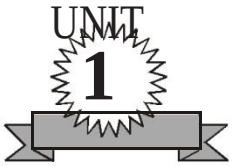
Estimation and Costing

INTRODUCTION TO THE SUBJECT



1.1 DEFINITION OF ESTIMATING AND COSTING

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 avilable are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following require-ment are necessary for preparing an estimate.

a) Drawings like plan, elevation and sections of important points.

b) Detailed specifications about workmenship & properties of materials etc.

c) Standard schedule of rates of the current year.

1.2 NEED FOR ESTIMATION AND COSTING

1. Estimate give an idea of the cost of the work and 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 arange 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.

1.3 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

1.4 DATA REQUIRED TO PREPARE AN ESTIMATE

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

1.4.1 DRAWINGS

If the drawings are not clear and without complete dimensions the prepa-ration of estimation become very difficult. So, It is very essential before prepar-ing an estimate.

1.4.2. 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 vari-ous items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

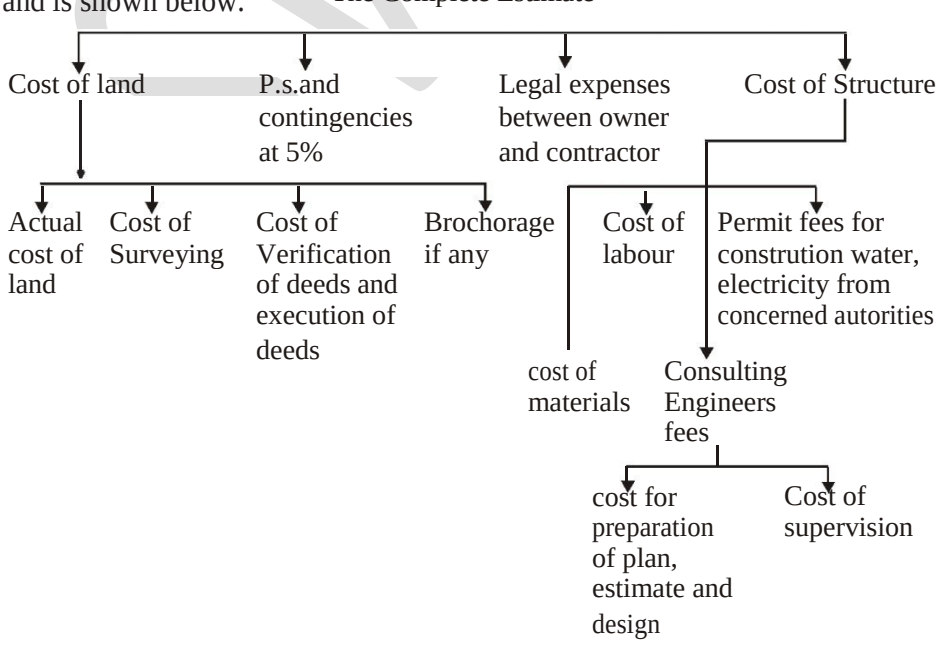
1.4.3. RATES:

For preparing the estimate the unit rates of each item of work are re-quired.

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 labour, skilled or unskilled of masons, carpenters, Mazdoor, etc.,

1.5 COMPLETE ESTIMATE:

Most of people think that the estimate of a structure includes cost of land, cost of materials and labour, But many other direct and indirect costs included and is shown below.



1.6 LUMPSUM:

While preparing an estimate, it is not possible to workout in detail in case of petty items. Items other than civil engineering such items are called lumpsum items or simply L.S.Items.

The following are some of L.S. Items in the estimate.

1. Water supply and sanitary arrangements.
2. Electrical installations like meter, motor, etc.,
3. Architectural features.
4. Contingencies and unforeseen items.

Ingeneral, certain percentage on the cost of estimation is alloted for the above L.S.Items

Even if subestimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

1.7 WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled su-pervisors, work assistance, watch men etc., are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount alloted towards the work charged establishment. that is, establishment which is charged directly to work. an L.S.amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

EXERCISE

Short Answer Questions

1. State the requirements of an estimate?
2. Briefly Explain need for estimation?
3. What is work charged establishment?

Chapter 2 MEASUREMENT OF MATERIALS AND WORKS

2.1 UNITS OF MEASUREMENTS:

The units of measurements are mainly categorised 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:

a) Single units work like doors, windows, trusses etc., are expressed in numbers.

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

c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., are expressed in square meters (m^2)

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

[BASED ON IS 1200 REVISED]

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 founda-tion 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, Sun-shade	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 pro-portion 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.

2.2 RULES FOR MEASUREMENT :

The rules for measurement of each item are invaribly 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, labour, 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.
   i) Linear measurement shall be measured to the nearest 0.01m.
   ii) Areas shall be measured to the nearest 0.01 sq.m
   iii) Cubic contents shall be worked-out to the nearest 0.01 cum
4. Same type of work under different conditions and nature shall be measured separately under separate items.
5. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.
6. In case of masonary (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:
   a) from foundation to plinth level
   b) from plinth level to First floor level
   c) from Fist floor to Second floor level and so on.

2.3 METHODS OF TAKING OUT QUANTITIES:

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., canbe workout by any of following two methods:

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

a) Long wall-short wall method:

In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall. To get the

Measurement of Materials and Works 8 length of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of short wall measured into in and may be found by deducting half breadth from its centre line length at each end. The length of long wall usually decreases from earth work to brick work in super structure while the short wall increases. These lengths are multiplied by breadth and depth to get quantities.

b) Centre line method:

This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with mainall, the centre line length gets reduced by half of breadth for each junction. such junction or joints are studied caefully while calculating total centre line length.The estimates prepared by this method are most accurate and quick.

c) Partly centre line and partly cross wall method:

This method is adopted when external (i.e., alround the building) wall is of one thickness and the internal walls having different thicknesses. In such cases, centre line method is applied to external walls and long wall-short wall method is used to internal walls. This method suits for different thicknesses walls and diffeent level of foundations. Because of this reason, all Engineering departments are practicing this method.

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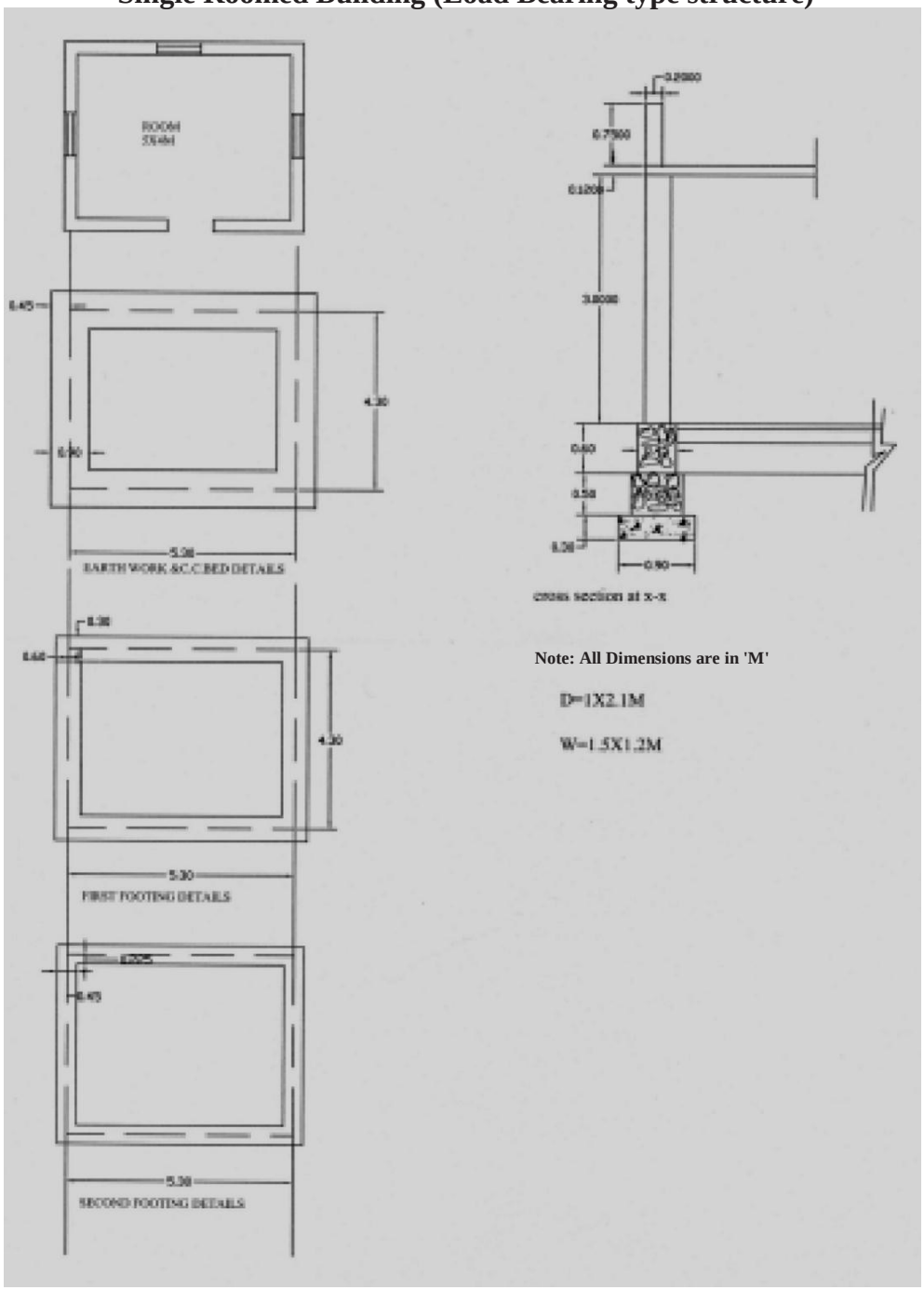
P.B.-1: From the Drawing given below determine (a) Earth work exca-vation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6).

Single Roomed Building (Load Bearing type structure)



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Long wall - Short wall Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation for foundation**						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement		**=**	$\frac{5.76+5.184}{4}$	**=**	**10.94 m_3**	
4.	**Brick masonary** with CM (1:6) for super structure						
	a) Long Wall	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
					Total	**17.28**	**m^3**

Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation 5.3 4.3	1	19.2	0.9	1.4	24.192	**m^3** L=2(5.3+4.3)=19.2
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944**	**m^3**
4.	**Brick masany** with CM (1:6) for super structure	1	19.2	0.3	0.3	17.28	**m^3**

EXERCISE

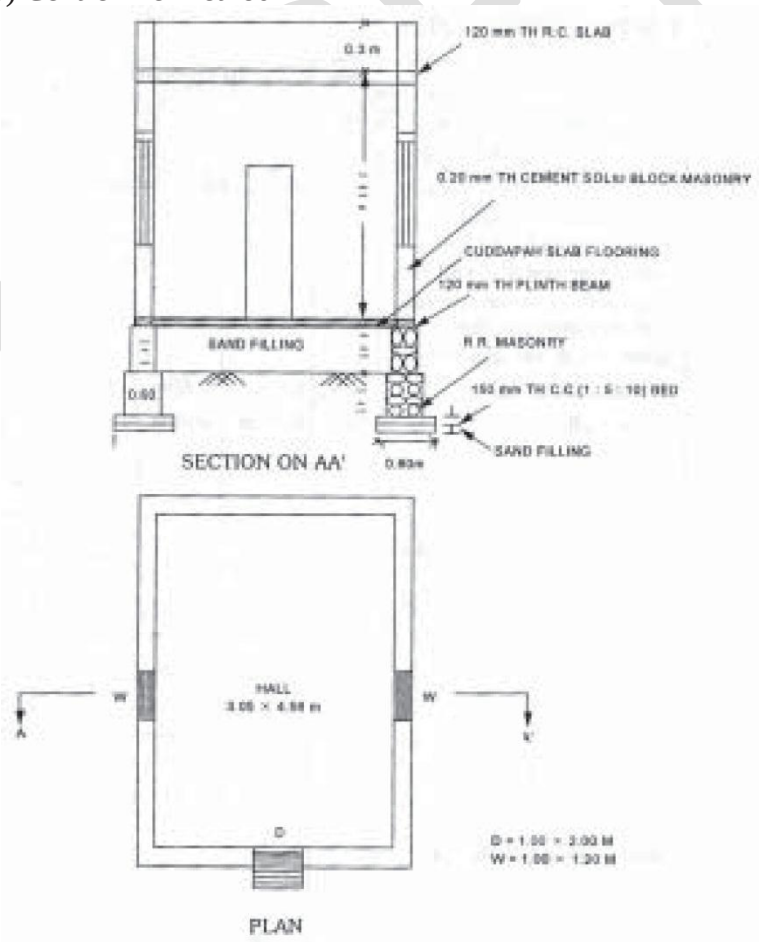
I. Short Answer Questions

1. List the difference between centre line method and long wall-short wall method of taking out measurements.
2. What are the rules to be followed while taking the mesurements?
3. Mension the units for the following items.

   a) flooring b) R.R.Masonry c) Plastering for pointing d) Damp proof course e) R.C. sunshade (Sepcified width and thickness)

II. Essay type questions

1. From the Drawing given below determine (a) Earth work excavation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6). by
   (a) longwall - short wall method
   (b) Centre line Method



Chapter 3

TYPES OF ESTIMATES

3.1 DETAILED ESTIMATE:

The preparation of detailed estimate consists of working out quantities of various items of work and then determine the cost of each item. This is prepared in two stages.

i) Details of measurements and calculation of quantities:

The complete work is divided into various items of work such as earth work concreting, brick work, R.C.C. Plastering etc., The details of measure-ments are taken from drawings and entered in respective columns of prescribed proforma. the quantities are calculated by multiplying the values that are in num-bers column to Depth column as shown below:

Details of measurements form

S.No.	Description of Item	No	Length (L) m	Breadth (B) m	Depth/ Height (D/H)m	Quantity	Explanatory Notes

ii) Abstract of Estimated Cost :

The cost of each item of work is worked out from the quantities that already computed in the detals measurement form at workable rate. But the total cost is worked out in the prescribed form is known as abstract of estimated form. 4%of estimated Cost is allowed for Petty Supervision, contingencies and Unforeseen items.

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ABSTRACT OF ESTIMATE FORM

Item No.	Description/ Particulars	Quantity	Unit	Rate	Per (Unit)	Amount

The detailed estimate should accompained with

i) Report

ii) Specification

iii) Drawings (plans, elevation, sections)

iv) Design charts and calculations

v) Standard schedule of rates.

3.1.1.Factors to be consisdered While Preparing Detailed Esti-mate:

i) **Quantity and transportation of materials:** For bigger project, the re-quirement of materials is more. such bulk volume of mateials will be pur-chased and transported definitely at cheaper rate.

ii) ***Location of site:*** The site of work is selected, such that it should reduce damage or in transit during loading, unloading, stocking of mateirals.

iii) ***Local labour charges:*** The skill, suitability and wages of local laboures are consideed while preparing the detailed estimate.

3.2 DATA:

The process of working out the cost or rate per unit of each item is called as Data. In preparation of Data, the rates of materials and labour are obtained from current standard scheduled of rates and while the quantities of materials and labour required for one unit of item are taken from Standard Data Book (S.D.B)

3.2.1 Fixing of Rate per Unit of an Item:

The rate per unit of an item includes the following:

1) ***Quantity of materials & cost:*** The requirement of mateials are taken strictly in accordance with standard data book(S.D.B). The cost of these includes first cost, freight, insurance and transportation charges.

ii) ***Cost of labour:*** The exact number of labourers required for unit of work and the multiplied by the wages/ day to get of labour for unit item work.

iii) ***Cost of equipment (T&P):*** Some works need special type of equip-ment, tools and plant. In such case, an amount of 1 to 2% of estimated cost is provided.

iv) ***Overhead charges:*** To meet expenses of office rent, depreciation of equipment salaries of staff postage, lighting an amount of 4% of estimate cost is allocated.

3.3 METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:

Preliminary or approximate estimate is required for studies of various as-pects of work of project and for its administrative approval. It can decide, in case of commercial projects, whether the net income earned justifies the amount invested or not. The approximate estimate is prepared from the practical knowl-edge and cost of similar works. The estimate is accompanied by a report duely explaining necessity and utility of the project and with a site or layout plan. A percentage 5 to 10% is allowed for contingencies. The following are the meth-ods used for preparation of approximate estimates.

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

a) Plinth area method: The cost of construction is determined by multiplying plinth area with plinth area rate. The area is obtained by multiplying length and breadth (outer dimensions of building). In fixing the plinth area rate, carefull observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, hight of building, roof, wood work, fixtures, number of storeys etc.,

As per IS 3861-1966, the following areas include while calculating the plinth area of building.

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m^2, lifts, airconditionsing ducts etc.,

c) Area of barsati at terrace level:

Barsati means any covered space open on one side constructed on one side constructed on terraced roof which is used as shelter during rainy season.

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.

b) Unenclosed balconies.

c) Architectural bands, cornices etc.,

d) Domes, towers projecting above terrace level.

e) Box louvers and vertical sunbreakers.

b) Cubical Contents Method: This method is generally used for multistoreyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of building is obtained by Length x breadth x depth or height. The length and breadth are measured out to out of walls excluding the plinth off set.

The cost of string course, cornice, carbelling etc., is neglected.

The cost of building= volume of buildings x rate/ unit volume.

c) Unit Base Method: According to this method the cost of structure is deter-mined by multiplying the total number of units with unit rate of each item. In case schools and colleges, the unit considered to be as 'one student' and in case of hospital, the unit is 'one bed'. the unit rate is calculated by dividing the actual expenditure incured or cost of similar building in the nearby locality by the num-ber of units.

Problems on Plinth Area Method

Example 3.1: Prepare an approximate estimate of building project with total plinth area of all building is 800 sqm. and from following data.

i) Plinth area rate Rs. 4500 per sqm
ii) Cost of water supply @7½%of cost of building.
iii) Cost of Sanitary andElectrical installations each @ 7½% of cost of building.
iv) Cost of architectural features @1% of building cost.
v) Cost of roads and lawns @5% of building cost.
vi) Cost of P.S. and contingencies @4% of building cost. Determine the total cost of building project.

Solution :

Data given:

Plinth area = 800m^2.

Plinth area rate = Rs. 4500 per Sqm.

∴ Cost of building = 800 x 4500 = Rs. 36,00,000=00

Add the cost of the water supply charges @7½%

$$= \frac{36,00,000 \times 7.5}{100} = 2,70,000\ 00$$

Add the Cost of Sanitary and electrical installation @ 15%

$$= \frac{36,00,000 \times 15}{100} = 5,40,000\ 00$$

Add the cost of archetectural features @1%

$$= 36,00,000 \times 1$$

$$\frac{}{100} = 36,000\ 00$$

$$36,00,000 \times 5 = 1,80,000\ 00$$

Add the cost of Roads Lawns @ 5%=

$$\frac{}{100}$$

Add the Cost of P.S. and contingencies @ 4%

$$= \frac{36,00,000 \times 4}{100} = 1,44,000\ 00$$

Total Rs. 47,70,000=00

Assume Add supervision charges 8% on overall cost

$$= 47,70,000 \times \frac{8}{100} = 3,81,600 = 00$$

Grand Total Rs. 51,51,600=00

Example 3.2 : The plinth area of an appartment is 500 sqm. Detemine the total cost of building from the following data:

a) Rate of construction = Rs.1230/--per m^3.

b) The height of appartment = 16.25 m

c) Water Supply, Sanitary and Electrical installations each at 6% of building cost.

d) Architectural appearance @ 1% of building cost.

e) Unforeseen item @2% of Building cost.

f) P.S. and contingencies @4% of building.

Solution :

a) The Cost of building = cubic content x cubic rate

= 500 ×16.25 ×1230 = Rs. 99,93,750/-

b) Provision for water supply, sanitary and

Electrical installations water supply and sanitation each @ 6%

$$= \frac{99,93,750 \times 18}{100} = Rs.17,98,875/-$$

i.e total percent = 3×6 = 18% building cost

c) Architectural appearance @1%= $\frac{99,93,750 \times 1}{100}$ = Rs. 99,937/-

d) Unforeseen items @2% = Rs. 1,99,875/-

e) P.S. and contingenies @4% = Rs. 3,99,750/-

Total = Rs.1,24,92,187/-

Sundries 7,813/-

Total cost of the building project = Grand Total = Rs.1,25,00,000/-

Example 3.3: The plinth area and plinth area rate of a residential building are 100 sqm and Rs. 5000/- respectively. Determine the total cost of building as-suming suitable provisions.

Solution :

Cost of building = 100 x 5000 = Rs.5,00,000

Cost of water supply and

sanitary fittings @15% = $\frac{5,00,000 \times 15}{100}$ = Rs. 75,000

Cost of Electrification @7½% = $\frac{5,00,000 \times 7.5}{100}$ = Rs. 37,500

Cost of Roads & Lawns @5%= $\frac{5,00,000 \times 5}{100}$ = Rs. 25,000

Cost of P.S.& contingencies@4%= $\frac{5,00,000 \times 4}{100}$ = Rs. 20,000

Total Cost Rs. 6,57,500/-

Example 3.4 : Prepare an approximate Extimate of a proposed building from the follwoing?

Plinth area of the building = 226 sqm.

Cost of the structure = 2500 per sqm.

Water supply and sanitary arangements = 12½%

Electrification =7%

Fluctuation of rates = 5%

petty supervision charges = 3%

sol: Cost of Building = 226x 2500 = Rs.5,65,000

Water supply & Sanitory arrangements @ 12½ %

$= \frac{5,65,000 \times 12.5}{100}$ = Rs. 70,000

Electrification @7% $= \frac{5,65,000 \times 7}{100}$ = Rs. 39,550

Fluctuation of rates 5% = $\frac{5,65,000 \times 5}{100}$ = Rs. 28,250

Pettysupervision charges 3%= $\frac{5,65,000 \times 3}{100}$ = Rs.16,950

Total Cost Rs. = 7,19,750.00

Problem on Cubical content Method:

Example 3.5 : Prepare the rough estimate for a proposed commertial comples for a municipal corporation for the following data.

Plinth Area = 500m^2/floor
Ht of each storey = 3.5m
No.of storeys = G+2
Cubical content rate = Rs. 1000/m^3

Provided for a following as a pecentage of structured cost

a) water supply & Sanitary arrangement -8%
b) Electrification -6%
c) Fluctuation of rates - 5%
d) Contractors profit - 10%
e) Petty supervision & contingencies - 3%

Sol : Cubical content = No.of storeys (Plinth Area x height of each storey) = 3(500x3.5) = 5250m^3

Structural cost = Cubical content x cubical content rate
= 5250 x 1000 = 52.5 Lakhs

other provisons:-

a) Water supply and sanitation = 52.5x8/100 = Rs.4.2 Lakhs
b) Electrification = 52.5 x 6/100 = Rs.3.15 lakhs
c) fluctuation of rates = 52.5 x 5/100 = Rs.2.625
Total = Rs. 9.975 Lakhs
Structural cost = Rs. 52.500 Lakhs
Total = Rs.62.475 Lakhs

d) P.S./& contingencies = 62.475 x 3/100 = Rs.1.874 Lakhs
e) Contractors Profit = 62.475 x 10/100 = Rs.6.247 Lakhs

Total Cost = Rs.70.596 Lakhs

Problems on Unit Base Method:

Example 3.6: Prepare an approximate estimate or rough cost estimate of a hospital building for 50 beds. The cost of construction altogether for each bed is Rs. 60,000/-. Determine the total cost of hospital building.

Solution:

No. of beds = 50

Cost of construction = Rs. 60,000/-

Total Cost of Hospital building = 50x 60,000= **Rs. 30,00,000/-**

Example 3.7: To prepare the rough cost estimate of a hostel building which accommodate 150 students. The cost of construction including all provisions is Rs. 15,000/- per student. Determine total cost of building.

Solution :

No.of students= 150

Cost of construction including all L.S. provisions = Rs. 15,000/-Total Cost of hostel building =150 x 15000 = Rs. 22,50,000/-(Rupees twenty two lakhs, fifty thousands only)

EXERCISE

I. SHORT ANSWER QUESTIONS:

1. List the factors to be consider while preparing detailed estimate and explain breifly?
2. What are the differences between plinth area method and Unit base method?
3. List the requirements of data preparation.

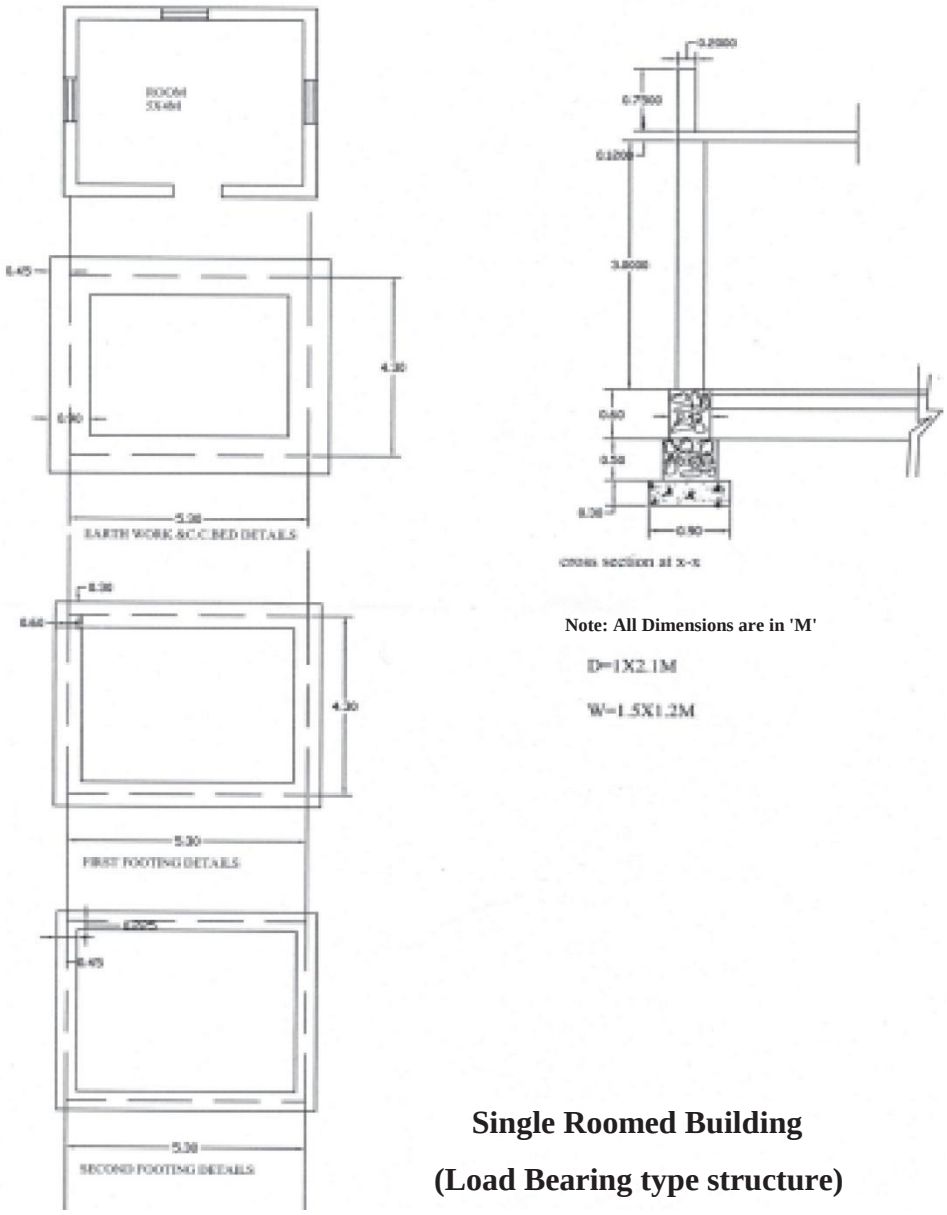
II ESSAY TYPE QUESTIONS :

1. Prepare the approximate cost of building project (group HOuseing)
   i) No.of houses = 150
   ii) Plinth area of each dwelling = 600m^2
   iii) Plinth area rate = Rs. 5,000/-per m^2
   iv) Cost of water supply & sanitary arrangements @12½%
   v) Electrification at 7½% of cost of builing.
   vi Cost of roads & Lawns @5%
   vii) Cost of P.S.& contingencies @4%
2. Prepare a rough cost estimate of a cinema theatre which accommodate 1700 seats. The cost of construction including all provisions is Rs.6000/- per seat.
3. What are the methods of preparation of approximate estimates and explain briefly.

Chapter 4 DETAIL & ABSTRACT ESTIMATES OF BUILDINGS

Example 1: From the given figure below calculate the detailed and abstract estimate for the single roomed building (Load bearing type structure) by

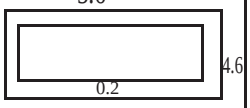
a) long wall & short wall method (b) Centre Line Method



Single Roomed Building

(Load Bearing type structure)

23 ***Estimation and Costing*** **a) Long wall - Short Method**

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement						
			=	5.76+5.184	=	**10.94 m^3**	
4.	**Brick masonary** with CM (1:6) for super structure						
	a) Long Walls	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
	c) for parapetwall						
							
	a) Long Walls	2	5.6	0.2	0.75	**1.68**	
	b) Short walls	2	4.4	0.2	0.75	**1.32**	
					Total	**20.28**	**m^3**

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S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m^3**
	Net Brick Masonry		**=**	**20.28 - 2.25 =**		**18.03m_3**	
5.	**R.C.C. (1:2:4) for**						
	a) Roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) Beams						
	i) Long beams	2	5.6	0.3	0.3	1.008	
	ii) short beams	2	4.0	0.3	0.3	0.720	
					Total	**5.074**	**m^3**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85
8	**Flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	**m^2**
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	L= 2(5.0+4.0) = 18 .0
	Out side						
	For walls	1	20.4	--	3.87	61.2	L=2(5.6+4.6)=20.4
	Basement outside	1	21.6	--	0.6	12.96	H=3.0+0.12+0.75=3.87
	Parapet wall						(upto parapet wall)
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**146.18**	**m^2**
	Doors	1x2	1.0	--	2.1	4.2	
	Windows	3x2	1.5	--	1.2	10.8	
						15.0	**m^2**
	Net Plastering	**= 146.18 - 15.0**				**= 131.18**	**m^2**

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
10	Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	**m^2**
11	White Washing with two coats with Janatha cement						
	Same as quantity of plastering for walls and ceiling					151.18	(= 131.18+20= 151.18)
12.	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					151.18	(=131.18+20)151.18)
13	Supply & Fixing of best country wood for						
	a) Doors	1				1 No.	
	b) Windows	3				3No.	
14	Painting with ready mixed synthetic enamil paits with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	**m^2**
15	Petty supervision and contingencies at 4% and rounding off.						

Detail & Abstract Estimates of Buildings 26

b) Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work exevation** for foundation	1	19.2	0.9	1.4	24.192	**m³**
	5.3 / 4.3						L=2(5.3+4.3)=19.2
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184	**m³**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944**	
4.	**Brick masonry** with CM (1:6) for super structure	1	19.2	0.3	3.0	17.28	**m³**
	For parapet wall	1	20.0	0.2	0.75	3.00	
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m³**
	Net Brick Masony	**=**	**17.28**	**+3.0-2.25**	**=**	**18.03**	**m³**
5.	**R.C.C. (1:2:4) for**						
	a) roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) beams	1	19.2	1.3	0.3	1.728	
					Total	**5.074**	**m³**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85

8.	**flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	
	Out side						
	For walls	1	20.4	--	3.87	61.2	
	Basement outside	1	21.6	--	0.6	12.96	
	Parapet wall						
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**146.18**	**m** ^{2}
	Doors	1x 2	1.0	--	2.1	4.2	L=5.0-0.075-0.075=4.85
	Windows	3x 2	1.5	--	1.2	10.8	B= 4.0-0.075-0.075=3.85
						15.0	**m** ^{2}
	Net Plastering =		**146.18-15**	**=**		**131.18**	**m** ^{2}
10	Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	**m** ^{2}
11	White Washing with two coats with Janatha cement						
	Same as quantity of plastering for walls and ceiling					151.18	**m** ^{2} (131.18+20=151.18)
12.	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					151.18	**m** ^{2}
13	Supply & Fixing of best country wood for						
	a) Doors	1				1 No.	
	b) Windows	3				3No.	

Detail & Abstract Estimates of Buildings 28

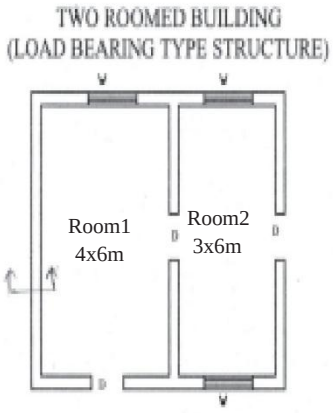
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
14	Painting with ready mixed synthetic enamil paints with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	**m^2**
15	Petty supervision and contingencies at 4% and rounding off.						

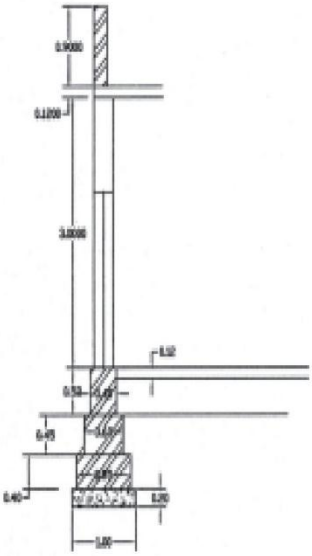
Abstract estimate of single roomed building (load bearing structure)

S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excaation	24.192	m^3	465	$10m^3$	1125.00
2.	Cement concrete(1:4:8)	5.184	m^3	4545	$1m^3$	8009.30
3.	RR.masonry in C.M.(1:5)	10.94	m^3	1391	m^3	15217.50
4.	Sand filling in basement	8.96	m^3	195.20	$10m^3$	175.00
5.	Brick masonry in country bricks of standard size in CM(1:8)	18.03	m^3	2291	m^3	41306.73
6.	R.C.C. (1:2:4) for lintels, beams etc.	1.984	m^3	6030	m^3	11963.52
7.	R.C.C.(1:2:4) for slabs,	3.09	m^3	6030	m^3	18633.00
8.	Cement concrete (1:5:10) for flooring	1.86	m^3	1452	m^3	2700.72
9.	Supplying and fixing of country wood for doors.	2.1	m^2	1650	m^2	3465.00
10.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
11	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	151.18	m^2	582	$10m^2$	8798.70
12	White washing with best shell lime	151.18	m^2	116	$10m^2$	1753.68
13	Flooring with spartek tiles set in C.M (1:3)	20	m^2	4230	$10m^2$	8460.00
14	Painting with ready mixed enamel paint	16.875	m^2	335	$10m^2$	565.31
					Total	**134593.46**
15	Povision for water supply and sanitary arangements @12.5%					16824.18
16	Provision for electrification @7.5%					10094.50
17	Povision for architectural appearance @2%					2691.86
18	Provision for unforeseen items 2%					2691.86
19	Provision for P.s.and contingencies @4%					5383.73
					Grand Total Rs.	**172279.65**

Detail & Abstract Estimates of Buildings 30

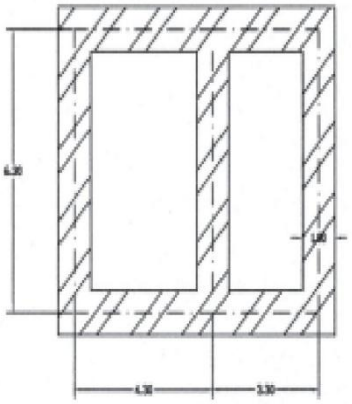
Example :2 :-From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method



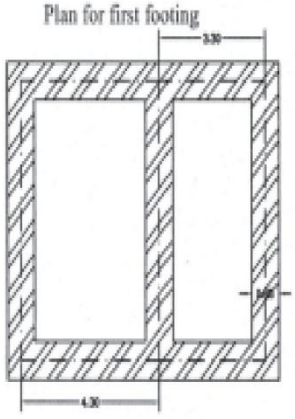


D=1x2.1
W=1.5x1.2

Note: All Dimensions are in 'M'



Plan for first footing

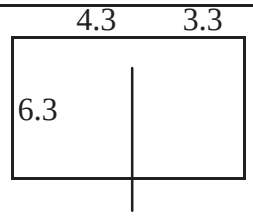
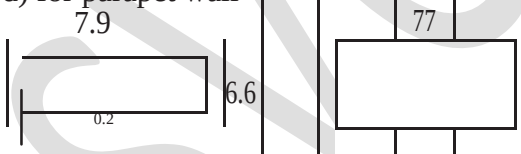


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	8.6	1.0	1.05	18.05	L=7.6+0.5+0.5=86
	b) Short walls	3	5.3	1.0	11.05	16.70	L=6.3-0.5-0.5=5.3
					Total	**34.75**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	8.6	1.0	0.2	3.44	
	b) Short walls	3	5.3	1.0	0.2	3.18	
					Total	**6.62**	**m^3**
3.	**Brick masanory for** footings with CM (1:4)						
	first footing						
	a) Longwalls	2	8.45	0.85	0.4	5.746	L=7.6+0.425+0.425=8.45
	b) Short walls	3	5.45	0.85	0.4	5.560	L=6.3-0.425-0.425=5.45
	2nd fooring						
	a) Long walls	2	8.20	0.6	0.45	4.428	L=7.6+0.3+0.3=8.2
	b) short walls	3	5.70	0.6	0.45	4.617	L=6.3-0.3-0.3=5.7
	ii) for base ment	2	8.00	0.4	0.4	2.560	L=7.6+0.2+0.0=8.0
	long walls	3	5.90	0.4	0.4	2.832	L=6.3-0.2-0.2= 5.9
	short walls						
	iii) for super structure	2	7.90	0.3	3.0	14.22	L=7.6+0.15+0.15=7.9
	long walls	3	6.00	0.3	3.0	16.20	L=6.3-0.15-0.15=6.0
	short walls						
	iv) Parapet wall						
	7.9 / 6.6 / 0.2						
	a) long walls	2	7.90	0.2	0.70	2.212	
	b) Shot walls	2	6.20	0.2	0.70	1.736	
					Total	**60.11**	
	Deductions for openings						
	Doors	3	1.0	0.3	2.1	1.89	
	Windows	3	1.5	0.3	1.2	1.62	
	Lintels over doors	3	1.20	0.3	0.10	0.108	
	windows	3	1.70	0.3	0.10	0.153	
	Net B.M.=60.11-377=56.34m^3				Total	**3.771**	

Detail & Abstract Estimates of Buildings 32

4	RCC(1:2:4)for						
	a) roof slab	1	7.9	6.6	0.12	6.256	
	b) for lintles over doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	0.153	
	c) beams	1	33.8	0.3	0.3	3.042	
					Total	**9.298**	m^3
5.	Plastering for walls	1	20.0	--	3.0	60.00	L=2(4.0+6.0)=20
	a) Inside room1	1	18.0	---	3.0	54.00	
	room2	1	29.0	---	3.0	87.00	L=2(7.9+6.6)=29
	b) out side	1×2	28.2	---	0.70	39.48	L=2(7.7+6.4)=28.2
	Parapet wall(Sides)	1×1	28.2	0.20	--	5.64	
					Total	**246.12**	m^2
	Deductions						
	a) doors	3×2	1.0	---	2.10	12.6	
	b) windows	3×2	1.5		1.20	10.8	
					Total	**23.4**	m^2
	Net Plastering		**= 246.12- 23.4 =**			**222.72**	m^2
6.	flooring with cuddapah slab in cm (1:3)						
	Room1	1	4.0	6.0	---	24	
	Room2	1	3.0	6.0	---	18	
					Total	**42**	m^2
7	Plastering for ceiling =same as flooring					42	
8	White washing = same as plastering for walls & Ceiling						
						=222.72 +42 = 264.72	m^2
9	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					264.72	m^2
10	Supply & Fixing of best country wood for						
	a) Doors	3				3Nos.	
	b) Windows	3				3 Nos	
11	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--		14.175	
	b) Windows	2¼x3	1.5	--		11.13	
						25.305	m^2
12	2% unforeseen items						
13	4% P.S& contingencies and round off.						

33 ***Estimation and Costing*** **b) Centre Line Method**

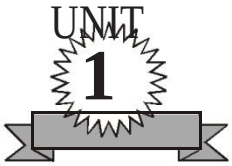
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
							
	Total centre line length =(4.3+3.3)2+6.3x3=34.1m						
1.	**Earth work excavation**	1	33.1	1.0	1.05	34.75	L=34.1-2x1/2=33.1
2.	**C.C.(1:4:8) bed for foundation**	1	33.1	1.0	0.20	6.62	**m** ^{3}
3.	**Brick masonry with CM(1:4)**						
	a) for foundation						
	i) first footing	1	33.25	0.85	0.40	11.30	L=34.1-0.85 =33.25
	ii) 2nd footing	1	33.50	0.60	0.45	9.045	L=34.1-0.6 x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4 x2/2
	c) for super structure	1	33.80	0.30	3.0	30.42	L=34.1-0.3x2/2
	d) for parapet wall						
						6.4	
	Total centre line length = 2(7.7+6.4) =28.2	1	28.2	0.2	0.70	3.948	
					Total	**60.10**	**m**^{3}
	Deductions for						
	Openings Doors	3	1.0	0.3	2.1	1.89	
	windows	3	1.5	0.3	1.2	1.62	
	Lintels Doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	1.153	
					Total	**3.771**	**m** ^{3}
	Net B.M.=60.11-	3.771=56.34 m	3				
4.	Quantity of R.C.C.Roof, flooring, White washing is method.	Plastering same	for as	walls Longwall	and cealing &Short	and wall	

Detail & Abstract Estimates of Buildings 34 Abstract estimate of two roomed building (Load bearing type structure)

S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	34.75	m^3	465	$10m^3$	1615.90
2.	Cement concrete(1:4:8)	6.62	m^3	1545	$1m^3$	10228.00
3.	Sand filling in basement	12.036	m^3	195.20	$10m^3$	235.00
4.	Brick masonry in country Bricks of standard size in CM(1:8)	56.34	m^3	2291	m^3	129075.00
5.	R.C.C. (1:2:4) for lintels, beams etc.	3.303	m^3	6030	m^3	19918.00
6.	R.C.C.(1:2:4) for slabs,	6.26	m^3	6030	m^3	37748.00
7.	Cement concrete (1:5:10) for flooring	4.2	m^3	1452	m^3	6098.40
8.	Supplying and fixing of country wood for doors.	6.3	m^3	1650	m^2	10395.00
9.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
10.	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	222.72	m^2	582	$10m^2$	12962.30
11	White washing with best shell lime	264.72	m^2	116	$10m^2$	3070.75
12	Flooring with spartek tiles set in C.M (1:3)	42	m^2	4230	$10m^2$	17766.00
13	Painting with ready mixed enamel paint	25.305	m^2	335	$10m^2$	8477.17
						128090.00
14	Provision for water supply and sanitary arrangements @12.5%					16011.25
15	Provision for electrification @7.5%					9606.75
16	Provision for architectural appearance @2%					2561.80
17	Provision for unforeseen items 2%					2561.80
18	Provision for P.S.and contingencies @4%					5123.60
				Grand Total		**163955.23**

Estimation and Costing

INTRODUCTION TO THE SUBJECT



1.1 DEFINITION OF ESTIMATING AND COSTING

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 avilable are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following require-ment are necessary for preparing an estimate.

a) Drawings like plan, elevation and sections of important points.

b) Detailed specifications about workmenship & properties of materials etc.

c) Standard schedule of rates of the current year.

1.2 NEED FOR ESTIMATION AND COSTING

1. Estimate give an idea of the cost of the work and 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 arange 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.

1.3 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

1.4 DATA REQUIRED TO PREPARE AN ESTIMATE

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

1.4.1 DRAWINGS

If the drawings are not clear and without complete dimensions the prepa-ration of estimation become very difficult. So, It is very essential before prepar-ing an estimate.

1.4.2. 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 vari-ous items of work laying down the Quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of work.

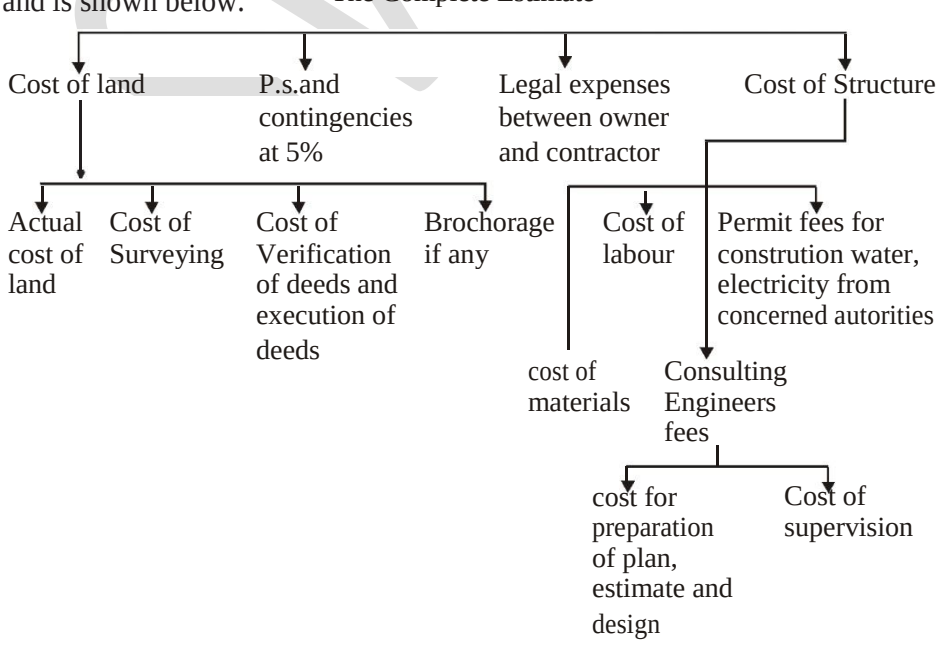
1.4.3. RATES:

For preparing the estimate the unit rates of each item of work are re-quired.

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 labour, skilled or unskilled of masons, carpenters, Mazdoor, etc.,

1.5 COMPLETE ESTIMATE:

Most of people think that the estimate of a structure includes cost of land, cost of materials and labour, But many other direct and indirect costs included and is shown below.



1.6 LUMPSUM:

While preparing an estimate, it is not possible to workout in detail in case of petty items. Items other than civil engineering such items are called lumpsum items or simply L.S.Items.

The following are some of L.S. Items in the estimate.

1. Water supply and sanitary arrangements.
2. Electrical installations like meter, motor, etc.,
3. Architectural features.
4. Contingencies and unforeseen items.

Ingeneral, certain percentage on the cost of estimation is alloted for the above L.S.Items

Even if subestimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

1.7 WORK CHARGED ESTABLISHMENT:

During the construction of a project considerable number of skilled su-pervisors, work assistance, watch men etc., are employed on temporary basis. The salaries of these persons are drawn from the L.S. amount alloted towards the work charged establishment. that is, establishment which is charged directly to work. an L.S.amount of 1½ to 2% of the estimated cost is provided towards the work charged establishment.

EXERCISE

Short Answer Questions

1. State the requirements of an estimate?
2. Briefly Explain need for estimation?
3. What is work charged establishment?

Chapter 2 MEASUREMENT OF MATERIALS AND WORKS

2.1 UNITS OF MEASUREMENTS:

The units of measurements are mainly categorised 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:

a) Single units work like doors, windows, trusses etc., are expressed in numbers.

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

c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., are expressed in square meters (m^2)

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

[BASED ON IS 1200 REVISED]

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 founda-tion 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, Sun-shade	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 pro-portion 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.

2.2 RULES FOR MEASUREMENT :

The rules for measurement of each item are invaribly 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, labour, 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.
   i) Linear measurement shall be measured to the nearest 0.01m.
   ii) Areas shall be measured to the nearest 0.01 sq.m
   iii) Cubic contents shall be worked-out to the nearest 0.01 cum
4. Same type of work under different conditions and nature shall be measured separately under separate items.
5. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.
6. In case of masonary (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:
   a) from foundation to plinth level
   b) from plinth level to First floor level
   c) from Fist floor to Second floor level and so on.

2.3 METHODS OF TAKING OUT QUANTITIES:

The quantities like earth work, foundation concrete, brickwork in plinth and super structure etc., canbe workout by any of following two methods:

a) Long wall - short wall method

b) Centre line method.

c) Partly centre line and short wall method.

a) Long wall-short wall method:

In this method, the wall along the length of room is considered to be long wall while the wall perpendicular to long wall is said to be short wall. To get the

Measurement of Materials and Works 8 length of long wall or short wall, calculate first the centre line lengths of individual walls. Then the length of long wall, (out to out) may be calculated after adding half breadth at each end to its centre line length. Thus the length of short wall measured into in and may be found by deducting half breadth from its centre line length at each end. The length of long wall usually decreases from earth work to brick work in super structure while the short wall increases. These lengths are multiplied by breadth and depth to get quantities.

b) Centre line method:

This method is suitable for walls of similar cross sections. Here the total centre line length is multiplied by breadth and depth of respective item to get the total quantity at a time. When cross walls or partitions or verandah walls join with mainall, the centre line length gets reduced by half of breadth for each junction. such junction or joints are studied caefully while calculating total centre line length.The estimates prepared by this method are most accurate and quick.

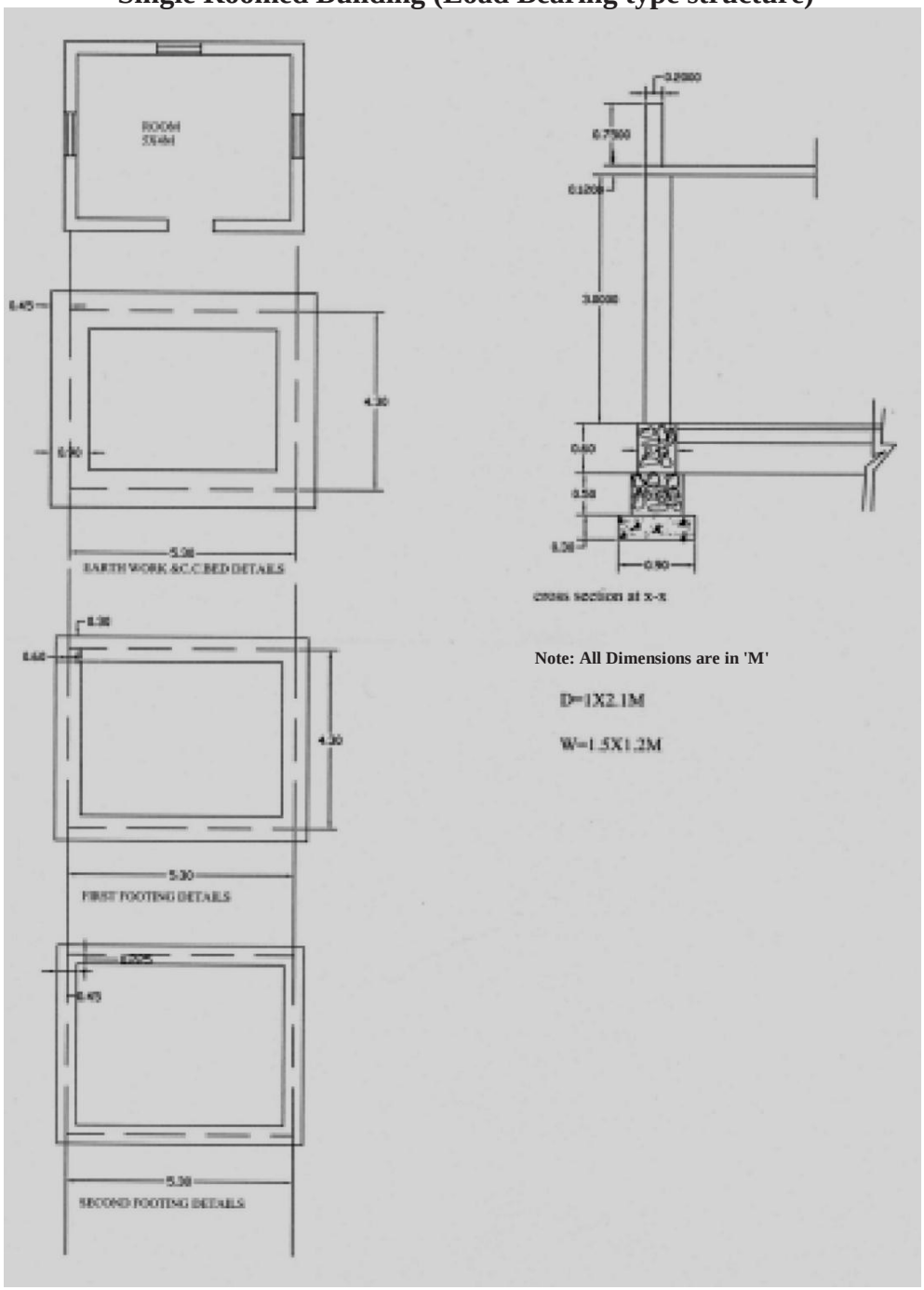
c) Partly centre line and partly cross wall method:

This method is adopted when external (i.e., alround the building) wall is of one thickness and the internal walls having different thicknesses. In such cases, centre line method is applied to external walls and long wall-short wall method is used to internal walls. This method suits for different thicknesses walls and diffeent level of foundations. Because of this reason, all Engineering departments are practicing this method.

9 *Estimation and Costing*

P.B.-1: From the Drawing given below determine (a) Earth work exca-vation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6).

Single Roomed Building (Load Bearing type structure)



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Long wall - Short wall Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation for foundation**						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement		**=**	$\frac{5.76+5.184}{4}$	**=**	**10.94 m_3**	
4.	**Brick masonary** with CM (1:6) for super structure						
	a) Long Wall	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
					Total	**17.28**	**m^3**

Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation 5.3 4.3	1	19.2	0.9	1.4	24.192	**m^3** L=2(5.3+4.3)=19.2
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944**	**m^3**
4.	**Brick masany** with CM (1:6) for super structure	1	19.2	0.3	0.3	17.28	**m^3**

EXERCISE

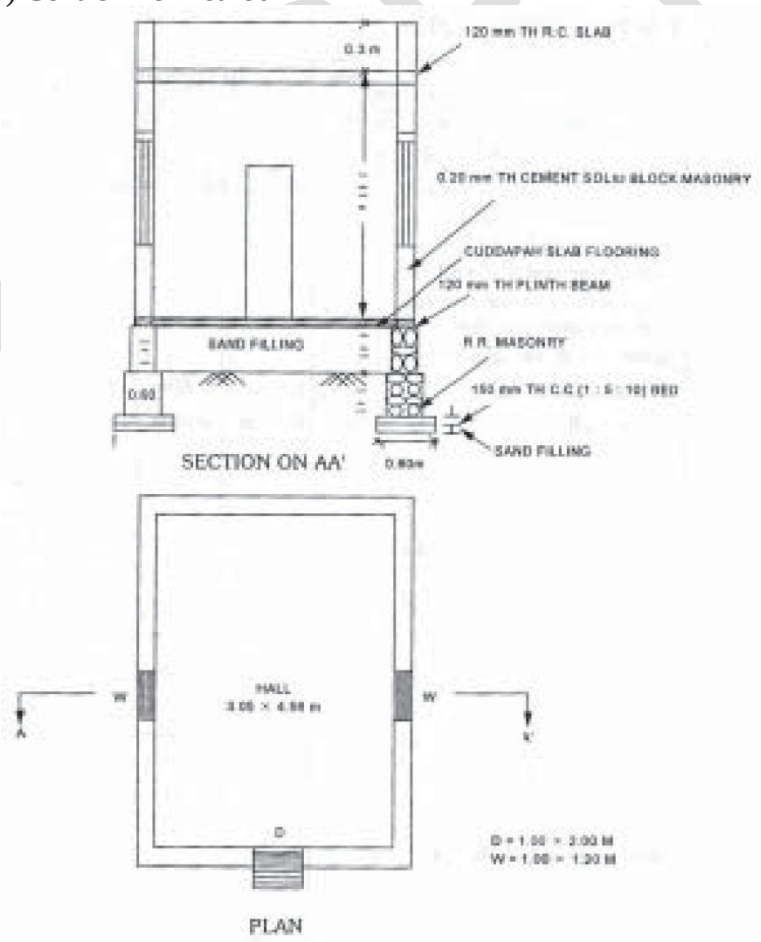
I. Short Answer Questions

1. List the difference between centre line method and long wall-short wall method of taking out measurements.
2. What are the rules to be followed while taking the mesurements?
3. Mension the units for the following items.

   a) flooring b) R.R.Masonry c) Plastering for pointing d) Damp proof course e) R.C. sunshade (Sepcified width and thickness)

II. Essay type questions

1. From the Drawing given below determine (a) Earth work excavation (b) CC (1:5:10) Bed (c) R.R.Masonry in C.M. (1:6) (d) Brick Work in C.M.(1:6). by
   (a) longwall - short wall method
   (b) Centre line Method



Chapter 3

TYPES OF ESTIMATES

3.1 DETAILED ESTIMATE:

The preparation of detailed estimate consists of working out quantities of various items of work and then determine the cost of each item. This is prepared in two stages.

i) Details of measurements and calculation of quantities:

The complete work is divided into various items of work such as earth work concreting, brick work, R.C.C. Plastering etc., The details of measure-ments are taken from drawings and entered in respective columns of prescribed proforma. the quantities are calculated by multiplying the values that are in num-bers column to Depth column as shown below:

Details of measurements form

S.No.	Description of Item	No	Length (L) m	Breadth (B) m	Depth/ Height (D/H)m	Quantity	Explanatory Notes

ii) Abstract of Estimated Cost :

The cost of each item of work is worked out from the quantities that already computed in the detals measurement form at workable rate. But the total cost is worked out in the prescribed form is known as abstract of estimated form. 4%of estimated Cost is allowed for Petty Supervision, contingencies and Unforeseen items.

Types of Estimates 14

ABSTRACT OF ESTIMATE FORM

Item No.	Description/ Particulars	Quantity	Unit	Rate	Per (Unit)	Amount

The detailed estimate should accompained with

i) Report

ii) Specification

iii) Drawings (plans, elevation, sections)

iv) Design charts and calculations

v) Standard schedule of rates.

3.1.1.Factors to be consisdered While Preparing Detailed Esti-mate:

i) **Quantity and transportation of materials:** For bigger project, the re-quirement of materials is more. such bulk volume of mateials will be pur-chased and transported definitely at cheaper rate.

ii) ***Location of site:*** The site of work is selected, such that it should reduce damage or in transit during loading, unloading, stocking of mateirals.

iii) ***Local labour charges:*** The skill, suitability and wages of local laboures are consideed while preparing the detailed estimate.

3.2 DATA:

The process of working out the cost or rate per unit of each item is called as Data. In preparation of Data, the rates of materials and labour are obtained from current standard scheduled of rates and while the quantities of materials and labour required for one unit of item are taken from Standard Data Book (S.D.B)

3.2.1 Fixing of Rate per Unit of an Item:

The rate per unit of an item includes the following:

1) ***Quantity of materials & cost:*** The requirement of mateials are taken strictly in accordance with standard data book(S.D.B). The cost of these includes first cost, freight, insurance and transportation charges.

ii) ***Cost of labour:*** The exact number of labourers required for unit of work and the multiplied by the wages/ day to get of labour for unit item work.

iii) ***Cost of equipment (T&P):*** Some works need special type of equip-ment, tools and plant. In such case, an amount of 1 to 2% of estimated cost is provided.

iv) ***Overhead charges:*** To meet expenses of office rent, depreciation of equipment salaries of staff postage, lighting an amount of 4% of estimate cost is allocated.

3.3 METHODS OF PREPARATION OF APPROXIMATE ESTIMATE:

Preliminary or approximate estimate is required for studies of various as-pects of work of project and for its administrative approval. It can decide, in case of commercial projects, whether the net income earned justifies the amount invested or not. The approximate estimate is prepared from the practical knowl-edge and cost of similar works. The estimate is accompanied by a report duely explaining necessity and utility of the project and with a site or layout plan. A percentage 5 to 10% is allowed for contingencies. The following are the meth-ods used for preparation of approximate estimates.

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

a) Plinth area method: The cost of construction is determined by multiplying plinth area with plinth area rate. The area is obtained by multiplying length and breadth (outer dimensions of building). In fixing the plinth area rate, carefull observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, hight of building, roof, wood work, fixtures, number of storeys etc.,

As per IS 3861-1966, the following areas include while calculating the plinth area of building.

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m^2, lifts, airconditionsing ducts etc.,

c) Area of barsati at terrace level:

Barsati means any covered space open on one side constructed on one side constructed on terraced roof which is used as shelter during rainy season.

d) Porches of non cantilever type.

Areas which are not to include

a) Area of lofts.

b) Unenclosed balconies.

c) Architectural bands, cornices etc.,

d) Domes, towers projecting above terrace level.

e) Box louvers and vertical sunbreakers.

b) Cubical Contents Method: This method is generally used for multistoreyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of building is obtained by Length x breadth x depth or height. The length and breadth are measured out to out of walls excluding the plinth off set.

The cost of string course, cornice, carbelling etc., is neglected.

The cost of building= volume of buildings x rate/ unit volume.

c) Unit Base Method: According to this method the cost of structure is deter-mined by multiplying the total number of units with unit rate of each item. In case schools and colleges, the unit considered to be as 'one student' and in case of hospital, the unit is 'one bed'. the unit rate is calculated by dividing the actual expenditure incured or cost of similar building in the nearby locality by the num-ber of units.

Problems on Plinth Area Method

Example 3.1: Prepare an approximate estimate of building project with total plinth area of all building is 800 sqm. and from following data.

i) Plinth area rate Rs. 4500 per sqm
ii) Cost of water supply @7½%of cost of building.
iii) Cost of Sanitary andElectrical installations each @ 7½% of cost of building.
iv) Cost of architectural features @1% of building cost.
v) Cost of roads and lawns @5% of building cost.
vi) Cost of P.S. and contingencies @4% of building cost. Determine the total cost of building project.

Solution :

Data given:

Plinth area = 800m^2.

Plinth area rate = Rs. 4500 per Sqm.

∴ Cost of building = 800 x 4500 = Rs. 36,00,000=00

Add the cost of the water supply charges @7½%

$$= \frac{36,00,000 \times 7.5}{100} = 2,70,000\ 00$$

Add the Cost of Sanitary and electrical installation @ 15%

$$= \frac{36,00,000 \times 15}{100} = 5,40,000\ 00$$

Add the cost of archetectural features @1%

$$= 36,00,000 \times 1$$

$$\frac{}{100} = 36,000\ 00$$

$$36,00,000 \times 5 = 1,80,000\ 00$$

Add the cost of Roads Lawns @ 5%=

$$\frac{}{100}$$

Add the Cost of P.S. and contingencies @ 4%

$$= \frac{36,00,000 \times 4}{100} = 1,44,000\ 00$$

Total Rs. 47,70,000=00

Assume Add supervision charges 8% on overall cost

$$= 47,70,000 \times \frac{8}{100} = 3,81,600 = 00$$

Grand Total Rs. 51,51,600=00

Example 3.2 : The plinth area of an appartment is 500 sqm. Detemine the total cost of building from the following data:

a) Rate of construction = Rs.1230/--per m^3.

b) The height of appartment = 16.25 m

c) Water Supply, Sanitary and Electrical installations each at 6% of building cost.

d) Architectural appearance @ 1% of building cost.

e) Unforeseen item @2% of Building cost.

f) P.S. and contingencies @4% of building.

Solution :

a) The Cost of building = cubic content x cubic rate

= 500 ×16.25 ×1230 = Rs. 99,93,750/-

b) Provision for water supply, sanitary and

Electrical installations water supply and sanitation each @ 6%

$$= \frac{99,93,750 \times 18}{100} = Rs.17,98,875/-$$

i.e total percent = 3×6 = 18% building cost

c) Architectural appearance @1%= $\frac{99,93,750 \times 1}{100}$ = Rs. 99,937/-

d) Unforeseen items @2% = Rs. 1,99,875/-

e) P.S. and contingenies @4% = Rs. 3,99,750/-

Total = Rs.1,24,92,187/-

Sundries 7,813/-

Total cost of the building project = Grand Total = Rs.1,25,00,000/-

Example 3.3: The plinth area and plinth area rate of a residential building are 100 sqm and Rs. 5000/- respectively. Determine the total cost of building as-suming suitable provisions.

Solution :

Cost of building = 100 x 5000 = Rs.5,00,000

Cost of water supply and

sanitary fittings @15% = $\frac{5,00,000 \times 15}{100}$ = Rs. 75,000

Cost of Electrification @7½% = $\frac{5,00,000 \times 7.5}{100}$ = Rs. 37,500

Cost of Roads & Lawns @5%= $\frac{5,00,000 \times 5}{100}$ = Rs. 25,000

Cost of P.S.& contingencies@4%= $\frac{5,00,000 \times 4}{100}$ = Rs. 20,000

Total Cost Rs. 6,57,500/-

Example 3.4 : Prepare an approximate Extimate of a proposed building from the follwoing?

Plinth area of the building = 226 sqm.

Cost of the structure = 2500 per sqm.

Water supply and sanitary arangements = 12½%

Electrification =7%

Fluctuation of rates = 5%

petty supervision charges = 3%

sol: Cost of Building = 226x 2500 = Rs.5,65,000

Water supply & Sanitory arrangements @ 12½ %

$= \frac{5,65,000 \times 12.5}{100}$ = Rs. 70,000

Electrification @7% $= \frac{5,65,000 \times 7}{100}$ = Rs. 39,550

Fluctuation of rates 5% = $\frac{5,65,000 \times 5}{100}$ = Rs. 28,250

Pettysupervision charges 3%= $\frac{5,65,000 \times 3}{100}$ = Rs.16,950

Total Cost Rs. = 7,19,750.00

Problem on Cubical content Method:

Example 3.5 : Prepare the rough estimate for a proposed commertial comples for a municipal corporation for the following data.

Plinth Area = 500m^2/floor
Ht of each storey = 3.5m
No.of storeys = G+2
Cubical content rate = Rs. 1000/m^3

Provided for a following as a pecentage of structured cost

a) water supply & Sanitary arrangement -8%
b) Electrification -6%
c) Fluctuation of rates - 5%
d) Contractors profit - 10%
e) Petty supervision & contingencies - 3%

Sol : Cubical content = No.of storeys (Plinth Area x height of each storey) = 3(500x3.5) = 5250m^3

Structural cost = Cubical content x cubical content rate
= 5250 x 1000 = 52.5 Lakhs

other provisons:-

a) Water supply and sanitation = 52.5x8/100 = Rs.4.2 Lakhs
b) Electrification = 52.5 x 6/100 = Rs.3.15 lakhs
c) fluctuation of rates = 52.5 x 5/100 = Rs.2.625
Total = Rs. 9.975 Lakhs
Structural cost = Rs. 52.500 Lakhs
Total = Rs.62.475 Lakhs

d) P.S./& contingencies = 62.475 x 3/100 = Rs.1.874 Lakhs
e) Contractors Profit = 62.475 x 10/100 = Rs.6.247 Lakhs

Total Cost = Rs.70.596 Lakhs

Problems on Unit Base Method:

Example 3.6: Prepare an approximate estimate or rough cost estimate of a hospital building for 50 beds. The cost of construction altogether for each bed is Rs. 60,000/-. Determine the total cost of hospital building.

Solution:

No. of beds = 50

Cost of construction = Rs. 60,000/-

Total Cost of Hospital building = 50x 60,000= **Rs. 30,00,000/-**

Example 3.7: To prepare the rough cost estimate of a hostel building which accommodate 150 students. The cost of construction including all provisions is Rs. 15,000/- per student. Determine total cost of building.

Solution :

No.of students= 150

Cost of construction including all L.S. provisions = Rs. 15,000/-Total Cost of hostel building =150 x 15000 = Rs. 22,50,000/-(Rupees twenty two lakhs, fifty thousands only)

EXERCISE

I. SHORT ANSWER QUESTIONS:

1. List the factors to be consider while preparing detailed estimate and explain breifly?
2. What are the differences between plinth area method and Unit base method?
3. List the requirements of data preparation.

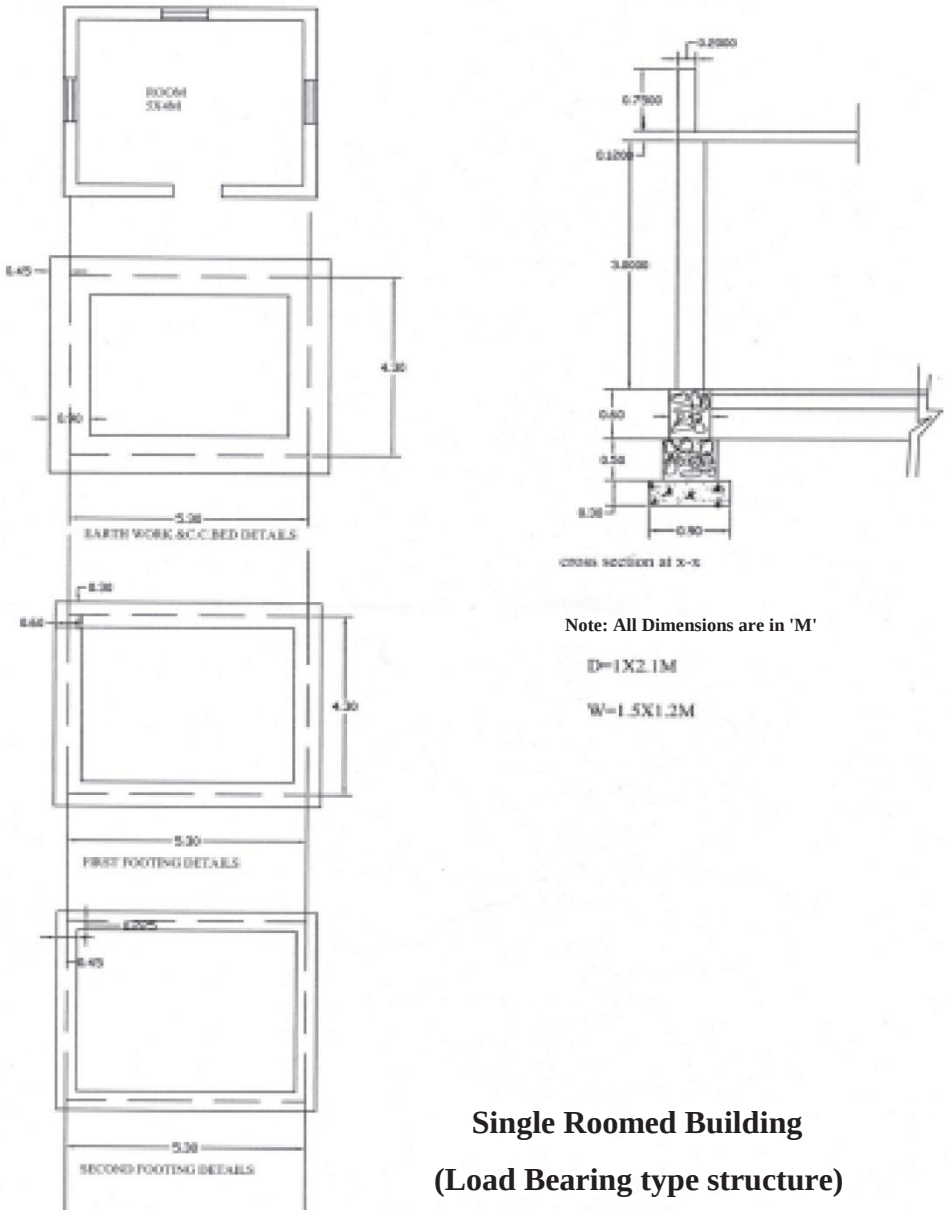
II ESSAY TYPE QUESTIONS :

1. Prepare the approximate cost of building project (group HOuseing)
   i) No.of houses = 150
   ii) Plinth area of each dwelling = 600m^2
   iii) Plinth area rate = Rs. 5,000/-per m^2
   iv) Cost of water supply & sanitary arrangements @12½%
   v) Electrification at 7½% of cost of builing.
   vi Cost of roads & Lawns @5%
   vii) Cost of P.S.& contingencies @4%
2. Prepare a rough cost estimate of a cinema theatre which accommodate 1700 seats. The cost of construction including all provisions is Rs.6000/- per seat.
3. What are the methods of preparation of approximate estimates and explain briefly.

Chapter 4 DETAIL & ABSTRACT ESTIMATES OF BUILDINGS

Example 1: From the given figure below calculate the detailed and abstract estimate for the single roomed building (Load bearing type structure) by

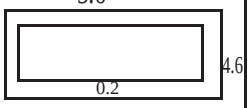
a) long wall & short wall method (b) Centre Line Method



Single Roomed Building

(Load Bearing type structure)

23 ***Estimation and Costing*** **a) Long wall - Short Method**

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	6.2	0.9	1.4	15.264	L=5.3+.45+.45 =6.2 D= 0.3+0.5+0.6 = 1.4
	b) Short walls	2	3.4	0.9	1.4	8.568	L= 4.3-0.45-0.45= 3.4
					Total	**24.192**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	6.2	0.9	0.3	3.348	
	b) Short walls	2	3.4	0.9	0.3	1.836	
					Total	**5.184**	**m^3**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings						
	i) Long walls	2	5.9	0.6	0.5	3.54	L= 5.3+0.3+0.3=5.9
	ii) Short walls	2	3.7	0.6	0.5	2.22	L=4.3-0.3-0.3 = 3.7
					Total	**5.76**	**m^3**
	b) Basement						
	i) Long walls	2	5.75	0.45	0.6	3.105	L= 5.3+0.225+0.225= 5.75
	ii) Short walls	2	3.85	0.45	0.6	2.079	L= 4.3-0.225-0.225 =3.85
					Total	**5.184**	**m^3**
	Total R.R. Masonry for footings and Basement						
			=	5.76+5.184	=	**10.94 m^3**	
4.	**Brick masonary** with CM (1:6) for super structure						
	a) Long Walls	2	5.6	0.30	3.00	10.08	L=5.3+0.15+0.15=5.6
	b) Short walls	2	4.0	0.30	3.00	7.20	L=4.3-0.15-0.15=4.0
	c) for parapetwall						
							
	a) Long Walls	2	5.6	0.2	0.75	**1.68**	
	b) Short walls	2	4.4	0.2	0.75	**1.32**	
					Total	**20.28**	**m^3**

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S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m^3**
	Net Brick Masonry		**=**	**20.28 - 2.25 =**		**18.03m_3**	
5.	**R.C.C. (1:2:4) for**						
	a) Roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) Beams						
	i) Long beams	2	5.6	0.3	0.3	1.008	
	ii) short beams	2	4.0	0.3	0.3	0.720	
					Total	**5.074**	**m^3**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85
8	**Flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	**m^2**
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	L= 2(5.0+4.0) = 18 .0
	Out side						
	For walls	1	20.4	--	3.87	61.2	L=2(5.6+4.6)=20.4
	Basement outside	1	21.6	--	0.6	12.96	H=3.0+0.12+0.75=3.87
	Parapet wall						(upto parapet wall)
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**146.18**	**m^2**
	Doors	1x2	1.0	--	2.1	4.2	
	Windows	3x2	1.5	--	1.2	10.8	
						15.0	**m^2**
	Net Plastering	**= 146.18 - 15.0**				**= 131.18**	**m^2**

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
10	Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	**m^2**
11	White Washing with two coats with Janatha cement						
	Same as quantity of plastering for walls and ceiling					151.18	(= 131.18+20= 151.18)
12.	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					151.18	(=131.18+20)151.18)
13	Supply & Fixing of best country wood for						
	a) Doors	1				1 No.	
	b) Windows	3				3No.	
14	Painting with ready mixed synthetic enamil paits with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	**m^2**
15	Petty supervision and contingencies at 4% and rounding off.						

Detail & Abstract Estimates of Buildings 26

b) Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work exevation** for foundation	1	19.2	0.9	1.4	24.192	**m³**
	5.3 / 4.3						L=2(5.3+4.3)=19.2
2.	**C.C.(1:4:8) bed for** foundation	1	19.2	0.9	0.3	5.184	**m³**
3.	**R.R.Masonry in CM (1:6) for**						
	a) Footings	1	19.2	0.6	0.5	5.76	
	b) Basement	1	19.2	0.45	0.6	5.184	
					Total	**10.944**	
4.	**Brick masonry** with CM (1:6) for super structure	1	19.2	0.3	3.0	17.28	**m³**
	For parapet wall	1	20.0	0.2	0.75	3.00	
	Deductions for openings						
	a)Doors	1	1.0	0.3	2.1	0.63	
	b) Windows	3	1.5	0.3	1.2	1.62	
					Total	**(-)2.25**	**m³**
	Net Brick Masony	**=**	**17.28**	**+3.0-2.25**	**=**	**18.03**	**m³**
5.	**R.C.C. (1:2:4) for**						
	a) roof slab	1	5.6	4.6	0.12	3.090	
	b) Lintels over						
	i) Doors	1	1.2	0.3	0.15	0.054	
	ii) Windows	3	1.5	0.3	0.15	0.202	
	c) beams	1	19.2	1.3	0.3	1.728	
					Total	**5.074**	**m³**
6.	**Sandfilling for basement**	1	4.85	3.85	0.48	8.96	L=5.0-0.075-0.075=4.85
7	**C.C.(1:4:8) for flooring**	1	4.85	3.85	0.1	1.86	B= 4.0-0.075-0.075=3.85

8.	**flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	For walls	1	18.0	--	3.0	54.0	
	Out side						
	For walls	1	20.4	--	3.87	61.2	
	Basement outside	1	21.6	--	0.6	12.96	
	Parapet wall						
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**146.18**	**m** ^{2}
	Doors	1x 2	1.0	--	2.1	4.2	L=5.0-0.075-0.075=4.85
	Windows	3x 2	1.5	--	1.2	10.8	B= 4.0-0.075-0.075=3.85
						15.0	**m** ^{2}
	Net Plastering =		**146.18-15**	**=**		**131.18**	**m** ^{2}
10	Plastering for Ceiling with CM(1:5)	1	5.0	4.0	--	20.0	**m** ^{2}
11	White Washing with two coats with Janatha cement						
	Same as quantity of plastering for walls and ceiling					151.18	**m** ^{2} (131.18+20=151.18)
12.	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					151.18	**m** ^{2}
13	Supply & Fixing of best country wood for						
	a) Doors	1				1 No.	
	b) Windows	3				3No.	

Detail & Abstract Estimates of Buildings 28

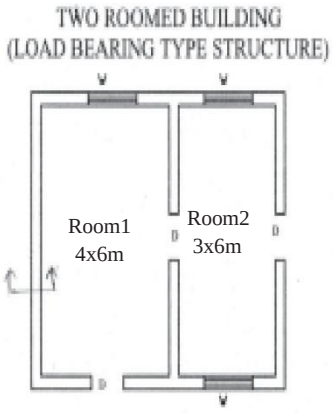
S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
14	Painting with ready mixed synthetic enamil paints with two coats over primary coat for new wood for						
	a) Doors	2¼x1	1.0	---	2.1	4.725	
	b) Windows	2¼x3	1.5	---	1.2	12.15	
					Total	**16.875**	**m^2**
15	Petty supervision and contingencies at 4% and rounding off.						

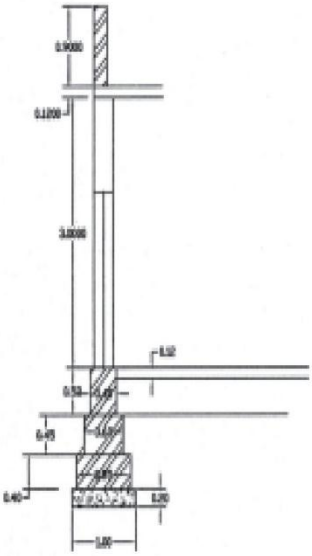
Abstract estimate of single roomed building (load bearing structure)

S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excaation	24.192	m^3	465	$10m^3$	1125.00
2.	Cement concrete(1:4:8)	5.184	m^3	4545	$1m^3$	8009.30
3.	RR.masonry in C.M.(1:5)	10.94	m^3	1391	m^3	15217.50
4.	Sand filling in basement	8.96	m^3	195.20	$10m^3$	175.00
5.	Brick masonry in country bricks of standard size in CM(1:8)	18.03	m^3	2291	m^3	41306.73
6.	R.C.C. (1:2:4) for lintels, beams etc.	1.984	m^3	6030	m^3	11963.52
7.	R.C.C.(1:2:4) for slabs,	3.09	m^3	6030	m^3	18633.00
8.	Cement concrete (1:5:10) for flooring	1.86	m^3	1452	m^3	2700.72
9.	Supplying and fixing of country wood for doors.	2.1	m^2	1650	m^2	3465.00
10.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
11	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	151.18	m^2	582	$10m^2$	8798.70
12	White washing with best shell lime	151.18	m^2	116	$10m^2$	1753.68
13	Flooring with spartek tiles set in C.M (1:3)	20	m^2	4230	$10m^2$	8460.00
14	Painting with ready mixed enamel paint	16.875	m^2	335	$10m^2$	565.31
					Total	**134593.46**
15	Povision for water supply and sanitary arangements @12.5%					16824.18
16	Provision for electrification @7.5%					10094.50
17	Povision for architectural appearance @2%					2691.86
18	Provision for unforeseen items 2%					2691.86
19	Provision for P.s.and contingencies @4%					5383.73
					Grand Total Rs.	**172279.65**

Detail & Abstract Estimates of Buildings 30

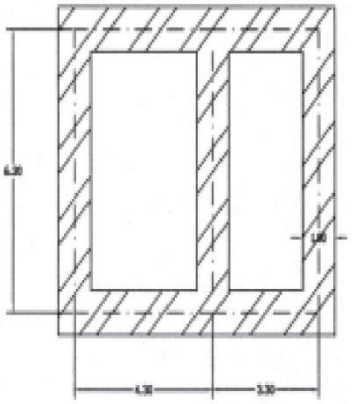
Example :2 :-From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method



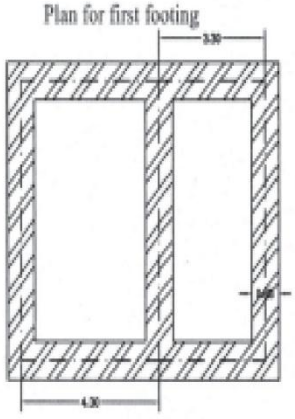


D=1x2.1
W=1.5x1.2

Note: All Dimensions are in 'M'



Plan for first footing



S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation** for foundation						
	a) Long walls	2	8.6	1.0	1.05	18.05	L=7.6+0.5+0.5=86
	b) Short walls	3	5.3	1.0	11.05	16.70	L=6.3-0.5-0.5=5.3
					Total	**34.75**	**m^3**
2.	**C.C.(1:4:8) bed for** foundation						
	a) Long walls	2	8.6	1.0	0.2	3.44	
	b) Short walls	3	5.3	1.0	0.2	3.18	
					Total	**6.62**	**m^3**
3.	**Brick masanory for** footings with CM (1:4)						
	first footing						
	a) Longwalls	2	8.45	0.85	0.4	5.746	L=7.6+0.425+0.425=8.45
	b) Short walls	3	5.45	0.85	0.4	5.560	L=6.3-0.425-0.425=5.45
	2nd fooring						
	a) Long walls	2	8.20	0.6	0.45	4.428	L=7.6+0.3+0.3=8.2
	b) short walls	3	5.70	0.6	0.45	4.617	L=6.3-0.3-0.3=5.7
	ii) for base ment	2	8.00	0.4	0.4	2.560	L=7.6+0.2+0.0=8.0
	long walls	3	5.90	0.4	0.4	2.832	L=6.3-0.2-0.2= 5.9
	short walls						
	iii) for super structure	2	7.90	0.3	3.0	14.22	L=7.6+0.15+0.15=7.9
	long walls	3	6.00	0.3	3.0	16.20	L=6.3-0.15-0.15=6.0
	short walls						
	iv) Parapet wall						
	7.9 / 6.6 / 0.2						
	a) long walls	2	7.90	0.2	0.70	2.212	
	b) Shot walls	2	6.20	0.2	0.70	1.736	
					Total	**60.11**	
	Deductions for openings						
	Doors	3	1.0	0.3	2.1	1.89	
	Windows	3	1.5	0.3	1.2	1.62	
	Lintels over doors	3	1.20	0.3	0.10	0.108	
	windows	3	1.70	0.3	0.10	0.153	
	Net B.M.=60.11-377=56.34m^3				Total	**3.771**	

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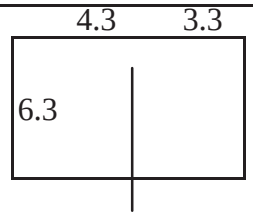
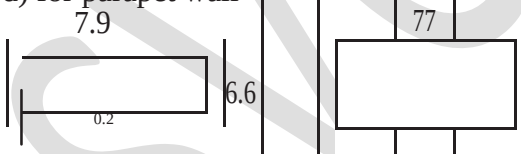
4	RCC(1:2:4)for						
	a) roof slab	1	7.9	6.6	0.12	6.256	
	b) for lintles over doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	0.153	
	c) beams	1	33.8	0.3	0.3	3.042	
					Total	**9.298**	m^3
5.	Plastering for walls	1	20.0	--	3.0	60.00	L=2(4.0+6.0)=20
	a) Inside room1	1	18.0	---	3.0	54.00	
	room2	1	29.0	---	3.0	87.00	L=2(7.9+6.6)=29
	b) out side	1×2	28.2	---	0.70	39.48	L=2(7.7+6.4)=28.2
	Parapet wall(Sides)	1×1	28.2	0.20	--	5.64	
					Total	**246.12**	m^2
	Deductions						
	a) doors	3×2	1.0	---	2.10	12.6	
	b) windows	3×2	1.5		1.20	10.8	
					Total	**23.4**	m^2
	Net Plastering		**= 246.12- 23.4 =**			**222.72**	m^2
6.	flooring with cuddapah slab in cm (1:3)						
	Room1	1	4.0	6.0	---	24	
	Room2	1	3.0	6.0	---	18	
					Total	**42**	m^2
7	Plastering for ceiling =same as flooring					42	
8	White washing = same as plastering for walls & Ceiling						
						=222.72 +42 = 264.72	m^2
9	Colour washing with two coats						
	Same as quantity of plastering for walls and ceiling					264.72	m^2
10	Supply & Fixing of best country wood for						
	a) Doors	3				3Nos.	
	b) Windows	3				3 Nos	
11	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--		14.175	
	b) Windows	2¼x3	1.5	--		11.13	
						25.305	m^2
12	2% unforeseen items						
13	4% P.S& contingencies and round off.						

33 ***Estimation and Costing*** **b) Centre Line Method**

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
							
	Total centre line length =(4.3+3.3)2+6.3x3=34.1m						
1.	**Earth work excavation**	1	33.1	1.0	1.05	34.75	L=34.1-2x1/2=33.1
2.	**C.C.(1:4:8) bed for foundation**	1	33.1	1.0	0.20	6.62	**m** ^{3}
3.	**Brick masonry with CM(1:4)**						
	a) for foundation						
	i) first footing	1	33.25	0.85	0.40	11.30	L=34.1-0.85 =33.25
	ii) 2nd footing	1	33.50	0.60	0.45	9.045	L=34.1-0.6 x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4 x2/2
	c) for super structure	1	33.80	0.30	3.0	30.42	L=34.1-0.3x2/2
	d) for parapet wall						
						6.4	
	Total centre line length = 2(7.7+6.4) =28.2	1	28.2	0.2	0.70	3.948	
					Total	**60.10**	**m**^{3}
	Deductions for						
	Openings Doors	3	1.0	0.3	2.1	1.89	
	windows	3	1.5	0.3	1.2	1.62	
	Lintels Doors	3	1.2	0.3	0.1	0.108	
	Windows	3	1.7	0.3	0.1	1.153	
					Total	**3.771**	**m** ^{3}
	Net B.M.=60.11-	3.771=56.34 m	3				
4.	Quantity of R.C.C.Roof, flooring, White washing is method.	Plastering same	for as	walls Longwall	and cealing &Short	and wall	

Detail & Abstract Estimates of Buildings 34 Abstract estimate of two roomed building (Load bearing type structure)

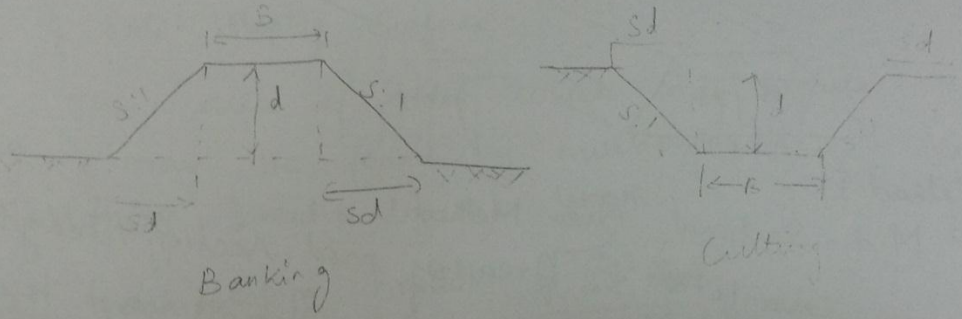
S.No.	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	34.75	m^3	465	$10m^3$	1615.90
2.	Cement concrete(1:4:8)	6.62	m^3	1545	$1m^3$	10228.00
3.	Sand filling in basement	12.036	m^3	195.20	$10m^3$	235.00
4.	Brick masonry in country Bricks of standard size in CM(1:8)	56.34	m^3	2291	m^3	129075.00
5.	R.C.C. (1:2:4) for lintels, beams etc.	3.303	m^3	6030	m^3	19918.00
6.	R.C.C.(1:2:4) for slabs,	6.26	m^3	6030	m^3	37748.00
7.	Cement concrete (1:5:10) for flooring	4.2	m^3	1452	m^3	6098.40
8.	Supplying and fixing of country wood for doors.	6.3	m^3	1650	m^2	10395.00
9.	Supplying and fixing of country wood for windows and ventilators.	5.4	m^2	2300	m^2	12420.00
10.	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	222.72	m^2	582	$10m^2$	12962.30
11	White washing with best shell lime	264.72	m^2	116	$10m^2$	3070.75
12	Flooring with spartek tiles set in C.M (1:3)	42	m^2	4230	$10m^2$	17766.00
13	Painting with ready mixed enamel paint	25.305	m^2	335	$10m^2$	8477.17
						128090.00
14	Provision for water supply and sanitary arrangements @12.5%					16011.25
15	Provision for electrification @7.5%					9606.75
16	Provision for architectural appearance @2%					2561.80
17	Provision for unforeseen items 2%					2561.80
18	Provision for P.S.and contingencies @4%					5123.60
				Grand Total		**163955.23**

UNIT-2 Estimate of Other Structures.

Road Estimating

Cross section of earthwork of road in banking or cutting is usually in the form of trapezium.

Qty of earth work may be calculated by following method Quantity = sectional area × length.



Banking

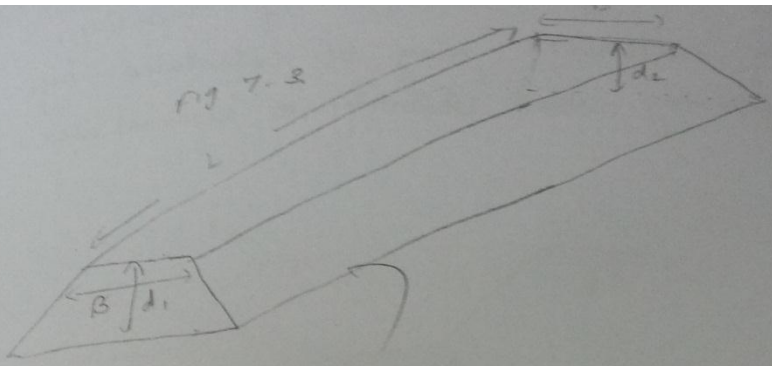
Sectional area = Area of central rectangular portion + Area of 2 side triangular portions.

$$= Bd + 2(\tfrac{1}{2} Sd \times d)$$

$$A = Bd + sd^2$$

$$\boxed{Qty = (Bd + Sd^2) \times L}$$

when the ground is in a longitudinal slope, the ht of bank (or) the depth of cutting will be different at the two ends of the section. & mean ht (or) depth may be taken for 'd' & the sectional area at mid section is taken out for mean ht.



Method I -

Mid - Sectional Area Method :-

Quantity = Area of mid section × Length.

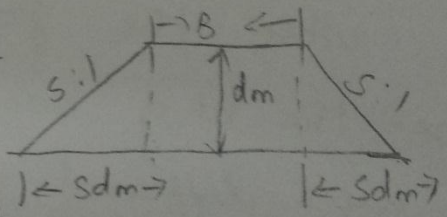
Let d_1 & d_2 be the ht of bank at two ends portion of embankment.

L - Length of the section

B → formation width.

S:1 → horizontal : Vertical

Area of mid section = Area of rectangular portion + area of 2 triangular portion.



$= Bdm + \frac{1}{2}Sdm^2 + \frac{1}{2}Sdm^2$

$A = Bdm + Sdm^2$

Quantity of Earthwork $= (Bdm + Sdm^2) \times L$

$Q = (Bd + Sd^2) \times L$

d → mean ht (or) depth.

Calculations

Stations (or) Chainage	Depths (or) Ht	Mean Depth (or) Ht "d"	Area of Central Portion Bd	Area of sides Sd^2	Total Sectional Area $(Bd+Sd^2)$	Length b/w Stns L	Quantity $(Bd+Sd^2) \times L$	
							Embankment	Cutting

Area of Side sloping Surface:

The area of sides which may require turfing, may be found by multiplying the mean sloping breadth by the length.

The mean sloping breadth: $\sqrt{S^2d^2+d^2}$

$= \sqrt{S^2d^2+d^2}$

$B = d\sqrt{S^2+1}$

Area of both sides slopes $= 2L \times d\sqrt{S^2+1}$

Calculation:

Stations (or) Chaining	Depths (or) ht	Mean depth (or) ht	Breadth sides slopes $d\sqrt{S^2+1}$	Lengths b/w stations L	Total Area of both side slopes $2Ld\sqrt{S^2+1}$

Method II

Mean Sectional Area Method:

Qty = Mean Sectional Area × Length

Sectional area at one end: $A_1 = Bd_1 + Sd_1^2$

" " at other end: $A_2 = Bd_2 + Sd_2^2$

d_1, d_2 are hts (or) depths at 2 ends

The mean sectional Area $A = \frac{A_1 + A_2}{2}$

Quantity $Q = \frac{A_1 + A_2}{2} \times$ Length.

Calculation

Sta (or) Chainage	Ht (or) Depth "d"	Area Central Portion Bd	Area sides sd^2	Total sectional Area $Bd+sd^2$	Mean sectional Area	Length b/w station L	Quantity $(Bd+sd^2) \times L$ Embankment	Cutting

Method III Prismoidal formula Method:-

Quantity (or) Volume: $L/6 (A_1 + A_2 + 4A_m)$

$A_1, A_2 \rightarrow$ Cross sectional areas at the 2 ends of the embankment.

$d_1 d_2 \rightarrow$ hts of banks at the 2 ends.

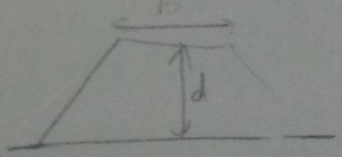
$d_m \rightarrow$ mean ht at the mid section.

$B \rightarrow$ formation width.

$s:1 \rightarrow$ side slope.

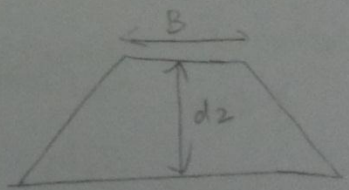
1) Cross sectional area at one end.

$$A_1 = Bd_1 + sd_1^2$$

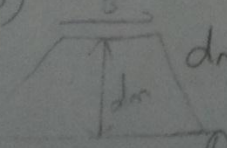


2) Cross sectional area at other end

$$A_2 = Bd_2 + sd_2^2$$



3) Cross section at middle



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

$$A_m = Bd_m + sd_m^2 = B\left(\frac{d_1+d_2}{2}\right) + s\left(\frac{d_1+d_2}{2}\right)^2$$

Quantity $= \frac{L}{6}(A_1 + A_2 + 4A_m)$ ... 1.

$= \frac{1}{6}\left[(Bd_1 + Sd_1^2) + (Bd_2 + Sd_2^2) + 4\left\{B\left(\frac{d_1+d_2}{2}\right) + S\left(\frac{d_1+d_2}{2}\right)^2\right\}\right]$

$= \frac{1}{6}\left[\left(Bd_1 + Bd_2 + 4\frac{Bd_1}{2} + 4\frac{Bd_2}{2}\right) + Sd_1^2 + Sd_2^2 + \left(4S \times \frac{d_1^2 + d_2^2 + 2d_1d_2}{4}\right)\right]$

$= \frac{L}{6}\left[(3Bd_1 + 3Bd_2) + 2Sd_1^2 + 2Sd_2^2 + 2Sd_1d_2 \right]$

$= \frac{3BL}{6}(d_1+d_2) + \frac{2LS}{6}\left[d_1^2 + d_2^2 + d_1 + d_2\right]$

$= \frac{BL}{2}(d_1+d_2) + \frac{LS}{3}\left[d_1^2 + d_2^2 + d_1d_2\right]$

$= \left\{B\left(\frac{d_1+d_2}{2}\right) + S\left(\frac{d_1^2 + d_2^2 + 2d_1d_2}{3}\right)\right\} \times L$

Problem-1

Calculate the qty of earthwork for 200 m length for a portion of a road in an Uniform ground the ht of banks at the two ends beings 1.00m & 1.60m. The formation width is 10m & side slopes 2:1 (Horizontal : Vertical) Assume that there is no transverse slope.

Sol

Method I

Qty: $(Bd + Sd^2) \times L$

Given $B = 10m$, $S = 2$, $L = 200m$

d = mean depth $= \frac{d_1+d_2}{2} = \frac{1.00+1.60}{2}$

$Q = (Bd + Sd^2) \times L$

$= (10 \times 1.3 + 2 \times 1.3^2) \times 200$

$= (13 + 3.38) \times 200 = 16.38 \times 200 = 3276 \text{ Cum}$

By Method I

A_1 = Sec. area at one end

A_2 = " " " other end

$A_1 = Bd_1 + Sd_1^2 = (10 \times 1) + (2 \times 1^2) = 12 \text{ Sqm}$

$A_2 = Bd_2 + Sd_2^2 = (10 \times 1.6) + (2 \times 1.6^2) = 21.12 \text{ Sqm}$

Mean Sec. area $= \frac{A_1 + A_2}{2}$

$= \frac{12 + 21.12}{2} = 16.56 \text{ Sqm}$

Qty = Mean Sec area × Length.

$= 16.56 \times 200 = 3312 \text{ Cum}$

Method II by Prismoidal formula

$Q = L/6 (A_1 + A_2 + 4A_m)$

A_1 = Sec. area at one end

$= Bd_1 + Sd_1^2 = (10 \times 1) + (2 \times 1^2) = 12 \text{ Sqm}.$

A_2 = Sec. area at one end

$= Bd_2 + Sd_2^2$

$= (10 \times 1.6) + (2 \times 1.6^2) = 21.12 \text{ Sqm}$

A_m = Mid sec. area

$= Bd_m + Sd_m^2$

$d_m = \frac{d_1 + d_2}{2} = \frac{1.00 + 1.60}{2} = 1.30 \text{ m}.$

$A_m = (10 \times 1.30) + (2 \times 1.30^2)$

$= 16.38 \text{ Sqm}.$

Quantity = $\frac{200}{6}$ [12 + 21.12 + (4 × 16.38)]

= $\frac{200}{6}$ × 98.64 = 3288 cum.

2) Calculate the area of the side slopes of Portion of a bank for a length of 200 m the heights of banks a the two ends being 2.50 m & 3.50 m & the ratio of the side slope 2 : 1

ii) If the side slopes are to be provided with 15 cm thk stone pitching, ~~solution~~ Calculate the cost of pitching at the rate of Rs. 150/- per cum.

i) Mean height d = $\frac{2.5 + 3.5}{2}$ = 3m

Sloping breadth at the mid section = $d\sqrt{s^2+1}$

= $3 \times \sqrt{2^2+1}$

= 6.71

Area of 2 side slopes = $2L \times d\sqrt{s^2+1}$

= $2 \times 200 \times 3m\sqrt{2^2+1}$

= 2 × 200 × 6.71

= 2684 sqm

ii) Qty of pitching = Area × thickness

= 2684 × 0.15 = 402.6 cum

Cost of stone pitching = 402.6 × 150

= 60390.00 Rs.

Quantity = $\frac{200}{6}$ [12 + 21.12 + (4 × 16.38)]

= $\frac{200}{6}$ × 98.64 = 3288 cum.

2) Calculate the area of the side slopes of Portion of a bank for a length of 200 m the heights of banks a the two ends being 2.50 m & 3.50 m & the ratio of the side slope 2 : 1

ii) If the side slopes are to be provided with 15 cm thk stone pitching, ~~solution~~ Calculate the cost of pitching at the rate of Rs. 150/- per cum.

i) Mean height d = $\frac{2.5 + 3.5}{2}$ = 3m

Sloping breadth at the mid section = $d\sqrt{s^2+1}$

= $3 \times \sqrt{2^2+1}$

= 6.71

Area of 2 side slopes = $2L \times d\sqrt{s^2+1}$

= $2 \times 200 \times 3m\sqrt{2^2+1}$

= 2 × 200 × 6.71

= 2684 sqm

ii) Qty of pitching = Area × thickness

= 2684 × 0.15 = 402.6 cum

Cost of stone pitching = 402.6 × 150

= 60390.00 Rs.

Ex-3. Reduced level (RL) of ground along the centre line of a proposed road from chainage 10 to 20 are given below. The formation level at the 10th chainage is 104 and the road is in downward gradient of 1 in 150 up to chainage 14 and then the gradient changes to 1 in 100 downward. Formation width of road is 10 m and side slopes of banking are 2:1 (H:V). Length of the chain is 30 m.

Draw Longitudinal section of the road and a typical cross-section and prepare an estimate of earthwork at the rate of Rs. 270% cum.

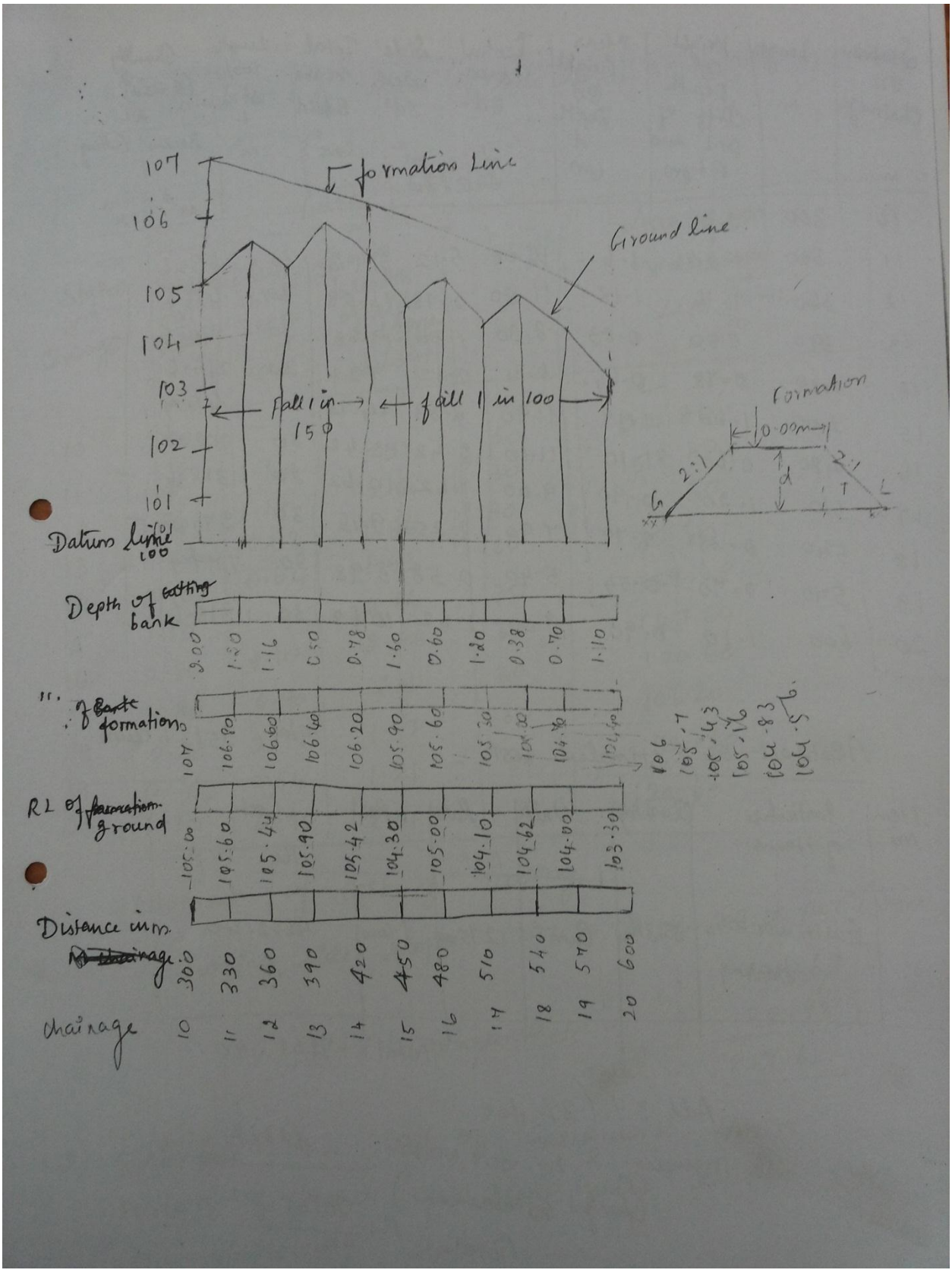
i) Find also the area of the side slopes and the cost of turfing the side slopes at the rate of Rs 60.00 % sq.m.

Chainage	10	11	12	13	14	15	16	17	18	19	20
RL of ground	105.00	105.60	105.44	105.90	105.42	104.30	105.00	104.19	104.62	104.00	103.3

RL of formation 107.00

Gradient Down gradient 1 in 150 →

← Down gradient 1 in 100


107
106
105
104
103
102
101
formation Line
Ground line
fall 1 in 150
fall 1 in 100
Datum line 100
Formation
10.00m
2:1
2:1
Depth of cutting bank
3.00 1.80 1.16 0.50 0.78 1.60 0.60 1.80 0.38 0.70 1.10
R.L of formation
106 106.80 106.60 106.40 106.20 105.90 105.60 105.30 105.00 104.70 104.40
R.L of ground
105.60 105.44 105.90 105.42 104.30 105.00 104.10 104.62 104.00 103.30
105.17 105.43 105.16 104.83 104.57
Distance in m
Chainage
300 330 360 390 420 450 480 510 540 570 600
10 11 12 13 14 15 16 17 18 19 20

Stations (or) Chainage m	Length m	Height (or) Depth Diff of G.L and F.L (m)	Mean height (or) Depth d (m)	Central area Bd m^2	Side area sd^2 m^2 (s=0.5)	Total sec-area $Bd+sd^2$ m^2	Length inb/w stns L m^2	Quantity (Bd+sd²)L Banking m^3	Cutting m^3
10	300	2.00	—	—	—	—	—	—	—
11	330	1.20	1.6	16.00	5.12	21.12	30	633.6	—
12	360	1.16	1.18	11.80	2.78	14.58	30	437.4	—
13	390	0.50	0.83	8.30	1.38	9.68	30	290.4	—
14	420	0.78	0.64	6.4	0.82	7.22	30	216.6	
15	450	1.60	1.19	11.90	2.83	14.73	30	441.9	
16	480	0.60	1.10	11.10	2.42	13.42	30	402.6	
17	510	1.20	0.90	9.00	1.62	10.62	30	318.6	—
18	540	0.38	0.79	7.90	1.25	9.15	30	274.5	—
19	570	0.70	0.54	5.40	0.58	5.98	30	179.4	—
20	600	1.10	0.90	9.00	1.62	10.62	30	318.6	—

Total = 3513.6 cum

Abstract of Estimated cost :-

Item No	Particulars of items	Quantity	Unit	Rate Rs. P.	Per	Cost Rs P.
	Earth work in banking	3513.6	Cum	275.00	1 Cum	9662.40
					Total	9662.40

Add 3% (3% for Contingencies & 2% for work Charged Establishment) 483.12

Total. Rs 10145.52

Calculation of Areas of side slopes.

$S = 2$

$\sqrt{S^2+1} = 2.236$.

Station (or) Chainage	Height (or) Depth	Mean height Depth d (m)	Sloping breadth of side slope $d\sqrt{S^2+1}$	Length L m	Area of both side slopes $2 \times d\sqrt{S^2+1} \times L$ sq.m.
10	2.00	—	—	—	—
11	1.20	1.60	3.58	30	214.80
12	1.16	1.18	2.64	30	158.40
13	0.50	0.83	1.86	30	111.60
14	0.78	0.64	1.43	30	85.80
15	1.60	1.19	2.66	30	159.60
16	0.60	1.10	2.46	30	147.60
17	1.20	0.90	2.01	30	120.60
18	0.38	0.79	1.77	30	106.20
19	0.70	0.54	1.21	30	72.60
20	1.10	0.90	2.01	30	120.60

Abstract of cost of Turfing

Turfing side slopes 1297.80 @ Rs 60.00 per 1000 sq.m

= 778.68

Add 5 % contingencies etc 38.93

Total : 817.61

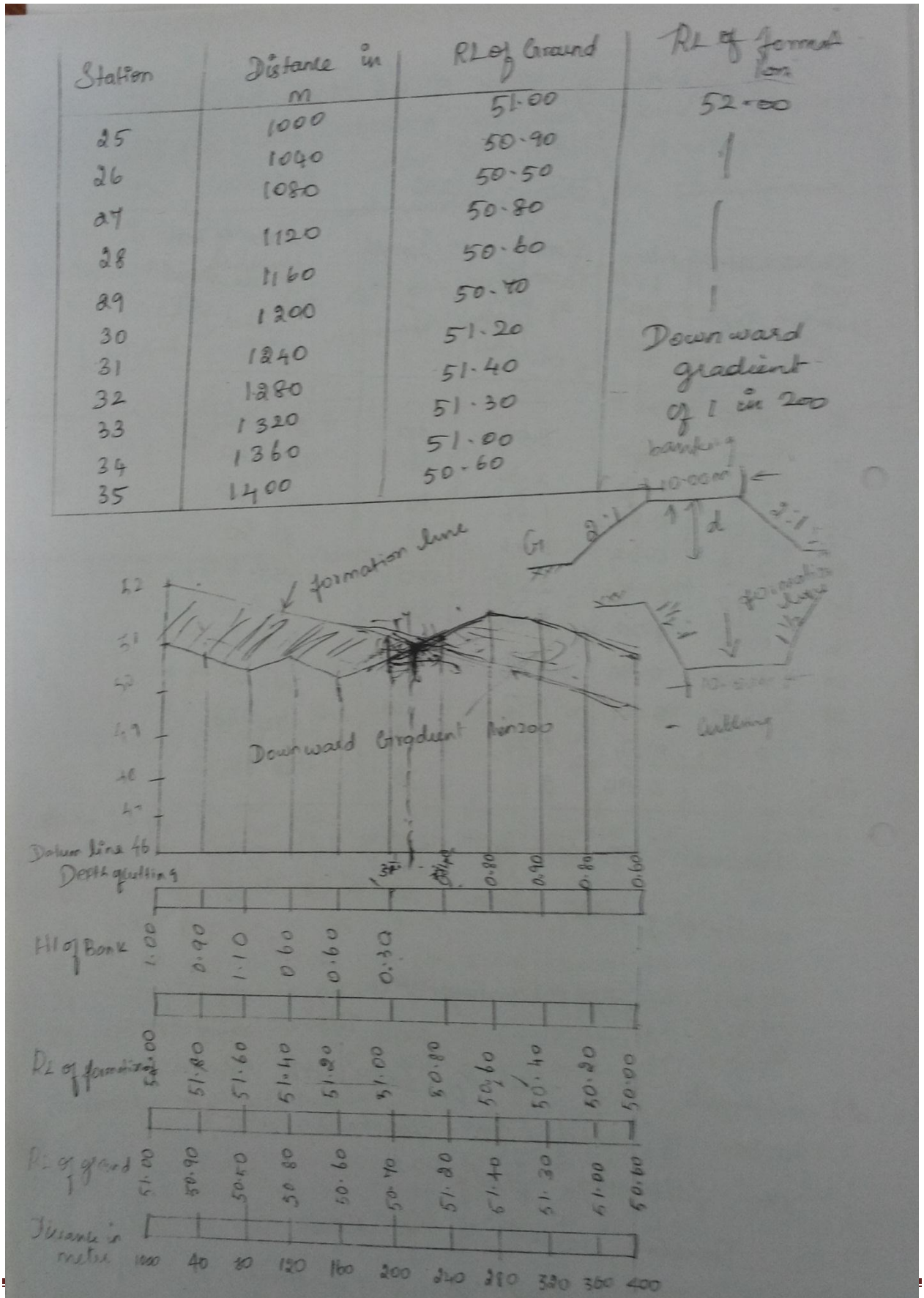
2) Estimate the cost of Earthwork for a portion of road for 400 metre length from the following data.

Formation width of the road is 10 metre.

Side slopes are 2:1 in banking, 1/2:1 in Cutting

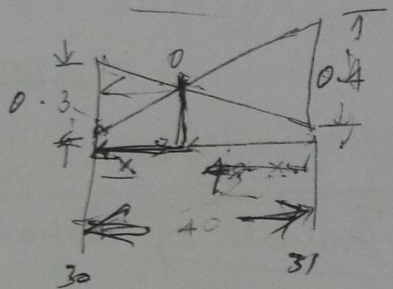
Station	Distance in m	RL of Ground	RL of formation
25	1000	51.00	52.00
26	1040	50.90	
27	1080	50.50	
28	1120	50.80	
29	1160	50.60	
30	1200	50.70	
31	1240	51.20	
32	1280	51.40	
33	1320	51.30	
34	1360	51.00	
35	1400	50.60	

Downward gradient of 1 in 200



The road passes from banking to cutting in between the stations 30 (1200 m) and 31 (1240 m) The distance where it passes through Zero, i.e. ground level, may be determined as follows.

The two Δ's on either side of Zero point are symmetrical



$$\frac{x}{0.3} = \frac{40-x}{0.4}$$

$$0.4x = 0.3(40-x)$$

$$0.4x = 12 - 0.3x$$

$$0.7x = 12$$

$$x = 12/0.7 = 17.14\,m$$

$$= 17\,m \text{ say}$$

Therefore length of banking portion is 17m, & the length of cutting portion is $40 - 17 = 23\,m$.

ation	Distance Km m	Ht (or) Depth Diff of Col 2	Mean ht (or) Depth d (m)	Central area Bd (m)	Area of sides sd^2 m^2	Total sec area $Bd+sd^2$ m^2	Dist in b/w Stations L (m)	Quantity $(Bd+sd^2)\times L$ Banking m^3	Cutting m^3
28	1-00	1.00	—	—	—	—	—	—	—
16	1-40	0.90	0.95	9.50	1.81	11.31	40	452.40	
27	1-80	1.10	1.00	10.00	2.00	12.00	40	480.00	
28	1-120	0.60	0.85	8.50	1.45	9.95	40	398.00	
29	1-160	0.60	0.60	6.00	0.72	6.72	40	268.80	
20	1-200	0.30	0.45	4.50	0.41	4.91	40	196.40	
Passes from banking to cutting									
1	1-217	0.06	0.15	1.50	0.05	1.55	17	26.35	—
31	1-240	0.40	−0.20	2.00	0.06	2.06	23		47.38
32	1-280	0.80	−0.60	6.00	0.54	6.54	40		261.6
33	1-320	0.90	−0.85	8.50	1.08	9.58	40		383.20
34	1-360	0.80	−0.85	8.50	1.08	9.58	40		383.20
35	1-400	0.60	−0.60	4.00	0.74	4.74	40		309.60
							Total	1821.95	1384.98

Abstract of cost @

Item	Particulars of items	Quantity	Unit	Rate	Per	Cost
1.	Earthwork in Banking	1821.95	Cum	275.00	% cum	5010.36
2.	Earthwork in Cutting	1384.98	Cum	350.00	% cum	4847.43
					Total	9857.79
	Add 3% for contingencies					295.73
	Add 2% to work charged Establishment					197.16
						10350.68

Estimate of Septic tank for 25 Users.

Septic tank:

Septic tank is usually consists of Brick wall in Cement mortar not less than 20cm (9") th & the foundation floor are of CC 1:3:6 (or) 1:2:4.

Both inside & Outside faces of wall and floor are plastered with minimum th 12mm

floor should be slope 1 in 20, Septic tank may also be built stone masonry, precast (or) cast in situ Cement concrete 1:2:4 proportion.

Cover of the septic tank is of RCC slab with circular openings.

Soak Pit (or) Seepage pit:-

Soak pit not less than 90cm in dias & not less than 1.5 m depth below invert level of the inlet pipe.

The pit is constructed with lining of brick or stone with open joints

Ex-1 Prepare a detailed Estimate of a septic tank with soak pit for 25 users for the drawings.

Item no	Particulars of items	No	L	B	D	Qty	Remarks
1	Earth work Septic tank	1	2.8	1.7	1.95	9.26	Ht = 1.40 + 0.3 + 0.2 + 0.05 = 1.95 m.
	Soak pit up to 3.00 m depth.	1	$\frac{\pi \times 2.00^2}{4}$		3.00	9.42	
	Soak pit lower portion.	1	$\frac{\pi \times 1.4^2}{4}$		0.20	0.30	
					Total	19.00	cum.
2	Cement concrete 1:3:6 - floor & foundation ~~Sloping~~ Sloping floor	1	2.80	1.70	0.20	0.95	Average thickness $\frac{10+0}{2}$ = 5 cm
		1	2.00	0.90	0.05	0.09	
	1st class BW in 1:4 cm in. Septic tank						
	Long walls.					0.94	
	1st step	2	2.60	0.30	0.60	~~0.32~~	
	2nd step	2	2.40	0.20	1.15	~~0.92~~ 1.10	
	Short walls						
	1st step	2	0.9	0.30	0.60	0.32	
	2nd step	2	0.9	0.20	1.15	0.42	
4	2nd class BW in 1:6 cm						
	Soak pit						
	Upper portion	1	$\pi \times 1.20$	0.20	0.50	0.38	
	Lower portion	1	$\pi \times 1.20$	0.20	0.20	0.15	
						0.53	
5	2nd class dry BW in soak pit	1	$\pi \times 2$	0.20	2.50	1.88	cum.

6. Precast R.C work finished smooth including steel reinforcement complete laid in position.

Roof Cover slab of Septic tank	1	2.40	1.30	0.075	0.234	7.5cm thk
Roof cover slab of Soak pit	1	$\frac{\pi \times 1.40^2}{4}$	×	0.075	0.115	
Baffle wall in Septic tank	1	1.00	0.04	0.45	0.018	
				Total	0.367 cum	

7. 12mm cement plaster 1:3 with standard water proofing compound in Septic tank

Long walls	2	2.00	–	1.70	6.80
Short walls	2	0.90	–	1.70	3.06
			Total		9.86 sqm

8. 20mm Cement plaster 1:3 with standard water proofing compound in floor of septic tank

	1	2.00	0.90	–	1.80 sqm.

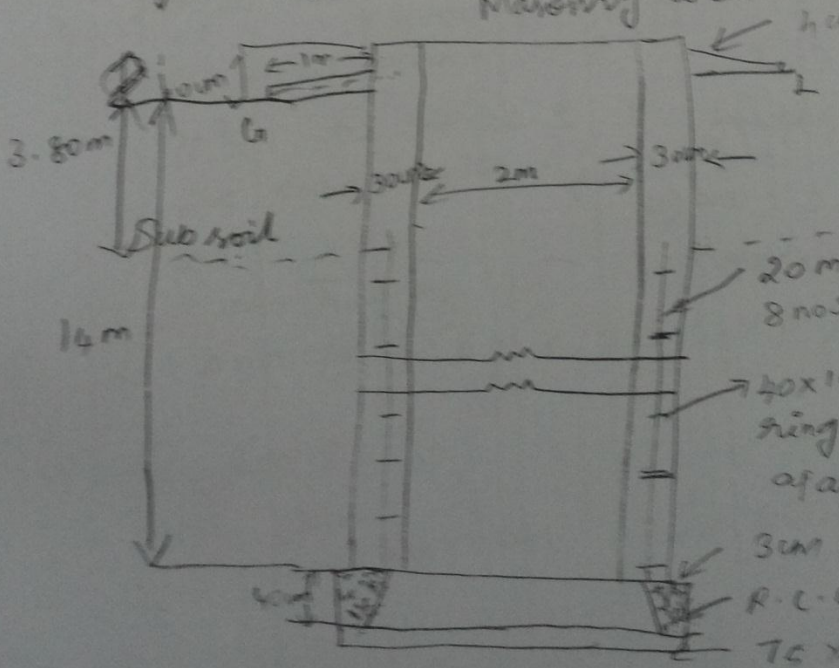
9. 50mm size brick aggregate :-

Outside of soak pit	1	$(\pi \times 3.55)$	×0.15	2.50	1.84	L = mean Girth.
At bottom of soak pit	1	$\frac{\pi \times 1.01^2}{4}$	×	0.20	0.16	
					2.00 cum	

2

Tube well

1) Prepare a detailed Estimate of a masonry well of 2 metre diameter and 14 metre deep exclusive the curb from the drawing, the soil water level being 3.80 m below G.L. The steining of well is of 30cm thk of I st class brick masonry in 1:6 Cement mortar. the inside & exposed surfaces shall be pointed with 1:2 cement mortar. The well should be provided raised 60cm above G.L & an apron of 4cm C.C. over 7.5 cm L.C. 1 metre wide shall be provided all round the well. The curb shall be of RCC with 75 X 75 X 6 mm angle iron Cutting edge.



	Coarse sand Outer side of soak pit	1	(π×1.85)	×.15	2.50	2.18 cum	L = mean circum
	Iron foot steps of 16mm dia bar	4	—	—	—	4 nos	
12	100 mm dia S.W pipe laying & jointing with 1:3 Cm complete						
	Inlet end from Latrine to septic tank	1	3.00	—	—	3.00	
	Outer end from septic tank to soak pit.	1	3.30	—	—	3.30	
						6.30	
13	S.W Tee 100mm dia with one leg of 40cm	1	—	—	—	1 no.	
14	S.W Bend 100 mm dia	1	—	—	—	1 no	
15	50mm dia. C.I Ventilating pipe	1	2.00	—	—	2.00	rm.,
16	50 mm dia C.I Cowl at top of Ventilating pipe	1	—	—	—	1 no.	

Item no	Items	No	L	B	D	Qty	Remarks
1.	Earth work excavation up to subsoil water level.						
	i) Up to 1.5m depth.	1	$\frac{\pi \times 2.66^2}{4}$	x	1.5	8.34	outer dia = 2+0.33/2 +0.03x2 = 2.66m
	ii) 1.5m to 3.00m	1	"	"	1.5	8.34	
	iii) 3.00m to 3.80	1	"		0.8	4.45	
2.	R.C.C work in Curb including steel (Sectional area x mean length at C.G)	1/2	x(.33x 0.40)	(πx2.40)		0.506 cum	Mean dia of C.G of Δ section $2 \times \frac{4}{3} \times 0.33 = 2.44m$
3.	Iron work						
	Angle iron 75x75 x 6mm @ 6.8 kg in curb -	1	(π x 2.66)	x 6.8kg		56.84	L = outer circ
	Vertical tie rods 20mm dia @ 2.47kg	8	x (10.60x 2.47kg)			209.45	
	Flat iron ring of 40x10mm @ 3.1kg	8	(πx2.30 x 3.1)			179.30 kg	
4	1st class BW in well Steining in 1:6 cement mortar	1	πx2.30	0.30	14.6	31.67	S = Mean circumference sqm.
5	Cement pointing 1:6 inside						

	Inside	1	$(\pi \times 2.00) \times$	14.60	91.80	
	Outside above Gr.L	1	$(\pi \times 2.60) \times$	0.485	3.96	
	Top of wall	1	$(\pi \times 2.30) \times \frac{30}{2}$		2.17	HT abv apron L = Mean Circumference.
6.	4cm L-C over 7.5 cm L-C apron (floor)	1	$(\pi \times 3.60) \times$	1.00	11.30	
7.	Sinking of well – below springing (Sub soil water level)					
	i) upto 1.50m below springing level	1	– –	1.50	1.50rm	
	2) 1.50m to 3.00m below springing level.	1	– –	1.50	1.50rm	
	3) 3.00m to 6.00m below springing level	1	– –	3.00	3.00rm	
	4) 6.00m to 9.00m	1	– –	3.00	3.00rm	
	5) 9.00m to 10.20m	1	– –	1.20		

EXAMPLE

ØCalculate the total rough cost estimate and cost per Flat for a multi-storey (4-storeyed) block consisting of 40 residential flats. Other details are given in the table:

Sr. No	PORTION	AREA (sq. ft)	UNIT COST (Rs./sq.ft.)		Building Works	Sanitory Works
Electric Services		Sui Gas Services				
1	Main Flat Area	(i) Ground Floor	(ii) Ist Floor	(iii) 2nd Floor	(iv) 3rd Floor	
20030 20030 20030 20030		1800 1500 1650 1800		130 130 130 130		100 100 100 100
60 60 60 60						
2	Park Area at G. Floor	75,800	800	--------	40	-------
3	Circulation Area in all 4 floors	1936	1050	--------	70	-------
4	Covered Shopping Area at G. Floor		920	950	--------	70 -------
5	Attached Servant Quarters	2112	1150	55	70	40

Add the following costs as Lump Sum :

1- Road and Walkways = 15,00,000/-

2- Land Scapping = 12,00,000/-

3- External Sewerage = 7,00,000/-

4- External Water Supply, Overhead and Underground Water Tanks with pumping machinery for each set of Flats = 19,00,000/-

5- External Electricity = 3,00,000/-

6- Boundary Wall = 6,00,000/-

7- Miscellaneous unforeseen items
= 8,00,000/-

8- Add 6 % development charges.

9- Add 3 % consultancy charges

EXAMPLE 2

•Prepare a Rough-cost Estimate of a residential building project with a total plinth area of all building of 1500 sq.m. given that:

• linth Area Rate = Rs: 950.00 / sq. ft.

•Extra for special architectural treatment = 1.5 % of the buiding cost.

•Extra for water supply and sanitary installations = 5 % of the building cost.

•Extra for internal installations = 14 % of the buiding cost

•Extra for Electric & Sui gas services = 16 % of buiding cost

•Contigencies 3 % overall

•Supervision charges = 8 % overall

•Design charges = 2 % overall

EXAMPLE 3

•Prepare a Rough-cost Estimate based on unit costs of per unit plinth area basis of a four storeyed office building having a carpet area of 2000 sq.m. for obtaining the administrative approval of the

Government. It may be assumed that 30 % of the built up area will be taken by the corridors, verandas, lavatories, staircase, etc. and 10 % of built up area will be occupied by walls. The following data is given:

•Plinth Area Rate = Rs: 1100.00 / sq. ft.
•Extra for special architectural treatment = 0.5 % of the buiding cost.
•Extra for water supply and sanitary installations = 6 % of the building cost.

Example 3

•Extra for internal installations = 14 % of the buiding cost
•Extra for electric services = 12.5 % of buiding cost
•Extra for sui gas services = 6 % of buiding cost
•Extra due to deep foundations at site = 1.0 % of buiding cost
•Contigencies = 2.5 % overall
•Supervision charges = 8 % overall
•Design charges = 2.5 % overall

Example 4
•Prepare a Rough-cost Estimate for obtaining the administrative approval of the Government for a hospital project to serve both indoor and outdoor patiesnts in an important rural area. The hospital will consist of the following:
•Main administrative office with dispensing operations, etc.
•Two general wards, each of 20 general beds.
•Superintendent Doctor's Residence.
•Two Assistant Doctor's Residences.
•Eight single Nurses Quarters.
•Four Compounder's Quarters.
•Twelve lower staff's Quarters.

DETAILED ESTIMATE
•Detailed estimates are prepared by carefully and separately calculating in detail the costs of various items of the work that constitute the whole project from the detailed working drawings after the design has been finalized.

•The mistakes, if any, in the rough cost estimate are eliminated in the detailed estimate.

•Detailed estimates are submitted to the competent authorities for obtaining technical sanction.

DETAILED ESTIMATE
•The whole project is sub-divided into different items of work or activities. The quantity for each item is then calculated separately from the drawings as accurately as possible. The procedure is known as "taking out of quantities".

•The quantities for each item may be estimated and shown in the pattern which is called "Bill of quantities."

•The unit, in which each item of the wok is to be calculated, should be according to the prevailing practice as followed in various departments of the country.

Sr. No	Description of item	No	Measurements			Quantity	Total Quantity	Remarks
			Length	Breadth	Height			

BILL OF QUANTITIES

Sr. No.	Description of Item	Unit	Quantity	Rate	Cost	Remarks

PRICED BILL OF QUANTITIES

DETAILED ESTIMATE

•Each item of the work is then multiplied by its estimated current rate calculated by a fixed procedure to find out cost of the item.

•At the end, a total of all items of the work are made to get the total estimated cost.

•The rates are usually as per Schedule of Rates for the locality plus a premium to allow for rise in labor and material rates over and above the schedule of rates.

•A percentage, usually 5% is also provided on the total estimated cost for the work to allow for the possible contingencies due to unforeseen items or expenditure or other causes, besides 2% establishment charges.

DETAILED ESTIMATE

ØBesides drawings and details of measurements and calculation of quantities (Bill of Quantities), the following documents are also usually submitted with the detailed estimate for obtaining Technical Sanction:

1.A report explaining History, necessity, scope and main features of the project, its design, and estimate, etc.

2. Specifications lying down the nature and class of work and material to be used in various parts of the work.

3. The abstract of cost (priced Bill of Quantities) showing the total quantities under each sub-head, rate per unit of measurement, and cost.

4. Calculation sheets showing calculations for important parts of the structure. In fact, in estimating the art and skill lies only in the computation of details without any omissions, of all parts of the building or work.

CLASSIFICATION DEPENDING UPON PURPOSE OF DETAILED ESTIMATE

1- **CONTRACTOR ESTIMATE** It is made by the contractor for determining the price or prices to be bid. It is usually a carefully prepared detailed estimate.

2- **ENGINEER'S ESTIMATE**

This type of estimate is made by the Engineer (Consultant) usually for the purposes of financing the work and for checking bids and running bills submitted by contractors.

3- **PROGRESS ESTIMATES**

•These are made by the Engineer at regular intervals for the completed parts of the project during the progress of the work for determining the amounts of partial payments to be made to the contractor.

CONTRACT DEFINITION

•An agreement made between two or more parties which is enforceable by law to provide something in return for something else from a second party.

•A construction contract is a contract specifically negotiated for the construction of an asset or a combination of assets that are closely interrelated or interdependent in terms of their design, technology and function or their ultimate purpose or use.

Contract = offer + acceptance + consideration

•It can be very simple or they may be
very long and complicated legal documents

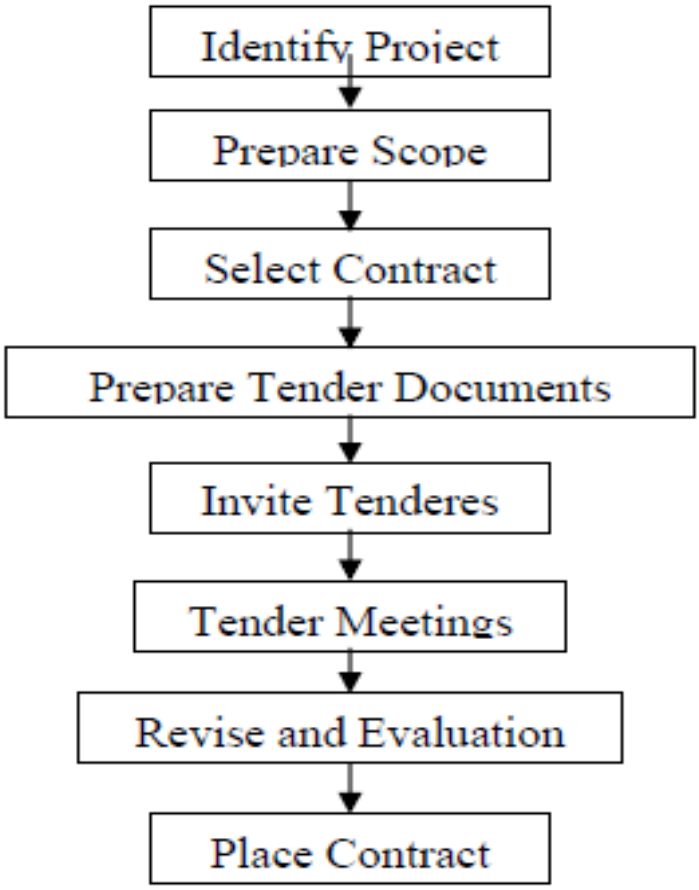
•It can be very simple or they may be
very long and complicated legal documents

Major Project Phases

•The major phases in the project cycle that are common to most design and construction projects are :

Project Planning
Design
Schematic Design
Design Development
Contract Documents
Construction Procurement (Bidding Phase)
Construction
Post Construction

Steps of contracting process



Why contract is necessary in construction?

- Reduced stress for owner
- Easy work and growth of the company.
- Single point of contact for owner simplifies communications.
- Ready availability of post-commissioning services
- Ensures quality and reduces practical issues faced in other ways .
- Owner protected against changing prices for materials, labor, etc.
- Cost is known at the start of the project

Why contract is necessary in construction?

Describe scope of work
Establish time frame
Establish cost and payment provision
Minimize disputes
Improve economic return of investment

Introduction to contracts

Why Use contract in construction:

Describe scope of work
Establish time frame
Establish cost and payment provision
Set fourth obligations and relationship
Minimize disputes
Improve economic return of investment

Content of the contract
oIdentify the parties
oPromises and responsibilities
oScope of work
oPrice and payment terms
oCommercial terms and conditions
oProject execution plan.

Major Contract Types (traditional)

Lump Sum Contract
•One price for the whole contract
•Lump sum includes costs plus overheads and profits
•Higher risk to contractor
•Price quoted is a guaranteed price as per contract documents.
•Payment based on a scheduled percentage scheme (monthly progress claims)
•The contractor is free to use means and methods to complete the work and responsible for proper performance
•Work must be well defined at bid time.
•Fully developed plans and specifications

Lump Sum Contract/ advantage
•Low risk on the owner, Higher risk to the contractor
•Cost known at outset
•Contractor will assign best personnel
•Contractor selection is easy.

Lump Sum Contract/disadvantage
•Changes is difficult and costly.
•Contractor is free to use the lowest cost of material equipment, methods.

Lump Sum Contract
•With this kind of contract the engineer and/or contractor agrees to do the a described and specified project for a fixed price. Also named "Fixed Fee Contract". Often used in engineering contracts.

•A Fixed Fee or Lump Sum Contract is suitable if the scope and schedule of the project are sufficiently defined to allow the consulting engineer to estimate project costs

•Payment may be staged at intervals on the completion
•The contract has a very limited flexibility for design changes.
•The tendered price may include high level of financing and high risk contingency.
• Where considerable risk has been places with the contractor, this contract may lead to cost cutting, trivia claims, or bankruptcy.
•Contract final price is known at tender.

•An important risk t the client is that of not receiving competitive bids from desirable contractors who may avoid a high-risk lump-sum contract.
•This contract may be used for a turnkey construction.
•It is appropriate when work is
–defined in detail,
–limited variations are expected,
–level of risk is low and quantifiable, and
–client does not wish to be involved in the management of his project.

Unit Price
Quote Rates / Prices by units
No total final price
Re-negotiate for rates if the quantity or work considerably exceeds the initial target
Payment to contractor is based on the measure.
Unbalanced bids
Higher risk to owner
Ideal for work where quantities can not be accurately established before construction starts.

Unit Price contract
Require sufficient design definition to estimate quantities of units
Contractors bid based on units of works
Time & cost risk (shared)
üOwner : at risk for total quantities
üContractor : at risk for fixed unit price.
Large quantities changes (>15-25%) can lead to increase or decrease of unit price.

Unit Price / Requirement
•Adequate breakdown and definition of work units
•Good quantity surveying and reporting system.
•Adequate drawings.
•Experience in developing BOQ
•Payment based on the measurement of the finished works.

•Quantity sensitive analysis of unit prices to evaluate total bid price for potential quantity variation.

Unit Price / advantages

•Suitable for competitive bid
•Easy for contract selection
•Early start is possible
•Flexibility : quantities and scope can be easily adjusted

Unit Price / Disadvantages

vFinal cost not known from the beginning (BOQ only is estimated)
vStaff needed to measure the finished quantities and report on the units not completed.
vUnit price sometime tend to draw unbalanced bid. (For Unit-Price Contracts, a balanced bid is one in which each bid is priced to carry its share of the cost of the work and also its share of the contractor's profit.
Contractors raise prices on certain items and make corresponding reductions of the prices on other items ,without changing the total amount of the bid)

Cost Plus

1.Actual cost plus a negotiated reimbursement to cover overheads and profit.
2.different methods of reimbursement :
–Cost + percentage
–Cost + fixed fee
–Cost + fixed fee + profit-sharing clause.
3.Higher risk to owner
4.Compromise : Guaranteed Maximum Price (GMP) reduces risk to owner while maintain advantage of cost plus contract.
5.By using this type of contract the contractor can start work without a clearly defined project scope, since all costs will be reimbursed and a profit guaranteed.

Advantages Disadvantages
profitable for the contractor No incentive to finish job quickly
Owner does not know total price
Larger the cost of the job, the higher the fee the owner pays

Cost + Percent of Cost
–Fee = percentage of the total project cost
•(Cost = $500.000,Fee = 2%)

Advantages Disadvantages
Fee amount is fixed regardless of price fluctuation Expensive materials and construction techniques may be used to expedite construction
Provides incentive to complete the project quickly

Cost + Fixed Fee

•Fee = percentage of the original estimated total figure
–Utilized on large multi-year jobs
– Ex: WW treatment plant Facility (Cost = $20 million, Fee = 1%)
–$20 Million 1% fee = $200,000 Million

Cost Plus Fixed Fee
–Most common form of negotiated contracts
–COST = expenses incurred by the contractor for the construction of the facility
•Includes: Labor, equipment, materials, and administrative costs
– FEE = compensation for expertise
• Includes: profit

Advantag es Disadvantages
Provides incentive to the contracto r to save money Contractor must absorb any amount over the GMP
Plans & specs. need to detailed
Cost + Fixed Fee + Profit-Sharing Clause
–Rewards contractors who minimize cost
–Percentage of cost under GMP is considered profit and shared with the contractor
•Guaranteed Maximum Price (GMP)
•% of profit sharing is specified in contract

Cost + Fixed Fee + Profit-Sharing Clause
variation of this type of contract is called a guaranteed maximum price (GMP).
•In this type of contract the contractor is reimbursed at cost with an agreed-upon fee up to the GMP, which is essentially a cap; beyond this point the contractor is responsible for covering any additional costs within the original project scope
•An incentive clause, which specifies that the contractor will receive additional profit for bringing the project in under the GMP.

Construction Documents
Bidding requirements
Notice to Bidders
Instruction to Bidders
Proposal Form
Contract Documents
Contract Forms
Conditions of the Contract
Specifications
Drawings
Addenda

Change Orders
Agreement.

Construction Documents

•Construction Documents are defined as the written and graphic documents prepared or assembled by the A/E for communicating the design of the project and administering the contract for its construction.

• **2 major groups**

1.Bidding Requirements

Used to attract bidders & explains bidding process

2.Contract Documents

Legally enforceable requirements that become part of the contract

Include all construction documents except bidding forms

CONSTRUCTION DOCUMENTS BIDDING REQUIREMENTS

BIDDING REQUIREMENTS

Bidding Requirements are used to attract bidders and explain the procedures to be followed in preparing and submitting bids .

Bidding requirements help bidders follow established procedures and submit bids that will not be disqualified because of technicalities. They do not become part of the contract documents

Bidding documents

All of the construction documents issued to bidders before the signing of an owner-contractor agreement.

Bid Package

Documents available to the contractor and on which he must make a decision to bid or not

A set of plans and technical specifications, Proposal form, general conditions, special conditions, Description of the project to be constructed

DEFINITION

¢An offer in writing to execute some specified work or to supply some specified articles at certain rates, within a fixed time under certain conditions of contract and agreement, between the contractor and the department or owner or party

WHY TENDERING ????

(A)Procurement of goods in Public

Interest –

i.Efficiency,

ii.Economy,

iii.Transparency

(B) Fair & Equitable treatment of suppliers

(C)Promotion of Competition

CONTRACTUAL RELATIONSHIPS

COMPETITIVE TENDERING

lInvites contractors to submit the lowest price for which they are willing to carry out a project
lRelies on the information contained in drawings, specifications and bills of quantities prepared on behalf of the construction client.
lTypes

- Open
- Selective
  - ¢One or two stages
- Single Tender

OPEN TENDERING

lAllows any contractor to submit a tender to an advertised project
lProcess

- Client advertises openly in the press or the trade publications inviting contractors to apply for the project
- Contractor that is able to under take the project would request a tender document
- After receiving the tender from the architect, the contractor may be required to give a deposit and to ensure a bona fide tender. This is done to filter out the contractors who are not interested in submitting a tender.

OPEN TENDERING
¢Advantages
lMaximum competition
lLowest price obtained
¢Disadvantages
lLarge waste of effort because too many contractors are tendering
lContractor submitting lowest tender may not be properly equipped to undertake the contract
lClient may be inclined to accept lowest tender irrespective of reputation of contractor
lPoor quality building or bankruptcy may occur

SELECTIVE TENDERING

lWhere contractors of known reputation are selected to submit a tender

- The cheapest among them is selected to deliver the project

lCommonest method of awarding a tender

lProcess

- A design team select a number of contractors (normally 6) that are already known to them and invite them to tender for the project

Contractors' tenders are usually based on a completed design

Project is awarded to the contractor with the lowest tender.

SELECTIVE TENDERING

¢Advantages

lAs tenderers are known, selection of cheapest bid is not as high a risk as in an open tender

¢Disadvantages

lLimiting the number of tenderers may exclude new bidders who may offer more innovative ideas or slutions

TWO-STAGE TENDERING

lAim - to speed up the procurement process by getting the architect and the contractor to start the project as soon as possible.

With this approach the contractor will be able to start work (e.g. excavation, foundations) on site as soon as possible.

lImprove build ability - utilising skills of architect and contractor

lProcess

Usually a contractor will be chosen through a form of selective competition with a simple bill of approximate quantities, these will be:

¢The preliminary items

¢Major items of measured work

TWO-STAGE TENDERING

Where contractors' tenders are based on a partially developed consultants design (Stage 1 tender). The contractor then assists with the final development of the design and tender documents, against which tenders for the construction works are prepared (Stage 2 tender). The first stage tenderer has the opportunity to tender or negotiate the second stage

Specialist items used included as Prime Cost Sum, upon which contractors are given the opportunity to include sums for profit and attendance.

The client will also ask the contractor to state their overheads and profits. These prices will determine the price agreement that will be negotiated with the successful contractor.

TWO-STAGE TENDERING

¢Advantages

lAllows contractor to have input into design and build ability and helps team-building, thereby helping avoid future adversarial attitudes

lFast tendering

lSpeed of construction (build-ability)

lCosts are known for quick negotiation

¢Disadvantages

lThe architect and contractor might not agree on designs

lDue to problems with architect and contractor the project completing time could suffer

SINGLE TENDER

q If only a particular firm is the manufacturer

qEmergent need to procure from a particular source

qTechnical reason to be recorded (standardization of machinery – HP, SONY etc.)

N.B. - Single response to an open bid can't be termed as Single Tender

NEGOTIATION TENDER

¢The process of negotiation tendering involves the client consulting chosen contractors to negotiate the contract and its terms.

¢ This process is adopted for special circumstances. For example, it is often used in emergency situations that require the completion of a project within a short span of time or with complex contracts in which financial and technical properties are difficult to identify.

¢This negotiation tendering process is also used in situations involving security projects of national importance.

WEB-BASED TENDERING

¢Web-based tendering has become a popular option. Web-based technology is used for the tendering processes.

¢Under this system, tenders are advertised online and tender documents uploaded. Any interested person can fill out the tender documents and bid for a project online. Various electronic tendering applications are used in countries like America, Australia, Europe and Japan.

TENDER EVALAUTION

¢Evaluation may be 2 stages

lPre-tender or Pre-Qualification (Pre-Qual)

- Ensure that contractors are
  - ¢Reputable
  - ¢Capable
  - ¢Experienced

lPre-Contract

- Ensure that contractors
  - ¢Fully understand the contract
  - ¢Bid is realistic
  - ¢Proposed resources are adequate

TENDERING

lInvitation to Tender

- must state the place where and the date and time by which the tender must be received
- that the tender must be enclosed in a sealed envelope or package marked with the word 'Tender' followed by the subject to which it relates and the deadline for tender receipt.

Adequate time must be allowed for the preparation and return of tenders depending on size of project.

lReceipt, Custody and Opening of Tenders

All tender envelopes or packages received must be marked with the date and time of receipt and the initials of the receiving officer, and recorded.

All tenders shall remain sealed in secure custody until the time appointed for their opening.

¢Any tender received after the specified time shall be recorded as such but must not be considered.

Tenders shall be opened at one time and in the presence of at least two officers who shall be independent of each other and shall sign a complete record of all tenders opened, showing the date and time of opening and the value of each tender.

lAcceptance of Single Quotation or Tender Received

Where only one tender or quotation is received, the Project Director could determine for contracts up to a certain price whether or not to accept the quotation or tender. For high value projects decisions need to made jointly with project sponsors. The tendering exercise may be repeated.

Tenders should be opened as soon as possible after the latest time for receipt of tenders.

In the event of the lowest tenderer withdrawing his offer, the second and third lowest tenderers should be informed that their tenders were not the most favourable received but their offers are being actively considered.

lNominated Sub-Contractors and Suppliers

Where nominated sub-contractors are to be used, they must go through a similar process to the main contractor

TENDERING

¢Tenderers shall certify and give undertakings that:

lthe tender is genuine and intended to be competitive;

lthey have not fixed or adjusted the amount of the tender by or under or in accordance with any agreement or arrangement with any other person*;

lthey have not done and will not do, at any time before the time and date specified for the return of the tender, any of the following:

linform any person the amount or approximate amount of the proposed tender, except where the confidential disclosure of the approximate amount of the tender was necessary to obtain insurance premium or other quotations necessary for tender preparation;

lenter into any agreement or arrangement with any other person with the aim of preventing tenders being made or as to the amount of another tender or the conditions on which the tender is made;

loffer to pay or give or agree to pay or give any sum of money or valuable consideration directly or indirectly to any person for doing or having done or causing or having caused to be done in relation to any other tender or proposed tender for the Council any of the actions specified and described in this section;

lcause or induce any person to do any of these things

TENDER DOCUMENTS

lCovering letter
lAn invitation to tender
lInstructions to bidders
lSpecifications and detailed descriptions of the goods and services to be purchased including criteria for evaluation
lDetails of other professionals and parties involved
lDraft of basic terms and conditions of contracts
lStandard forms for tenders, including the quality and price schedules, health & safety questionnaires
lDetails of information required from the tenderer as part of the submission

EARNEST MONEY DEPOSIT

¢To safeguard the interest of Deptt (withdrawal / alter the bid by bidder)
¢Exemption – Regd. With Central Purchase Organisation / National Small Industries Corporation
¢EMD - 2 % to 5% of estimated value
¢Can be DD/ FDR/Banker Cheque /BG
¢Unsuccessful bidders EMD should be returned /refunded at the earliest.

PERFORMANCE SECURITY

¢From the successful bidders
¢Amount – 5% to 10%
¢DD/FDR
¢Should be valid for 60 days beyond the date of completion of all the contractual obligations of the supplier including warranty
¢Bid Security should be refunded on receipt of Performance Security

ARBITRATION

•The process by which the parties under a contract get their disputes and differences,settled through th intervention of an impartial or a committee of experts in a judicial manner.
•The impartial person or persons are known as the Arbitrators.

Advantages

•When the subject matter of the dispute is highly technical, arbitrators with an appropriate degree of expertise can be appointed (as one cannot "choose the judge" in litigation) [5]

•Arbitration is often faster than litigation in court [5]
•Arbitration can be cheaper and more flexible for businesses
•Arbitral proceedings and an arbitral award are generally non-public, and can be made confidential [6]

•In arbitral proceedings the language of arbitration may be chosen, whereas in judicial proceedings the official language of the country of the competent court will be automatically applied
•Because of the provisions of the New York Convention 1958, arbitration awards are generally easier to enforce in other nations than court judgments

•In most legal systems there are very limited avenues for appeal of an arbitral award, which is sometimes an advantage because it limits the duration of the dispute and any associated liability

Disadavantages

•Arbitration may be subject to pressures from powerful law firms representing the stronger and wealthier party [citation needed]

•Arbitration agreements are sometimes contained in ancillary agreements, or in small print in other agreements, and consumers and employees often do not know in advance that they have agreed to mandatory binding pre-dispute arbitration by purchasing a product or taking a job

•If the arbitration is mandatory and binding, the parties waive their rights to access the courts and to have a judge or jury decide the case

•In some arbitration agreements, the parties are required to pay for the arbitrators, which adds an additional layer of legal cost that can be prohibitive, especially in small consumer disputes [citation needed]

•In some arbitration agreements and systems, the recovery of attorneys' fees is unavailable, making it difficult or impossible for consumers or employees to get legal representation [citation needed] ; however most arbitration codes and agreements provide for the same relief that could be granted in court

•If the arbitrator or the arbitration forum depends on the corporation for repeat business, there may be an inherent incentive to rule against the consumer or employee

•There are very limited avenues for appeal, which means that an erroneous decision cannot be easily overturned

•Although usually thought to be speedier, when there are multiple arbitrators on the panel, juggling their schedules for hearing dates in long cases can lead to delays

•In some legal systems, arbitral awards have fewer enforcement options than judgments; although in the United States arbitration awards are enforced in the same manner as court judgments and have the same effect

•Arbitrators are generally unable to enforce interlocutory measures against a party, making it easier for a party to take steps to avoid enforcement of member or a small group of members in arbitration due to increasing legal fees, without explaining to the members the adverse consequences of an unfavorable ruling

•Rule of applicable law is not necessarily binding on the arbitrators, although they cannot disregard the law [citation needed]

•Discovery may be more limited in arbitration or entirely nonexistent

•The potential to generate billings by attorneys may be less than pursuing the dispute through trial

•Unlike court judgments, arbitration awards themselves are not directly enforceable. A party seeking to enforce an arbitration award must resort to judicial remedies, called an action to "confirm" an award

•Although grounds for attacking an arbitration award in court are limited, efforts to confirm the award can be fiercely fought [citation needed] , thus necessitating huge legal expenses that negate the perceived economic incentive to arbitrate the dispute in the first place.
•Arbitrability

•By their nature, the subject matter of some disputes is not capable of arbitration. In general, two groups of legal procedures cannot be subjected to arbitration:
•Procedures which necessarily lead to a determination which the parties to the dispute may not enter into an agreement upon: [7] Some court procedures lead to judgments which bind all members of the general public, or public authorities in their capacity as such, or third parties, or which are being conducted in the public interest. For example, until the 1980s, antitrust matters were not arbitrable in the United States. [8]

•Matters relating to crimes, status and family law are generally not considered to be arbitrable, as the power of the parties to enter into an agreement upon these matters is at least restricted. However, most other disputes that involve private rights between two parties can be resolved using arbitration. In some disputes, parts of claims may be arbitrable and other parts not. For example, in a dispute over patent infringement, a determination of whether a patent has been infringed could be adjudicated upon by an arbitration tribunal, but the validity of a patent could not: As patents are subject to a system of public registration, an arbitral panel would have no power to order the relevant body to rectify any patent registration based upon its determination.
•Some legal orders exclude or restrict the possibility of arbitration for reasons of the protection of weaker members of the public, e.g. consumers. Examples: German law excludes disputes over the rental of living space from any form of arbitration, [9] while arbitration agreements with consumers are only considered valid if they are signed by either party, [10] and if the signed document does not bear any other content than the arbitration agreement

Sum in Dispute (Claim + Counter Claim) (In Indian Rupees)	Arbitrator's Fees (In Indian Rupees)
Upto 50,000	10000
50,001 to 1,00,000	10,000 + 14% excess over 50,000
1,00,001 to 5,00,000	24,000 + 5.25% excess over 1,00,000
5,00,001 to 10,00,000	66,000 + 3.8% excess over 5,00,000
10,00,001 to 20,00,000	1,04,000 + 1.9% excess over 10,00,000
20,00,001 to 50,00,000	1,42,000 + 0.9% excess over 20,00,000
50,00,001 to 1,00,00,000	1,96,000 + 0.5% excess over 50,00,000
1,00,00,001 to 5,00,00,000	2,46,000 + 0.2% excess over 1,00,00,000
5,00,00,001 to 8,00,00,000	4,06,000 + 0.13% excess over 5,00,00,000
8,00,00,001 to 10,00,00,000	4,84,000 + 0.09% excess over 8,00,00,000
Over 10,00,00,000	5,20,000 + 0.06% excess over 10,00,00,000

Kinds of Arbitration

1.Arbitration without intervention of a court.
2.Arbitration with intervention of a court, where there is no suit pending
3.Arbitration in suits

Arbitration without intervention of a court
•It arises from the execution of an arbitration agreement
•The court may set aside the award of the arbitrator only in exceptional circumstances.
•After the award by the arbitrator is declared , the parties concerned can apply for a decree on the award, same as any other decree of a court of law

Arbitration with intervention of a court
•The section of the act gives an alternative right to the parties to an arbitration agreement
•The appointment of arbitrator can be done jointly by the parties or one arbitrator by each party or the court

Arbitration in Suits (Cases)
•When a suit is pending before a court and when the parties desire to settle the same through arbitration before the judgement is pronounced, they can apply for the same and in such cases,the court may refer the matter to the arbitrator,apppointed in such a manner as may be agreed upon between the parties.

UNIT- IV VALUATION

Introduction

The following the methods of valuation being adopted in General practice by a practicing valuer are:

- Land and Building Method
- Rent Capitalization Method
- Development Method
- Profit Method
- Direct Comparison Method

Land Building Method:
By this method, the value of the land and the value of Building are assessed separately and added to get the present value of the property. Depreciation is calculated either by straight line method or applying Linear method.
Rental or Capitilisation Method:
Rental method of valuation consists in capitilising the Net Annual Rental Income (NARI) at an appropriate rate of interest or rate of capitilisation.
Net annual rent income equals to Gross Annual Rental Income (GARI) minus outgoings like Property Tax, repairs, maintenance, Service Charges, Insurance Premium, Rent Collection and Management Charges etc.
Development Method (or Residual Method):
This method is used to evaluate such property where there is a development potential, so that the value of the property after development will be increased more than the expenditure incurred. For example, a large portion of land can be divided into small plots and developed fully so as to provide plots of land for a residential Colony or a large complex of multi-storied buildings, housing ownership flats in a Co-operative Housing Society.
Profit Method:
This method is applicable to Hotels, Cinema Theatres, Marriage Halls and Public Places. This method as the name suggests deals in working the profit from a property and subsequently capitalizing the same at appropriate rate of return depending upon a number of factors.

- The net profit to be adopted should be an average of last three years of profit.
- Part of the profits is due to goodwill which should be properly reflected in the rate of return.

GENERAL Procedure to do the Valuation of Building

- Measure the Plinth Area. Observe the specification and other factors which affect the value.
- Adopt suitable Replacement Rate of construction (for the Building portion alone) depending upon the existing conditions and specifications.
- Multiply the plinth area by the unit rate to get the replacement value of the building.
- Ascertain the age of the Building.

- Estimate suitable total life of the Building.
- Assume suitable % age for salvage value. Calculate Depreciation by Straight line method. Depn % = (Age / Total life) x (100 - % Salvage value). If the age is not known or if the building has crossed its service life, estimate future life and calculate the depreciation by using the formula.

$$D = \frac{Total\ life - Future\ life}{Total\ life} \text{ x (100 - \% age salvage value)}$$

- Depreciation % age multiplied by the Replacement value will be the Depreciation Value.
- Present Value = Replacement Value – Depn. Value

This is the value of Building.

- Add suitable depreciated value for other works like Amenities, extra works, miscellaneous works etc.
- Add suitable value separately for services depending upon the actual's specifications.

- **Different Methods of Valuation**
- **1) Land and Building Method for Bungalows / Flats.**
  a) Bungalows / Houses: In this case the cost of land and building are assessed separately and added to get the present value of the property
  Valuation of Land to be considered
  i) Guide lines from Registrar's Department (Circle rates)
  ii) Price paid within a reasonable time, in bonafied transactions of purchase of lands acquired.
  iii) Demand, locality, characteristics like shape, size and location of Roads and Parks.
  iv) Opinions of relevant person such as Neighbors, Brokers and recent sales and prevailing trend.
- **Valuation of Building to be considered**
- Plinth area rates bases on CPWD or State PWD and adjusted by Index cost,
- Present Value of Building
- Flats: The above method of Land and building method can not be applied on flats since G. House societies and DDA/ MCD Flats are effected by various factors like common passages, lifts, common places of assembly, parking. Mostly it depends on Social built up of the housing complex also. The rates are assessed from Per Square feet rate of the super area which includes Plinth area + common share of common areas such as Entrance, lifts, passages, stair hall and parking etc. It is generally taken as 15-20% higher than the plinth area. The valuation is done, thus on Prevailing rates of the super area in the locality. Area are Defined as
- 1) Floor Area
  2) Plinth Area
  3) Super Area
- We will discuss on this when we take up the Land/ Building/ Flat valuation in details.

- **2) Rental Capitalization Method:** It consists of capitalizing the net annual Rental Income (NAR) at an appropriate rate of Interest and rate of Capitalization (80% as per Wealth Tax rules for Delhi / NCR) Net annual Rent income equals to Gross Rental Income – outgoings like Property tax, repairs, maintenance service charges, Insurance premiums, rent collection and management charges etc. app. 40%
- **3) Development Method:** This method is used to evaluate such property where there is a developmental potential, so that value of property after development will be increased more than the expenditure incurred, for example large portion of land can be divided in small plots and developed fully so as to provide plots of land for residential societies, or a large complex of multistoried buildings, shopping / commercial complex etc. In such case the cost is decided per acre (4840 Sqyd). The cost can be arrived at by assessing the cut plot rates in the vicinity adjusted by the following facts :
- A) Cost of Development which is 20% : It includes
- i) Roads
  ii) Gardens / Parks
  iii) Underground drains
  iv) Electric mains and sub station
  v) Earth filling / cutting
  vi) M.C taxes
  vii) Sewage
- B) Professional Charges to Architect Engineer
- C) Cost of obtaining Vacant Possession from the existing occupant is required.
- D) Developers Profit: 15-25%
- This is a vast subject and shall be taken up separately.
- **4) Profit Method:** This method is applicable to Hotels, Cinemas, PVRS, and Marriage Halls. This method as the name suggests deals in working the profit from the property subsequently capitalizing, the same at appropriate rate based on factors.
- i) AV of Net Profit for last three years
  ii) Good will of the Property
- This is in general as to what the Profession of Valuation is and is required to be done dedicatedly and with honesty.

MORTGAGE:

- An owner can borrow money against the security of his property, and for that purpose he is required to grant an interest to the party advancing the loan.
- The loan is required to be returned in specific time
- The person who takes the loans is known as Motgagor
- The person who is advances the loan is known as Motgagee

LEASE:

- BUILDING LEASE : The owner of a freehold land out his plot of land to somebody to construct a building on payment of a yearly ground rent by the leaseholder

- At the end of the lease period , the lessor has got the right on his land together with the structure on the land.
- OCCUPATIONAL LEASE:The building is built by the owner (Freeholder) and the build up property is given on lease for the purpose of occupation for a specified period on payment of certain amount of annual rent.
- The lease period should be 10 to 30 years
- Tha maintenance of the structure is usually done by the leaseholder which may be provided in the lease deed(document)
-

UNIT V
REPORT PREPARATION

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

PRINCIPLES FOR REPORT PREPARATION:

Minute writing

As minutes are the documents administrators are most often called upon to produce following a meeting, we begin by distinguishing reports from minutes.

The purpose of minutes is to provide a permanent, and publicly-accessible, record of what passed at a particular meeting. For those unable to attend a meeting, minutes provide a summary of the discussions which took place, the decisions which were reached, and the actions which are to be taken as a consequence of decisions reached at the meeting.

Minute-writing thus involves summarising the key points of the meeting, and ensuring accurate representation of all that took place. The key feature of minutes is their objective and neutral tone, and the breadth of the information they provide: they record all discussions that took place, placing no emphasis on particular discussions or points.

The structure of minutes is generally dictated by the agenda that was circulated prior to the meeting, which provides details of what is to be discussed.

Although reports are frequently discussed at meetings, they differ from minutes both in structure and intent.

What is a report?

Where minutes are taken to provide a verbatim account of what passed at a meeting, reports provide an accurate and concise summary of the discussions and events leading to a particular outcome. They involve an investigation – often by a forum, workshop or panel – followed by conclusions and recommendations. In this sense, they place emphasis where minutes don't. They are concerned less with capturing what was discussed and more with exploring how a particular outcome was reached.

A report is therefore written to the final decisions and outcomes, and will reflect a logical argument culminating in a recommendation for a particular action.

To highlight the difference between reports and minutes, let's consider reports produced in a slightly different context. If we think of a news report, we find an editor commissioning a journalist to investigate an issue of concern to the public, often by going along to an event and observing what happens. The journalist will film the event, making notes and finding out what

s/he can about the background to the event. S/he then chooses an angle which makes the story interesting and relevant to viewers while still accurately and objectively reflecting what passed. The filmed material is edited so that it forms a logical narrative, with the reporter introducing the events with some background and contextual information. The news report is concluded with some reflections on what was found, and what might be done to change/ fix the situation. Reporters take a mass of information and condense it into something easy to grasp.

By super-imposing this onto writing a report in the HE environment, we find a Chair commissioning an officer/ secretary to produce a report of an event (usually a workshop or panel discussion) that describes and summarises the results of an investigation and subsequent discussion, and makes some recommendations for improvement.

Reporters have a duty to present information clearly, concisely, accurately and objectively. The aim is to clarify. To get their story across, they also need to make it punchy and easy to understand. And so it should be with your report.

Planning a report

Dictionary definitions of reports include:

A statement of the results of an investigation or of any matter on which definite information is required.

Oxford English Dictionary

An account prepared for the benefit of others, especially one that provides information obtained through investigation and published ... or broadcast.

Collins English Dictionary

These definitions capture many of the salient features of reports and are captured by the three foundations of report writing: defining the purpose of the report; investigating the topic thoroughly; organising the information into sections.

A useful report rests on these foundations. Before moving onto the actual structure of reports, let's consider these in turn.

Defining the purpose of a report

Before you can begin communicating, you need to clarify: why you are writing; what to include; what to leave out; who your readers are.

The purpose of a report is to present facts, findings and conclusions in such a way that the recommendations are accepted and acted upon. By expressing the purpose in a single sentence,

your attention is focussed, making it much easier to take notes of the event and structure the information into a meaningful communication.

The key principle of any report is that all information should be clear and useful. If you are unsure whether to include something, ask yourself, "So what?". What is the purpose of the point you are making? Does it support the conclusions and recommendations? Will it assist the participants in making amendments or changes?

All reports set out a series of facts based on evidence. The information must be verifiable and presented in a way that is useful to the reader. Most readers will have some background in the area the report is investigating however as reports are used both to communicate and to inform, it should be possible for a reader to understand what is written without any previous knowledge. When considering what to include, think about what your readers already know, what you need to tell them, and what use they can make of the information in the report.

If you have a clear idea of the purpose of the report, knowing what to include and how to structure the information will rest on the needs of the audience, making your report useful and informative.

Investigating the topic

Reports are structured forms of writing that stress the process of information-gathering as much as the content. Most reports in HE are concerned with investigations by panels or workshop participants. The information is likely to come from supporting documents that are distributed before the meeting. The resulting report is an account of the discussions that were held around the information, the observations that were made, and conclusions reached.

Prepare yourself for report-writing by reading all the supporting documents. The more familiar you are with the information that is being discussed, the easier it will be to follow the discussions, and identify important points that should be noted.

Familiarity with the topic under investigation, together with knowing what the purpose of the report is, should prepare you for the actual investigation (panel or workshop), ensuring that you are able to listen actively to what is said. This supports your ability to note important points and organise the information in a meaningful way.

Organising the information

Once the meeting or workshop has taken place, you will be expected to provide an account of the investigation and discussion. Reports should have a logical structure presenting a coherent argument, with the format providing clear sign-posts to indicate what conclusions will be reached. It should be easy for readers to find the information they want.

Remember, the key is to be clear, concise and persuasive.

The way you organise the information you have gathered affects both the structure and sense of the report. It is the first step to writing as it involves planning the structure and layout, and deciding what you want to say, in what order. You will usually have a mass of information including written notes, observations, participation in discussions, supporting documents and appendices. By planning how to arrange and present this, you save yourself time and are likely to produce a better-organised, clearer report.

The structure of a report tends to mirror the recommendations and conclusions reached, as opposed to an agenda. When writing up minutes, the structure is determined by what precedes the meeting; it is based on the agenda. When writing a report, the structure is determined by what follows from the meeting, that is, by the findings and conclusions.

Begin planning by recording the recommendations and conclusions, and then structuring the rest of the information around these outcomes/ findings. The chair of most panels or workshops will summarise the conclusions and recommendations at the end of the event, which provides a useful initial template for the body of your report.

Two useful ways of planning are: Creating an outline by noting down all facts, observations and ideas as you remember them. Once you have all your points on paper, organise and group them into sections, assessing whether they are relevant to the conclusions and recommendations. You can then number the points in order and begin organising them under headings using arrows and lines to link up related points. With this method, you will gradually get a network of ideas grouped under headings which provides you with the structure of your report. Mind-mapping. Write your topic in the middle of the page and draw lines to branch out from it with your main ideas. By pouring your ideas out at random, and linking main ideas to each other, you can concentrate on the content, and the order and organisation will emerge from allowing your ideas to flow into themes.

Structuring a report

The accepted structure for a report includes 5 sections at least, although you may wish to include additional sections such as an abstract, title page and appendices of supporting documents.

There is no need to write your report chronologically. In many instances, it is easier to begin writing the final section (recommendations), and finish with the summary or introduction. Complete the various sections in whatever order makes most sense to you, slotting them into the structure once you have completed the first draft of writing up. Once you have a first draft, it should be easier to see whether the report rests on the key foundations of defined purpose, thorough investigation and logical argument (organised information).

The formal structure of a report is generally as follows:

1. Summary

There are two schools of thought on summaries and what you choose will probably be informed by the type of report you are writing, the length, and your audience. The summary can be placed at the beginning of the report as an executive summary providing readers with an overview. Here, it should provide enough detail to give a good idea of what passed, and what the key conclusions were, without having to read the entire report.

Or it can be placed with the conclusions where it provides a round-up of the key points supporting the conclusions reached. Where the summary is placed with the conclusions, the report often includes an abstract at the beginning which provides an overview of the purpose and conclusions of the report.

The summary should be concise, informative, and able to stand alone from the report. This section condenses and focuses information, drawing objective findings from detailed data and discussions. It is probably best written after you have drafted the entire report. The clarity of your summary is a good yardstick for the overall clarity of the report; if you can't sum up the findings in a paragraph, the report may be lacking a coherent narrative or structure.

2. Introduction and background

The introduction provides contextual information for the entire report. It should cover: the topic under investigation, the purpose of the report, the method (how the information was gathered and conclusions reached), the source of information.

Include details on the scope of the report, and a brief background to the subject under investigation. Returning to our news report analogy, the introduction provides brief answers to the 5 W's and H: who, what, when, where, why, and how?

3. Discussion

The discussion forms the main body of your report. It contains all the facts and details, and provides an account of the discussions which lead to the final outcomes. The discussion is presented as a logical argument culminating in the conclusions and recommendations. While it should be objective and accurate, it is also persuasive and engaging: reports always have a message and this should emerge clearly from this section.

As you are likely to have quite a lot of information to present, this section should be divided into sub-sections under descriptive headings which reflect the discussion which took place.

To make it easier for readers to find information, use a progressive numbering system where each section receives its own number. Main paragraphs are numbered as sub-sections of the section title and should express stand-alone, discrete points. Where a

point is complicated, or there are linked issues to note, list these as sub-sections of the paragraph using decimal points. For instance:

1. Section title

1.1 _____

1.1.1 _____

1.1.2 _____

This provides your report with a coherent structure, and makes it easier to read and use in an active sense. It also helps the reader focus on, and respond to, particular issues raised in the recommendations by allowing him/ her to refer to a numbered paragraph. Finally, it is useful should you decide to include a table of contents.

4. Conclusion

The conclusion outlines the main findings of the investigation. It is the logical progression from the main discussion where all the information was analysed. In the conclusion, the results are interpreted, and attention is drawn to the significance of key points and information in the supporting documents. In this section, identify important issues, outline problems encountered, and provide explanations and succinct clarification. The conclusion should not present any new information.

In many instances, the conclusion can be based on the summing up by the chair at the end of the discussion/ event, and may include thanks extended to participants and other contributors.

This section should be brief.

5. Recommendations

Reports provide an account of discussions leading to an outcome. Their purpose is to persuade, and the recommendations should flow naturally from the conclusions as suggestions for addressing problems identified in the conclusion. Recommendations should be noted in full detail as they form the basis for amendments in information and policy. Where relevant, include details of deadlines and timeframes.

Publishing a report

As with all pieces of writing, it often helps to leave some time between writing the first draft of a report and producing the final version. Returning to the draft after a break can give you fresh eyes, allowing you to assess whether the report rests on firm foundations, is well-structured and communicates its findings and recommendations in a clear and informative way. If you are satisfied with your final draft, the report can be submitted.

As a report is a commissioned piece of writing, it must be approved before it is released. Generally, it is the chair of the event (usually a panel, or workshop) that is responsible for checking the report and giving approval for its publication. Once the final draft has been

approved, send a copy to all participants of the event, drawing attention to any deadlines attached to the recommendations.

A copy of the approved report is retained by the faculty/ department and, where appropriate, is published for general access.

ACCURACY:

- Report factual information – e.g., "I saw.
- Report information gained from the *physical senses* – e.g., sight, smell, taste, auditory, and touch.
- Be aware of feelings that may destroy objective descriptions. Strong feelings can cause the writer to seek evidence to support her feelings and reject evidence that does not support them.
- Make distinctions between fact and hearsay, fact and opinion, and fact and conclusions.
- Be clear about the meaning of words; avoid jargon.
- Clarify all abbreviations, such as SOB for shortness of breath.
- Proofread the report and rewrite as needed.

Completeness

- Completeness is achieved by reporting *all* the facts discovered during the course of an investigation.
- When in doubt, include the information. Information that appears irrelevant to the investigator may be relevant to the reviewer.
- In most cases, the only information the reader will have will be the information in the report.
- Partially stated facts can be misleading and misinterpreted.
- Explain why certain information is lacking or incomplete.
- Provide a detailed explanation of the possible source of additional information and undeveloped leads.

Conciseness

- Avoid unrelated, extraneous, incidental, and nonessential information and detail.
- Pay attention to grammar.
- Avoid adjectives, wit, sarcasm, flowery expressions, and repetition. A report is not a literary or creative writing exercise.
- Use singleness of thought and purpose. A good report will give the reader a clear idea or picture of the investigation.
- Use headings, paragraphing, sentence structure, indentations, underlining, and capitalization to emphasize and give weight and/or visibility to information the investigator deems more important.

Impartiality/Objectivity

- The investigator is a fact finder. Report the material and evidentiary facts without addition or subtraction.
- Do not conceal or withhold information.
- Do not assume.
- Do not conclude.
- Maintain an unbiased and open mind about the case.

Basic Principles of Good Report Writing

- Avoid formulating preconceived ideas about the guilt of the accused.
- Avoid becoming emotionally involved in the process of seeking information.

Clarity and Report Formatting

- Arrange the contents of the report in discrete sections to facilitate the reader's review and understanding of the report.
- Write in chronological order.
- Avoid ambiguous sentences and vague statements.
- Additional parts of the complete report may include the title page, information on undeveloped leads, investigator's conclusions, witness list, and exhibit/evidence list

The Estimate Report

Regardless of how an estimate is prepared, it should be presented in a clear, concise manner. The following elements are typically included in an estimate report:

1. Project title, location, list of individuals who worked on the estimate, and the date
2. Written overview of findings
3. Summary chart of estimate findings, preferably on one sheet of paper, with appropriate backup material appended or referenced
4. List of any estimate values or quotes provided by others and included in the estimate
5. Reconciliation of estimate to budget and/or previous estimates, with identification of variances and explanations for same
6. Recommendations for corrective actions if costs vary from budget
7. Method used to prepare the estimate
8. Documents on which the estimate is based
9. Assumed schedule (bid date, construction start, completion)
10. Type of contract and procurement method assumed
11. Outline of items included and specific lists of items excluded from estimate
12. Time basis of currency included in estimate and basis of escalation included
13. Design and construction contingencies included
14. Market conditions at the time of the estimate and projected to the bid date
15. Outline specifications, performance, and quality levels assumed in estimate
16. A list of alternatives examined
17. General comments on any special conditions that might affect future prices