LECTURE NOTE

ESTIMATION & COSTING ENGINEERING 3RD SEMESTER

Diploma (Civil Engineering)

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CHAPTER-I

INTRODUCTION

1.1 GENERAL

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

1. Drawings like plan, elevation and sections of important points.
2. Detailed specifications about workmanship& properties of materials etc.
3. Standard schedule of rates of the current year.

1.2 UNITS OF MEASUREMENTS

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

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

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

c) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified thickness etc., and 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 foundation trenches	cum	Per%cum
	3. Earth work in filling in plinth	cum	Per%cum
II	**Concrete:**		
	1. Lime concretre in foundation	cum	percum
	2. Cement concrete in Lintels	cum	percum
	3. R.C.C.in slab	cum	percum
	4. C.C. or R.C.C. Chujja, Sunshade	cum	percum
	5. L.C. in roof terracing (thickness specified)	sqm	persqm

	6. Cement concrete bed	cum	per cum
	7. R.C. Sunshade (Specified Width & Hight	cum	1rm
III	**Damp ProofCource (D.P.C)**		
	(Thickness should be mentioned)	sqm	persqm
IV	**Brick work:**		
	1. Brickwork in foundation	cum	percum
	2. Brick work in plinth	cum	percum
	3. Brick work in super structure	cum	percum
	4. Thin partition walls	sqm	percum
	5. Brick work in arches	cum	percum
	6. Reinforced brick work (R.B. Work)	cum	percum
V	**Stone Work:**		
	Stone masonry	cum	percum
VI	**Wood work:**		
	1. Door sand windows frames or chowkhats, rafters beams	cum	percum
	2. Shutters of doors and windows (thickness specified)	sqm	persqm
	3. Doors and windows fittings (like hinges, tower bolts, sliding bolts, handles)	Number	per number
VII	**Steel work**		
	1. Steel reinforcement bars etc in R.C.C. and R.B.work. quintal	Quintal	per quintal
	2. Bending, binding of steel Reinforcement	Quintal	per quintal
	3. Rivets, bolts, & nuts, Anchor bolts, Lewis bolts, Holding down bolts.	Quintal	per quintal
	4. Iron hold fasts	Quintal	per quintal
	5. Iron railing (height and types specified)	Quintal	per quintal
	6. Iron grills	sqm	per sqm

VIII	**Roofing**		
	1. R.C.C. and R.B.Slab roof (excluding steel)	cum	per cum
	2. L.C. roof over and inclusive of tiles or brick or stone slab etc (thickness specified)	sqm	per sqm
	3. Centering and shuttering form work	sqm	per sqm
	4. A.C.Sheet roofing	sqm	per sqm
IX	**Plastering, points&finishing**		
	1. Plastering-Cement or Lime Mortar (thickness and 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, vamishing (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.

1.2.1 RULES FOR MEASUREMENT

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

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

3. All works shall be measured subject to the following tolerances.

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 separatelyunder 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 masonry (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.

1.3 REQUIREMENTS OF ESTIMATION AND COSTING

1. Estimate gives 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 arrange contract.

4. Estimate is also required to control the expenditure during the execution of work.

5. Estimate decides whether the proposed plan matches the funds available or not.

1.3.1 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

1.3.2 DATA REQUIRED TO PREPARE AN ESTIMATE

1. Drawings i.e. plans, elevations, sections etc.

2. Specifications.

3. Rates.

1.3.3 DRAWINGS

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

1.3.4 SPECIFICATIONS

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

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

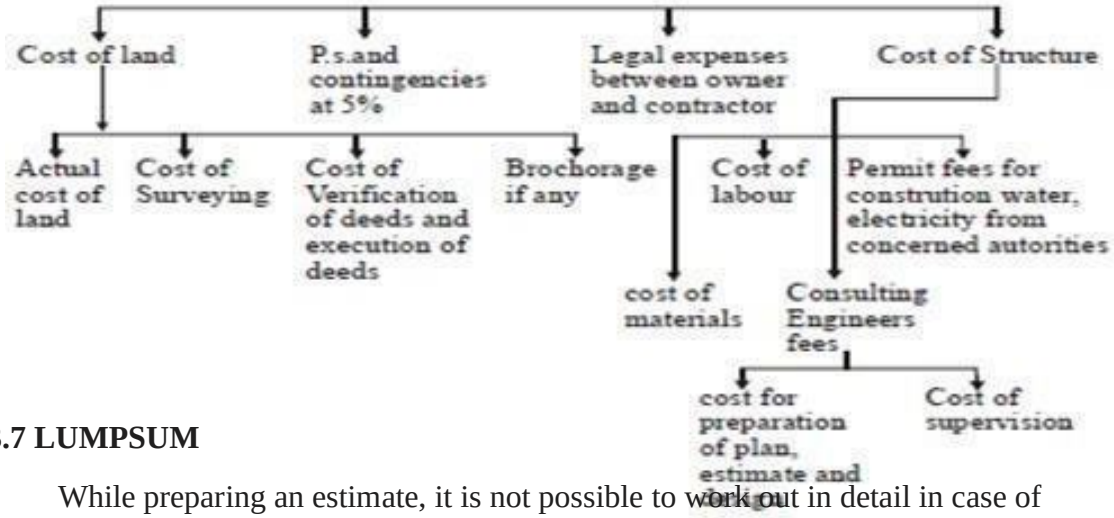
1.3.5 RATES

For preparing the estimate the unit rates of each item of work are required.

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

1.3.6 COMPLETE ESTIMATE

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



1.3.7 LUMPSUM

While preparing an estimate, it is not possible to work out in detail in case of petty items. Items other than civil engineering such items are called lump sum 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.

In general, certain percentage on the cost of estimation is allotted for the above L.S.Items Even if sub estimates prepared or at the end of execution of work, the actual cost should not exceed the L.S.amounts provided in the main estimate.

1.3.8 WORK CHARGED ESTABLISHMENT:

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

1.4 METHODS OF TAKING OUT QUANTITIES

The quantities like earth work, foundation concrete, brickwork in plinthand super structure etc., can be 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.

1.4.1 LONG WALL-SHORT WALL METHOD

In this method, the wall along the length of room is considered to be longwall while the wall perpendicular to long wall is said to be short wall. To get thelength 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 linelength at each end. The length of long wall usually decreases from earth work tobrick work in super structure while the short wall increases. These lengths aremultiplied by breadth and depth to getquantities.

1.4.2 CENTRE LINE METHOD

This method is suitable for walls of similar cross sections. Here the totalcentre line length is multiplied by breadth and depth of respective item to get thetotal quantity at a time. When cross walls or partitions or verandah walls joinwith main all, the centre line length gets

reduced by half of breadth for eachjunction. Such junction or joints are studied carefully while calculating total centreline length. The estimates prepared by this method are most accurate and quick.

1.4.3 PARTLY CENTRE LINE AND PARTLY CROSS WALL METHOD

This method is adopted when external (i.e., around the building) wall isof 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 isused to internal walls. This method suits for different thicknesses walls and differentlevel of foundations. Because of this reason, all Engineering departments arepracticing this method.

1.4.4 DETAILED ESTIMATE

The preparation of detailed estimate consists of working out quantities of various items of work and then determines 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 measurements are taken from drawings and entered in respective columns of prescribed preformed. The quantities are calculated by multiplying the values that are in numbers 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 details 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

ABSTRACT OF ESTIMATE FORM

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

The detailed estimate should accompanied with

I) Report

ii) Specification

iii) Drawings (plans, elevation, sections) iv)

Design charts and calculations

v) Standard schedule of rates.

1.4.5 FACTORS TO BE CONSISDERED WHILE PREPARING DETAILED ESTIMATE

i) Quantity and transportation of materials:

For bigger project, the requirement of materials is more. such bulk volume of materials will be purchased 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 materials.

iii) Local labor charges:

The skill, suitability and wages of local labors are considered while preparing the detailed estimate.

1.4.6 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 labor are obtained from current standard

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

1.4.7 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 materials is taken strictly in accordance with standard data book(S.D.B). The cost of these includes first cost, freight, insurance and transportation charges.

2) 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.

3) Cost of equipment (T&P):

Some works need special type of equipment, tools and plant. In such case, an amount of 1 to 2% of estimated cost is provided.

4)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.

1.4.8 METHODS OF PREPARATION OF APPROXIMATE ESTIMATE

Preliminary or approximate estimate is required for studies of various aspects 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 knowledge 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 methods used for preparation of approximate estimates.

a) Plinth area method

b) Cubical contents methods

c) Unit base method.

1.4.9 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, careful observation and necessary enquiries are made in respect of quality and quantity aspect of materials and labour, type of foundation, height of building, roof,

wood work, fixtures, number of storey's etc., As per IS 3861-1966, the following areas include while calculating the plinth area of building

Types of Estimates

a) Area of walls at floor level.

b) Internal shafts of sanitary installations not exceeding 2.0m_2, lifts, air-conditioning 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.

1.4.10 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 ofstring course, cornice, corbelling etc., is neglected. The cost of building= volume of buildings xrate/ unit volume.

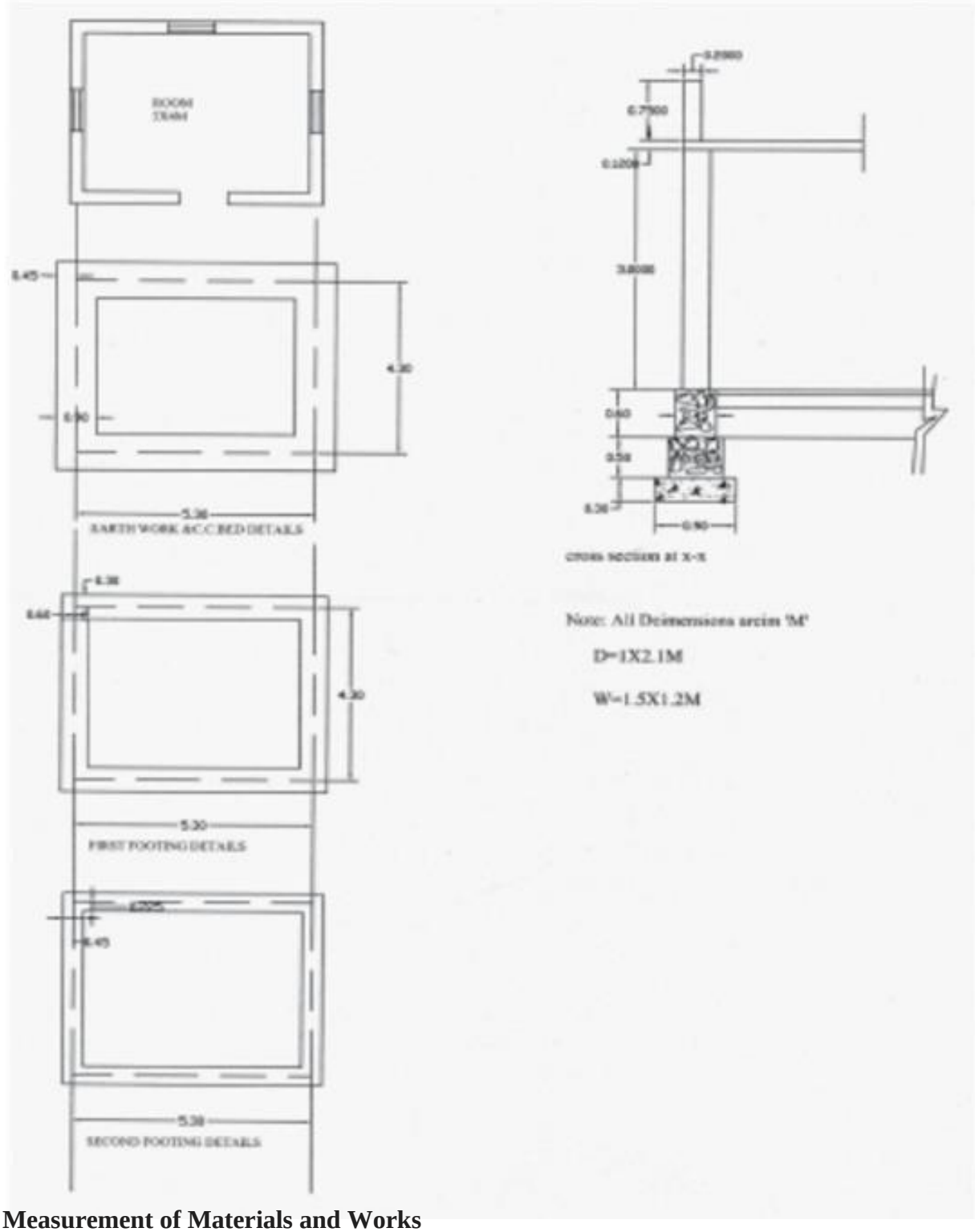
1.5 PROBLEMS

1.5.1 Estimation of different foundations, steps and boundary walls. Example : 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).

Single Roomed Building (Load Bearing type structure)



Measurement of Materials and Works

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 = 5.76+5.184 = 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

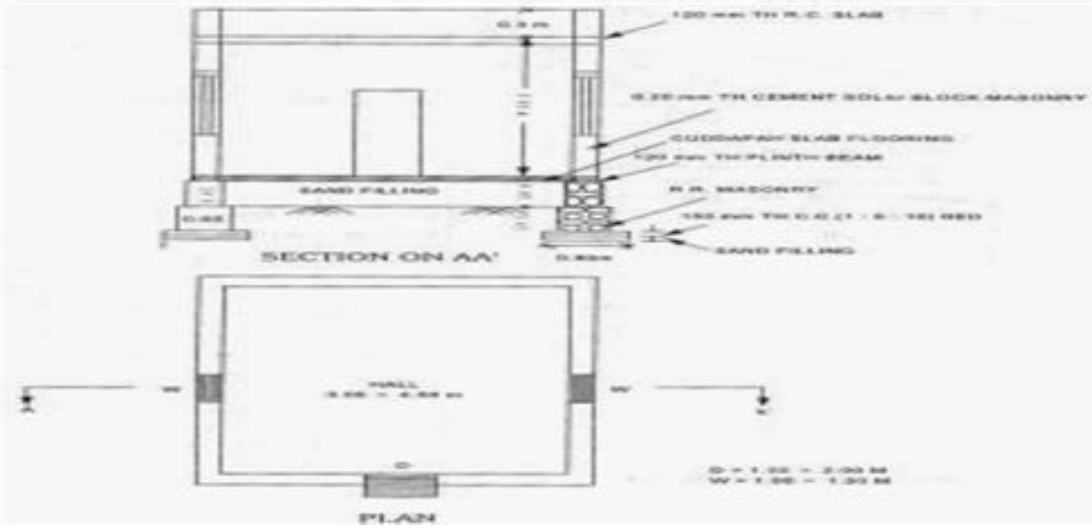
Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	**Earth Work excavation for foundation** 	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

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



QUESTION BANK

PART- A

1. What are the difference between preliminary estimates, detailed estimates, supplementary estimates and revised estimates ?
2. What do you understand by
   a. Overhead cost
   b. Analysis of rates
   c. Contingencies and supervision charges
   d. Standard measurements book
   e. Prime cost
   f. Provision of tools and pants and work charged establishment in an estimate.
   g. Lump-sum items
3. Distinguish clearly between
   a. Revised estimate and supplementary estimate
   b. Administrative approval and technical sanction
   c. Plinth area estimate and cube rate estimate
   d. Contingencies and supervision charges
   e. Preliminary estimate and detailed estimate
4. Explain the following
   a. Schedule of rates
   b. Cube rate estimate
   c. Preliminary estimate