MODULE- 1

TECHNICAL TERMS

1. ESTIMATE

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

2. QUANTITY SURVEY

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

3. DETAILED SPECIFICATION

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

4. RATES

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

5. SITE PLAN

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

6. LINE PLAN

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

7. INDEX PLAN

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

8. DETAILED PLAN

This plan indicates a plan of a construction drawn to a definite scale, showing all detailed information required for its execution. Various sections and elevations are clearly drawn on this plan.

9. CENTRE LINE PLAN

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

10. SUPPLEMANTARY ESTIMATE

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

11. ADMINISTRATIVE APPROVAL

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

12. TECHNICAL SANCTION

It means the sanction and order by the competent authority of the department for the detailed estimate design calculations quantities of work rates and cost of work. After the technical sanction of the estimate is received the work is then taken up for construction.

13.COMPETENT AUTHORITY

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

13. ORDINARY MEASUREMENT BOOK

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

14. LUMPSUM ITEMS

Sometimes while preparing estimate for the certain small items like front architecture or decoration work of a building it is not possible to workout detailed quantities so far such lump sum items a lump sum rate is provided.

15. PLINTH AREA

The built up covered area of a building measured at floor level of any storey is called plinth area.

17. CIRCULATION AREA

The total cost of construction including all expenditures incurred plus the cost of external services up to the end of the completion of the work is called capital cost. It also includes the cost of preliminary works, miscellaneous items and supervision charges etc.

INTRODUCTION

1.1 GENERAL

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

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 measurements normally 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	1nn
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.

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 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 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.

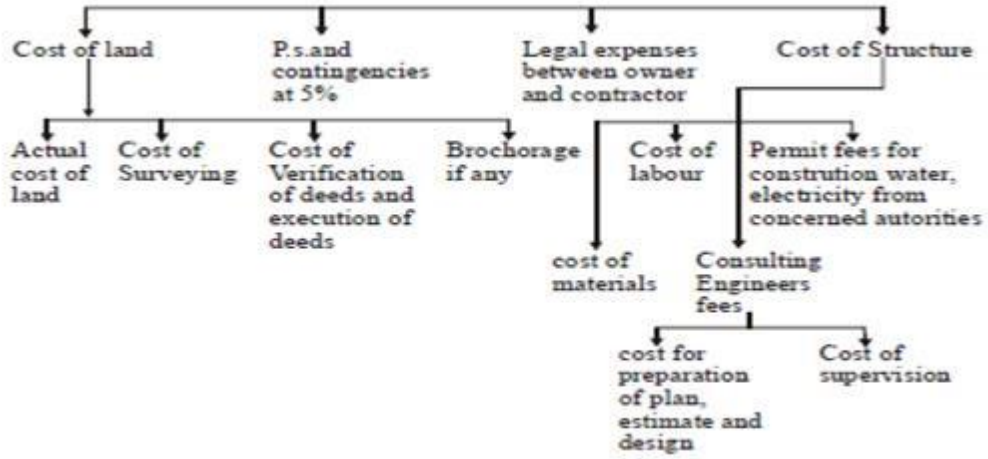
1.3.5 RATES

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.



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. An L.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 plinth and 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 the 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.

1.4.2 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 main all, the centre line length gets reduced by half of breadth for each junction. 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 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 different level of foundations. Because of this reason, all Engineering departments are practicing 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

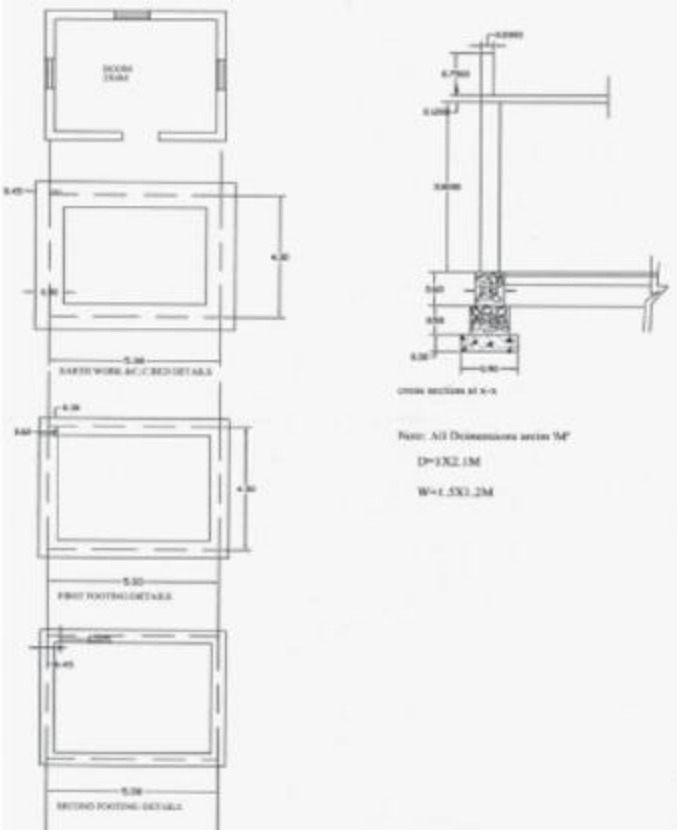
This method is generally used for multistoreyed buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of 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 of string course, cornice, corbelling etc., is neglected. The cost of building= volume of buildings x rate/ unit volume.

1.5PROBLEMS

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).

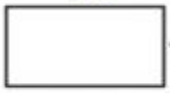
Single Roomed Building (Load Bearing type structure)



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

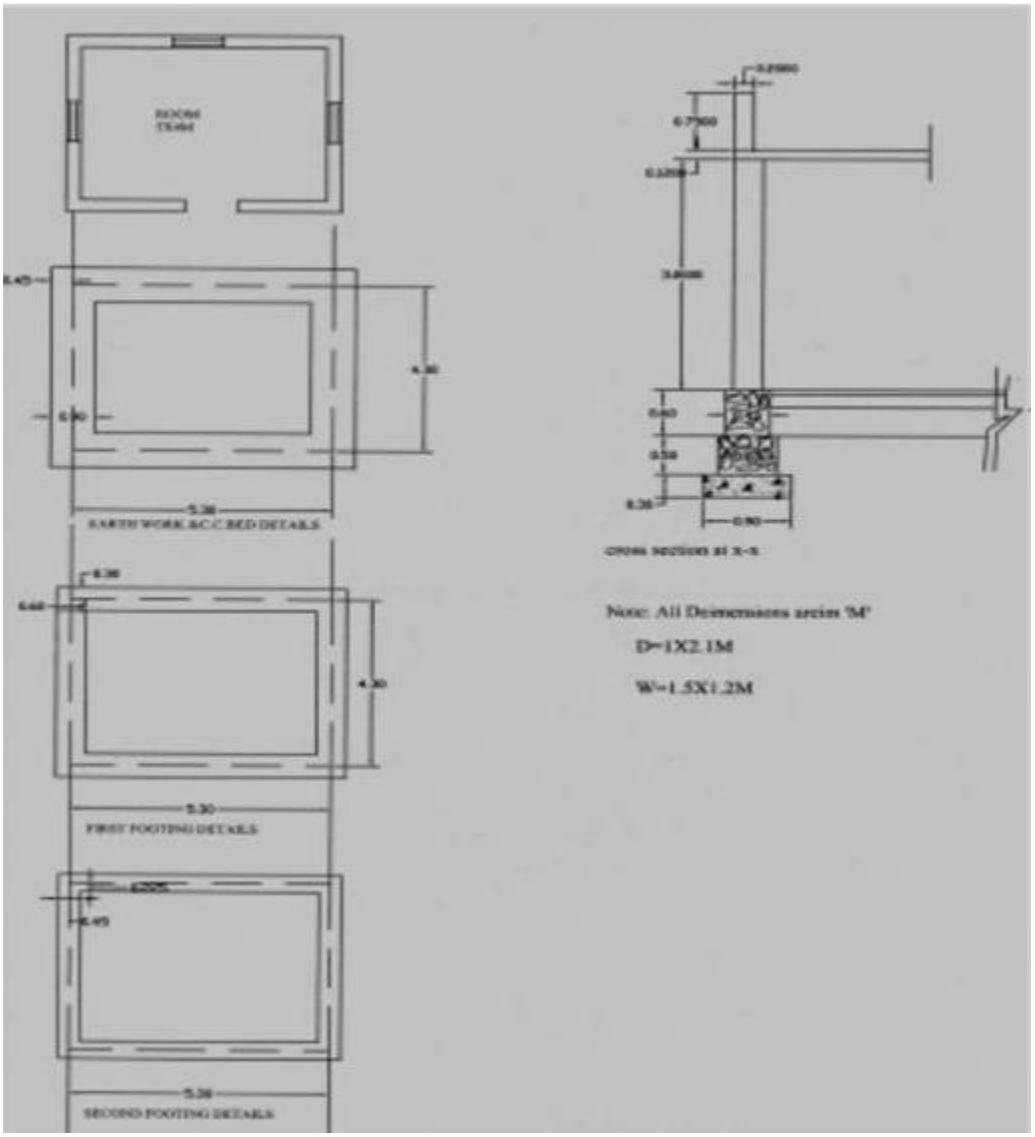
(a) longwall - short wall method

(b) Centre line Method

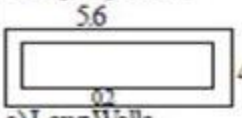
1.5.2.From the given figure below calculate the detailed and abstract estimate for the single roomed building (Load bearing type structure) by

a) long wall & short wall method

b) Centre Line Method


5.30
EARTH WORK & C.C BED DETAILS
5.30
FIRST FOOTING DETAILS
5.30
SECOND FOOTING DETAILS
CROSS SECTION AT X-X
Note: All Dimensions are in 'M'
D=1X2.1M
W=1.5X1.2M

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 parapet wall						
	5.6  4.6 0.2						
	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

Detail & Abstract Estimates of Buildings 24

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 =			**18.03**	m^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						
	Forwalls	1	18.0	--	3.0	54.0	L=2(5.0+4.0)=18.0
	Out side						
	Forwalls	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 (upto parapet wall)
	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	m^3 L=2(5.3+4.3)=19.2
	53 / 43						
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	
4.	**Brick masonry with**						
	CM (1:6) for superstructure	1	19.2	0.3	3.0	17.28	m^3
	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	m^3
	Net Brick Masonry =		17.28	+3.0	-2.25 =	18.03	m^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	1	19.2	1.3	0.3	1.728	
					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

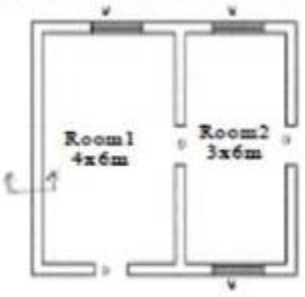
8.	**flooring with Mosaic tiles**	1	5.0	4.0	--	20.0	
9	**Plastering with CM (1:6)for super structure**						
	Inside						
	Forwalls	1	18.0	--	3.0	54.0	
	Out side						
	Forwalls	1	20.4	--	3.87	61.2	
	Basement outside	1	21.6	--	0.6	12.96	
	Parapet wall						
	a) Inside	1	18.8	--	0.75	14.1	
	b) top	1	19.6	0.2	---	3.92	
	Deductions for opeinings				Total	**146.18**	m^2
	Doors	1x2	1.0	--	2.1	4.2	L=5.0-0.075-0.075=4.85
	Windows	3x2	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.	

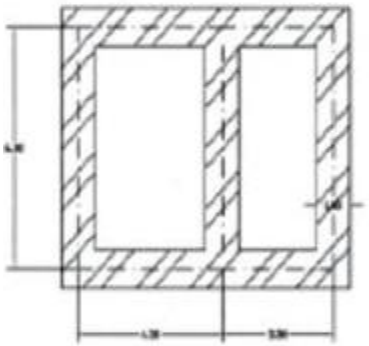
Abstract estimate of single roomed building (load bearing structure)

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

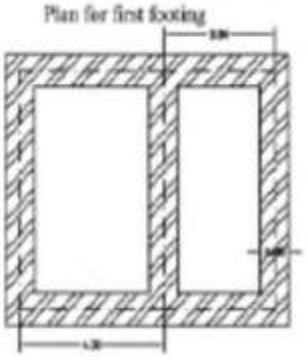
1.5.3 From the given figure below calculate the details and abstract estimate for the double roomed building (Load bearing type structure) by a) long wall & short wall method (b) Centre Line Method

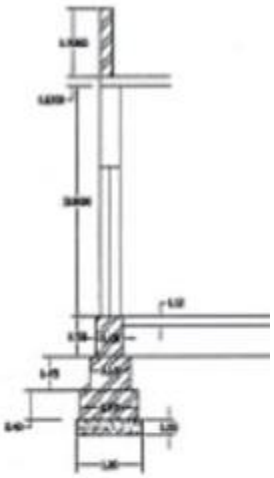
TWO ROOMED BUILDING
(LOAD BEARING TYPE STRUCTURE)





Plan for first flooring





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

Note: All Dimensions are in 'M'

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=8.6
	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) Long walls	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 footing						
	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**	

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.						

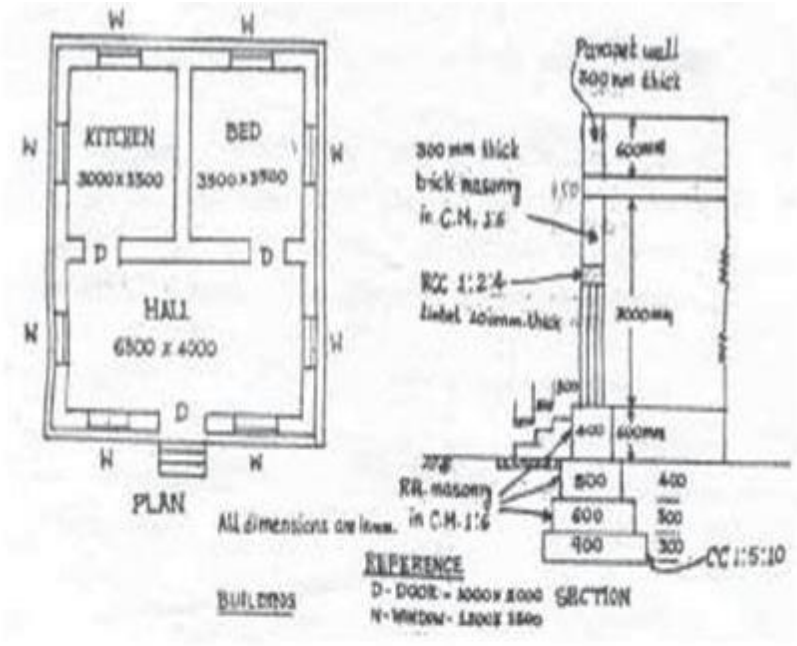
b) Centre Line Method

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	4.3 3.3 6.3 **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=34.1-0.6x2/2
	b) for basement	1	33.7	0.40	0.40	5.392	L=34.1-0.4x2/2
	c) for super structure	1	33.80	0.30	3.0	30.42	L=34.1-0.3x2/2
	d) for parapet wall 79 66 02			77		64	
	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=56.34m³						
4.	Quantity of R.C.C. Roof, Plastering for walls and cealing and flooring, White washing is same as Longwall & Short wall method.						

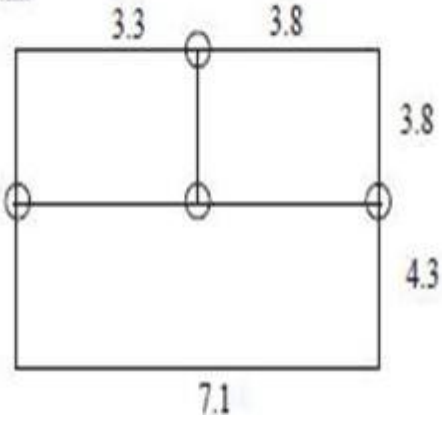
Abstract estimate of two roomed building (Load bearing type structure)

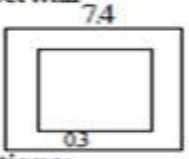
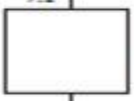
S.No	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	34.75	m^3	465	$10m^3$	1615.90
2.	Cement concrete(1:4:8)	6.62	m^3	1545	$1m^3$	10228.00
3.	Sand filling in basement	12.036	m^3	195.20	$10m^3$	235.00
4.	Brick masonry in country Bricks of standard size in CM(1:8)	56.34	m^3	2291	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

1.5.4 From the given figure below calculate the details and abstractestimate for the single Storied residential buildingwith no of rooms (Load bearing type structure) by Centre Line Method



Centre line diagram



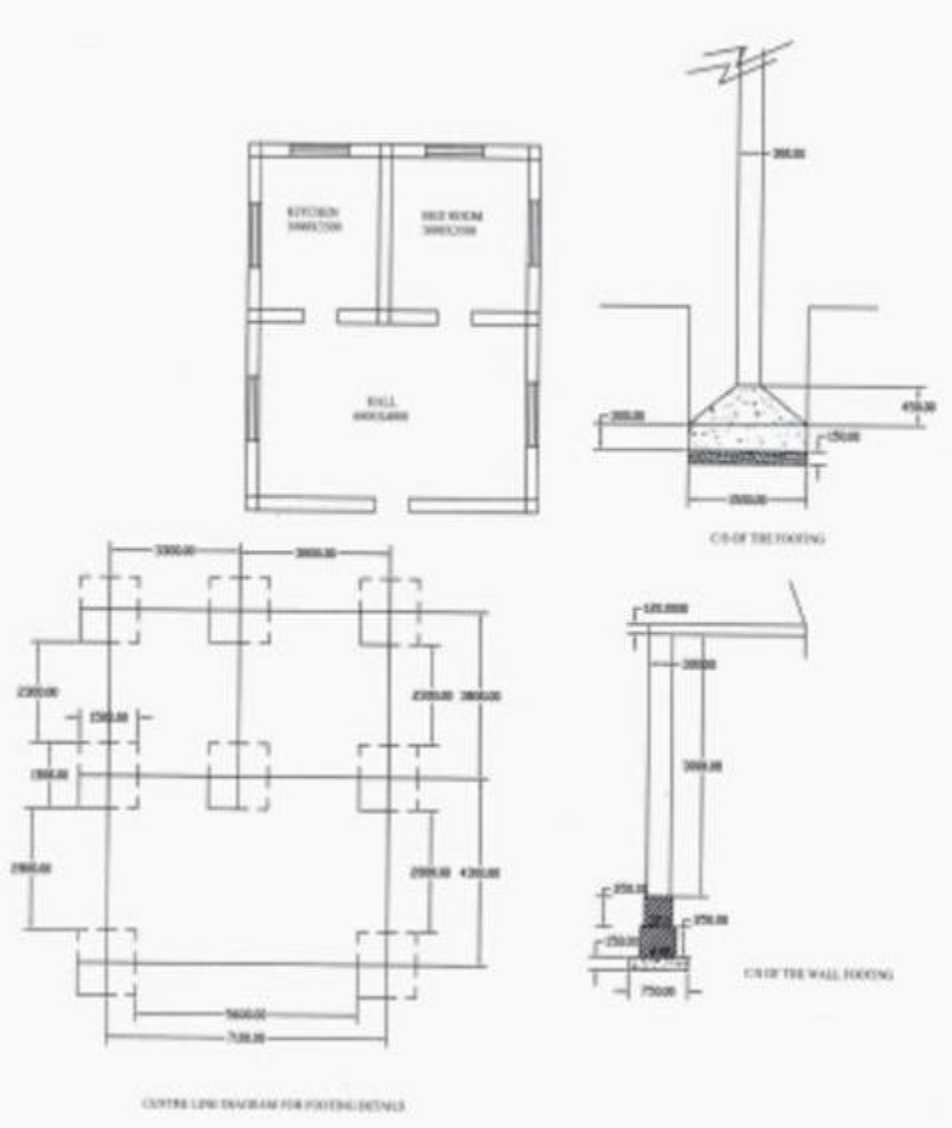
S.No.	Particulars of Items	No	L	B	H	Q	Explanation
1.	Earth work Excavation	1	39.5	0.9	1.0	35.55	41.3-4x0.9/2=39.5
2.	C.C. bed (1:5:10)	1	39.5	0.9	0.3	10.665	m^3
3.	R.R. Masonary in CM 1:6						
	1st Footing	1	40.1	0.6	0.3	7.218	41.3-4x0.6/2=40.1
	IInd Footing	1	40.3	0.5	0.4	8.06	41.3-4x0.5/2=40.3
	Basement	1	40.5	0.4	0.6	9.72	41.3-4x0.4/2=40.5
					Total	25.00	m^3
4.	Damp proof course over basement alround the building with CC (1:2:4)	1	40.5	0.6	---	16.2	m^2
	Deduct for Door sills	3	1.0	0.3		- 0.9	m^2
	Net Quantity =16.2-0.9=15.3sq.m				---		
5.	First class brick work in wall in						
	a) superstructure with CM1:6	1	40.7	0.3	3.0	36.63	L =41.3-4x0.3/2
	b) Parapet wall	1	30.4	0.3	0.6	5.472	L=2(7.1+8.1)
					Total	42.102	m^3
	 						
	Deductions:						
	Doors	3	1.0	0.3	2.0	1.80	
	Windows	8	1.2	0.3	1.5	4.32	
	Lintel opening over						
	Doors	3	1.2	0.3	0.1	0.108	Asue 100mm
	Windows	8	1.4	0.3	0.1	0.336	projection on either
					Total	6.564	side
	Net Quantity of BM = 42.102-6.564 = 35.538m^3						
6.	Plastering with 12mmth in CM 1:5	1x2	40.1	---	3.0	240.6	L=41.3-4x0.3=40.1
	Deductions for openings						

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Doors	3x2	1.0	---	2.0	12.0	
	windows	8x2	1.2	---	1.5	28.8	
					Total	**40.8**	m^2
	Plastering for parapet wall (sides)	1x2	30.4	---	0.6	36.48	
	Top	1	30.4	0.3	---	9.12	
					Total	**45.60**	m^2
	Net Plastering = 240.6-40.8+45.6=245.4 m^2						
7.	Flooring with 25mmmth CC(1:2:4)						
	Kitchen	1	3.0	3.5	--	10.5	
	Bed	1	3.5	3.5	--	12.25	
	Hall	1	6.8	4.0	--	27.20	
	Sills of Doors	3	1.0	0.3	--	0.90	
8.	Ceiling = Same as Flooring				Total	**50.85**	m^2
						50.85	m^2
9.	white washing = Same as Plastering for walls and ceiling 245.4+50.85 = 296.25 m^2						
10.	RCC(1:2:4) for						
	a) Slab	1	7.40	8.40	1.5	9.324	
	b) lintels over Doors	3	1.2	0.3	0.1	0.108	
	Windows	8	1.4	0.3	0.1	0.336	
	c) beams	1	40.7	0.3	0.3	3.663	
					Total	**13.431**	m^3
11	Supply & Fixing of best country wood for						
	a) Doors	3				3Nos.	
	b) Windows	8				8 Nos	
12	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--	2.0	13.50	
	b) Windows	2¼x8	1.2	--	1.5	32.40	
						45.90	m^2
13	2% unforeseen items						
14	4% P.S& contingencies and round off						

Abstract estimate of single storeyed residential building with no of rooms (lead beary type)

S.No	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	35.55	m^3	465	$10m^3$	1653.00
2.	Cement concrete(1:4:8)	10.665	m^3	1545	$1m^3$	164.77.50
3.	RR masonry in C.M.(1:5)	25.00	m^3	1391	m^3	34775.00
4.	Sand filling in basement	23.775	m^3	195.20	$10m^3$	464.00
5.	Brick masonry in country bricks of standard size in CM(1:8)	35.535	m^3	2291	m^3	81417.60
6.	R.C.C. (1:2:4) for lintels, beams etc.	4.107	m^3	6030	m^3	24765.20
7.	R.C.C.(1:2:4) for slabs,	9.324	m^3	6030	m^3	56223.70
8.	Cement concrete (1:5:10) for flooring	5.085	m^3	1452	m^3	7383.40
9.	Supplying and fixing of country wood for doors.	6.00	m^2	1650	m^2	9900.00
10.	Supplying and fixing of country wood for windows and ventilators.	14.40	m^2	2300	m^2	33120.00
11	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	245.40	m^2	582	$10m^2$	14282.30
12	White washing with best shell lime	296.25	m^2	116	$10m^2$	3436.50
13	Flooring with spartek tiles set in C.M (1:3)	50.85	m^2	4230	$10m^2$	21509.50
14	Painting with ready mixed enamel paint	45.90	m^2	335	$10m^2$	1537.65
						306945.35
15	Provision for water supply and sanitary arrangements @12.5%					38368.20
16	Provision for electrification @7.5%					23020.90
17	Provision for architectural appearance @2%					6138.90
18	Provision for unforeseen items 2%					6138.90
19	Provision for P.S.and contingencies @4%					12277.80
						392890.00

1.5.6 From the given figure below calculate the details and abstract estimate for the single storied residential building withno. of rooms (**Framed Structured** type) by Centre Line Method



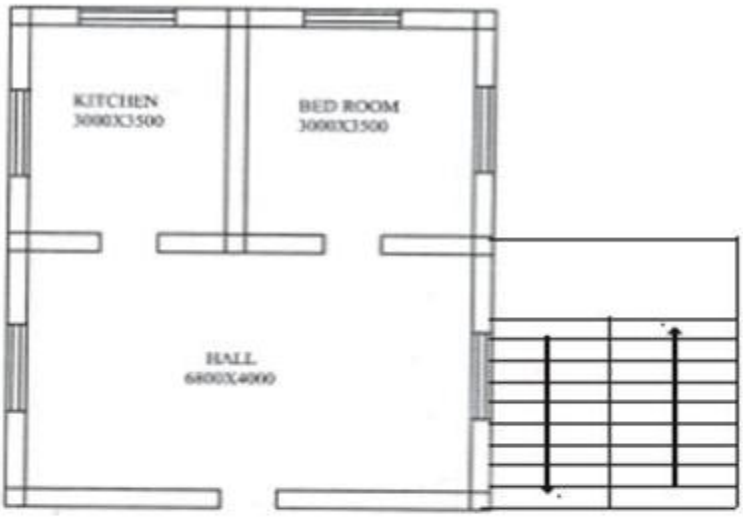
S.No.	Particulars of Items	No	L	B	H	Q	Explanation
1	Earth work excavation for foundation for						
	a) pillars	8	1.5	1.5	1.80	32.4	
	b) around the building and cross walls	1	26.3	0.75	0.85	27.9	L= 5.6+2.8x2+ 2.3x3+(1.8+2.3)2
					Total	60.3	m^3
2.	C.C. (1:4:8) for						
	a) pillars	8	1.5	1.5	0.15	2.7	
	b) around the building and cross walls	1	38.3	0.75	0.15	4.3	L= 3.5x3+3x2+ 3.5x2+4x2+6.8=38.3
					Total	7.0	m^3
3.	Brick Masonry with C.M. (1:6) for						
	a) first footing	1	38.3	0.45	0.35	6.03	
	b) Second Footing	1	38.3	0.35	0.30	4.69	
	c) Superstructure	1	38.3	0.3	3.0	4.02	
	d) Parapet wall	1	30.4	0.3	0.6	5.47	L=(7.1+8.1)x2=30.4
					Total	20.21	m^3
	6.8 / 7.8 / 0.3 / 7.1 / 8.1						
	Deduction for opening						
	a) Doors	3	1.0	0.3	2.0	1.8	
	b) Windows	8	1.2	0.3	1.5	4.32	
					Total	6.12	m^3
	Net Brick Masonry	=20.21-6.12			=	14.09	
4.	R.C.C.(1:1.5:3) for columns						
	a) Rectangular portion	8	1.5	1.5	0.3	5.40	
	b) Trepezoidal portion	8	0.9	0.9	0.45	2.92	
	c) Square portion upto GL	8	0.3	0.3	0.9	0.65	
	d) Squareporiton above GL	8	0.3	0.3	3.0	2.16	
					Total	11.13	m^3
5.	Plastering with 12mmth in CM1:5	1x2	40.1	---	3.0	240.6	L=41.3-4x0.3=40.1
	Deductions for openings						

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	Doors	3x2	1.0	---	2.0	12.0	
	windows	8x2	1.2	---	1.5	28.8	
					Total	**40.8**	m^2
	Plastering for parapet wall (sides)	1x2	30.4	---	0.6	36.48	
	Top	1	30.4	0.3	---	9.12	
					Total	**45.60**	m^2
	Net Plastring = 240.6-40.8+45.6=245.4 m^2						
6.	Flooring with 25mmth CC(1:2:4)						
	Kitchen	1	3.0	3.5	--	10.5	
	Bed	1	3.5	3.5	--	12.25	
	Hall	1	6.8	4.0	--	27.20	
	Sills of Doors	3	1.0	0.3	--	0.90	
7.	Ceiling = Same as Flooring				Total	**50.85**	m^2
						50.85	
8.	white Washing = Same as Plastering for walls and ceiling 245.4+50.85 = 296.25 m^2						
9.	RCC(1:2:4) for						
	a) Slab	1	7.40	8.40	1.5	9.324	
	b) lintels over Doors	3	1.2	0.3	0.1	0.108	
	Windows	8	1.4	0.3	0.1	0.336	
	c) beams	1	40.7	0.3	0.3	3.663	
					Total	**13.431**	m^3
10	Supply & Fixing of best county wood for						
	a) Doors	3				3Nos.	
	b) Windows	8				8 Nos	
11	Painting with ready mixed synthetic enamil paints two coats over primary coat for new wood for						
	a) Doors	2¼x3	1.0	--	2.0	13.50	
	b) Windows	2¼x8	1.2	--	1.5	32.40	
						45.90	m^2
12	2% unforeseen items						
13	4% P.S& contingencies and round off						

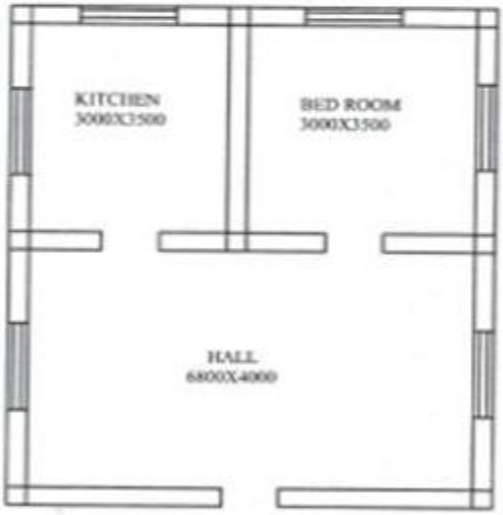
Abstract estimate of single storeyed residential building (framed structure type)

S.No	Description of item	Quantity	Unit	Rate	Per	Amount
1.	Earth work excavation	60.30	m^3	465	$10m^3$	2804.00
2.	Cement concrete(1:4:8)	7.00	m^3	1545	$1m^3$	10815.00
3.	Brick masonry in country bricks of standard size in CM(1:5) Reefs columns	14.09	m^3	2291	$10m^3$	32250.20
4.	R.C.C. (1:2:4) for lintels, beams, columns etc.	15.237	m^3	7405	m^3	112830.00
5.	R.C.C.(1:2:4) for slabs,	9.324	m^3	6030	m^3	56223.70
6.	Cement concrete (1:5:10) for flooring	5.085	m^3	1452	m^3	7383.40
7.	Supplying and fixing of country wood for doors.	6.00	m^3	1650	m^2	9900.00
8.	Supplying and fixing of country wood for windows and ventilators.	14.40	m^2	2300	m^2	33120.00
9.	Plastering to all exposed surfaces of brick work and basement with C.M (1:5)	245.40	m^2	582	$10m^2$	14282.30
10	White washing with best shell lime	296.25	m^2	116	$10m^2$	3436.50
11	Flooring with spartek tiles set in C.M (1:3)	50.85	m^2	4230	$10m^2$	21509.50
12	Painting with ready mixed enamel paint	51.00	m^2	335	$10m^2$	1708.50
13	Provision for staircase	LS	m^2			50000.00
14	Provision for water supply and sanitary arrangements @12.5%					354584.60 44323.00
15	Provision for electrification @7.5%					26593.80
16	Provision for architectural appearance @2%					7091.70
17	Provision for unforeseen items 2%					7091.70
18	Provision for P.s.and contingencies @4%					14183.40
						Total Rs. 453868.00

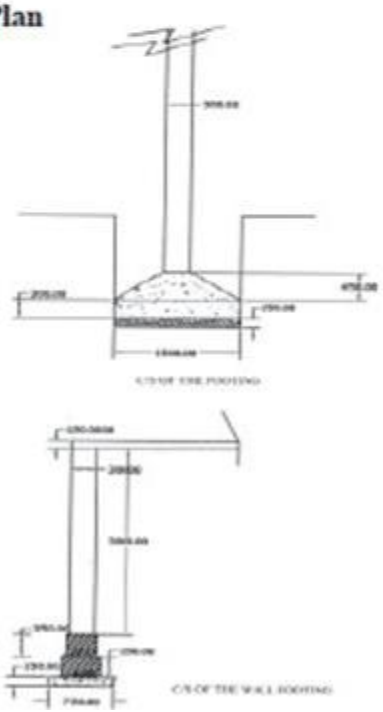
1.5.7 From the given figure below calculate the details and abstractestimate for the two storied residential building withno. of rooms (Framed Structured type) by Centre Line Method



Ground Floor Plan



First Floor Plan



S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
	The quantities of various items of the building for the Ground floor is same as previous problem. Here the quantities of various items of the building for the First floor is mentioned here.						
	First Floor						
1	R.C.C. (1:1.5:3) for						
	a) Columns	8	0.3	0.30	3.0	2.16	
	b) Slabs	1	7.40	8.4	0.15	9.324	
	c) beams	1	40.7	0.3	0.3	3.663	
	d) lintels over doors	1	1.2	0.3	0.1	0.036	
	windows	6	1.4	0.3	0.1	0.252	
					Total	15.435	m^3
2.	B.M with CM(1:8) in the first floor	1	28.6	0.3	3.0	25.74	
	Parapet wall	1	30.4	0.3	0.6	5.47	
	Deductions for openings						
	Doors	1	1.0	0.3	2.0	-0.6	
	Windows	6	1.2	0.3	1.5	-3.24	
	Net BM = 25.74+5.47-0.6-3.24 =					27.372	m^3
3.	Plastering with CM (1:4)						
	for walls	1x2	30.4	--	3.0	182.4	
	for parapet wall sides	1x2	30.4	--	0.6	36.48	
	Parapet wall Top	1	30.4	0.3	--	9.12	
	Deductions						
	Doors	1	1.0	---	2.0	-2.0	
	Windows	6	1.2	--	1.5	-10.8	
					Total	215.2	m^2
4.	Flooring with CM(1:3)	1	6.8	7.8	---	53.04	m^2
5.	Plastering for ceiling with CM(1:3) = Same as Flooring					53.04	m^2
6.	White washing or colour washing = same as ceiling & BM = 53.04 + 215.2 = 268.24						m^2
7.	The estimation of a staircase is mentioned separately in the next problem						

MODULE-2

Subject: QUANTITY SURVEYING AND ESTIMATION
Subject code: 15CV81

ROAD ESTIMATION

Introduction:-

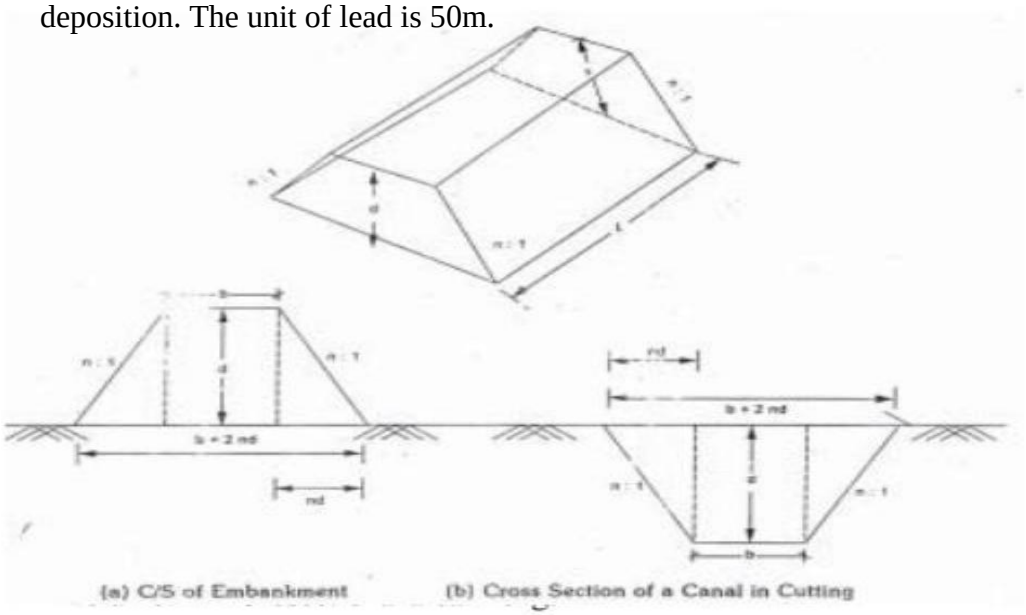
Generally all the Civil Engineering projects like roads, railways, earth dams, canal bunds, buildings etc. involves the earth work.This earth work may be either earth excavation or earth filling or Some times both will get according to the desired shape and level.

Basically the volume of earthwork is computed from length, breadth, and depth of excavation or filling.

Lead and Lift:

Lead:

It is the average horizontal distance between the centre of excavation to the centre of deposition. The unit of lead is 50m.



(a) C/S of Embankment (b) Cross Section of a Canal in Cutting

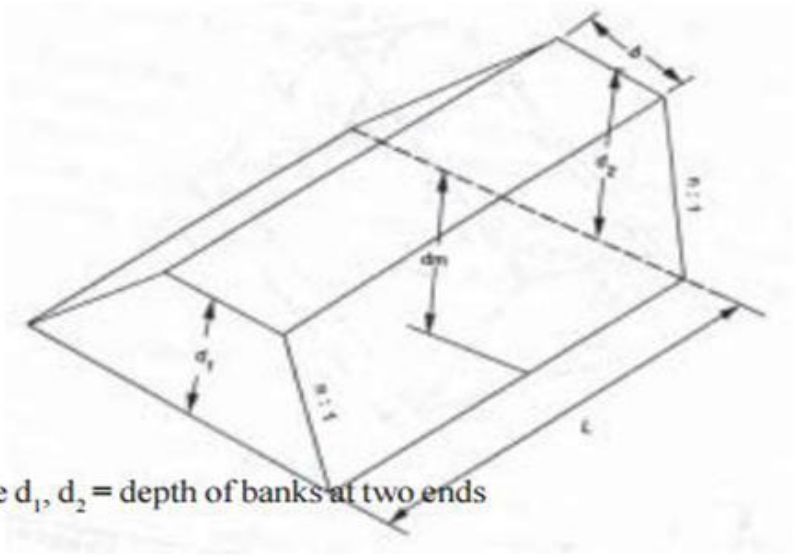
$$V = (bd+2x1/2x\ ndx\ d)L$$

$$V = (bd+nd^2)L$$

Case 2:

When the ground is in longitudinal slope or the formation has uniform gradient for a length the earth work may be calculated by the following methods.

i. By Mid Section or Mid ordinate method.



Where d_1, d_2 = depth of banks at two ends

$$\text{Mid ordinate (or) Average depth } (d_m) = \frac{d_1 + d_2}{2}$$

ii) Trepezoidal formula: (for two sections)

In this method also called mean sectional area method

Let A_1 & A_2 be two areas at two ends.

$A = (bd_1 + nd_1^2)$, $A_2 = (bd_2 + nd_2^2)$

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

Volume of earth work (v) = Am ×L

iii) Trepezoidal formula for a series of c/s areas at equal intervals.

Let $A_1, A_2, A_3 \ldots\ldots A_n$ are the cross sectional areas along L.S of Road 'L" is the distance between two cross sections

The volume of earth work

$$V = L\left[\left(\frac{A_1 + A_n}{2}\right) + (A_2 + A_3 + \ldots\ldots + A_{n-1})\right] \text{ (or)}$$

iv) Prismoidal formula for a series of cross sectional areas at equal intervals.

Note : This method is adopted when there is odd number of cross sections.

Volume of earth work

$$V = \frac{L}{3}\left[(A_1 + A_n) + 4(A_2 + A_4 + A_6 + \ldots\ldots + A_{n-1}) + 2(A_3 + A_5 + \ldots\ldots + A_{n-2})\right]$$

$$= \frac{\text{length}}{3}\text{(Sum of first and last areas)+4(even areas)+2(odd Areas)]}$$

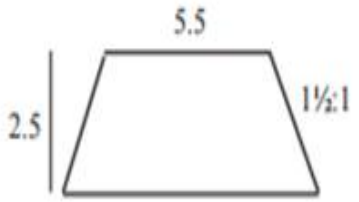
Example 7.1 : Find the volume of earth work in embankment of length 12m. Top width is 5.5m and depth is 2.5m the side slopes ara 1½:1

Sol : Top width b=5.5m

Depth d= 2.5m

side slopes =1½:1 i.e. n=1.5

length L=12m



Example 7.2 : The depths at two ends of an embankment of road of length 70m are 2m and 2.5m. The formation width and side slopes are 8m and 2:1 respectively. Estimate the Quantity of earth work by

a) Mid Sectional Area (ii)Mean sectional Area method.

Sol: a) b=8m, d1=2m, d2=2.5m, l=70m, n=2

$$\text{Mean depth } d_m = \frac{d_1+d_2}{2} = \frac{2+2.5}{2} = 2.25\text{m}$$

Mid sectional Area = Am = $bdm+ndm^2 = (8x2.25+2x2.25^2)2 = 28.125m^2$

Volume of earth work (V)= AmxL = $28.125x70 = 1968.75m^3$.

b) Area of c/s at one end $A_1 = bd_1 + nd_1^2 = 8x2+2x2^2 = 24m^2$

Area of C/s at other end $A2 = bd_2+nd_2^2 = 8\times2.5+2\times2.5^2 = 32.5m^2$

$$\text{Mean Sectional Area (Am)} = \frac{A_1+A_2}{2} = \frac{24+32.5}{2} = 28.25m^2$$

Example 7.3: RL of ground level is given below. Draw the longitudinal section of the road and prepare an estimate of earthwork at the rate of Rs. 275.00% cu m.

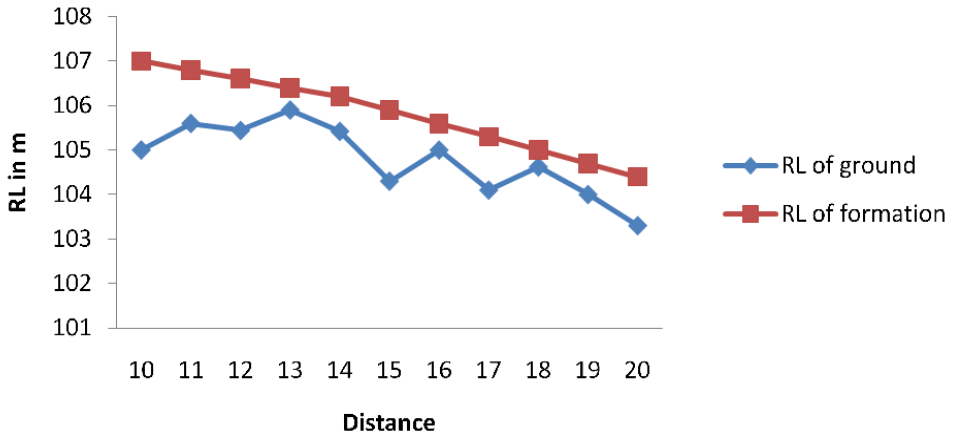
Chainage	10	11	12	13	14	15	16	17	18	19	20
RL of ground	105	105.6	105.44	105.9	105.42	104.3	105	104.1	104.62	104	103.3
RL of formatiom	107										

Down gradient of 1 in 150 upto 14th chainage and 1 in 100 from 15th to 20th chainage.

Stations	Length	RL of ground	RL of formation	Height	Mean depth	Area	Length	Quantity	
								Banking	Cutting
10	300	105	107	2	_	_	_	_	_
11	330	105.6	106.8	1.2	1.6	21.12	30	633.6	
12	360	105.44	106.6	1.16	1.18	14.5848	30	437.544	
13	390	105.9	106.4	0.5	0.83	9.6778	30	290.334	
14	420	105.42	106.2	0.78	0.64	7.2192	30	216.576	
15	450	104.3	105.9	1.6	1.19	14.7322	30	441.966	
16	480	105	105.6	0.6	1.1	13.42	30	402.6	
17	510	104.1	105.3	1.2	0.9	10.62	30	318.6	
18	540	104.62	105	0.38	0.79	9.1482	30	274.446	
19	570	104	104.7	0.7	0.54	5.9832	30	179.496	
20	600	103.3	104.4	1.1	0.9	10.62	30	318.6	
							Total	3513.76 cu m	

Abstract of estimated cost

Item No.	Particular	Quantity	Unit	Rate	Per	Cost
1	Earthwork in banking	3513.762	cu m	275	% cu m	9662.8455
				Add 5% Lumpsum		483.142275
					Grand total	10145.9878



Cement concrete road

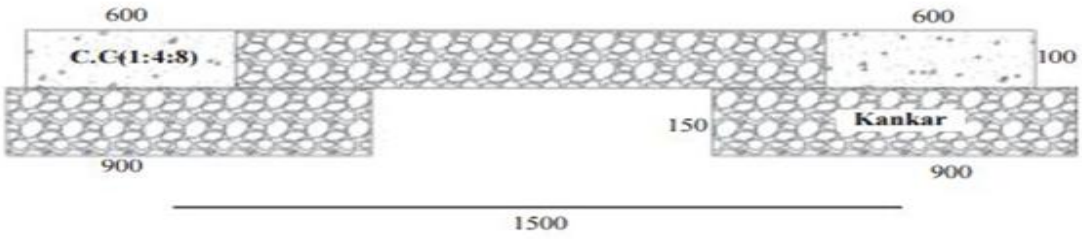
C.C. road is laid over an existing W.B.M road, In certain cases. It is laid over a prepared sub grade and a base course is provided. The concrete used for roads is M15 grade using 20mm H.B.G. metal while for base course a concrete of 1:4:8 using 40mm HBGmetal the stages of Estimations of a C.C.road is

a) Earth work excavation and deposting on the bank
b) Cement concrete (1:4:8) for base course
c) Cement concrete (1:2:8) for wearing course.

Example 8.2:- Calculation for the estimation of a C.C.road for a length of 100m and width of C.C.road is 3.50m with 100mm thickness of earh layer.

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:4:8) for base course including cost and conveyance of all materials at site machine mixing, laying curing etc.	1	100	3.5	0.1	35. cum	
2	C.C.(1:2:4) for pavement	1	100	3.5	0.1	35cum	
3	Provision for mastic pads					L.S.	
4	Unforcean items @2%					L.S.	
5	Petty supervision @4%					L.S	

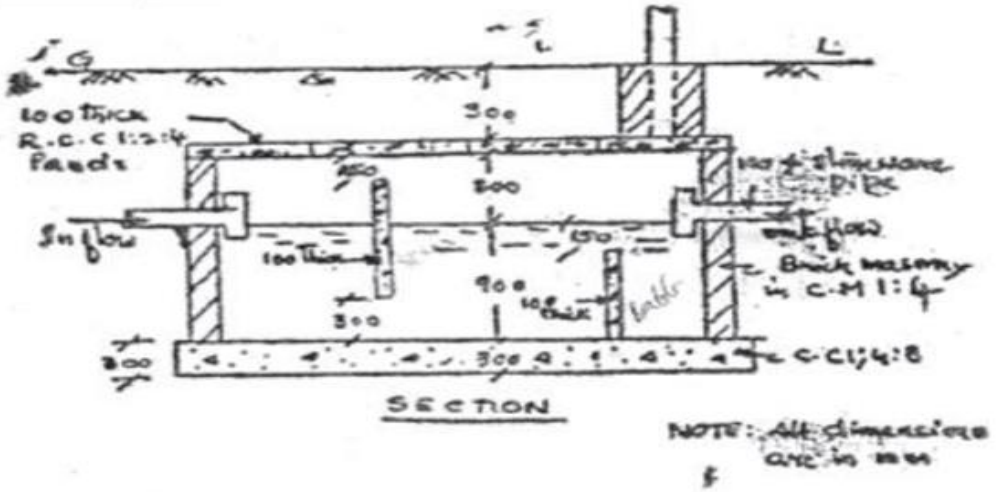
Example 8.3 :- Prepare an estimate for 1 Km length of C.C. track or the fig shown below.

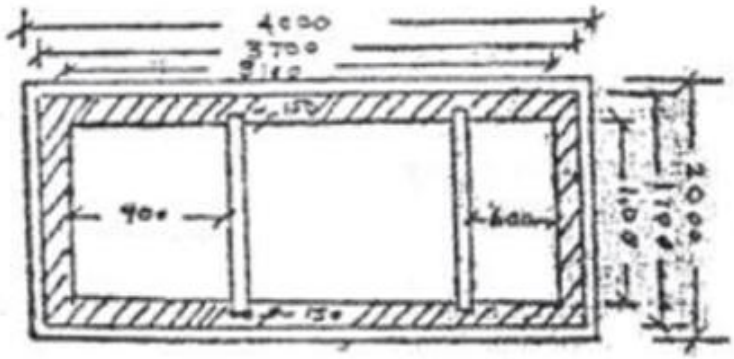


S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	C.C.(1:2:4) in tracks including laying	2	1000	0.6	0.1	120m^3	
2.	laying of kankar (for loose thickness increase with $33\frac{1}{3}$%)						
	a) in between C.C tracks	1	1000	0.9	0.133	120	
	b) under C.C. tracks	2	1000	0.9	0.20	360	
						480 m^3	

Example 8.4:- Calculate the quantities of different items of the figure shown in below

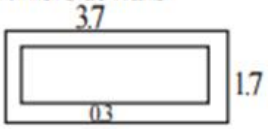
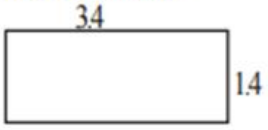
SEPTIC TANK

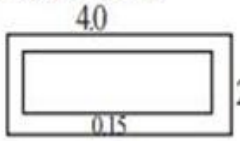
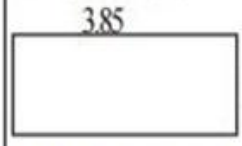




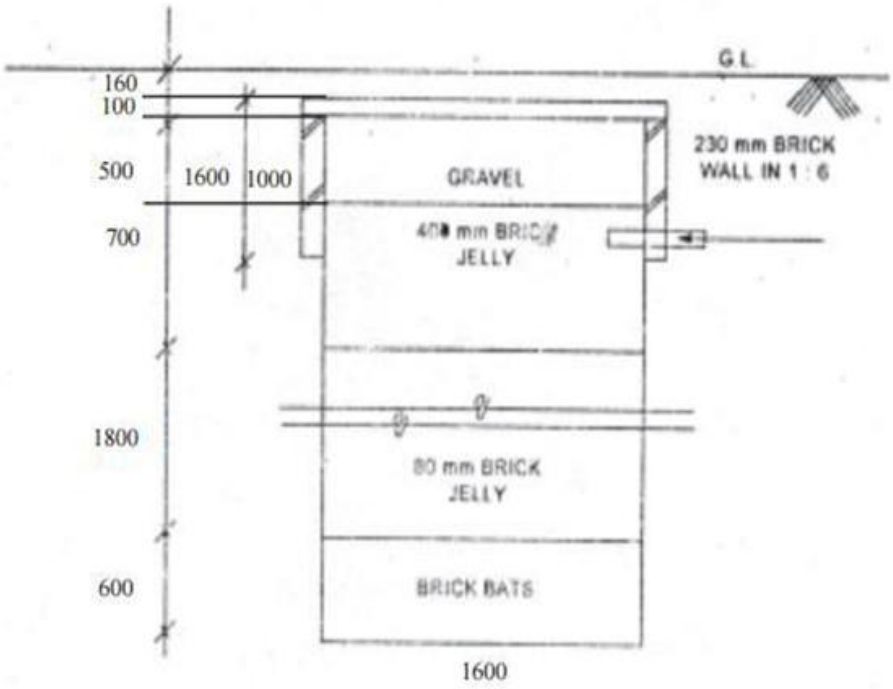
PLAN

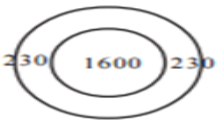
SEPTIC TANK

S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1	Earth work excation upto GL.	1	4.0	2.0	1.9	15.2m^3	
2.	C.C. (1:4:8)bed	1	4.0	2.0	0.3	2.4m^3	
3.	Brick masonary in CM 1:4 for side walls						
							
	Long wall short wall method						
	Long wall	2	3.7	0.3	1.2	2.664	
	Shortwalls	2	1.1	0.3	1.2	0.792	
	(or)				Total	**3.456**	
	centre line method						
							
	total centre line length (3400+1400)2=9600	1	9.6	0.3	1.2	3.456	
4	R.C.C. (1:2:4) using 20mm HBG metal						
	a) R.C.C slab		3.70	1.70	0.1	0.629	
	b) Baffle wall		1.40	0.1	0.75	0.105	
	c) Scum board		1.40	0.1	0.75	0.105	
					Total	**0.839**	
5.	Plastering with CM(1:4)						
	with 20mm th						
	a) Inner surface of septic tank		8.40	---	1.2	10.08	(3.1+1.1)2=8.4
	b) flooring		3.1	1.1	--	3.41	
	c) Sides of Scum board	1x2	1.1	--	0.75	1.65	
	d) Top and bottom	1x2	1.1	0.1	--	0.22	
	e) sides of baffle wall	1x2	1.0	--	0.75	1.65	
	f) top of baffle wall	1x1	1.0	0.1	---	0.1	
	Deduct for Pipe openings	2	$\frac{\pi}{4}\times(0.1)^2$			0.0157	
	Total (net) Plastering				Total	**17.10**	

6.	a) Earth filling with excavated soil around the brick wall  centre line method  Total Centre line length = (1.85+3.85)2 = 11.4	1	11.4	0.15	1.30	2.223	
	b) over R.C.C. pannels (neglecting the space for venti pipe footing)	1	3.70	1.70	0.30 Total	1.1887 **4.11**	
7	supply fixing of steel grills including labour for fabrication @ 750N/m³	1	0.839	x750=	6292N	62.92 Kgs	
8	Provision of 100mm dia inlet and out let tees	1x2	---	--	--	2Nos	
9.	Provision of A.C. ventilating shaft 3m hight duly embedded in b/w at bottom	1x1			1 No	1 No	
10	Provision for A.C. cowl for ventilating pipe	1x1			1nos	1 No	
11	Unforcean itsm @2x				L.S	L.S	
12	P.S.& contingencies @4%				L.S	L.S	

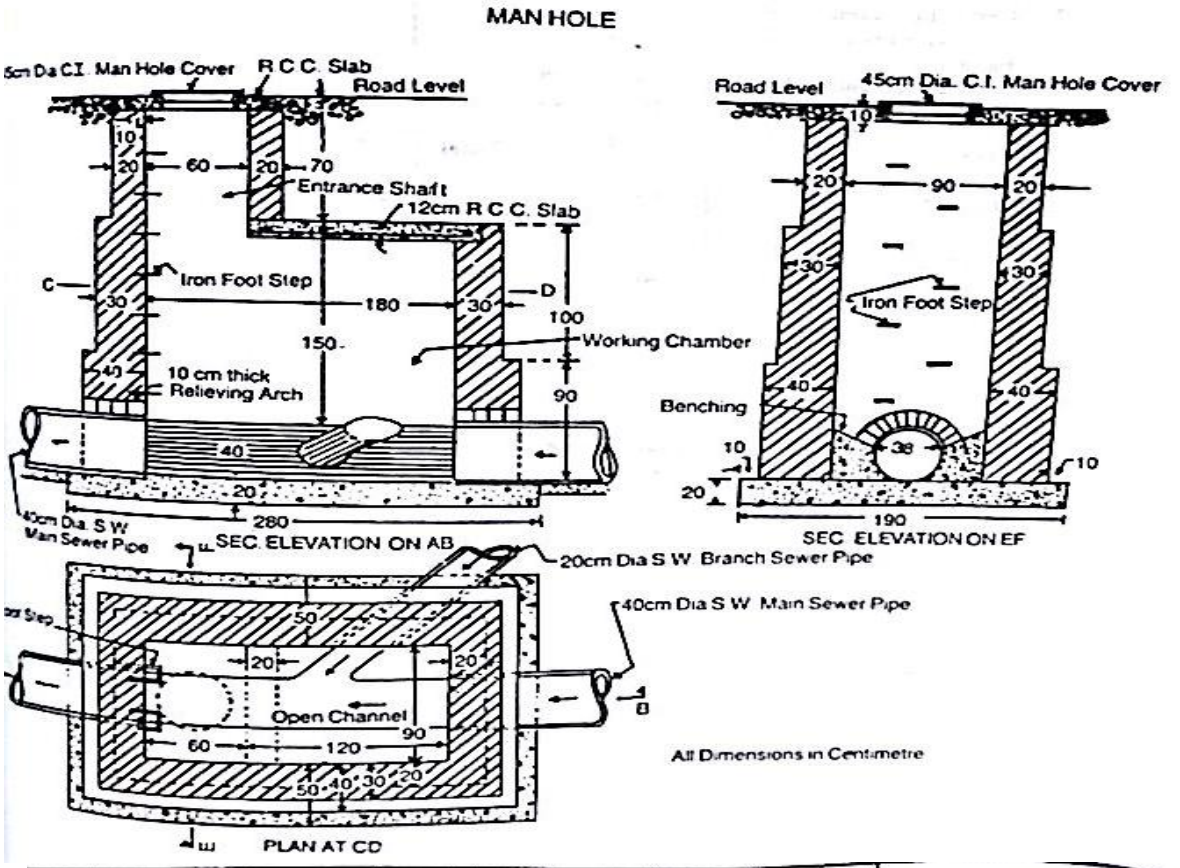
SOAK PIT



S.No.	Particulars of Items	No.	L	B	H	Q	Explanation
1.	Earth work excavation in non cohesive soils like sandy soils with an intial lead & lift						
	a) Soak pit	1	$\frac{\pi}{4}$ x 1.6^2		3.86	7.76	
	b) side brick wall	1	$\frac{\pi}{4}(2.06^2 - 1.6^2)$		1.16	1.53	
					Total	**9.29**	
2.	Brick work in CM (1:5) with country bricks including cost and conveyance etc complete alround the pit						
		1	$\frac{\pi}{4}(2.06^2 - 1.6^2)$	0.9		1.19	
	centre line method						
		1	$\pi(1.83)$	0.23	0.9	1.19	

3.	supply & packing including cost &conveyance						
	a) Brick bats	1	$\frac{\pi}{4} \times$	1 .6 ²	0.6	1.2	
	b) 80mm brick jelly	1	$\frac{\pi}{4} \times$	1 .6 ²	1.8	3.62	
	c)40mm brick jelly	1	$\frac{\pi}{4} \times$	1 .6 ²	0.7	1.4	
	d) gravel brick jelly	1	$\frac{\pi}{4} \times$	1 .6 ²	0.5	1.00	
					Total	**7.22**	
4.	R.C.C.(1:2:4) slab panels (precast) using 20mm HBG metal inlcuidng cost & conveyance	1	$\frac{\pi}{4} \times$	2 .06 ²	0.1	0.33	
5.	Filling with clay soil on top of pit upto GL.	1	$\frac{\pi}{4} \times$	2 .06 ²	0.16	0.53	
7.	Laying of joining 100mm popies including earth work Encavation, sand filling packing joints etc complets						
	L=12+0.23+1.6/2	1	13.03		---	13.03	RM
8	Unforcean items of work @2%	1	--		--	LS	
9	Petty supervision and contingencies @4%	1	---		---	LS	

Example 8.5: Prepare a detailed estimate of a manhole from the given drawing.



Item No.	Particulars of items and details of works	No.	Length m	Breadth m	Height or Depth m	Quantity	Explanatory notes
1	Earthwork in excavation ...		2.80	1.90	2.90	15.43	cu m
2	Cement concrete 1:3:6 with brick ballast—						
	Foundation and bed	1	2.80	1.90	0.20	1.06	
	Benching ...	1	1.80	.0.90	0.40	0.65	
					Total	1.71	
	Deduct—						
	Upper portion of main channel ...	1	1.80	.90+.38 / 2	0.15	0.17	
	Upper portion of branch channel ...	1	0.30	0.20	0.15	0.01	
			Total	of ded	uction	0.18	
				Net	Total	1.53	cu m

3	I-class brickwork in 1 : 4 cement mortar—						No deduction for pipes.
	Long walls 1st step	2	2.60	0.40	0.90	1.88	L=60+20+20
	Long walls 2nd step	2	2.40	0.30	1.00	1.44	=100 cm
	Long walls 3rd step	2	1.00	0.20	0.70	0.28	
	Long walls 1st step	2	0.90	0.40	0.90	0.65	
	Short walls 2nd step	2	0.90	0.30	1.00	0.54	
	Short walls 3rd step	2	0.90	0.20	0.70	0.25	
					Total	5.04	cu m
4	Cement pointing 1:2—Long walls up to slab ...	2	1.80	—	1.50	5.40	
	Short walls up to slab ...	2	0.90	—	1.50	2.70	
	Short—left face ...	1	0.90	—	0.82	0.74	
	Short—right face above slab ...	1	0.90	—	0.70	0.63	
	Remaining face ...	2	0.60	—	0.82	0.98	
					Total	10.45	sq m
5	20 mm thick cement plaster I : 3 in floor and channels ...	1	1.80	1.20	—	2.16 sq m	B=90+30=120 cm *Additional 30 cm for channel curvature.*
6	R.C.C. slab including steel complete work—						
	Roof slab of working chamber ...	1	1.35	1.20	0.12	0.194	
	Roof slab of shaft ...	1	0.80	1.10	0.10	0.088	
					Total	0.282	
	Deduct manhole cover ...	1	$\pi \times .45^2$ / 4	x	0.10	0.016	
				Net	Total	0.266	cu m
7	C.I. Manhole cover 42 cm dia. including frame ...	1	—	—	—	1 No.	
8	Iron foot steps of 16 mm dia. bar ...	7	—	—	—	7 Nos.	

Item No.	Particulars of items	Quantity	Unit	Rate Rs. P.	Per	Amount Rs. P.
1	Earthwork in excavation including timbering as required ...	15.43	cu m	350.00	% cu m	54.00
2	Cement concrete 1 : 3 : 6 with brick ballast	1.53	cu m	300.00	/ cu m	459.00
3	I class brickwork 1 : 4 cement mortar ...	5.04	cu m	345.00	/ cu m	1738.80
4	Cement pointing 1 : 2 ...	10.45	sq m	5.60	/ sq m	58.52
5	20 mm thick cement plaster 1 : 3 in floor and channels neat cement finished ...	2.16	sq m 305	15.00	/ sq m	32.40
6	R.C.C. slab including reinforcement complete work ...	0.266	cu m	675.00	/ cu m	179.55
7	C.I. Manhole cover 45 cm dia. including frame heavy type ...	1	no.	60.00	/ no.	60.00
8	Iron foot steps fixed in position ...	7	nos.	2.00	/ no.	14.00
					Total...	2596.27
	Add 5% for Contingencies and Workcharged Establishment...					129.81
					Grand Total...	2726.08

MODULE – 3

"SPECIFICATION AND ANALYSIS OF RATES"

SPECIFICATIONS

Specifications describe the nature and the class of the work, materials to be used in the work, workmanship etc. and is very important for the execution of the work. The cost of a work depends much on the specifications. Specifications should be clear.

Purpose of giving Specifications

- The cost of an unit quantity of work is governed by its specifications.
- Specification of a work is required to describe the quality and quantity of different materials required for a construction work and is one of the essential contract documents.
- This also specifies the workmanship and the method of doing the work. Thus specification of a work serves as a guide to a supervising staff of a contractor as well as to the owner to execute the work to their satisfaction.
- A work is carried out according to its specification and the contractor is paid for the same. Any change in specification changes the tendered rate.
- As the rate of work is based on the specification, a contractor can calculate the rates of various items of works in tender with his procurement rates of materials and labour. Thus tender rate without specification of works is baseless, incomplete and invalid.
- Specification is necessary to specify the equipment tools and plants to be engaged for a work and thus enables to procure them beforehand.
- The necessity of specification is to verify and check the strength of materials for a work involved in a project.

Types of Specifications

1. General Specifications
2. Detailed Specifications

General Specifications

In general specifications, nature and class of works and names of materials that should be used are described. Only a brief description of each and every item is given. It is useful for estimating the project. The general specifications do not form a part of contract document.

Detailed Specifications

The detailed specifications form a part of a contract document. They specify the qualities, quantities and proportions of materials and the method of preparation and execution for a particular item of works in a project. The detailed specifications of the different items of the work are prepared separately and they describe what the work should be and how they shall be executed. While writing the detailed specifications, the same order sequence as the work is to be carried out is to be maintained.

RCC Specifications

Shuttering shall be done using seasoned wooden boards of thickness not less than 30mm.

- Surface contact with concrete shall be free from adhering grout, nails, splits and other defects.
- All the joints are perfectly closed and lined up.
- The shuttering and framing is sufficiently braced.
- Nowadays timber shuttering is replaced by steel plates.
- All the props of approved sizes are supported on double wedges and when taken out, these wedges are eased and not knocked out.
- All the framework is removed after 21 days of curing without any shocks or vibrations.
- All reinforcement bars conform IS specifications and are free from rust, grease oil etc.
- The steel grills are perfectly as per detailed specifications.
- The covers to concrete are perfectly maintained as per code.
- Bars of diameter beyond 25mm diameter are bent when red hot.
- The materials proportion should be as per the specifications of the concrete.

Number of Cement bags required for a specific cement concrete ratios

- For cement concrete of ratio 1:1:2(1 cement:1sand/coarse sand:2graded stone aggregate) require 11no bags of 50kg.
- For cement concrete of ratio 1:1.5:3 require 7.8no bags of 50kg.
- For cement concrete of ratio 1:2:4 require 6 no bags of 50kg.
- For cement concrete of ratio 1:3:6 require 4.25no bags of 50kg.
- For cement concrete of ratio 1:4:8 require 3.2 no bags of 50kg.
- For cement concrete of ratio 1:5:10 require 2.50 no bags of 50kg.
- For cement concrete of ratio 1:6:12 require 2.25 no bags of 50kg.

Brick Masonry with Cement Mortar

Masonry is the building of structures from individual units laid in and bound together by mortar; the term *masonry* can also refer to the units themselves. The common materials of masonry construction are brick, stone such as marble, granite, travertine, limestone, concrete block, glass block and tile. Masonry is generally a highly durable form of construction. Brick masonry construction involves use of high quality materials in construction. Use of low grade materials in construction or mortar mix in inappropriate ratio can affect the quality of construction.

Specifications for Brick masonry in Cement Mortar

- The bricks shall be of first class, regular in shape, size and colour.
- The bricks should be free from flaws, cracks and lumps of any kind.
- Shall have minimum crushing strength 10.5N/mm2.
- The bricks shall not absorb the water more than one sixth of the weight of the brick.
- The sand used shall be medium coarse, clean, sharp, free from clay, mica and other organic matter.
- The cement used shall satisfy the requirement of Bureau of Indian Standard.
- The mortar is designated in specified proportion of cement and sand. The materials are weighed or measured and mixed on watertight platform after allowing bulkage of sand.
- Bricks before laying shall be thoroughly soaked in water.
- The bricks laid truly horizontal in course with frogs upwards.
- The brickwork shall be raised 1m in height at a strength all round the building.
- Only fresh mortar within ½ hour for cement mortar, the time of adding water shall be used.
- During rains, no brickwork is carried out when special arrangements are made.
- The brickwork shall be kept wet for atleast 10 days.

Coursed Rubble Masonry

- Masonry is affected by the use of low grade materials that is in case of stone masonry, use of low grade stones, improperly cut stones, chipped off stones etc. The mortar mix should follow a specific standard for the proper bonding between the joints of Course Rubble Masonry. Therefore, specifications have to be given for the materials used, the laying technique, Bond or Through stones, Quoins and curing – for the ultimate strengthening of the final masonry work.

Specifications for Coursed Rubble Stone (CRS) Masonry

Material Specifications

- Stone shall be hard, sound, free from decay and weathering. Stones with porous matter or with boulder skin shall be rejected. The size of stones shall not be less than 15cm in any direction.
- Cement and sand for cement mortar or lime and surkhi for lime mortar shall be of standard specification.

Laying Technique specified

- All the stones shall be thoroughly wetted before laying. Every course of stone shall be hammer dressed and laid truly horizontal and every vertical joint shall be truly vertical. Faces shall be accurately squared and each face joint shall be dressed at right angles. The face stones shall be laid in alternate headers and stretchers fashion. The masonry shall shall be carried up regularly and true to plumb. The thickness of joints shall not exceed 12mm.

Bond or through stones

- The stones going through in the walls shall be well distributed by arranging them in a staggered fashion in successive courses. The intervals of through stones shall not be less than 1.5m in each course. For walls upto 60cm thickness, a through stone shall extend from one face of the wall to the other.

Laying of Quoins

- Corner stones or quoins shall be dressed to correct angle. The short bed of the stone shall be at least equal to height. The quoins shall be laid with header and stretcher in alternate layers.

Curing Method

- The work shall be protected from rain or sun while it is green. At the end of the day's work, the top surface of the walls shall be kept flooded so that it acquires the required strength. The masonry shall be kept moist on all the faces for at least 7 days.

Plain Cement Concrete (PCC) is a construction material generally used as a binding materials and is composed of cement, (commonly Portland Cement) and other cementitious materials such as fly ash and slag cement, aggregate (generally a coarse aggregate made of

gravels or crushed rocks such as limestone or granite, plus a fine aggregate such as sand), water, and chemical admixtures.

Specifications for Plain Cement Concrete (PCC)

Materials Specifications

- **Aggregate** shall be of invert materials and should be clean, dense, hard, sound, durable, non-absorbent and capable of developing good bond with mortar.
- **Coarse aggregate** shall be of hard broken stone of granite or similar stone, free from dust, dirt and other foreign matters. The stone ballast shall be of 20mm size and smaller. All the coarse material should be retained in a 5mm square mesh and should be well graded such that the voids do not exceed 42%.
- **Fine aggregate** shall be of coarse sand consisting of hard, sharp and angular grains and shall pass through a screen of 5mm square mesh. Sand shall be of standard specifications, clean and free from dust, dirt and organic matter. Sea sand shall not be used.
- **Cement shall be fresh Portland cement of standard ISI specifications** and shall have the required tensile and compressive stresses and fineness.
- **Water** shall be clean and free from alkaline and acid matters and suitable for drinking purposes.
- **Proportion Specifications**

  1:2:4 (cement : sand : stone ballast) by volume when specified. Minimum compressive strength of concrete of 1:2:4 proportion shall be 140 kg/cm2 in 7 days.
- **Hand mixing**

  Mixing shall be done on masonry platform or sheet iron tray.
- **Machine mixing**

  Stone ballast, sand and cement shall be put into cement concrete mixer to have the required proportions.
- **Slump**

  Regular slump test should be carried out to control the addition of water and to maintain the required consistency. A slump of 7.5cm to 10cm may be allowed for building work.
- **Formwork**

Formwork centering and shuttering shall be provided as required as per the standard specification before laying concrete to confine to support or to keep the concrete in position. The inner surface of shuttering shall be oiled to prevent concrete sticking to it.

- **Laying Technique**

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

- **Curing Method**

  After about two hours of laying of concrete, when the concrete has begun to harden, it shall be kept damp by covering with wet gunny bags or wet sand for 24 hours.

ANALYSIS OF RATES

In order to determine the rate of a particular item, the factors affecting the rate of that item are studied carefully and then finally a rate is decided for that item. This process of determining the rates of an item is termed as analysis of rates or rate analysis.

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

1. Specifications of works and material about their quality, proportion and constructional operation method.
2. Quantity of materials and their costs.
3. Cost of labours and their wages.
4. Location of site of work and the distances from source and conveyance charges.
5. Overhead and establishment charges
6. Profit

Cost of materials at source and at site of construction:

The costs of materials are taken as delivered at site inclusive of the transport local taxes and other charges.

Purpose of Analysis of rates:

Purpose of Analysis of rates:

1. To work out the actual cost of per unit of the items.
2. To work out the economical use of materials and processes in completing the particulars item.

3. To work out the cost of extra items which are not provided in the contract bond, but are to be done as per the directions of the department.

4. To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.

Cost of labour -types of labour, standard schedule of rates:

The labour can be classified in to

1) Skilled – 1st class

2) Skilled – 2d Class

3) Unskilled

The labour charges can be obtained from the standard schedule of rates 30% of the skilled labour provided in the data may be taken as Ist class, remaining 70% as II class.

The rates of materials for Government works are fixed by the superintendent Engineer for his circle every year and approved by the Board of Chief Engineers. These rates are incorporated in the standard schedule of rates.

Lead statement: The distance between the source of availability of material and construction site is known as "Lead " and is expected in Km. The cost of conveyance of material depends on lead.

Rate Analysis:

Every construction project is divided into number of activities. Each activity consists of different types of civil or construction works.

For example, the in the construction of a building, the activities can be excavation or earthwork, Concrete work, masonry work, Wood work such as doors and windows, plumbing, flooring, waterproofing, finishing work such as plastering, painting and distempering.

The Activity earthwork can be divided into many types based on depth and type of soil. For example, an excavation of 1.5m deep in soft soil, an excavation of 3m deep in hard soil. Likewise, concrete work can be divided into many types based on its mix proportions and its placement.

For example, M25 reinforced concrete work in foundation, M30 reinforced concrete work in columns, slabs etc. Likewise, there can be many small civil works in every construction project.

The cost of any construction project is calculated based on each works associated with every construction activity. Thus it is essential to calculate cost of each small works.

Rate analysis of Civil Works or Building Works is the determination of cost of each construction work per unit quantity. This cost includes the cost of materials, labours, machinery, contractors profit and other miscellaneous petty expenses required for the particular work to be complete in unit quantity.

For example, cost of 1 cubic meter of M20 RCC work in slab, Cost of 1 cubic meter of excavation in soft soil of 1.5m depth, cost of 1 square meter of plastering of 20mm, cost of 1 square meter of painting work with specified paint in 2 layers or 3 layers as required.

The cost of materials in rate analysis is calculated as combination of cost of material at origin, its transportation costs, taxes. The rate of labour is based on skill of the labour, such as skilled labour, semi-skilled and unskilled labour. The cost of materials and labours vary from place to place. Thus, the cost of each construction work varies from place to place.

What are the Factors Affecting Analysis of Rates of Civil Works?

Factors which affect the rate analysis of civil works are:

- Specification of the civil work and materials such as quality of materials, proportion of mortar or concrete, thickness of plastering, number of coats of painting, depth of excavation, type of soil etc.
- Location of the construction site – Distance of construction site from source of materials, availability of labours, availability of water, machinery etc. influence the rate analysis of construction work.
- Quantity of materials, number of different types of labours and rates of materials and labours influence the rate analysis.
- Profit of the contractor, miscellaneous expenses and other overheads also influence the rate analysis.

Types of Construction Project Costs – Direct and Indirect Costs

Any construction project consists of direct and indirect costs which forms the total costs and expenses resulting from the use of principal components for implementing construction projects. Different classification of construction project costs and their features are explained below.

Types of Construction Project Costs

Before moving into the main classification of project costs, some of the specific costs encountered in construction projects are explained below.

1. Fixed Cost

This is defined as the cost spent once for a particular point of time. The purchase of equipment, machinery etc comes under fixed cost assets.

2. Time-Related Cost

Time-related cost is the cost spend for a particular activity for a given duration. The cost spent on wages, equipment and building rents etc comes under this category.

3. Quantity -Proportional Cost

This type of cost will vary based on the quantities. Materials costs are examples of quantity-proportional costs.

Major classification of construction projects costs are:

1. Project direct costs
2. Project Indirect Costs

Total Project Cost = Project Direct Costs + Project Indirect Costs

Direct Costs of Construction Project

The costs and expenses that are accountable directly on a facility, function or product are called as direct costs. In construction projects, the direct costs are the cost incurred on labor, material, equipment etc.

These costs for a construction project are developed as estimates by means of detailed analysis of the contract activities, construction method, the site conditions, and resources.

Different direct costs in construction projects are material costs, labor costs, subcontractor costs, and equipment costs.

Indirect Costs of Construction Project

The costs, unlike direct costs, is not directly accountable for a particular facility, product or function. Indirect costs can be either variable or fixed.

The main sections coming under indirect costs are personnel costs, security costs, and administration costs. These costs do not have a direct connection with the construction project.

The indirect cost can be classified as:

1. Project Overhead Costs

In a construction project, the cost of some of the items cannot be directly allocated for a specific activity. Most of the site related costs come under this section and are categorized as project overhead costs.

Project overhead costs can either be fixed or time-related costs. Different costs coming under overhead costs are the costs of stores, safety facilities, workshops, offices, staffs and parking facilities. All those plants that are required to support the working crews will come under this cost.

The overhead cost is estimated by a detailed analysis of the site-related activities and their cost. Hence an accurate cost estimate is obtained. Most of the companies make use of forms and checklist developed by them to estimate these costs. The site overhead costs account for 5 to 15% of the total project costs.

2. General Overhead Costs

The general overhead costs cannot be directly charged for a specific project. These form the costs that are used to support the overall activities of the company. The general overhead costs will include the cost of the design engineers, expenses of head-office, cost of directors and managers, schedulers etc.

The general overhead expense and cost are found reasonable through continuous monitoring of the company expenses. The general overhead costs account for 2 to 5 % of the contract direct costs.

The amount of the general overhead that should be allocated to a specific project equals:

Example 1:- Calculate the Quantity of material for the following items.

a) R.C.C. (1:2:4) for $20m^3$ of work

b) R.C.C. (1:3:6) for $15m^3$ of work

a) Quantity of cement required $= \frac{1}{(1+2+4)} \times 1.52 \times 20 = 4.14m^3 \times \frac{1440}{50}$

$= 119.26$ bags

Quantity of Sand required $= \frac{2}{(1+2+4)} \times 1.52x20 = 8.28m^3$

Quantity of cource aggreate $= \frac{4}{7} x1.52x20 = 16.56m^3$

b) Quantity of cement required $= \frac{1}{10} \times 1.52 \times 1.5 = 2.28m^3 \times \frac{1440}{50} =$ ~~65.66~~ Bags

Quantity of sand required $= \frac{3}{10} \times 1.52x\ 15 = 6.84m^3$

Quantity of CA required $= \frac{6}{10} \times 1.52x15 = 13.68m^3$

Example 2:- Calculate the quantity of materials for the following items.

a) C.M. (1:4) for $1m^3$ of work

b) CM (1:6) for $1m^3$ of work

Hint: Cement will go to fill up the volds in sand. So total volume was be 4 instead of 1+4=5

a) Quantity of Cement required $= \frac{1}{4} \times 1 = 0.25m^3 = 0.25 \times \frac{1440}{50} = 7.2$ bags

Quantity of Sand required $= \frac{4}{4} \times 1 = 1m^3$

b) Quantity of cement required $= \frac{1}{6} \times 1 = 0.16m^3 = 0.16 \times \frac{1440}{50} = 4.8$bags

Quantity of sand required $= \frac{6}{6} \times 1 = 1m^3$

Example 3:-Calculate the Quantity of Cement required in bags for the following items.

a) B.M. in CM(1:3) for 15 cum of work using $0.2m^3$ of CM required for $1m^3$ of Brick work

b) RCC (1:2:4) for $20m^3$ of work

Sol : a) $1m^3$ of Brick work - $0.2m^3$ of CM(1:3)

$15\ m^3$ of Brick work $= 15 \times 0.2 = 3m^3$

Quantity of cement required in bags $= \frac{1}{3} \times 3 \times \frac{1440}{50} = 28.8$bags

b) Quantity of Cement required in bags $= \frac{1}{7} \times 1.52 \times 20 \times \frac{1440}{50} = 125$ bags

MODULE-4

CONTRACT MANAGEMENT-TENDER AND ITS PROCESS

Contents:

Invitation to tender, Prequalification, administrative approval and technical sanction. Bid submission and evaluation process. Contract formulation: covering award of contracts, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard tender document (source: CPWD/ PWD/ International Competitive Bidding – NHAI/NHEPC/NPC). Laws of contract as per Indian contract Act 1872, Types of contract, Lump sum contract, Item rate, % rate, Cost plus with Target Labour, EPC and BOT, Sub contracting. Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC

Tender

The tender is an offer in writing to execute some specified work or to supply the materials at certain rates within a fixed time under the certain conditions of agreements between the contractor and department or owner of any party.

Where where a lot of contractors are expected to quote, sealed tender in a prescribed form are invited from the approved list of contractors.

Necessity for tenders:

Entrusting work by calling tender is advantages because of

1. lower bids that may be obtained due to competition among the contractors.
2. selection of contractors can be made based upon their experience in their line.
3. personal interests, prejudices, preferences, partially etc. can be avoided by calling for tenders.

Tender document:

Before inviting tenders the tender documents have to be prepared and issued to the interested tenderers. These documents generally consists of the following:

1. detailed specifications of the work and material should be used.
2. a complete set of Drawings with details of various parts.
3. general conditions of contract.
4. special conditions.
5. schedule quantities of various items of the work. Approximate quantity of work under each item of work.
6. the location of the work.
7. the name of the division in which the work is situated.
8. the rates of Steel and cement if they are supplied by the department.
9. hire charges for lorries, tools and plants to be levied when issued from the department.
10. condition regarding employment of Technical personals.
11. location of water. And supply. For power and rates.
12. the period of completion of work and the time and completion of each stage of work.

13. the amount of earnest money deposit and the form in which it is to be deposited.
14. the name of authority who is accepting or rejecting the tender.
15 conditions of penalty for slow progress and non fulfillment of the condition of the contract.
16. In case of dispute the procedure to be followed for arbitration and designation of the arbitrator to whom the reference is to be made.

Tender notice

After the tender documents have been prepared and approved by the authority, a notice inviting tenders has to be published on the notice board of all unit offices of the department. For works of Greater magnitude, wide publicity should be given to the notice inviting tenders. Tenders must be invited in the most open and public manner possible, buy advertisement in the press and by the notice in the English/ Hindi and the written language of the district, posted in the public place.

The following particulars are written in the tender notice.
1. name of the authority inviting the tender.
2. name of the work and its location.
3. estimated cost of the work.
4. period of contract and type of contract.
5. when and where the tender document should be purchased.
6. the amount to be paid for the set of tender documents.
7. last date and time of submission of tender.
8. the amount of earnest money that should be accompanied with the tender and the amount of security deposit to be paid by the selected contractor.
9. the date and time of the opening of tender.
10. the designation of the officer who accepts the tender.

Specimen of tender notice

Office of Executive Engineer,
PWD, Bengaluru Division.

Tender notification dated
Tender notification number

The sealed tender is duplicate In a prescribed form with the name of the work is invited from register contractors of Karnataka II for the following works and will be received bi Executive Engineer, Bengaluru division, Bengaluru up to 5:00 p.m. on 25th October 2010. the tender form with the complete set of contract can be had from office of Executive Engineer from 10 a.m. to 5:00 p.m. on all working days up to to 20th of October 2010 on the payment of Rs_____ tenders will be open at_____ a m or PM on date_____ by the Executive Engineer or is authorised agent in the office at_____ in the presence of contractor or representatives.

Details of estimates, terms of contract conditions etc.., maybe see in the office of Executive Engineer, Bengaluru division, Bengaluru during the working hours at the office.

The Executive Engineer receives the tender. He has the rights to accept or reject any or all the tenders without assigning reasons.

Work details

Sl no	Name of the work	Estimated cost	Time of completion	Cost of tender	Class of contractor	EMD
1	Construction of Public Library near RajajiNagar 4th block bus stand	20,00,000	6 months	30% + sales tax	class 1 contractor	2% of estimated cost

Sale of tender documents:

Tender document should be prepared and kept ready for sale to the contractors before the notice is actually sent to the Press or is pasted on the notice board and every contractor desiring to tender shall be asked to make a written application. it is the responsibility of the Executive Engineer/ Assistant Executive Engineer/ Assistant Engineer to see the tender documents are made available to the contractors as soon as the application is made.

Receiving, opening and scrutiny of tenders:

Receiving:

After issue of the tender document to contractors the tender opening authority authorises an officer to receive the tenders and tender may be sent either by post or can put in the tender box kept for the purpose in the premises of the owner. Tenders placed in tender box is locked and kept under the safe custody of the officer. The closing time for receipt of tenders should be kept after the normal time of delivery of the post. Tender received after the due date and time are rejected.

Opening of tenders:

The sealed tenders received are to be opened in the presence of all the contractors for their representatives tendering for the work at the time and place already notified.

The officer opening the tenders has to be read out the rates offered in case of item rate and percentage rate tenders and amount in the case of lump sum tenders for information of all those present. all the tenders will be serial in number and signed by the officer opening the tender.

Preparing comparative statement of tenders:

After the tenders are opened, a comparative statement is made in the office of the tender opening authority. It serves to compare the rates of various tenderers in respect of each item against the estimated rates. The excess for Savings for each tender is worked out.

1. comparative statement of percentage rates and lump sum tenders contains information regarding the name of the contractor, date of receipt of tenders, above or below the rates entered in the tender documents, amount in case of lump sum tenders. The recommendation regarding acceptance or rejection of the tender is recorded on it.
2. Comparative statement of item rate tenders is more elaborate and comprehensive and is after thorough computation and check under supervision of Divisional accountant.

The comparative statement must correctly in corporate the rates and amount and their totals drawn up and checked on the individual tenders. A mistake in it may lead to the work being awarded it to a contractor who is not lowest.

Scrutiny of tenders:

After preparing comparative statement the tender opening authority shall verify whether the contractor has agreed to all the tender conditions or he has included any special condition and the consequent variation in the total amount has to be calculated.

If the acceptance of a particular tender does not rest with the Divisional officer to forward the tenders along with comparative statements and tender documents with his recommendations for observations to the next higher authorities for consideration.

Acceptance of tenders:

Based upon the comparative statement, usually the lowest tender is accepted except in the case where the work of the contractor who was quoted the lowest rate has not been satisfactory on previous occasions or there is doubt.

The tender whose rates are accepted is intimated to sign the contract documents. if we fails to sign with in specified time, is offer may be cancelled and is security deposit forfitted and they work may be allotted to the next tender whose bid is lowest among others.

Execution of contract agreement:

After the acceptance of the tender the preparation of contract document, it the contractor is required to pay a the security deposit before the contract agreement is signed. The contract agreement should be executed in the prescribed form and signed by the contractor or is authorised representatives and the authority on the behalf of Government.

Earnest money deposit(EMD)

When the contractor submit the tender for a work , he has to deposit some amount usually at about 2% of the estimated cost to the department and a guarantee of the tender. If the contractor refuses to take up the work when is tender accepted, is earnest money is forfeited. But the earnest money of all other contractors whose tenders have not been accepted will be returned to the respective contractors. The earnest money may be in cash or fixed deposit in bank, cash certificate, bank guarantee like saving certificate etc.

Security deposit:

Once the tender is accepted, the selected contractors should deposit 10% of the total cost of work as security deposit with the Department. This amount includes the earnest money

already deposited. The contractor may deposit the entire amount at the beginning of the work or it may be deducted from the running bill of the contractor.

The contractor should fulfill all the conditions of contract and carry out the work satisfactory according to the specification and complete the work in time. If the contractor fails to satisfy terms of agreement, then the part or complete amount of security money will be forfeited. If he complete the work as per the conditions of the agreement with in the specified time, the security deposit will be refunded to the contractor. This amount will be refunded 6 month after the completion of work. any defects noticed during this observation period is to be rectified by the contractor at his cost.

Power of accepting the tender:

When the tenders are accepted by different authorities according to the power of delegation. This differs from state to state generally the chief engineer and the Superintendent engineer has full power. Executive Engineer will have limited powers.

Work order:

This type of agreement is used for petty works. In this case No formal agreement is drawn up with the contractor as in the case of piece work, when the work is awarded by the work order. It can be used in situations where it is not possible to call tender for petty works. The money limit is different in different states. Sometimes in work order time limit with in which the work is to be completed can be specified. Contractors are usually selected by taking quotations. payment is made on the measurement of work and 10 percentage of total amount is deducted from the running account bill as security deposit and which will be refund date in the final payment on the satisfactory completion of work.

Site order book

The contractor shall within 10 days of the received of the return order to take up work, He has to supply one site order book to the sub divisional officer/ Assistant Executive Engineer concerned. The site order book shall have machine number pages in triplicate and will be initialed by the Assistant Engineer Incharge. This site order book shall be kept at the site of work under the custody of the Assistant Engineer or is authorised representative. important points related to site order book are:

1.Directions or instructions from departmental officers to be issued to the contractor, will be entered in the site order book(except when the directions or instructions are given by separate letters).

2. The contractor or his authorised representative shall regularly note the entries in the site order book and may take any of the duplicate page of the site order book for his own record.

3.In case of supplementary(extra climes) five terms of claim shall not be entertained unless supported by entries in this site order book or any written order.

4. The site order book shall be enclosed along with the Final bill to verify the Supplementary climes.

Work program:

The contractor shall have to submit within 3 days from the written order to commence the work to the the Engineer in charge a fully detailed program showing the proposed methods of construction, plant and Temporary works, sequence of operation and time schedule of each such operation. The work program shall be approved by the Engineer in charge. the contractor must maintain the progress of work with the work program.

Contractors ledger

Contractors ledger is a personal account of a contractor where all transaction regarding the particulars of contractor are entered. It is maintained in the Divisional Office in prescribed form. All payments, recoveries adjustments etc are taken in Ledger. For every contractor separate ledger is maintained and each contractors ledger is closed and balanced monthly.

Contract

When two or more persons have common intention communicated to each other to create some obligation between them there is said to be an agreement.

An agreement which is enforceable by law is a "contract".

In civil engineering construction contract is an undertaking by a person or form to do any work under certain terms and conditions. the work maybe for construction for maintenance and repairs, for supply of materials or labours etc,.

Contractor:

The contractor means a person or firm to do any type of contract.

Contract system of execution of work:

All departmental works except in special circumstances will be usually executed through the contractors. the following procedure is followed:

1. after the detailed plans and drawings are approved and all the sanctions obtained, contract for a work is arranged by inviting sealed tenders
2. tenders are opened at the specified date by officer inviting tender in the presence of the contractor and comparative statement is prepared. usually the lowest tender is accepted.
3. the contractor whose tender is accepted has to come to an agreement with the department to execute the work as per the conditions in the agreement. the contractor will be issued the work order to come in the work.
4. the contractor will start the work under the supervision of Section Officer in charge. for all day works executed, the contractor will be paid on running account bill which will be prepared by the Section Officer.

Types of contract:

There are 6 types of contract:

1. Piece work contract.
2. Item rate or unit price contract .

3.lump sum contract.
4. cost plus percentage contract.
5. combination of lump sum and Schedule of Rates contract.
6 Labour contract.

1. Piece work contract:

It is an agreement by which the worker agrees to execute the different items of work on mutually agreed rates. The agreement contains different items of work to be carried out with proper description and rates for unit quantity of work.

The contractors agrees to execute a specific work at stipulated rates, without reference to total quantity or time taken. Small works which do not required Engineering skills for execution like earth work excavation, maintenance work, Patchwork and whitewashing may be carried through piece work contract.

Merits

1. It is the best suited for small work and they work which will not require theEngineering skill
2. Work maybe completed very quickly.
3. It is the economical as the worker takes the small works with their wages a little margin over it.
4. Where the works for small and spread out, fees work contract works out to be cheaper and quicker.

Demerits:

1. The time is not considered so the workers can take their own time to complete the job so that rate of progress of work will reduce.
2. The department has to arrange dated and close supervision and checking the peace worker who does not have professional skills.

2. Item rate or unit price contract:

In this contract the contractor undertakes the execution of work at the unit rates agreed at the time of tender. The payment is made to the contractor by detail measurement of the work actually executed by the contractor.

This method of contract is used in most of the works in projects, maintenance of buildings, irrigation projects etc.,

Merits:

1. since the work is distributed as an item wise there will be no dispute between the owner and the contractor.
2. drawing and specifications can be changed at any instant at any time.
3. finalisation of bill is done by taking the measurement of work done by the contractor hence it is economical

Demerits:

1. the final cost cannot be determined before the completion of work

2. comparative statement of item rate tender is more elaborate and comprehensive and intelligent scrutiny is required.

3. lump sum contract:

In this contract the contractor agrees to execute a complete work in all aspect for a specific amount within a specified time. The plans, drawings and specifications of all items of the work are provided to the contractor but the details of quantities will not be given and the contractor will have to complete the work as per plan and specification within the contract period.

on completion off the work, ok no measurements will be taken by the department.

The contractor will be paid and fixed amount as agreed by checking the whole work in comparing with plan, drawing and specification.

Merits:

1. production and cost of construction due to competition of contractors.
2. the amount to be spent on the work is known accurately well in advance.
3. the contractor try to complete the work early as it is advantages for him.

Demerits:

1. it is very difficult to make changes in drawings and plans during construction.
2. if the specifications and drawings are not clear, may lead to difficulties and defective construction.

4. Cost plus percentage contract:

This contract the contractor is paid the actual cost of the building plus a fixed percentage for is overhead expenses, services and profit.

The contractor procures the materials and arranges the labour at his own cost keeping the proper account and he is paid by the department or owner the whole cost together with certain percentage, normally 10 percentage as his profit.

Merits:

1. there is no chance of dispute for carrying out any extra. Item
2. the contractor can take the dishum independently and the work can be completed quickly.
3. there is no major difference of opinion with the contractor and owner.

Demerits:

1. the final cost cannot be determined before the completion of the work.
2. the quality of work maybe poor.
3. it is very difficult to calculate actual cost incurred by the contractor. the department/ Warner as to keep a check over labour, material cost and Quality of work.

5. Labour contract:

In this contract the contractor undertakes only the labour portion of the work. All the necessary materials are supplied to the site by the department or owner and the contractor arranges his own labours and gets the work done as per the specification.

The contractor is paid for the labours only on the actual quantities of the work done measured under the item rate basis.

Merits:

1. the materials stored by the government for the utilised.
2. since materials are supplied by department, better progress and standard quality can be maintained.

Demerits:

1. there may be a delay in obtaining the materials by the department.
2. a large Storage Area is required to store the different kinds of materials a constant guarding etc are essential.
3. Theft from store, shortage of materials, accounting all the materials are constant worries for a department.

6. Negotiated contract:

When work is awarded it on contract by manual negotiation between the parties without call of tenders, it is said to be a negotiated contract. In PWD contractors are negotiated only in special circumstances such as:

1. to obtain reasonable rates

2.to meet this situation arises out of emergency e like construction of Shelters for displaced persons comer strengthening Runway for National Defence extra at short notice

General conditions of contract

The following are the general conditions of contract:

1. the rates A grade by the contractor should be for complete work including transportation of materials, labours, tools, plants and all other necessary arrangements.
2. the contractor should deposit 10% of the cost of the work as security deposit. play contractor May deposit the entire amount at the beginning of the work or it may be deducted from the running bill of the contractor.
3. a contractor should complete the work within the specified time, otherwise is liable for penalty
4. the time may be extended by the department for valid reasons requested by the contractor.
5. the cost of the material issued to the contractor or equipment given to the contractor shall be deducted from is running bill.
6. the work has to be done directly according to the drawing, plan and specifications and order issued by the authority.

7. the contractor may be terminated for his bad work or unsatisfactory progress and the part or full security deposit may be fortified.
8. the work shall be open for inspection.
9. extra items which are not included in the contractor shall be paid as per current schedule of rates.
10. compensation to the workman shall be paid by the contractor for any accident or damage.
11. all taxes, royalties etc,. shall have to be paid by the contractor which are included in the rates.

Contract agreement:

Contract agreement is a written document binding legally the contractor and the department to follow the rules and regulations and the conditions given, till the work entrusted to the contractor is completed. All pages of the agreement must be signed by both the parties.

The contract agreement must contain the following details:

1. title page with name of the work and contract number.
2. index page giving the contents of the agreement with page references.
3. tender notice with description of work, location, time, period of completion etc,.
4. Bill of quantities and total cost of works etc,.
5. schedule of issue of materials giving list of materials to be issued to the contractor with rate and place of issue.
6. general specifications giving the clauses and type of work.
7. detailed specifications for each item of work and materials.
8. complete drawing with plan, elevation, site plan and other relevant detail drawings,all fully dimensioned.
9. conditions of contract giving rate of labour, materials, tools and plants, progress rate excetra.
10. special conditions regarding nature of work, Texas, royalties, labour amenities excetra

Law of contract as per Indian Contract Act 1872

The Contracts or agreements between various parties are framed and validated by the Indian Contract Act. Contract Act is one of the most central laws that regulates and oversees all the business wherever a deal or an agreement is to be reached at. The following section will tell us what a contract is.

We will see how a contract is defined by The Indian Contract Act, 1872. We will also define the terms as per the Act and see what that means. In these topics, we will decipher all the vivid aspects of the Contract Act. Let us begin by understanding the concept of a contract.

Contract Act

The Indian Contract Act, 1872 defines the term "Contract" under its section 2 (h) as "An agreement enforceable by law". In other words, we can say that a contract is anything that is an agreement and enforceable by the law of the land.

This definition has two major elements in it viz – "agreement" and "enforceable by law". So in order to understand a contract in the light of The Indian Contract Act, 1872 we need to define and explain these two pivots in the definition of a contract.

Agreement

The Indian Contract Act, 1872 defines what we mean by "Agreement". In its section 2 (e), the Act defines the term agreement as "every promise and every set of promises, forming the consideration for each other".

Now that we know how the Act defines the term "agreement", there may be some ambiguity in the definition of the term promise.

Promise

This ambiguity is removed by the Act itself in its section 2(b) which defines the term "promise" here as: "when the person to whom the proposal is made signifies his assent thereto, the proposal is said to be accepted. Proposal when accepted, becomes a promise".

In other words, an agreement is an accepted promise, accepted by all the parties involved in the agreement or affected by it. This definition thus introduces a flow chart or a sequence of steps that need to be triggered in order to establish or draft a contract. The steps may be described as under:

i. The definition requires a person to whom a certain proposal is made.

ii. The person (parties) in step one have to be in a position to fully understand all the aspects of a proposal.

iii. "signifies his assent thereto" – means that the person in point one accepts or agrees with the proposal after having fully understood it.

iv. Once the "person" accepts the proposal, the status of the proposal changes to "accepted proposal".

v. "accepted proposal" becomes a promise. Note that the proposal is not a promise. For the proposal to become a promise, it has to be accepted first.

Thus, in other words, an agreement is obtained from a proposal once the proposal, made by one or more of the participants affected by the proposal, is accepted by all the parties addressed by the agreement. To sum up, we can represent the above information below:

Agreement = Offer + Acceptance.

Enforceable By Law

Now let us try to understand this aspect of the definition as is present in the Act. Suppose you agree to sell a unicorn for ten magic beans with a friend. Can you have a contract for this?

Well if you follow the steps in the previous section, you will argue that once you and your friend agree on the promise, it becomes an agreement. But in order to be a contract as per the definition of the Act, the agreement has to be legally enforceable.

Thus we can say that for an agreement to change into a Contract as per the Act, it must give rise to or lead to legal obligations or in other words must be within the scope of the law. Thus we can summarize it as Contract = Accepted Proposal (Agreement) + Enforceable by law (defined within the law)

THE INDIAN CONTRACT ACT, 1872

_____

ARRANGEMENT OF SECTIONS

_____

25. Agreement without consideration, void, unless it is in writing and registered, or is a promise to
compensate for something done, or is a promise to pay a debt barred by limitation law.
26. Agreement in restraint of marriage, void.
27. Agreement in restraint of trade, void.
Saving of agreement not to carry on business of which good-will is sold.
28. Agreements in restraint of legal proceeding void.
Saving of contract to refer to arbitration dispute that may arise.
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50. Performance in manner or at time prescribed or sanctioned by promise.
Performance of reciprocal promises
51. Promisor not bound to perform, unless reciprocal promisee ready and willing to perform.
52. Order of performance of reciprocal promises.
53. Liability of party preventing event on which the contract is to take effect.
54. Effect of default as to that promise which should be first performed, in contract consisting of
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55. Effect of failure to perform at fixed time, in contract in which time is essential.
Effect of such failure when time is not essential.
Effect of acceptance of performance at time other than that agreed upon.
56. Agreement to do impossible act.
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57. Reciprocal promise to do things legal, and also other things illegal.
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66. Mode of communicating or revoking rescission of voidable contract.
67. Effect of neglect of promisee to afford promisor reasonable facilities for performance.
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69. Reimbursement of person paying money due by another, in payment of which he is interested.
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137. Creditor‟s forbearance to sue does not discharge surety.
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235. Liability of pretended agent.
236. Person falsely contracting as agent, not entitled to performance.
237. Liability of principal inducing belief that agent‟s unauthorized acts were authorized.
238. Effect, on agreement, of misrepresentation or fraud by agent.
CHAPTER XI
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239. —266. [Repealed.]
SCHEDULE—[Repealed.]
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MODULE-5

CONTRACT MANAGEMENT POST AWARD

Contents:

Contract Management- Post Award: Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured advance, Suspension of work, Time limit for Completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delays and Compensations, Disputes and its resolution mechanism, contract management and administration.

Valuation: Definitions of terms used in valuation process, cost, estimate, value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land, building, facilities) freehold and leasehold, sinking funds Depreciation – methods of estimating depreciation, outgoing, Process and methods of valuation: Rent fixation, Valuation for mortgage, valuation of land

Contract Management- Post Award:

5.1 Performance security:

Performance security includes performance bonds provided by a bank or Insurance Company, retention funds and performance guarantee by a surety. In construction industry, a performance bond is used to provide security in various situations. Commonly, these performance points are used to provide security in respect to contractor's performance during contract period. Thus a performance Bond protects the client from the risk of a contractor failing to fulfil its contractual obligation to the client. Guarantee to the contractor that the project will be e satisfactorily completed.

There are two main types of performance Bonds.

1) On demand: This means that the bond, are the amount payable under the performance bond is payable to the client requesting such payment. There is no requirement to show that the contractor is in Breach of its obligation.

2) Conditional: This means that the bond is payable only after the occurrence of a prescribed event. Usually, this is triggered by a default committed by the contractor such as a delay by the contractor to complete the work by the stipulated period or a failure to rectify the defects after the completion of works.

The client is better protected if the performance Bond lasts until the end of the defects liability period when the final certificate is issued. Performance bonds may be represent around 5 to 10% of the contract value.

5.2 Mobilization and equipment advances:

Mobilisation advance payment are payments of funds to supplier or contractor before Anticipation of, and for the purpose of performance under the contract. The basic purpose is to extend financial assistance within the terms to the contractor to mobilize the man and material

resources for timely and take off the project or procurement of equipment material and other service contact.
Mobilization advance is a kind of payment to the supplier for contractor.

5.3 Liquidated damages and bonus:

Liquidated damage is an amount of compensation payable by a contractor to the owner or to the government due to delayed construction having no relationship with real damage. If the contractor fails to complete the works within the time prescribed in the tender then the contractor shall pay to the owner or to the government the sum stated in the tender as liquidated damages.

Liquidated damages or an amount of money, agreed upon by the parties at the time of contract signing that established the damages that can be recovered in the event a party e breaches the contract. The Amount is supposed to reflect the best estimate of actual damages when the party's Sign the contract. In construction, the damages frequently the failure to complete the work on time

Liquidated damage class can provide many benefits:

1) When setting a predetermined amount of damages, it allows both parties chance to negotiate and settle on a number they feel both its fair and reasonable.
2) In the event of breach the owner can immediately calculate the damage without going through to the trouble of actual damages.
3) This allows the contractor to chart out the level of risk involved, and schedule appropriately.
4) Amount must be used as compensation not as a penalty.
5) The amount must be liquidated that is agreed upon advance.

Time limit for completion:

If the contractor cannot complete the work due to you having some unavailable problem in the execution or any other ground the contractor shall give any immediate report of such incidence to the Engineer in charge .He can apply for extension of time in writing to the Engineer in charge. The Engineer in charge may grant such extension of time on reasonable grounds for few days.

Security Deposit:

It is deducted from the running account bills, as funds available to client for any repair of the work during the defect liability period (if the contractor fails to rectify the mistakes)

As the project is being executed, it has to be executed as per the procedure of contract. The contractor is responsible for ensuring the quality of the project and ensuring 30 need effect occurs the execution must be rectified by the contractor without any extra cost.

In order to ensure that the contractor as to rectified and if he would not able to do that the client must execute that but cost must be able to recover from the contractor and security deposit is the basis for that.

The money is refunded to contractor after this defect liability period has lapsed.

5.4 MEASUREMENT BOOK

Importance:

➢ Measurement book is the initial record of all kinds of works.

➢ Measurement books are the basis of all accounts of quantities of work done by contractor and materials purchased for specific work.

➢ They must be maintained accurate and kept carefully so that they may be produced in a court of law as evidence.

5.4.1THE RULES TO BE FOLLOWED IN RECORDING MEASUREMENT BOOK:

The following are important points kept in mind while taking, recording in measurement book:

a. The measurement should be recorded by engineer in charge to whom the measurement book has been issued.

b. The measurement of work should be taken accurately and recorded neatly for different items in respective columns.

c. Measurements should be recorded neatly and directly, in the Measurement book at the site of the work.

d. For materials supply, quantities received are measured by weighing or counting and recorded in the measurement book.

e. All measurement should be taken using the steel or metallic tape and entered in ink directly in the measurement book.

f. Copying the measurement book from the note book should be strictly avoided.

g. Erasing or reentering are not allowed, the mistakes should be crossed out and correct entry done should be attested by dated initials of Engineer who has taken the measurement.

h. When any measurement is cancelled, then cancellation should be attested by dated initials of officer and reason for cancellation should be mentioned.

i. All measurements should be done continuously without leaving any blank page. If blank page is left out by mistake that should be cancelled by drawing the diagonal lines attested with dated initials.

j. The person recording the measurement shall put his signature at the end of the measurements book certifying "measured by me".

k. Each measurement book should be provided with an index and kept up-to-date.

l. When measurements are entered for running contract, a reference to the last set of measurements, should be duly entered in the measurement book.

5.4.2 PRE-MEASUREMENT

Generally the measurement of the work is taken after the construction at the finishing stage, but for certain items of work the measurements are taken before their actual completion because it may not possible to check such items after the completion of the works, such measurements are known as premeasurement

Example:

i. Reinforced concrete work The Steel bars/reinforcement gets embedded inside the concrete hence it is necessary to premeasure the steel bars/reinforcement to know the size and spacing of bars provided in the form work before placing the concrete.
ii. Clearance of jungle the construction of road work, it is necessary to clear the shrubs of plants before the road work is started. So area of jungle to be cleaned is pre-measured before the clearance of site is started. iii. During the construction of road, the materials like the stone aggregate and the gravel can't be counted after spreading on the road surface. These materials are stocked at the site of the road and measurement is taken.

5.4.3PAYMENT OF BILLS

When a contractor has executed a work as per contract, he is paid with reference to the submitted bills. Bill: It is the account of work done or materials supplied. It contains full particulars like total amount, amount due and agreement number is also mentioned.

5.4.4 VOUCHER

It is the return document as a proof of payment. After the preparation of bill the payment is made and the bill is checked, duly acknowledged by payee who affixes his signature on a revenue stamp. After the payments are made a voucher becomes the document.

5.4.5 MODES OF PAYMENT

Payments to contractors are made in a variety elf modes:
i) Mobilization Advance
ii) First and Final payment
iii) Final payment
iv) Intermediate payment
v) Advance payment
vi) Secured advance payment

i) Mobilization Advance :

The mobilization advance is an amount paid to the contractor prior to the execution of work. Since these payments are not measured by contract performance, they differ from partial payments which are based on actual performance of tasks in furtherance of the contract. The basic purpose of mobilization advance payment is to extend financial assistance within the terms of contact to the contractor to mobilize the man and material resources for timely and smooth take off of the project or procurement of the equipment material or other services of contact. Mobilization advance is a kind of payment to the supplier or contractor, primarily extended as financial assistance within the terms of contracts.

ii) First and Final Payment:

This is the single payment made for a job on its completion. This is applicable only for small works. Small miscellaneous works can be given to a contractor by client without calling for tenders by executing a written understanding at rates within the schedule of rates. In such cases, he can pass the bill and make a single payment for the completed work/ contract. This is known as First and Final payment.

iii) Final Payment:

This refers to the payment made on running account to a contractor on the. Completion or termination of his contract and in full settlement of the account.

iv) Intermediate Payment: This is the payment made on a running account to the contractor for the work to be completed or materials to be supplied. This payment is done when only a part of the whole work or supply has been done and the work or supply is in progress. The contractor is paid time to time to the extent of completion of items of work. Running account bills of measured works or supplies made is known as intermediate payment.

v) Advance Payment:

This is a payment made on the running account to the contractor for the work done or supply of materials made by him, but not measured. The advance is adjusted through subsequent bills in which the actual measurements have been taken. Advance payment is not generally made to a contractor, but this can be done in exceptional cases when the work has sufficiently progressed (but, for which measurements cannot be taken) based on the certificate of the Assistant Engineer in charge of the work. The value of the work done shall not be less than the advance proposed to be made and detailed measurements shall be taken as soon as possible and the advance payment adjusted in the final bill.

vi) Secured Advance Payment:

This represents an advance payment made on security of materials brought to the site of work when the contract is for completed items of work. The advance amount not exceeding 70% of the value of materials brought to the site.

The payment will be made only after clarifying the following

1) The quantities of materials actually being brought to the site.
2) The contractor has not received any advance for such materials.
3) The materials are in good condition and as per specification.

5.5 PREPARATION AND PAYMENT OF FINAL BILLS

Before a final bill is prepared, the entries in the 'M' book shall be scrutinized by the Engineer In charge and arithmetical calculations duly certified by the head clerk. The rates shall be checked with the contract document and the Engineer shall compare quantities in the bill with the 'M' book before signing the same for submission to the office. In the office, the auditors shall check the arithmetical accuracy again exercising the official formalities of checking recoveries, etc. by carefully scrutinizing contractor's ledger; T and P hire charges register, etc. The memorandum of payment is made up with all recoveries shown therein. Final bills in all cases shall be based on detailed measurements only.

5.6 ADDITIONS AND ALTERATIONS OR VARIATIONS AND DEVIATIONS

A variation (sometimes referred to as a variation instruction, variation order or change order), is an alteration to the scope of works in a construction contract in the form of an addition, alteration or omission from the original scope of works.

Almost all construction projects vary from the original design, scope and definition. Whether small or large, construction projects will inevitably depart from the original tender design, specifications and drawings prepared by the design team. This can be because of

technological advancement, statutory changes or enforcement, change in conditions, geological anomalies, non-availability of specified materials, or simply because of the continued development of the design after the contract has been awarded. In large civil engineering projects variations can be very significant, whereas on small building contracts they may be relatively minor.

Variations may include:

➢ Alterations to the design

➢ Alterations to quantities.

➢ Alterations to quality.

➢ Alterations to working conditions.

➢ Alterations to the sequence of work.

Variations may also be deemed to occur if the contract documents do not properly describe the works actually required.

➢ Variations may not (without the contractors consent):

➢ Change the fundamental nature of the works.

➢ Omit work so that it can be carried out by another contractor.

➢ Be instructed after practical completion.

➢ Require the contractor to carry out work that was the subject of a prime cost sum. In legal terms, a variation is an agreement supported by consideration to alter some terms of the contract. No power to order variation is implied, and so there must be express terms in contracts which give the power instruct variations. In the absence of such express terms the contractor may reject instructions for variations without any legal consequences. Standard forms of contract generally make express provisions for the contract administrator (generally the architect or engineer) to instruct variations. Such provisions enable the continued, smooth administration of the works without the need for another contract. Variation instructions must be clear as to what is and is not included, and may propose the method of valuation.

5.7 VALUATION OF VARIATIONS

Variations may give rise to additions or deductions from the contract sum. The valuation of variations may include not just the work which the variation instruction describes, but other expenses that may result from the variation, such as the impact on other aspects of the works. Variations may also (but not necessarily) require adjustment of the completion date.

Variations may be valued by:

➢ Agreement between the contractor and the client.

➢ The cost consultant. A variation quotation prepared by the contractor and accepted by the client. By some other method agreed by the contractor and the client.

Valuations of variations are often based on the rates and prices provided by the contractor in their tender, provided the work is of a similar nature and carried out in similar conditions. This is true, even if it becomes apparent that the rates provided by the contractor were higher or lower than otherwise available commercial rates. If similar types of works to those instructed by a variation cannot be found in the drawings, specification or bills of

quantities, then fair valuation of the contractor's direct costs, overheads and profit is necessary. Further, if the contract administrator omits work from contractor's scope, such an omission must be genuine: that is, the work omitted must be omitted from the contract entirely, it cannot be used to take work away from the contractor to give it to another. Similarly, the contract administrator is not empowered to order variations to help the contractor if the contract works are proving too difficult or expensive for them. Many construction contracts allow the construction period to be extended where there are delays that are not the contractor's fault. This is described as an extension of time (EOT). Variations may (but do not necessarily) constitute relevant events that can merit an extension of time and so adjustment of the completion date. See Extension of time for more information.

5.8 BREACH OF CONTRACT

The contract binds the contractor and owner or department legally. The contractor should follow the rules and regulations, by laws of the department and complete the work within the specified period in agreement as per drawings and specifications. He should also obey the instructions given by the department and it is also the responsibility of the department or owner to see that the work done in time as per drawings and specifications and quality is also maintained. If all the above specifications are not done by both the parties then it will lead to breach of contract.

5.9 PENALTY ON CONTRACTOR

Penalty is a sort of fine imposed on contractor for non-fulfillment of the terms of contract. Every contract agreement makes provision for penalizing a contractor whenever there is a breach in the terms of agreement.

Slow progress: For slow progress the contractor may be penalized with 1% of the cost of construction per week and the maximum penalty shall not exceed 10% of the cost of contract.

Damages: In case of damages to the tools and plants, equipment's, machinery, etc. taken by the contractor, he will be asked to pay the repair charges of the equipment or will be directed to replace the equipment.

Termination of Contract: The Executive engineer or the competent authority is empowered to terminate the contract in case of bankruptcy or default of the contractor. An amount up to 10% of the estimated cost is forfeited. If the contract is to be terminated a notice to that effect has to be served on the contractor.

5.10 BLACK LISTING OF CONTRACTOR

➢ when the contractor cheats the Government.

➢ If he fails to satisfy the conditions laid down in the contract agreement.

➢ Refuses to work or runs away during the execution of the work.

➢ Executing work in poor and unsafe manner, even instructions are given by Engineer in-charge.

➢ Not following labor laws. Then he will be disqualified from taking any further contracts in the department. Such contractors are referred to as black listed contractor.

5.11 TIME EXTENSION OF CONTRACT

If the contractor cannot complete the work due to having been unavoidably hindered in its execution or any other ground; the contractor shall give an immediate report of such hindrance to the Engineer-in Charge. He can then apply for extension of time in writing to the Engineer-in-Charge within seven days of the date of completion. The Engineer-in Charge may grant such extension of time on reasonable grounds.

5.12 TERMINATION OF CONTRACT

The contract agreement may be terminated in the following conditions:

➢ **Bankruptcy:** If both or one of the parties become bankrupt the contract may be terminated since the work cannot be completed due to lack of funds.

➢ **Breach of conditions**: If one party fails to follow the conditions mentioned in the contract then the other party has every right to terminate the contract and can also claim for damages done to him through court of law or through arbitration.

➢ **Impossibility to complete work:** Due to valid reasons it may not be possible to complete the job which is partially completed. For example, the land may be acquired by the government or floods may drown the land etc. In all such cases the contract is terminated as it is impossible to complete the work. The damages to the contractor shall be made good by the owner or the department as the case may be.

➢ **Agreement:** Due to extraordinary circumstances it may become necessary to terminate the contract by mutual agreement. For example the owner or contra... to: may expire and no other person may be there to fulfill the agreement.

➢ **Completion of the work:** If the work is completed satisfactorily as per the conditions in the agreement then also the contract is terminated after making the final payment to the contractor and releasing his security deposit.

To terminate a contract, a registered notice is served on the contractor framing; charges against him for violation of the clause or clauses of the terms and conditions of contract allowing a fixed time of usually 7 days or 14 days. In case, the contractor fails to defend him or the notice remains un replied the contract can be terminated by the owner.

5.13 ESCALATION

The completion period for big project works is usually long and the cost of materials and labor becomes more and more day by day. It is therefore difficult for a contractor to predict the future cost of materials at the time of submission of his tender. The result is that a contractor does not find interest to carry out the work-due to high rise of basic cost. Thus, progress of many important works is hampered. In order to overcome such drawbacks many departments, provide the price escalation clause in the tender. On the other-hand, many contractors incorporate such a condition at the time of submission of their tenders. Escalation clause includes basic price of the important materials (such as Cement, Steel, Wood, etc.) which directly affect the cost of construction and excess amount to be paid by owner if cost of materials increased above basic price.

5.14 SETTLEMENT OF ACCOUNT OR FINAL PAYMENT

After the works are completed in all respects, the engineer accurately prepares the final amount of the works and then, after deducting all previous payments, the owner pays the final amount to the contractor.

The usual provisions to be made under this clause will be as follows:

1. The period to be given to the engineer for the preparation of the final bill is usually a fortnight to one month.
2. The period to be given to the owner for paying the final amount is usually a fortnight to one month
3. There is mention of certain percentage of amount during maintenance period, if any. A typical clause can be framed as follows: After acceptance of the works under this contract, the engineer shall prepare a final estimate of the works as soon as practicable but within one month from the date of such acceptance and the engineer shall give a certificate of final payment to the contractor. The owner, after receipt of such certificate from the contractor, shall pay the entire sum within one month after deducting all previous payments, other dues, etc. One-half of the retained amounts shall be paid along with the final payment while the other half shall be paid at the end of the maintenance period.

5.15 CLAIMS

In the context of a civil engineering contract normally a claim means a demand by a contractor for payment of an item or items of work carried out by him on behalf of the employer for which a readily identifiable amount cannot be ascertained under the terms of the contract. Such a claim is always made upon the employer but under standard forms of contract it is first considered by the engineer and, should his decision be disputed, it is adjudicated by arbitration or in the courts of law.

5.16 DELAY'S AND COMPENSATION

Delay in construction projects can be defined as the time difference between the date of project completion stated in the contract and the date of the actual completion.

A fundamental specification of the construction contract is the project period or time of project execution, which is established prior to bidding.

The successes execution of construction projects and keeping them within estimated cost and prescribed schedules depend upon a methodology that requires expert engineering judgment.

Project completion for the owner means that he can make use of his new assets on time by habitation; renting, or selling. Any delay in project completion will disturb his plans. The client will not be able to make use of the property, and his business will be affected in almost all areas, especially finance.

For the contractor, any delay in completion of the project gives rise to indirect overhead expenses and additional payments to the project staff and workforce. It also means that he will possibly be subjected to compensation claims. .His next project might be cancelled as a result of delays in the present project, and loss of future opportunities will be made more likely by damage to his reputation and credibility. Construction contracts generally allow the construction period to be extended where there is a delay that is not the contractor's fault. This

is described as an extension of time (EOT). When it becomes reasonably apparent that there is, or that there is likely to be, a delay that could merit an extension of time, the contractor gives written notice to the contract administrator identifying the relevant event that has caused the delay. If the contract administrator accepts that the delay was caused by a relevant event, then they may grant an extension of time and the completion date is adjusted.

Relevant events may include:

➢ Variations.

➢ Exceptionally adverse weather.

➢ Civil commotion or terrorism.

➢ Failure to provide information.

➢ Delay on the part of a nominated sub-contractor.

➢ Statutory undertaker's work.

➢ A delay in giving the contractor possession of the site.

➢ Force majeure (such as an epidemic or an 'act of God').

➢ Loss from a specified peril such as flood.

➢ The supply of materials and goods by the client. ➢ Strikes. ➢ Changes in statutory requirements.

5.17 ARBITRATION

The actual conditions encountered in practice cannot always be foreseen by the parties involved in a contract.

The problems may be technical, managerial, or financial in nature and they may be caused by various factors such as follows:

➢ Accidents

➢ Delayed payments

➢ Faulty contract documents

➢ Inadequate programming

➢ Inefficient execution

➢ Late issue of drawings

➢ Poor communications

➢ Procurement delays

➢ Over-zealous supervision, etc.

Definition: The process by which the parties under a contract get their disputes and differences settled through the intervention of an impartial person or a committee of experts in a judicial manner is known as the arbitration. The impartial person or persons are known as the arbitrators.

Thus, the definition of arbitration includes the following three concepts:

1. It is the reference of disputes and differences by parties which are at least two in number.
2. Such reference is made to a person or persons other than court of law of competent jurisdiction.

3. The person or persons determine the award in a judicial way after hearing the concerned parties. In case of building contracts, a condition of contract pertaining to the arbitration is invariably added for the settlement of disputes. The proceedings of arbitration are controlled in India by the provisions of the Arbitration Act of 1940.

5.18 CONTRACT MANAGEMENT AND ADMINISTRATION

Construction projects in India are worth crores of rupees per year. It is the most competitive and risky business: The money involved in this sector is from public fund, so it becomes very important to see that such projects get successful to avoid any type of blockage of funds.

In addition it is equally important to complete the project in time to avoid obsolescence loss of the product. In almost all construction projects, there is a contract between owner (client) and contractor for desired product after successful completion of the construction project. Each construction contract is unique and need unique understanding and interpretation as per the contractual requirements.

Each contract carries a set of obligations to be performed by the parties involved in the contract, so there is a need of contract administration. In current time, the projects are becoming giant in size and more complex due to technological development, joint ventures and foreign collaboration, specified needs, time constraints, special infrastructural requirements and parallel involvement of various agencies in project.

Today construction industry is operating under high level of competition-and profitability became the prime concern for all the contracting organizations.

The real strength of successful contracting parties lies in cooperation of the owner and contractor as partners of the same team with common goal laying more stress on their mutual trust and understanding, their positions are rarely equal and contracts are left open to multiple interpretations. Hence, study of Contract Administration is necessary tool for completion of project. It is said that efficient and effective contract administration will reduce the cost of project by 10%.

Contracting is an integral part of construction projects. Managing the contracts therefore is equally important for the success of any business process due to rapid increase in multiple contracts.

The appropriate procedures of settlement of dispute in a civil engineering contract are as follows:

1. **Appointment of the Arbitrator:**

The contractor should submit his/her settlement of facts containing in detail his/her grievances and claims against the respondent within the period of limitation of 90 days. On receipt of request from a contractor for the appointment of an arbitrator, the Executive Engineer /Superintending Engineer should examine the above facts and also whether the claim of the contractor is time barred and falls within the preview of the arbitration clause. The Superintending Engineer should then send his/her report to the chief engineer for his/her final orders. The Chief Engineer shall then appoint an arbitrator. In the absence of the chief engineer the administrative head of the department, the chief engineer should process the case so as to appoint an arbitrator within at least 30 days from the receipt of such a request.

2. Preparation and Submission of a Case for Arbitration:

(a) When an arbitrator is appointed he/she usually calls a preliminary meeting. In the meeting, the arbitrator directs the claimant or contractor to submit his/her statement of facts containing in detail his/her grievances and claims against the respondents, within a specified date. This statement is accompanied with copies of all documents, correspondences, agreements, bills, drawings, vouchers, etc., which the claimant wants to highlight in justifying his/her claims. One copy of the statement of facts is also forwarded to the respondent. Next, the arbitrator, directs the respondent to submit his/her counter statement of facts within a specified date.

(b) The respondent who is usually the Executive Engineer takes prompt action to prepare the defense duly supported by adequate documentary evidence and witness to the Superintending Engineer and the department counsel, as may be necessary, expeditiously so as to reach the arbitrator by the date and within the time specified by him. One copy of the counter statement of facts is also forwarded to the claimant.

3. Hearing of the Case:

The case thereafter proceeds as per the provision in the Act. In conduction, the case sittings are held one after another. The statement facts are read by the claimant's representative, mainly a legal practitioner elucidating salient points in the claim. Certified copies of letters, agreements, documents, bills, drawings, site instruction book, etc., are produced by the claimant to make the case strong.

If the respondent so wants, the arbitrator can give permission to cross examine the witness. After the claimant completes his/her pleading against the statement of facts filled by him, the arbitrator directs the respondent to proceed with his/her pleadings as per counter statement filed by him.

In course of the pleadings, the respondent's representative too also produces copies of documents, agreements, and drawings, correspondence, etc., conductive to his/her counter statement for strengthening his/her case. He/She also produces witnesses to support the counter statement if deemed necessary.

After completion of the pleadings of both the parties, each party is given the permission to argue his/her case on the basis of the findings in course of the sittings held in the case.

The arbitrator hears the pleadings and the argument of both the parties and scrutinizes and examines all documents and papers produced in course of the sittings. He/She then closes the case and publishes the award. In accordance with the relevant clause, the case has to be completed within a period of four months from the date the arbitrator first entered into reference.

4. Issue of the Award:

When the arbitrator has made his/her award, he/she shall sign it and shall give notice in writing to parties of the making and signing thereof and the amount of fees and charges payable in respect of the arbitration and the award. The award should always be obtained on the non judicial stamped paper. The authority of an arbitrator ceases as soon as the award is made and no action of the parties by way of consent or otherwise would give the arbitrators to make a second award. When some money is payable to the party, he/she should first supply, to the

arbitrator, a stamped paper of appropriate value as may be asked for by the arbitrator according to amount of the award, as per the rules of the state.

5. Filing of Award:

After the award is written on the stamped paper, it should be examined for its acceptability by the party. Once it is decided to accept the award, immediate action should be taken to have the award made a rule of the court by taking necessary steps before the court by either party. If the reference was made by the court, the arbitrators or umpires should file the award in the court. In case the reference made by the parties is out of court, the arbitrators or the umpires should give notice of the same to the parties as soon as the award is made. They shall file the award in court if so requested by the parties. If the arbitrators do not file in court, any of the parties may move the court requiring the arbitrators or the umpires to file the award in the court. An application for this purpose should be made within thirty days from the date of service of the notice of making the award. An award will not be bad if it was made before, but filed after the date fixed by the court. In arbitrations out of court the award need not necessarily be filed in court to give validity to it.

6. Effect In Case the Award is not Filed:

A party can enjoy the effect of an arbitration award determined by moving an application to that effect in the court. But no suit can be filed for a decision upon the extensity, effect, or validity of an award. An arbitration award cannot be set aside, amended, modified or in any way affected otherwise than as provided in the Act. A suit cannot therefore be filed to enforce an award or to obtain a relief on the basis of an award, in case the award has been acted upon by the parties, even though it was filed in court. The party in house favor the award is given will take steps to get it made the rule of the court. In case the award is not acceptable to a party, steps should be taken to file objections against the application for filling of the award in the court according to law.

5.19 CONTRACT MANAGEMENT AND ADMINISTRATION

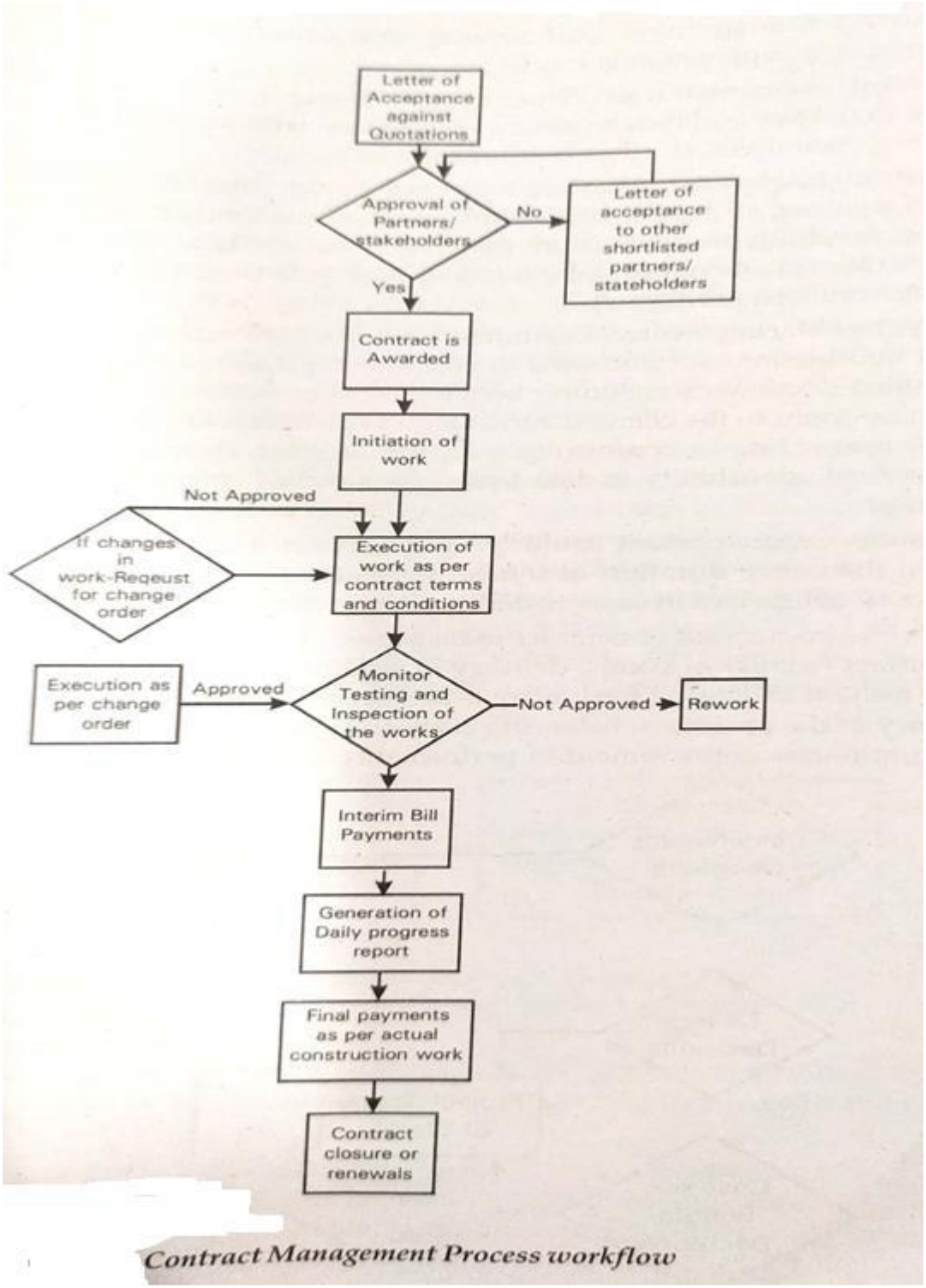
Construction projects in India are worth crores of rupees per year. It is the most competitive and risky business; The money involved in this sector is from public fund, so it becomes very important to see that such projects get successful to avoid any type of blockage of funds.

In addition it is equally important to complete the project in time to avoid obsolescence loss of the product. In almost all construction projects, there is a contract between owner (client) and contractor for desired product after successful completion of the construction project. Each construction contract is unique and need unique understanding and interpretation as per the contractual requirements.

Each contract carries a set of obligations to be performed by the parties involved in the contract, so there is a need of contract administration. In current time, the projects are becoming giant in size and more complex due to technological development, joint ventures and foreign collaboration, specified needs, time constraints, special infrastructural requirements and parallel involvement of various agencies in project. Today construction industry is operating

under high level of competition and profitability became the prime concern for all the contracting organizations.

The real strength of successful contracting parties lies in cooperation of the owner and contractor as partners of the same team with common goal laying more stress on their mutual trust and understanding, their positions are rarely equal and contracts are left open to multiple interpretations. Hence, study of Contract Administration is necessary tool for completion of project. It is said that efficient and effective contract administration will reduce the cost of project by 10% Contracting is an integral part of construction projects. Managing the contracts therefore is equally important for the success of any business process due to rapid increase in multiple contracts.



Contract Management Process workflow

Contract Management: All activity that occurs in the contracting process. Monitoring and supervision is crucial

Contract Administration: The management of all actions, after the award of a contract that must be taken to assure compliance with contract. The act of managing duties, responsibilities, or rules is administration.

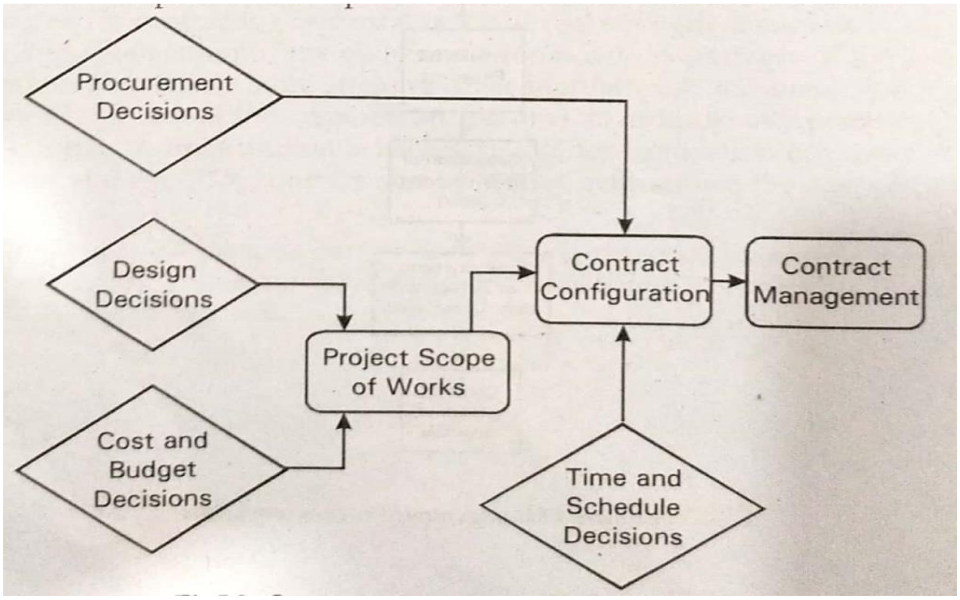
"Contract Administration" is a process of carrying out construction work in a planned manner on behalf of the appointee. Construction work includes detailed planning, feasibility study etc. from the every stage of project.

The objective of Contract Administration is developing better relationship between owner and contractor by reducing conflicts/arbitration.

Contract Management and administration involves making decisions and the timely flow of information and decisions to enable completion of the project as required by the contract documents including review and observation of the construction project. This is important to the client, contractor and consultant not only to determine that the work is proceeding in conformity with the contract documents, but also because it allows a final opportunity to detect any inaccuracies, ambiguities or inconsistencies in the design.

Contract Management could be defined as a multi-stage process that goes on through the entire duration of the contract and ensures that the parties meet their contractual obligations in order to deliver the specific objectives provided in the contract.

The main purpose of contract management is to make sure that the objectives of the contract (supply of goods, delivery of services or execution of works) are met in a timely fashion and value for money is achieved. In practice this means optimizing the efficiency of the processes, balancing costs and risks against returns and ideally aiming for a continuous improvement in performance over the life of the contract. Figure below shows the contract administration and management process.



VALULATION:

5.20 Technical terms

1. **Expenditure:** The whole amount can be spent during the financial year or not.
2. **Capital cost:** Total cost including all the expenditure incurred from beginning to the completion of a work.
3. **Provisional sum:** Estimate of bill quantities for some special work to be done by a specialist firm whose details are known at the time of preparation of estimate.
4. **Rate of cost:** The cost per unit of subhead which is arrived at by dividing the up-to date final charges on a sub-head by its up-to-date progress.
5. **Premium:** The tendered percentage rate above the notified rates.
6. **Rebate:** The tendered percentage rate below the notified rates.
7. **Plinth area:** It is a covered area of a building measured at floor level. It is measured by taking external dimensions excluding plinth offset if any.
8. **Rates:** Rates followed are of sanctioned schedule of rates or non-scheduled, this Fact is to be mentioned under this sub – head.
9. **Contingencies:** Incidental expenses of miscellaneous character which cannot be classified approximately under any distinct sub-head, but is added in the cost of construction necessarily.
10. **Valuation:** Valuation is the technique of estimating or determining the fair price or value of a property such as building, a factory, other engineering structure of various types, land…etc.
11. **Salvage value:** it is the value at the end of its useful life without being dismantled. This is generally accounted by deducting the depreciation from its new cost.
12. **Sinking fund:** The fund is gradually accumulated by way of periodic on annual deposit for the replacement of the building or structure at the end of its useful life.
13. **Depreciation:** Depreciation is the gradual exhaustion of a usefulness of a property. Decrease or loss in the value of a property due to its structural deterioration use, life wear and tear, decay and obsolescence.
14. **Scrap value:** Scrap value of dismantled material. For a building when the life is over at the end of its utility period the dismantled materials such as steel, brick, Timber etc. will fetch a certain amount which is the scrap value of the building. The scrap value of a building maybe about 10% of the total cost of construction.
15. **Market Value:** The market value of a property is the amount which can be obtained at any particular time from the open market if the property is put for sale. The market value will differ from time to time according to demand and supply.

The market value also changes from time to time for various miscellaneous reasons such as changes in industry, changes in fashions, means of transport, cost of materials and labour etc.

16. **Book Value:** Book value is the amount shown in the account book after allowing necessary depreciations. The book value of a property at a particular year is the original cost minus the amount of depreciation allowed per year and will be gradually reduced year to year and at the end of the utility period of the property, the book value will be only scrap value.
17. **Capital cost:** Capital cost is the total cost of construction including land, or the original total amount required to possess a property. It is the original cost and does not change while the value of the property is the present cost which may be calculated by methods of Valuation.

18. Capitalized Value of a Property: The capitalized value of a property is the amount of money whose annual interest at the highest prevailing rate of interest will be equal to the net income from the property. To determine the capitalized value of a property, it is required to know the net income from the property and the highest prevailing rate of interest.

Therefore, Capitalized Value = Net income x year's purchase

19. Annuity: Annuity is the annual periodic payment for repayment of the capital amount invested by a party.

20. Obsolescence: The value of property structure becomes less by it's becoming out of date in style, in structure, in design etc. and this is termed as obsolescence. An outdated building with massive walls, arrangements of rooms not suited in present days and for similar reasons become absolute even if it is maintained in a very good condition and its value becomes less. The obsolescence maybe due to the reason such as progress in Arts, changes in functions, changes in Planning ideas, new inventions improvement in design techniques.

Obsolescence may be"

1. Internal obsolescence due to:
   - i) Poor, odd or eccentric original design
   - ii) Change in kind of construction
   - iii) Change in utility demand.
2. External obsolescence is:
   - i) Poor original location,
   - ii) Change in the character of the district,
   - iii) Specific detrimental influences, such as due to construction of factories, stock-yard, traffic locations and noises, etc.
   - iv) Zoning laws.

21. YEAR'S PURCHASE (Y.P): Year's purchase is defined as the capital sum required to be invested in order to receive an annuity of '1.00 at certain rate of interest.

$$\text{Year's purchase} = \frac{100}{\text{Rate of interest}} = \frac{100}{i}$$

5.21 OBJECTS / PURPOSE OF VALUATION

1. Buying or Selling Property: When it is required to buy or sell a property, its valuation is required.

2. Taxation: To assess the tax of a property, its valuation is required. Taxes may be municipal tax, wealth tax, Property tax etc., and all the taxes are fixed on the valuation of the property.

3. Rent Function: In order to determine the rent of a property, valuation is required. Rent is usually fixed on the certain percentage of the amount of valuation which is 6% to 10% of valuation.

4. Security of loans or Mortgage: When loans are taken against the security of the property, its valuation is required.

5. Compulsory acquisition: Whenever a property is acquired by law; compensation is paid to the owner. To determine the amount of compensation, valuation of the property is required. Valuation of a property is also required for **Insurance, Betterment charges, speculations** Etc.

5.22 SINKING FUND: The fund which is gradually accumulated by way of periodic or annual deposit for the replacement of the building or structure at the end of its useful life is termed as Sinking fund.

A certain amount of gross income is set aside periodically or annually normally as sinking fund to accumulate total cost of construction when the life of the building is over.

The calculation of Sinking fund depends on the life of the building and scrap value of the building. The cost of land is not taken into account in calculating Sinking fund as land remains intact.

The amount of annual instalment of the Sinking fund may be found out by the formula

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

S = Total amount of Sinking fund to be accumulated
n = Number of years required to be accumulate the sinking fund
i = rate of interest in decimal (E.g.: 7% = 0.07) and
I = annual instalment required.

5.23 DEPRECIATION

Depreciation may be defined as the decrease or loss in the value of a property due to structural deterioration, use, life wear and tear, decay and obsolescence. The value of a building or structure will be gradually reduced due to its use, life, wear & tear, etc., and a certain percentage of the total cost may be allowed as depreciation to determine the present value.

The present value of a property can be calculated after deducting the total amount of depreciation from the original cost.

Types of depreciation:

1. Physical depreciation:
    i. Wear and tear from operation.
    ii. Decrepitude i.e. action of time and the elements.
2. Functional depreciation:
    i. Inadequacy or suppression.
    ii. Obsolescence.
3. Contingent depreciation: .
    i. Accidents (due to negligence, the elements and structural defects).
    ii. Diseases (parasites, pollution of water, etc.).
    iii. Diminution of supply (natural gas, water, etc.).

5.23.1 Methods of calculating depreciation:

The various methods of calculating depreciation are as follows:

1. Straight-line method.
2. Constant percentage method or declining balance method.

3. Sinking fund method.
4. Quantity survey method.

1.**Straight line method:** In this method the property is assumed to lose value by a constant amount every year, and thus a fixed amount of original cost is deducted every .year, so that at the end of utility period only the scrap value is left.

$$\text{Annual depreciation} = \frac{C - S_c}{n}$$

Where C = original cost, Sc. = scrap value, n = life of the property in years.

2. **Constant percentage method:** In this method the property is assumed to lose value annually at a constant percentage of its value.

$$\text{The percentage rate of annual depreciation } p = 1 - \left(\frac{S_c}{C}\right)^{\frac{1}{n}}$$

By constant percentage method at the end of the first year the value of the property = C (1-p), at the end of second year = C (1-p) ^{2} and so on.
The above formula does not hold good .for the scrap value, S is zero.

3. **Sinking fund method:** In this method the depreciation of property is assumed to be equal to the annual sinking fund plus the interest on the fund for that year, which is supposed to be invested on interest on interest bearing investment.

$$\text{Annual Sinking fund to provide '1/- in 'n' years} = \frac{i}{(1+i)^n - 1} = x \text{ say}$$

$$\text{An amount of ₹.1/- per annum in 'n' years} = \frac{(1+i)^n - 1}{i} = y \text{ say}$$

$$\text{Therefore Rate of depreciation in '}n\text{' years} = x \times y\%$$

i = Rate of interest expressed in decimals.

4. Quantity survey method: In this method the property is studied in detail and loss value due to life, wear and tear, decay, obsolescence, etc. worked out. Only experienced valuer can work out the amount of depreciation and present value of a property by this method.

Difference between Depreciation and Obsolescence

Sl. No	Depreciation	Obsolescence
1	This is the physical loss in the value of the property due to wear & tear, decay, etc.	The loss in the value of the property is due to change of design, fashion, in structure of others, change in utility, etc.
2	Depreciation depends on its original condition, quality of maintenance and mode of use.	Obsolescence depends on normal progress in the arts, inadequacy to present or growing needs, etc.
3	This is variable according to the age of the property. More the age, more will be the amount for depreciation.	This is not dependent on age of the building. A new building may suffer in its usual rent due to obsolescence.
4	There are different methods by which the amount of depreciation can be calculated.	At present there is no method of calculation of obsolescence.

5.24 Year's Purchase

Year's purchase is defined as the capital sum required to be invested in order to receive a net receive a net annual income as an annuity of rupee one at a fixed rate of interest.

The capital sum should be 1×100/rate of interest.

Thus to gain an annual income of Rs x at a fixed rate of interest, the capital sum should be x (100/rate of interest).

But (100/rate of interest) is termed as Year's Purchase.

The multiplier of the net annual income to determine the capital value is known as the Year's Purchase (YP) and it is useful to obtain the capitalized value of the property.

5.25 VALUATION OF BUILDING

Valuation of a building depends upon the type of the building, its structure and durability, size, shape, width, width of roadways, the quality of material used in construction, etc. A building located in the market area will have higher value than similar building in the residential area. Building area having sewer, water' supply and electricity will have increase value.

The valuation of building is determined on working out its cost of construction at present day rate and allowing a suitable depreciation. Before valuation, the age of the building should be obtained from record or by enquiries or from visual inspection and its future life should be ascertained.

5.25.1 METHODS OF VALUATION

The following methods are usually followed for determination of Fair Market Value of the property

i) Land and building method
ii) Composite rate method
iii) Rent capitalization method
iv) Development method

v) Profit method
vi).Depreciation Method of Valuation

i. Land and Building Method

As the name indicates, in this method the value of land is added to the value of structure to arrive at the fair market value of the property.

The method is generally adopted in the following situations:

➢ In the case of self-occupied property.

➢ In the case of property partly self-occupied (i.e. more than 60%) and balance tenanted.

➢ In the case where it is not possible to obtain fair and maintainable rent.

➢ In case where there is no direct evidence of rent such as schools and hospitals etc.

➢ In the case where the property is not fully developed, or the return from the property is not commercial.

In this method, fair market value of land and depreciated value of the building on it together gives the final value of property.

ii. Composite rate method

Composite rate method represents rate per unit area of building along with the proportionate share of land. This method is used for residential apartments and commercial complexes. Composite Rate has two components, i.e. proportionate land components and building component. Land component is the deciding factor in apartment's valuation. Location land value, amenities provided by developer and specifications of land are necessary in computation of composite rate. Further in case of old building/flat land component is added to depreciated value to calculate the composite rate.

iii. Rent Capitalization Method

In this method the net rental income is calculated after deducting all outgoings from the gross rent and year's purchase is calculated after adopting the current bank interest.

Thus to determine the fair market value of the property gross income per annum is to be determined. From this income all the outgoings which are essential to be incurred for maintenance are to be deducted to find out the net rent or annual letting value.

Then valuation of a property is worked out by multiplying the net rental income by year's purchase.

This method is generally adopted to in the following situations : -

➢ In case the land is fully developed i.e. it has been put to full use legally permissible and economically justifiable and the income out the property is normal commercial and not a controlled return or a return depreciated on account of special circumstances.

➢ In the case of fully tenanted property and statutory control or terms and conditions of tenancy.

➢ In the case of a property small portion of which is self-occupied and balance large portion is tenanted.

➢ In the case of commercial establishment like cinemas and hotels, if the building is given on outright lease / rental basis and rent fetched is reasonable.

iv. Development Method

This method of valuation is used for the properties which are in the undeveloped stage or partly developed and partly undeveloped stage. The valuation in such a case depend on initial investment, development cost and expected profit.

This method of valuation of large extent of land is adopted in the following situations.

➢ when the comparable sales of large tracts are not available but sales of small plot are available.

➢ When the land is ripe for use for building purpose it possess necessary potentialities for urban use.

The complete procedure to determine the fair market value of the large tracts of land, under this method can divided into the following steps.

➢ Ascertain the demand for small plots in the area.

➢ Determine the area of land required for development work as per municipal bye laws.

Deduct this area from the total area of the plot so as to ascertain the area available for development of small size plots. By rough estimation it works out to 20 to 25% of the total area.

➢ Determine the number of small plots which can be legally formed out from the large tract of land with necessary provisions for infrastructure facilities.

➢ Determine the cost of development works such as cost in of construction of road as per municipal specifications with street lights, cost of laying parks, underground drains, water supply lines, sewer lines, electric lines and substation, earth fitting or cutting, cross drainage works and municipal taxes on open land. As the total amount of development is not paid to the contractor at the commencement of work so defer it for half of the period of construction at certain rate of interest say to 12%. Let the value be (A).

➢ Ascertain the total sale price of all the small plots of scheme on the valuation date from the comparable sales of small developed plots. As all these small plots cannot be sold at one time, so estimate the time of disposal of all the plots and defer the total sale price for half of the period of the sale @ 10% to 12%. Let it be of (B).

➢ From the sale price (B) deduct the following.

(i) Present value of the cost of development for half of the period of development (A) along with architect or engineers fee for his supervision and getting the scheme approved.

(ii) Incidental charges such as cost of stamps, registration legal cost, cost of advertisement etc.. Normally it is 8 to 10% of (B). If the cost of stamp, registration and legal cost is to be borne by the purchaser then this percentage should be modifier accordingly.

(iii) Developer's profit and risk 15% of (B).

➢ This amount available after above deductions from (B) will represent the fair market value of the large undeveloped plot on the date of valuation.

V.Profit method:

In the case of Hotels, Motels, Cinemas, Public houses which falls under the category of the Licensed premises, the fair market value (F.M.V) depends primarily on the earning capacity of the property. The F.M.V. of such properties is determined by applying profit method provided.

➢ The owner runs Hotel, Cinema himself.

➢ The owner gives Hotel or Cinema on conducting agreement to a conductor. The F.M.V. of the property is determined by capitalizing the net profits (70% tangible + 30% intangible) at certain rate of expenses, owners risk and other outgoings from the gross income.

VI. Depreciation Method of Valuation

According to this method of Valuation, the building should be divided into four parts:

1. Walls
2. Roofs
3. Floors
4. Doors and Windows

And the cost of each part should first be worked out on the present day rates by detailed measurements.

The present value of land and water supply, electric and sanitary fittings etc. should be added to the valuation of the building to arrive at total valuation of the property. Depreciation is the gradual exhaustion of the usefulness of a property. This may be defined as the decrease or loss in the value of a property due to structural deterioration, life wear and tear, decay and obsolescence.

Basis of Valuation and Its Suitability

Method	Basic of Valuation	Suitability
Land and building method	Fair market value of land component + Depreciated value of building	(i) Residential properties (ii) Self -occupied properties (iii) To certify the present worth (value) of an asset
composite rate method	Depreciated value of the flat plus proportionate share of flat divided by FSI achieved	(i) For apartment and valuation (ii) Valuation of commercial complexes.
Development potential method	Vast stretches of under developed or undeveloped land is developed and divided into small size plots and valued at market rates.	To estimate the fair market values of underdeveloped and undeveloped vast stretches of land.
Rent capitalization method	Net rent is capitalised. Depreciation is ignored.	(i) Tenanted commercial properties. To estimate the fair market value. (ii) Residential building under rent control Act. (iii) Old tenanted buildings. This method is not suitable if deference unbuilt area and the specified area exceeds 20% aggregate area.
Profit capitalization method	Net profit is capitalized	Commercial properties used as business ventures such as cinema hall, hotel, etc.
Market-Rent-Profit approach	On the basis of rent capitalization and pro method and prevailing market	Service properties, Special purpose properties, Cost of producing substitute properties.

5.25.2. Factors affecting valuation

The valuation of property varies from time to time. Factors affect the market value of property are as follows.

1. Forces of Demand and Supply: When there are few buyers as compared to a number of properties available for sale in a locality, it will result in low prices for the property and vice-versa.

2. Rise in Population: The rise in population is due to the growth of new industries in a particular area or influx or manipulation i by brokers will result in a heavy demand for land, building, and property.

3. Cost of Construction: The present cost of construction affects the value due to rapid changes in price index in comparison with the rate of depreciation.

4. Rent Control Act: The value of a property is calculated from its probable income through rent. But the rental value of a tenanted property in areas subject to Rent Control Act may not

reflect the value of a similar property unencumbered by tenancy as rents are artificially freeze while the price of land, labour, and building materials rise continuously. This may cause a slump in property values.

5. Imposition of Control of Prices of Building Materials: The imposition of control of prices of building materials will cause violent fluctuation in the prices of building materials and the value of the building will vary by an appreciable amount from time to time.

6. Rent Restriction Act: The value of a property is calculated from its probable annual income through rent and so due to certain enactment of the Rent Restriction Act by the government, it may cause the slump in the property values.

7. Improvement by Public Schemes: Taking up any public service scheme such as sewer line, water line, means of transport, etc., to an area lacking in modern. Amenities will tend to make that area more attractive and will be closely followed by an increase in land value. Even a proposal to bring a sewer line to an unanswered area or even before the roads are made and services installed, a mere proposal will cause rise in the value of property in that area.

8. Interest on Schedule Banks or. Government Securities: Lower the schedule bank interest or government security, higher may be the interest for making more money available for investment in property and vice-versa.

9. Abnormal Socio-Political Condition: Due to insecure conditions such as riots, war, etc., values may drop and remain so for, a considerable period.

5.26 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 specified time. The person who takes the loan is known as Mortgager and the person who advances the loan is known as Mortgage and the relevant document for the mortgage transaction is known as Mortgage deed.

5.27. FIXATION OF RENT

The rent of building is fixed on the basis of certain percentage of annual interest on the capital coast and all possible annual expenditures on outgoings. The capital cost includes the cost of construction of the building, the cost of sanitary and water supply work and the cost of electrical installations and the cost of subsequent additions and alterations if any.

Gross rent = Net rent +Outgoings

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

5.27.1 FIXATION OF RENT

Capitalized value of the property can be known by any of the methods discussed earlier and suitable value of year's purchase is adopted according to the admissible rate of interest (8% or any other fair rate).

Then,

Net income = capitalized value / year's purchase

All possible outgoings are added to this net income which will give gross income from the Property. Gross income or gross rent = Net rent + outgoings

The standard rent = (Gross Income / 12) per month.

Example:

(In Punjab / Haryana), standard rent is calculated on the capital cost of the residence and shall be either:

1. (a) A percentage equal to the rate of interest on the capital (which includes the cost on sanitary, water supply and electrical installation, fencing, boundary walls and service roads etc. as fixed from time to time) value of a building. In addition, municipal and other taxes and the expenditure for the maintenance of building are also realised, or

(b) 6%per annum of the capital value of a building constructed/ occupied after 1992 whichever is less. Interest Maintenance Depreciation Sanitary and Water 6 %, 6 1/2 %, Supply Installation 5 % ordinary repair11/2 % special repairs Electrical Installation 6 % 4 % 5 %

2. Municipal taxes etc. levied on the occupant will be payable to the occupant direct to the authorities concerned in addition to the above rent calculations.

3. Generally the value of the land is excluded. If value of land to be considered a little less percentage says 1 to 2 % on value of land be taken for calculation of standard rent.

PROBLEM: A building costing Rs. 3, 50,000/- has recently been constructed in a big city. The plot measuring 450 sq. m was purchased @ Rs. 150/- per square meter. Work out the rent of the property. Assume 8% as net return on the cost of the construction and 4 1/2 % on the land value. All expected outgoing are Rs. 10000/- per year.

Solution:

(1) Cost of construction= Rs.3, 50,000/-

Value of land = 450 150= Rs. 67500/-

Net return:

1. On cost of construction

= Rs. 28000/-

2. On value of land = = 3037.50

Net return = Rs.28000/- + 3037.50

= Rs. 31037.50

Outgoing = Rs. 10000/-

Gross income = Rs. 31037.50/12 = Rs. 4320/-

Rent / month = 41037.50 / 12 = Rs. 4320/- (approx.)

2 A govt. accommodation is built at the cost of Rs. 60,000/- . The water supply and sanitary and electrical installation expenditure is Rs. 15000/-. Calculate the standard rend of the building if the following rate of return are fixed:

i. 6% on construction cost.

ii. 1 1/2 % towards maintenance of building work,

iii. 4 1/2 % on installation expenditure.

iv. 4% on maintenance of installation.

v. Rs. 120/- as property tax per year.

vi. Cost of land is be neglected.

Solution:

(a) (i) Return on construction cost = = Rs. 3600/-

(ii) Return on installation cost = = Rs. 675/-

(iii) Cost of maintenance of building = = Rs. 900/-

(iv) Cost of maintenance of installations = = Rs. 600/-

(v) Property tax = Rs. 120/-
Gross return = Rs.5895/-
Standard rent = Gross rent / 12 =
= Rs. 491.25 P.M. (Per Month).
b) Standard rent is also equal to 6% of capital value
Capital value
(1) Construction cost = Rs. 60,000.00
(2) Installation cost = Rs. 15,000.00

Total = Rs. 75000.00
Standard rent =
= 4500/- per year
= Rs. 375/- P.M.
Because the standard rent by (b) method is less and, therefore, the standard rent shall be Rs. 375/- P.M.

WORKED EXAMPLES

1. The total cost of a new building is ₹1,50,000. Workout the depreciated cost of building after 20years by straight line method, if the scrap value is ₹15,000 assuming the life of the building is 80years.

Annual depreciation $= \frac{C - S_c}{n} = \frac{1,50,000 - 15,000}{80} = ₹1687.52$

Where C = original cost, S_c = scrap value, n = life of the property in years.

Depreciation for 20 years = 1687.50 × 20 = ₹33,750

Therefore depreciated cost of the building after 20 years = 1,50,000 – 33,750 = ₹1,16,250/-

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2. The present value of machine is ₹20000. Workout the depreciation cost at the end of 5 years, if the salvage value is ₹2000. Assume life of the machine be 16 years.

The percentage rate of annual depreciation $p = 1 - \left(\frac{S_c}{C}\right)^{\frac{1}{n}} = 1 - \left(\frac{2000}{20000}\right)^{\frac{1}{16}} = 0.134$

Therefore the value of the property at the end of

5 years $= C(1-p)^5 = 20000(1-0.134)^5 = ₹9741.35$

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3. The cost of construction of a new building according to present market is ₹3,00,000 having life of 70 years. But if the building is 15 years old, determine the depreciation amount which should be deducted from the cost of the new building at 6% compound interest.

Sinking fund coefficient for 70 years $I_c = \frac{i}{(1+i)^n - 1} = \frac{0.06}{(1+0.06)^{70} - 1} = 0.0010$

An amount of ₹1/- per annum in 15 years $= \frac{(1+i)^n - 1}{i} = \frac{(1+0.06)^{15} - 1}{0.06} = 23.25$

Therefore Rate of depreciation in 15 years $= 0.0010 \times 23.25 = 0.02326 = 2.326\%$

Total depreciation in 15 years on ₹3,00,000 $= \frac{2.326}{100} \times 300000 = ₹6978$

Therefore ₹6978 should be deducted due to depreciation from the cost of the new building.

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4. A building fetches a Gross Annual income of ₹50000. Total annual outgoings is ₹7500. Workout the capitalized value of the building, if the rate of interest is 5% per annum.

Gross annual income = ₹50000

Net annual income = gross income – outgoings = 50000 – 7500 = ₹42500

Year's purchase $= \frac{100}{5} = 20$

Capitalized value of the property = Net income $\times Y.P = 42500 \times 20 = ₹850000$

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5. The building fetches a gross income of ₹1500/- per month. Workout the capitalized value on the basis of 6% net yield, if all out going amount is equal to ₹3000/- per annum.

Gross annual income = ₹1500 per month $\times 12 = ₹18000$

Net annual income = gross income – outgoings = 18000 – 3000 = ₹15000

Year's purchase $= \frac{100}{6} = 16.67$

Capitalized value of the property = Net income $\times Y.P = 15000 \times 16.67 = ₹250050$

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6. Capitalized value of a property fetches a net annual rent of ₹1000.00 and the highest rate of interest prevalent is 8%. Find the capitalized value of the property.

Net annual rent = ₹1000 Year's purchase $= \frac{100}{8} = 12.5$

Capitalized value of the property = Net income $\times$ Y.P = $1000 \times 12.5 = ₹12500$

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7. A property produces a yearly income of ₹5250.00. The overall outgoings of the income of that property are ₹1250.00 p.a. Work out the capitalized value of the property, if the purchaser desires 8% of return on his capital.

Gross annual income = ₹5250

Net annual income = gross income-outgoings = 5250 – 1250 = ₹4000

Year's purchase $= \frac{100}{8} = 12.5$

Capitalized value of the property = Net income × Y.P = 4000 × 12.5 = ₹50000

8. A three storied building is standing on a plot measuring 800sqm. The plinth area of each storey is 400sqm. The building is of RCC framed structure and the future life may be taken as 70 years.The building fetches a gross rent of ₹1500/ - per month. Workout the capitalized value of the property on the basis of 6% net yield. For sinking fund 3% compound interest may be assumed. Cost of land may be taken as ₹50/- per sqm. Other data required may be assumed suitably.

Gross income per year = 1500×12 =₹18000

Sl. No	Outgoings per annum Assuming suitable datas	Calculation	Amount ₹
1	Repairs @ 1/12 of gross income	18000/12	1500
2	Municipal tax 20% of gross rent	$\frac{20}{100}\times 18000 = 3600$	3600
3	property tax 5% of gross rent	$\frac{5}{100}\times 18000 = 900$	900
4	Insurance premium@ ½ % of Gross rent	$\frac{0.50}{100}\times 18000 = 90$	90
5	Management charges@6% of Gross rent	$\frac{6}{100}\times 18000 = 1080$	1080
6	Other miscellaneous charges@2% of the gross rent	$\frac{2}{100}\times 18000 = 360$	360
7	Sinking fund required to accumulate the cost of the building in 70 years @ 3% (Which is at rate of ₹150/sqm = 400 × 3 ×150 = ₹180000)	I = 3/100, n = 70, S = 180000 $= \frac{Si}{(1+i)^n - 1} = \frac{180000\times 0.03}{(1+0.03)^{70} - 1} = 782$	782
		Total outgoings per annum =	**₹8312**

Net annual return = 18000 – 8312 = ₹9688

Year's purchase $= \frac{100}{6} = 16.67$

Capitalized value of the property = Net income $\times Y.P = 9688 \times 16.67 = ₹161499$

Cost of land @ ₹50 per sqm = $800 \times 50 = ₹40000$

Total value of the whole property = Capitalized value + Cost of land = ₹161499 + ₹40000 = ₹201499

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9. A residential building constructed on a plot measuring 525sqm. The construction cost of building is ₹175000.00. The land was purchased by the owner at ₹145.00 per sqm. The total outgoings including sinking fund is ₹11500.00. Workout the gross and net rent of the property, if the owner desires 6.5% return on the construction cost and 5% on the value of the land.

Cost of construction = ₹175000

Cost of land @ ₹145 per sqm = 525 × 415 = ₹76125

Net return:

On building @6.5% $= \frac{6.50}{100} \times 175000 = ₹11375$

On the land@5% $= \frac{5}{100} \times 76125 = ₹3806$

Total net return per year = 11375 + 3806 = ₹15181

Net rent per month $= \frac{15181}{12} = ₹1265$

Gross rent = Net return + Outgoing = ₹15181 + ₹11500 = ₹26681

Gross rent per month $= \frac{26681}{12} = ₹2223.41$ say ₹2230

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10. The building costing 8 lakhs has been constructed on a freehold site measuring 20m × 30m in a city. The land value may be taken as ₹600/- per sqm. The total outgoing expenditure is ₹35000.00 per annum. Workout gross rent of the property per month. Rate of interest on building is 6% and that on the land is 4%.

Cost of building = ₹ 800000

Cost of land @ ₹600 per sqm = $20 \times 30 \times 600 = ₹360000$

Net return: On building @6% $= \frac{6}{100} \times 800000 = ₹48000$

On the land@4% = $\frac{4}{100} \times 360000 = ₹14400$

Total net return per year = 48000 + 14400 = ₹62400

Net rent = $\frac{62400}{12} = ₹5200$

Gross rent = Net return + Outgoing = 62400 + 35000 = ₹97400

Gross rent per month = $\frac{97400}{12} = ₹8116.67$ say ₹8120

11. Prepare a preliminary estimate of a building project with the following extents of areas and details:

i. **Plinth rate including water supply and sanitary works installation @ ₹4500/sqm. Plinth area of building proposed -145.00sqm.**
ii. **Extra rate for roof projections & balcony @'2500/sqm. Roof projections & balcony areas to the building-25.00sqm.**
iii. **Extra for electrical installation work@5% of the plinth area cost.**
iv. **Extra for services-@6% of the plinth area cost.**
v. **Consulting & supervision charges-5% of the total cost.**

Sl.no	Particulars	Calculation	Cost (₹)
i	Plinth rate including water supply and sanitary works installation	₹4500/sqm × 145sqm = ₹652500	652500
ii	Extra rate for roof projections & balcony	₹2500/sqm × 25sqm = ₹62500	62500
iii	Extra for electrical installation work	5% of plinth area cost = $\frac{5}{100} \times 652500 = ₹32625$	32625
iv	Extra for services	6% of plinth area cost = $\frac{6}{100} \times 652500 = ₹39150$	39150
		Total cost=	786775
v	Consulting & supervision charges	5% of total cost = $\frac{5}{100} \times 786775 = ₹39339$	39339
		Total =	826114
		Contingencies 5% of the total=	41306
		Work charged 2 ½ % of the total=	20653
		Total estimated cost of building project=	**888073**

12. Prepare a preliminary estimate of a building project with total plinth area of all buildings of 1500sqm. Given that

i. **Plinth area rate - ₹4000/sqm.**

ii. **Extra for Architectural treatments - 1½ % of the building cost.**

iii. **Extra for water supply & sanitary installations - 5% of the building cost.**

iv. **Extra for electrical installations - 10% of the building cost.**

v. **Consulting & supervision & contingencies - 8% of total cost.**

Sl.no	Particulars	Calculation	Cost (₹)
i	Plinth area rate	₹4000/ *sqm* ×1500*sqm* =₹6000000	6000000
ii	Extra for Architectural treatments	1.5% of the building cost= $\frac{1.5}{100}\times 6000000 = ₹90000$	90000
iii	Extra for water supply & sanitary installations	5% of the building cost = $\frac{5}{100}\times 6000000 = ₹300000$	300000
iv	Extra for electrical installations	10% of the building cost = $\frac{10}{100}\times 6000000 = ₹600000$	600000
		Total cost=	**6990000**
v	Consulting & supervision & contingencies	8% of total cost = $\frac{8}{100}\times 6990000 = ₹559200$	559200
		Total =	**7549200**
		Work charged 2 ½ % of the total=	188730
		Total estimated cost of building project=	**7737930**

13. A person has purchased an old building at a cost ₹4,00,000/- on the basis that the cost of land is ₹2,00,000/- and the cost of building structure is ₹2,00,000/-. Considering the future life of the building structure be 20 years. Workout the amount of annual sinking fund at 4% interest when scrap value is 10% of the cost of the building.

Scrap value =10% of the cost of the building.

$$\text{Scrap Value} = \frac{10}{100}\times 200000 = ₹20000$$

The total amount of sinking fund to be accumulated at the end of 20years

S = Cost of building – Scrap value = 200000 – 20000 = ₹1,80,000
$i = 4/100 = 0.04$, $n = 20$, S = 180000

Annual installment of Sinking fund $= \frac{Si}{(1+i)^n - 1} = \frac{180000 \times 0.04}{(1+0.04)^{20} - 1} = ₹6050.42$

14. A pumping set with a motor has been installed in a building at a cost of ₹ 2,500.00. Assuming the life of the pump as 15 years, work out the amount of annual instalment of sinking fund required to be deposited to accumulate the whole amount of 4% compound interest.

The annual sinking fund, $= \frac{Si}{(1+i)^n - 1} = \frac{2500 \times 0.04}{(1+0.04)^{15} - 1} = 2500 \times 0.05 = ₹ 125$

If the owner will deposit ₹ 125 annually in 4% compound interest carrying investment for 15 years then he will get ₹ 2,500 accumulated.

15. An old building has been purchased by a person at a cost of ₹30,00,000 excluding the cost of the land. Calculate the amount of the annual sinking fund at 4% interest assuming the future life of the building as 20 years and the scrap value of the building as 10% of the cost of purchase.

The total amount of sinking fund to be accumulated at the end of 20 years.

$$S = 3000000 \times \frac{90}{100} = ₹ 27,00,000$$

Annual instalment of sinking fund, $= \frac{Si}{(1+i)^n - 1} = \frac{2700000 \times 0.04}{(1+0.04)^{20} - 1}$

$= 27,00000 \times 0.0336 = ₹ 90670.72$

Annual instalment for sinking fund required for 20 years = ₹ 90,670.72.