2.80 \times 3 = 8.40cum$
1:2:4	$\frac{15.4}{7} = 2.2cum$ (63.4bags)	$2.2 \times 2 = 4.4cum$	$2.2 \times 4 = 8.8cum$
1:3:6	$\frac{15.4}{10} = 1.54cum$ (44.40bags)	$1.54 \times 3 = 4.62cum$	$1.54 \times 6 = 9.24cum$
1:4:8	$\frac{15.4}{13} = 1.2cum$ (34.60bags)	$1.2 \times 4 = 4.8cum$	$1.2 \times 8 = 9.6cum$
1:5:10	$\frac{15.4}{16} = 0.97cum$ (28bags)	$0.97 \times 5 = 4.85cum$	$0.97 \times 10 = 9.70cum$

Problem 4

- Cement concrete bedding 1:4:8 for foundation

➢ **Take10 cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone ballast Sand Cement	 9.6 cum 4.8 cum 36 bags	 700 per cum 1300 per cum 330 per bag	 6720 6240 11880
2	**Labour** Head Mason Mason Mazdoor	 ¼ No. 2 Nos 20 Nos	 400 per day 390 per day 290 per day	 100 780 5800
3	Contingencies, etc		Lump sum	300
			Total =	31820
			Water charges @ 1% of the total=	318.20
			Total= Profit and overhead @ 10% of the total= Grand total=	32138.2 3213.82 35352.02

Problem 5

- P.C.C 1:3:6 for plinth

➢ **Take10 cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone ballast Sand Cement	 9.24 cum 4.62 cum 44.4 bags	 700 per cum 1300 per cum 330 per bag	 6468 6006 14652
2	**Labour** Head Mason Mason Mazdoor	 ¼ No. 2 1/2 Nos 21Nos	 400 per day 390 per day 290 per day	 100 975 6090
3	Contingencies, etc		Lump sum	300
			Total =	34591.00
			Water charges @ 1% of the total=	345.91
			Total= Profit and overhead @ 10% of the total= Grand total=	34936.91 3493.69 38430.60

Problem 6

- R.C.C 1:2:4 with graded coarse aggregate from 20mm down to 6mm excluding shuttering and reinforcement.

➢ **Take10 cum**

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Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone ballast Sand Cement	 8.8 cum 4.4 cum 66 bags	 700 per cum 1300 per cum 330 per bag	 6468 6006 14652
2	**Labour** Head Mason Mason Mazdoor Mixed operator	 1/2 No. 3 Nos 23 Nos 0.7 No	 400 per day 390 per day 290 per day 200 per day	 200 1170 6070 140
3	Hire charges of concrete Mixer Vibrator (Needle type 40mm) Scaffolding Sundries	0.7 day 0.7 day	800 per day 325 per day Lump sum Lump sum	560.00 227.50 200.00 50.00
			Total =	44637.50
			Water charges @ 1% of the total=	446.37
			Total= Profit and overhead @ 10% of the total= Grand total=	45083.87 4508.38 49592.25

Problem 7

- R.C.C work 1:1.5:3 for Beams, Columns excluding the cost of centering and shuttering.
- **Take10 cum**

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Coarse aggregate 20 mm down Sand Cement	 8.4 cum 4.2 cum 80.7 bags	 900 per cum 1300 per cum 330 per bag	 7560 5460 26631
2	**Labour** Head Mason Mason Mazdoor	 1/2 No. 3 Nos 23 Nos	 400 per day 390 per day 290 per day	 200 1170 6670
3	Hire charges of concrete Mixer Vibrator (Needle type 40mm) Scaffolding Sundries	0.7 day 0.7 day	800 per day 325 per day Lump sum Lump sum	560.00 227.50 200.00 50.00
			Total =	48728.50
			Water charges @ 1% of the total=	487.28
			Total= Profit and overhead @ 10% of the total= Grand total=	49215.78 4921.57 54137.35

Brickwork

- While constructing the brickwork, the quality of bricks and mortar required for one cubic meter of brickwork has to be worked out.
- As the brick sizes differ widely, the quality of bricks and mortar also differ.

Problem 8

- First class brickwork in cement mortar 1:4 in superstructure, ground floor.

➢ **Take 10cum**

➢ Calculation of materials per 10cum of brick work

- Number of bricks having size with mortar 10cm*10cm*20cm

  = (10/0.1*0.1*0.2) = 5000Nos

- The size of bricks without mortar = 10 – (5000*0.09*0.09*0.19) = 2.30 cum

- Adding extra 15% for frog filling, brick bonding courses & wastages etc.

  Volume of wet mortar = 2.3 + [(15/100)*2.3] = 2.64cum

- For dry mix (1/3rd) extra, therefore volume of dry mortar

  = 2.64 + [(1/3)*2.64] = 3.50cum

- **Cement & Sand for 1:4 mortar**

- Cement = [3.5/(1+4)] = 0.7 cum = (0.7/0.0347) = 21 bags

- Sand = [3.5/(1+4)]*4 = 2.8 cum

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Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Bricks 20cm*10cm*10cm Sand (Medium) Cement (0.70 cum) Scaffolding	 5000 Nos 2.8 cum 21 bags	 6 per No. 1300 per cum 330 per bag Lump sum	 30000 3640 6930 120
2	**Labour** Head Mason Mason Mazdoor	 1/2 No. 8 Nos 16 Nos	 400 per day 390 per day 290 per day	 200 3120 4640
3	Contingencies		Lump sum	180
			Total =	48830
			Water charges @ 1% of the total=	488.3
			Total= Profit and overhead @ 10% of the total= Grand total=	49318.3 4931.83 54250.13

Problem 9

- Random Rubble Masonry in cement mortar 1:6 in foundation and plinth

➢ **Take 10cum**

➢ Materials

- Stone = 12.5 cum
- Mortar (dry) = 4.2 cum
- Cement = [4.2/(1+6)] = 0.6 cum = 17 bags
- Sand = 0.6*6 = 3.6 cum

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone including through bond stone & wastage Sand (Medium) Cement	12.5 cum 3.6 cum 17 bags	500 per cum 1300 per cum 330 per bag	6250 4680 5610
2	**Labour** Head Mason Mason Mazdoor	1/2 No. 10 Nos 19 Nos	400 per day 390 per day 290 per day	200 3900 5510
3	Contingencies		Lump sum	100
			Total =	26250
			Water charges @ 1% of the total=	262.5
			Total= Profit and overhead @ 10% of the total= Grand total=	26512.50 2651.25 2913.75

Problem 10

- Coursed Rubble Masonry in cement mortar 1:6 in foundation and plinth

➢ **Take 10cum**

➢ Materials

- Stone = 12.5 cum
- Mortar (dry) = 4.0 cum
- Cement = [4.0/(1+6)] = 0.6 cum = 17 bags
- Sand = 0.57*6 = 3.4 cum

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone including through bond stone & wastage Sand (Medium) Cement	12.5 cum 3.4 cum 17 bags	500 per cum 1300 per cum 330 per bag	6875 4420 5610
2	**Labour** Head Mason Mason Mazdoor	1/2 No. 13 Nos 20 Nos	400 per day 390 per day 290 per day	200 5070 5800
3	Contingencies		Lump sum	100
			Total =	28175
			Water charges @ 1% of the total=	281.75
			Total= Profit and overhead @ 10% of the total= Grand total=	28456.75 2845.67 31302.42

Problem 11

- 2.5cm thick cement concrete 1:2:4 floor with neat cement finishing at top

➢ **Take 100 sqm**

➢ Materials

- Volume of concrete = 0.025*100 = 2.5 cum
- Addition 10% extra for unevenness of base concrete

  = 2.5 + [(10/100)*2.5] = 2.75 cum

- Adding 50% extra for dry volume = 2.75 + [(50/100)*2.75] = 4.125 cum

- Cement = [4.125/(1+2+4)] = 0.59 cum

  = (0.59/0.0347) = 17 bags

- Sand = 0.59*2 = 1.18 cum
- Coarse Aggregate = 0.59*4 = 2.36 cum

➢ For neat cement surface finishing additional 6 bags will be required

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Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Stone chips 12mm down size Sand (Coarse) Cement for flooring Cement for finishing	 2.36 cum 1.18 cum 17 bags 6 bags	 700 per cum 1300 per cum 330 per bag 330 per bag	 1652 1534 5610 1980
2	**Labour** Head Mason Mason Mazdoor	 1/2 No. 10 1/2 Nos 12 1/2 Nos	 400 per day 390 per day 290 per day	 200 4095 3625
3	Contingencies	LS	Lump sum	80
			Total =	18766
			Water charges @ 1% of the total=	187.66
			Total= Profit and overhead @ 10% of the total= Grand total=	18963.76 1896.37 20860.13

Problem 12

- 40mm thick flooring under layer of 30mm thick cement concrete flooring 1:2:4 with 10mm thick red oxide finishing cement plaster 1:3

- **Take 100 sqm**

Calculation of Materials

a) For under layer of 30mm thick C.C 1:2:4

Volume of concrete = 0.03*100 = 3 cum

Adding 10% extra for unevenness of base concrete = [3+{(10/100)*3} = 3.30 cum

Adding 50% extra for dry volume = [3.3+{(50/100)*3.3} = 4.95 cum

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- Cement = [4.925/(1+2+4)] = 0.71 cum

  = (0.71/0.0347) = 20.5 bags

- Sand = 0.71*2 = 1.42 cum

- Coarse Aggregate = 0.71*4 = 2.84 cum

- **Take 100 sqm**

Calculation of Materials

b) For top layer 10mm thick mortar 1:3

Volume of concrete = 0.01*100 = 1 cum

Adding 20% extra for rough under bed= [1+{(20/100)*1} = 1.20 cum

Adding 1/3rd extra for dry volume = [1.2+{(1/3)*1.2} = 1.60 cum

- Cement = [1.6/(1+3)] = 0.40 cum

  = (0.40/0.0347) = 11.76 bags

- Sand = 0.40*3 = 1.2 cum

c) For floating coat

Cement @2.2 kg per sqm = 100*2.2 = 4.4 bags

Total quantity of cement for top layer = 11.76 + 4.4 = 16.16 bags

Quantity of red oxide @ 3.5 kg per bag of cement = 16.16*3.5 = 57kg

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials**			
	a) For under bed			
	Stone chips 12mm down size	2.84 cum	700 per cum	1988
	Sand (Coarse)	1.42 cum	1300 per cum	1846
	Cement	20.5 bags	330 per bag	6765
	b) For top layer & finishing			
	Sand (Medium)	1.2 cum	1300 per cum	1560
	Cement	16.16 bags	330 per kg	5332
	Red oxide	57 kg	20 per kg	570
2	**Labour**			
	Head Mason	1 No.	400 per day	200
	Mason	20 Nos	390 per day	4095
	Mazdoor	27 Nos	290 per day	3625
	Special Mazdoor for rubbing	3 Nos	310 per day	930
3	Contingencies	LS	Lump sum	150

Problem 13

- Plastering with C.M 1:6 of 20mm thick

➢ **Take 100 sqm**

Calculation of Materials

Volume of wet mortar = 0.02*100 = 2 cum

Adding 20% extra for filling the depressions, joints, wastage etc

= [2+{(20/100)*2} = 2.40 cum

Adding 1/3rd extra for dry volume = [2.4+{(1/3)*2.4} = 3.20 cum

- Cement = [3.20/(1+6)] = 0.46 cum

  = (0.46/0.0347) = 13.25 bags

- Sand = 0.46*6 = 2.76 cum

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Cement (0.46 cum) Sand (Medium) Scaffolding	 13.25 bags 2.76 cum LS	 330 per bag 1300 per cum Lump sum	 4372.5 3588 100
2	**Labour** Head Mason Mason Mazdoor	 1/2 No. 14 Nos 18 Nos	 400 per day 390 per day 290 per day	 200 5460 5220
3	Contingencies	LS	Lump sum	125
			Total =	19065.50
			Water charges @ 1% of the total=	190.65
			Total= Profit and overhead @ 10% of the total= Grand total=	19256.15 1925.61 21181.76

Problem 14

- Wall painting (two or more coat) with plastic emulsion paint of approved brand

➢ **Take 100 sqm**

Sl No.	Particulars	Quantity	Rate	Amount
1	**Materials** Plastic emulsion paint Materials for filling holes & cracks (Putty)	 12 litres L.S	 220 per litre Lump sum	 2640 100
2	**Labour** Painter Helper Brushes, Sand Paper etc Sundries	 5.5 Nos 5.5 Nos LS LS	 360 per day 290 per day LS LS	 1980 1595 75 50
			Total =	6440
			Water charges @ 1% of the total=	64.40
			Total= Profit and overhead @ 10% of the total= Grand total=	6504.40 650.44 7154.84

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SUB CODE: BCV702

MODULE 5

- Chapter 1: Contracts: Types of contract-essential of contract –legal aspects, penal provision on breach of contract. Definition of the terms-Tender, Earnest money deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor refund of deposit. Administrative approval - Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Types of Contract

- In construction, contracts are crucial for defining the relationship between the parties involved (owners, contractors, subcontractors, and suppliers).
- The type of contract used depends on the scope of work, payment structure, risk allocation, and the nature of the project.

1. Lump Sum (Fixed Price) Contract

- **Definition**: In a lump sum contract, the contractor agrees to complete the project for a fixed price, regardless of the actual costs incurred during construction.
- **Advantages**: Provides cost certainty for the owner and is straightforward.
- **Disadvantages**: Risk of cost overruns falls on the contractor.
- **Example**: A contractor agrees to build a house for a fixed price of Rs. 2,00,00,000.

Types of Contract

2. Cost-Plus Contract

- **Definition**: In a cost-plus contract, the contractor is paid for the actual costs of the project (materials, labor, etc.) plus an additional fee for profit (either a fixed fee or a percentage of the costs).
- **Advantages**: Flexible for projects with uncertain scopes or changes.
- **Disadvantages**: Less predictable costs for the owner.
- **Example**: The contractor is reimbursed for all expenses and given 10% of the total costs as their fee.

3. Time and Materials (T&M) Contract

- **Definition**: In this contract, the owner pays for the time spent by the contractor (labor) and the materials used, usually with an agreed-upon markup for overhead and profit.
- **Advantages**: Useful when the scope of work is unclear or subject to change.
- **Disadvantages**: Costs can escalate if the project takes longer than expected.
- **Example**: The contractor charges Rs. 1000/hour for labor and Rs. 500 per unit of materials used.

Types of Contract

4. Unit Price Contract

- **Definition**: In a unit price contract, the contractor is paid based on the quantities of work performed (measured in units such as square meters, tons, etc.) at pre-agreed unit prices.
- **Advantages**: Flexible for projects where quantities are uncertain but can be measured.
- **Disadvantages**: Difficult to manage if quantities vary significantly during the project.
- **Example**: A road construction project where the price per meter of asphalt laid is agreed upon.

5. Design-Bid-Build (DBB) Contract

- **Definition**: In a traditional design-bid-build contract, the project is first designed by an architect or designer. After the design is complete, contractors bid to execute the construction work.
- **Advantages**: Clear division between design and construction, and competitive bidding helps control costs.
- **Disadvantages**: Potential for delays between design and construction phases and less flexibility for changes.
- **Example**: A public infrastructure project where designs are finalized before contractors submit bids.

Types of Contract

6. Design-Build Contract

- **Definition**: In a design-build contract, a single entity (design-builder) is responsible for both the design and construction of the project.
- **Advantages**: Streamlined process, faster project delivery, and fewer disputes since the designer and builder are the same entity.
- **Disadvantages**: Less owner control over the design process and potential for higher costs.
- **Example**: A private commercial building where one firm handles both the architectural design and construction.

7. Construction Management at Risk (CMAR)

- **Definition**: In this contract, the construction manager (CM) acts as a consultant to the owner during the design phase and assumes the risk for completing the construction within a guaranteed maximum price (GMP).
- **Advantages**: The owner gets early involvement of the construction manager, which can reduce risks and improve cost control.
- **Disadvantages**: The owner might have to pay more for the services of a construction manager.
- **Example**: A large-scale healthcare facility where a CM ensures the project is completed within budget.

Types of Contract

8. Integrated Project Delivery (IPD)

- **Definition**: In an IPD contract, all major project participants (owner, architect, contractor, etc.) collaborate closely and share risks and rewards in a collective way, often through a shared financial arrangement.
- **Advantages**: Promotes collaboration, innovation, and alignment of interests, leading to cost savings and reduced risk.
- **Disadvantages**: Requires trust and effective collaboration between all parties involved.
- **Example**: A large, complex building where the design, construction, and operational goals are aligned from the outset.

9. Joint Venture (JV) Contract

- **Definition**: A joint venture contract involves two or more parties coming together to execute a specific project, sharing profits, risks, and responsibilities.
- **Advantages**: Combines resources and expertise, ideal for large or complex projects.
- **Disadvantages**: Potential conflicts between parties and complex management.
- **Example**: Two construction firms partnering to build a large-scale infrastructure project like a bridge.

Types of Contract

10. Subcontractor Agreement

- **Definition**: In this contract, the main contractor hires a subcontractor to perform specific tasks or parts of the work under the main contract.
- **Advantages**: Delegates specialized tasks to experts and can help streamline construction.
- **Disadvantages**: Increased complexity in management and coordination between contractors and subcontractors.
- **Example**: A contractor hiring an electrical company to handle all the wiring and electrical installations for a building.

11. Turnkey Contract

- **Definition**: In a turnkey contract, the contractor is responsible for the entire project from design to construction and delivers the project to the owner in a finished, ready-to-use state.
- **Advantages**: Provides the owner with a completed, operational facility.
- **Disadvantages**: The owner has less control over the design and construction process.
- **Example**: A hotel or factory constructed by a contractor who also designs and hands over the fully operational building.

Types of Contract

12. Public-Private Partnership (PPP)

- **Definition**: A public-private partnership is a contract between a government entity and a private company to finance, build, and operate a public infrastructure project.
- **Advantages**: Helps fund public infrastructure projects without using public funds upfront.
- **Disadvantages**: Complicated structure, long-term commitments, and potential for political interference.
- **Example**: A toll road built by a private company under a government contract.

13. Framework Agreement

- **Definition**: A framework agreement is a long-term contract that sets out the terms under which individual projects or work orders can be issued during the contract period.
- **Advantages**: Allows for flexibility and easier procurement of future work under agreed terms.
- **Disadvantages**: Lack of clarity on the scope of specific future work.
- **Example**: A long-term agreement with a contractor for maintenance services over several years.

Breach of Contract

- A **breach of contract** is a violation of any of the agreed-upon terms and conditions of a binding **contract**.
- The **breach** could be anything from a late payment to a more serious violation such as the failure to deliver a promised asset.

Types of Contract Breaches

- One may think of a contract breach as either minor or material.
- A "minor breach" happens when you don't receive an item or service by the due date.
- For example, you bring a suit to your tailor to be custom fit. The tailor promises (an oral contract) that they will deliver the adjusted garment in time for your important presentation, but in fact, they deliver it a day later.

Types of Contract Breaches

- A "material breach" is when you receive something that is different from what was stated in the agreement.
- Say, for example, that your firm contracts with a vendor to deliver 200 copies of a bound manual for an auto industry conference.
- But when the boxes arrive at the conference site, they contain gardening brochures instead.

Types of Contract Breaches

- Further, a breach of contract generally falls under one of two categories:
- An "actual breach" when one party refuses to fully perform the terms of the contract
- An "anticipatory breach" when a party states in advance that they will not be delivering on the terms of the contract.

Legal Issues Concerning a Breach of Contract

- A plaintiff, the person who brings a suit to court claiming that there has been a breach of contract, must first establish that a contract existed between the parties.
- The plaintiff also must demonstrate how the defendant—the one against whom a claim or charge is brought in a court—failed to meet the requirements of the contract.

TENDER

- **Definition**: A **tender** is a formal invitation or offer to submit bids for the execution of a project or supply of goods/services. It involves the process of inviting contractors to bid for a construction project, and they provide their proposals, which include price quotes and project details.
- **Purpose**: The tendering process ensures transparency and fairness in selecting contractors for a particular job.
- **Example**: A government agency invites tenders for the construction of a new highway, asking contractors to submit their bids.

Earnest Money Deposit (EMD)

- **Definition**: **Earnest Money Deposit (EMD)** is a small amount of money submitted by a bidder along with their tender submission as a sign of good faith and to demonstrate their seriousness about executing the contract if selected.
- **Purpose**: The EMD serves to assure the owner that the bidder is genuinely interested. If the bidder withdraws after submitting the tender or fails to honor the terms of the tender, the EMD is usually forfeited.
- **Example**: A contractor submits an EMD of Rs. 10,00, 000 as part of their bid for a construction project, which will be refunded if they are not awarded the contract or after the contract is signed.

Tender Forms

- **Definition**: **Tender Forms** are standardized documents provided by the organization inviting the tender. They contain sections for bidders to fill out their bid details, including pricing, qualifications, scope of work, and technical specifications. The forms also include the terms and conditions governing the tender process.
- **Purpose**: Tender forms ensure that the bidding process is structured, and all bidders provide the necessary information in a uniform manner.
- **Example**: The tender form might include sections for the contractor's details, project timelines, and any specific requirements set by the owner, such as sustainability standards or safety protocols.

Tender Documents

- **Definition**: **Tender Documents** include all the documents that outline the scope, terms, conditions, specifications, and requirements of the project, which the bidders must follow. These documents form the basis of the contract between the employer and the contractor.
- **Purpose**: Tender documents provide all the necessary information for potential contractors to prepare and submit their bids accurately.
- **Components**:

- ✓ **Invitation to Tender**: The official notice of the tender.
- ✓ **Instructions to Bidders**: Guidelines on how to submit the bid.
- ✓ **General Conditions of Contract**: Terms and conditions governing the project.
- ✓ **Specifications**: Technical details about the project.
- ✓ **Drawings**: Architectural or engineering drawings related to the work.
- ✓ **Bill of Quantities**: A detailed list of materials and quantities required for the project.
- ✓ **Example**: A government agency issuing a set of tender documents for the construction of a public building, including drawings, materials specifications, and timelines.

Types of Tender

1. Open Tender:

- **Definition**: An open tender is where the invitation to tender is made publicly, and any qualified contractor can submit a bid.
- **Advantages**: Maximizes competition and usually results in the best price.
- **Disadvantages**: May attract unqualified or inexperienced contractors.
- **Example**: A government project for road construction that is open to all contractors.

2. Selective Tender:

- **Definition**: A selective tender is one where only pre-qualified contractors, who have been invited based on their reputation or experience, are allowed to submit bids.
- **Advantages**: Ensures that only qualified contractors participate.
- **Disadvantages**: Limits competition, potentially leading to higher costs.
- **Example**: Private company selects few well-established contractors to bid on the construction of a new office building.

Types of Tender

3. Negotiated Tender:

• **Definition**: In a negotiated tender, the client directly negotiates the contract terms and price with a specific contractor, often without inviting bids from multiple parties.

• **Advantages**: Fast and can result in a strong working relationship.

• **Disadvantages**: Limits competition and may result in a higher price due to lack of bidding.

• **Example**: A client selects a contractor they've previously worked with for a renovation project and negotiates the contract price.

4. Single-Stage Tender:

• **Definition**: A single-stage tender involves a straightforward bidding process where contractors submit their complete offers (including technical, financial, and other required documents) in one go.

• **Advantages**: Simpler and faster process.

• **Disadvantages**: May not allow enough time for bidders to thoroughly review the project.

• **Example**: A public sector project where all contractors submit their complete bids by a single deadline.

Types of Tender

5. Two-Stage Tender:

• **Definition**: In a two-stage tender, the process is divided into two stages. The first stage involves submitting preliminary bids based on design concepts or outlines. The second stage involves submitting a detailed bid based on a more refined design.

• **Advantages**: Allows contractors to clarify and refine their proposals, ensuring better value.

• **Disadvantages**: Longer and more complex process.

• **Example**: A construction project where the first stage involves conceptual designs, and the second stage involves more detailed, costed designs.

Comparative statements

- In contract law, comparative statements often refer to clauses or sections where the terms of a contract are compared with other documents, agreements, or situations.
- These types of clauses are used to clarify the relationship between the current contract and other relevant agreements, laws, or benchmarks.
- The goal of such clauses is to provide clarity and avoid ambiguity by comparing provisions or obligations in a way that makes the expectations and responsibilities of each party clear.

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Comparative statements

- Comparison with Previous Contracts
- Comparison with Industry Standards
- Comparison with Legal Requirements
- Comparison of Rights and Obligations
- Comparison of Performance Metrics or Results
- Comparison with Other Agreements in the Same Portfolio
- Comparison of Penalties or Liabilities
- Comparison of Financial Terms or Rates

Acceptance of Contract Documents

Acceptance of contract documents refers to the formal acknowledgment by the parties involved that they have reviewed, understood, and agreed to the terms of the contract. It involves a process that ensures both parties are aligned on the key provisions of the agreement, and that they are ready to move forward with the contractual relationship.

Key Aspects of Acceptance:

- **Signatures:** A common method of acceptance is the signing of the contract by all parties. This signifies that the parties agree to be bound by the terms.
- **Review and Negotiation:** Before signing, parties typically review the contract in detail, and they may negotiate certain terms, such as pricing, timelines, or specific conditions.
- **Acknowledgment of Amendments:** If the contract undergoes amendments after the initial drafting, the parties must accept these changes formally, either through a written acknowledgment or by incorporating the amendments into the final document.
- **Formal Acceptance Communication:** In some contracts, acceptance is communicated through a formal letter or document sent to the other party, indicating that they accept the terms as outlined.

Issue of Work Orders

Once the contract documents are accepted, the **work order** is issued. A work order is a formal request from the buyer or client to the service provider or contractor to begin a specific part of the work, typically under the terms of the contract.

Key Aspects of Work Orders:

- **Defining Specific Tasks:** A work order will often outline specific tasks or deliverables that need to be completed, such as construction work, maintenance, or provision of services.
- **Timeframe and Deadlines:** It will specify the timeline for the completion of the work, including milestones or deadlines.
- **Cost and Payment Terms:** A work order will include details about pricing, payment schedules, and any adjustments based on work done.
- **Acceptance and Confirmation:** The service provider typically acknowledges receipt of the work order and confirms that they will proceed under the agreed terms.
- **Scope of Work:** The work order often provides further detail on the specific scope of work, addressing any ambiguities in the contract or breaking down larger tasks into manageable units.

- **Process of Issuing Work Orders:**

1. **Drafting the Work Order:** Based on the terms in the accepted contract, the client (or buyer) drafts a work order, specifying the work to be done.
2. **Approval:** The work order is sent to the service provider or contractor for approval and acknowledgment.
3. **Execution:** Upon acceptance, the contractor or service provider begins executing the work or providing the service as outlined in the work order.
4. **Monitoring and Reporting:** Progress is monitored and reports may be generated to track the work's status against the agreed timeline and specifications.

Legal Implications & Importance

- **Binding Nature:** Once the contract is accepted and the work order is issued, both parties are legally bound to fulfill the obligations as specified. Failure to comply may lead to breach of contract claims.
- **Commencement of Work:** The issue of the work order signals the official start of the contractual performance. This is especially important for tracking timelines and ensuring that all terms are met within the agreed period.
- **Documentation:** Both the contract documents and work orders serve as official records. These documents help in resolving any disputes or clarifications about the work to be performed or the terms to be followed.

Differences between Contract Acceptance & Work Orders

- **Contract Acceptance** refers to the finalization of the overarching agreement, while **work orders** represent the initiation of specific tasks or projects under the contract.
- **Contract Acceptance** usually involves signing a formal document agreeing to all contract terms, whereas **work orders** are often issued for specific actions, deliveries, or services to be performed under those terms.
- **Contract Acceptance** may happen once (when the overall contract is signed), while **work orders** may be issued multiple times during the life of the contract, depending on the nature of the work.

Duties and liabilities in Contract

- In contract law, **duties** and **liabilities** are the obligations and responsibilities that each party assumes when entering into an agreement.
- They dictate what each party is required to do (or refrain from doing) during the performance of the contract, and they also determine the consequences for failing to meet those obligations.

Duties in a Contract

Duties refer to the specific actions, services, or obligations that each party must fulfill as part of the contract. These duties can arise from express terms (written or spoken agreements) or implied terms (based on common law or the nature of the relationship).

- **Types of Duties:**

1. **Performance Duty**:

- The primary duty in most contracts is the duty to perform. For example, a seller has the duty to deliver goods, and a buyer has the duty to pay for them.
- **Example:** In a construction contract, the contractor has the duty to build the structure as specified in the contract, while the client has the duty to pay according to the agreed terms.

Duties in a Contract

2. Duty of Good Faith and Fair Dealing:

- This duty requires parties to act honestly and fairly toward one another, avoiding deceptive practices or any actions that would undermine the contract's purpose.
- **Example:** A supplier must not withhold goods in a manner that harms the buyer's ability to use them or fulfill the contract's goals.

3. Duty to Inform:

- One party may have a duty to disclose relevant information to the other party. For example, in a contract for the sale of goods, the seller may have a duty to disclose defects in the product.
- **Example:** A contractor must inform the client of any issues or delays in meeting project timelines.

Duties in a Contract

4. Duty to Cooperate:

- Parties must cooperate to allow the contract to be performed as agreed. This duty often requires one party to assist the other in fulfilling their obligations.
- **Example:** In a lease agreement, the landlord has the duty to provide access to the property and maintain it in a habitable condition, while the tenant has the duty to pay rent.

5. Duty of Confidentiality:

- In some contracts, especially in business or employment contexts, one or both parties may be required to keep certain information confidential.
- **Example:** An employee may have a duty to keep proprietary company information confidential.

- **Breach of Duty:** If a party fails to perform their duties as specified in the contract, this can result in a **breach of contract**. The aggrieved party can seek **remedies** such as damages or specific performance.

Liabilities in a Contract

Liabilities refer to the legal responsibilities a party has when they fail to meet their duties under the contract. Liabilities typically arise from a breach of contract, but they can also arise from other causes, such as negligence or statutory obligations.

- **Types of Liabilities:**

1. **Contractual Liability**:

➢ A party is liable for failing to fulfill their obligations under the contract. This can result in compensatory damages, liquidated damages, or other agreed-upon remedies.

➢ **Example:** If a contractor fails to complete the construction on time, they might be liable to pay the client for any losses caused by the delay.

Liabilities in a Contract

2. Tort Liability:

- A party may also be liable for actions that cause harm or injury outside of the contract, even if the harm is not related to the breach of the contract. This can arise if a party's actions are negligent or intentional and cause harm to the other party or third parties.
- **Example:** If an employee working under a contract with a company negligently injures someone, the employer may be liable under tort law (such as negligence or vicarious liability).

3. Strict Liability:

- In some contracts, especially in cases involving dangerous activities or products, a party may be liable regardless of fault or negligence. This is known as **strict liability**.
- **Example:** A manufacturer may be strictly liable for defects in a product that cause injury, even if they were not negligent.

Liabilities in a Contract

4. Liability for Delay:

- Many contracts include specific penalties or liabilities for failure to meet deadlines. These are often referred to as **liquidated damages**, where the contract specifies the amount of damages to be paid in the event of a delay or breach.
- **Example:** A construction contract may include a clause requiring the contractor to pay a set amount of damages for each day they miss the project deadline.

5. Vicarious Liability:

- In certain cases, a party can be held liable for the actions of others under their control or employment, such as an employer being held liable for the actions of their employees while performing their job duties.
- **Example:** A company may be liable for the breach of contract committed by one of its employees if the employee was acting within the scope of their employment.

6. Liability for Misrepresentation:

- If a party makes false statements or misrepresents facts to induce the other party to enter into the contract, they may be liable for **misrepresentation**. Depending on the severity, the other party may be entitled to rescind the contract and seek damages.
- **Example:** If a seller knowingly provides false information about the condition of a product, they may be liable for misrepresentation.

- **Consequences of Liabilities:**

- **Damages**: A party in breach of the contract may have to pay for the actual loss caused by their failure to perform their obligations (compensatory damages), or a pre-agreed amount if specified in the contract (liquidated damages).
- **Specific Performance**: In some cases, the injured party may seek specific performance, which compels the breaching party to carry out their contractual duties, especially when monetary compensation is insufficient.
- **Termination**: A breach of duty or liability may give the aggrieved party the right to terminate the contract.

- **Distinction Between Duties and Liabilities**

- **Duties** are the responsibilities or tasks a party must perform under the contract, and they focus on actions that are required or expected by the parties involved.
- **Liabilities**, on the other hand, refer to the legal consequences and financial responsibilities resulting from a failure to perform those duties. Liabilities typically arise from breaches or failures to comply with the duties stipulated in the contract.

Termination of contract

- The **termination of a contract** refers to the legal ending or cancellation of a contract before its terms have been fully performed. This can occur for various reasons and can be voluntary or involuntary.

1. Mutual Agreement

- **Voluntary Termination**: Both parties agree to terminate the contract before its completion. This could be due to a variety of reasons, such as changed circumstances or the fulfillment of a party's needs.
- **Termination Clause**: Some contracts include a provision that allows the parties to terminate the contract by mutual consent.

Termination of contract

2. Performance Completion

- A contract can be terminated once all the terms and obligations specified in the contract have been performed by both parties.

3. Breach of Contract

- **Material Breach**: One party fails to perform a substantial part of the contract, making it impossible for the other party to fulfill their obligations or causing significant loss.
- **Minor Breach**: A small or partial breach that doesn't affect the contract's overall purpose. The non-breaching party may still terminate the contract, but often they will simply seek damages.
- **Anticipatory Breach**: If one party indicates, before the due date, that they will not perform their obligations, the other party may terminate the contract before the performance deadline.

Termination of contract

4. Frustration or Impossibility

- If performing the contract becomes impossible due to unforeseen events (e.g., natural disasters, war, or death of a key person), the contract may be terminated under the doctrine of **frustration**.
- If the performance of the contract becomes illegal or fundamentally altered, it can be terminated due to **impossibility of performance**.

5. Expiration of Term

- Contracts may also automatically terminate upon the expiration of the agreed-upon duration or at a specific date.

Termination of contract

6. Termination for Convenience

- In some contracts, especially in business or government contracts, one party may have the right to terminate the contract for convenience, meaning without any specific reason, by providing prior notice.

7. Termination by Notice

- Many contracts include provisions for terminating the agreement with a certain amount of notice (e.g., 30 days). This is often used in employment contracts or leases.

- **Legal Consequences of Termination:**

- **Damages**: The party terminating the contract may be required to pay damages to the other party for losses incurred due to the termination.
- **Restoration of Status Quo**: The parties may be required to return anything they received under the contract if it has been performed partially or not at all.

Completion certificate

A **Completion Certificate** is a formal document issued to confirm the successful completion of a contract, especially in the context of construction or service contracts. It is an important document that signifies the work has been completed in accordance with the terms, conditions, and specifications outlined in the contract.

- **Provisional Completion Certificate**: Sometimes issued when most of the work is done, but there are minor issues or defects to address.
- **Final Completion Certificate**: Issued when the work is fully complete, including any necessary corrections and after the employer is satisfied with the final outcome.

Quality control in Contract

- **Quality Control (QC)** in the context of a contract refers to the systematic process of ensuring that the work or products delivered under the contract meet the specified quality standards and requirements.
- Quality control is particularly important in industries such as construction, manufacturing, and services, where adherence to agreed-upon specifications and standards is critical to the success of the contract.
- In construction, quality control involves monitoring the workmanship, materials, and adherence to building codes and safety regulations. Inspections at various stages (e.g., foundation, framing, final inspection) help ensure that work meets the required quality standards.

Right of Contractor Refund of Deposit

- The **right of a contractor to refund of a deposit** refers to the contractor's entitlement to receive back any deposit they have paid under the terms of the contract, typically after the work is completed and certain conditions are met.
- This can arise in various contexts, including construction, service agreements, or product deliveries.
- A deposit in a contract is usually paid upfront by the contractor or service provider to secure a commitment from the other party (such as the employer or client) and can be held for various purposes, including securing performance or guaranteeing completion.

Key Points Regarding Refund of Deposit to Contractors

1. Nature of the Deposit:

- **Performance Bond or Security Deposit**: Often, a deposit is paid by the contractor as a form of security, ensuring that they will fulfill their contractual obligations. In this case, the deposit may be refundable once the contractor has satisfactorily completed the work.
- **Advance Payment**: Sometimes, a deposit is an advance payment made to the contractor, typically covering some initial costs for materials, labor, or other project-related expenses. The remainder of the payment is typically made upon completion or milestone achievement.

Key Points Regarding Refund of Deposit to Contractors

2. Conditions for Refund:

- The right of the contractor to receive a refund generally depends on the terms specified in the contract. Conditions for a refund might include:
  - **Completion of Work**: If the contractor has fulfilled all contractual obligations, completed the project to the agreed specifications, and the work is accepted by the employer, the deposit may be refunded.
  - **Defect Liability Period**: In some cases, a refund may be subject to a defect liability or warranty period. The employer may withhold the deposit until they are sure no defects or issues arise with the work.
  - **Contractual Clauses**: The contract may specify that the deposit will only be refunded after the work is inspected, or when specific milestones have been achieved, or after a certain period (such as 30 or 60 days post-completion).

Key Points Regarding Refund of Deposit to Contractors

3. Grounds for Withholding Deposit:

- The employer or client may have the right to withhold all or part of the deposit under certain conditions, such as:
  - **Incomplete Work**: If the contractor has not completed the work as per the contract, the deposit may be withheld until the outstanding work is done.
  - **Defects**: If there are defects or substandard work that needs to be rectified, the employer may hold back the deposit until the contractor corrects these issues.
  - **Contract Breach**: If the contractor breaches the contract terms (e.g., delays, poor workmanship), the employer may have the right to retain the deposit as compensation for damages.

Key Points Regarding Refund of Deposit to Contractors

4. Timing of Refund:

- The contract will usually specify when the refund is due. This could happen:
  - ➢ After a final inspection and acceptance of the work.
  - ➢ After the expiration of the defect liability period or warranty period.
  - ➢ Upon completion of all contractual conditions (e.g., final approvals or certifications).

Key Points Regarding Refund of Deposit to Contractors

5. Disputes Over Refund:

- If a contractor feels that the deposit is wrongfully withheld or there is a delay in receiving the refund, they may seek resolution through:
    - **Negotiation**: The contractor may try to negotiate directly with the client to resolve any issues regarding the deposit refund.
    - **Mediation or Arbitration**: If the contract contains a dispute resolution clause, the parties may be required to resolve the matter through mediation or arbitration.
    - **Legal Action**: If all else fails, the contractor may pursue legal action, depending on the nature of the contract and the laws in the relevant jurisdiction.

Key Points Regarding Refund of Deposit to Contractors

6. Security Deposits in Specific Contracts:

- In construction contracts, security deposits are commonly required to ensure that the contractor performs the work and returns the site in the agreed-upon condition. These deposits are typically refundable, minus any deductions for damages or unfulfilled contractual obligations.
- In service contracts, the employer or client may ask for a deposit to ensure that the contractor will complete the service to satisfaction, and the deposit is refundable once the service is provided.

Administrative Approval

- **Administrative approval** in a contract refers to the formal approval process typically required by one party, often the employer or client (e.g., a government agency, corporation, or project owner), before proceeding with certain aspects of a contract or its execution.
- This approval is part of the internal administrative procedures and ensures that the work, project, or deliverables meet the requirements set out in the contract, are consistent with budgetary constraints, and comply with relevant policies or regulations.

Technical Sanction

- **Technical Sanction** in a contract refers to the formal approval or authorization of technical aspects of the project, typically required before the execution of certain work or the release of funds.
- It is a key process in ensuring that the project design, specifications, and execution plans meet the required technical standards, and that they align with the objectives, safety, and regulatory requirements of the contract.
- Technical sanction ensures that the contractor and client (or employer) are on the same page regarding the technical scope of the project.

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Nominal Muster Roll (NMR)

- A **Nominal Muster Roll (NMR)** is an official document or register used in labor-intensive projects, particularly in construction and government contracts, to track and record the attendance, wages, and other details of workers employed on the site. It serves as an important tool for ensuring proper labor management, compliance with labor laws, and timely payment of wages.