

Theory & Objective

Thoroughly Revised & Improved Edition

Estimation and Costing

Useful for

• SSC-JE • RRB-JE • State-JE

Various Public Sector Units and Other Competitive Exams



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1

Rules of Measurement

CHAPTER

THEORY

1.1 | DEFINATION OF ESTIMATE AND COSTING

For all engineering works it is required to know before hand the probable cost of construction known as the estimated cost. If the estimated cost is more than the money available and than attempts are made to reduce the cost by reducing the work or by changing it's specifications and design.

The subject of estimating is simple; nothing much to understand knowledge of drawing is essential. One who understands and can read drawing may find out the dimensions, lengths, widths, heights. Find out the dimensions, lengths, widths, heights etc. from the drawing without difficulty and may calculate the quantities. The calculations mainly consists of $\text{length} \times \text{width} \times \text{height}$.

Accuracy in estimate is very important, if estimate is exceeded it becomes a very difficult for and arrange for the additional money. In accuracy in preparing estimate, omission of items, and changes in designs, improper rates, etc. are the reasons for exceeding the estimate through increase in the rates is one of the main reason. In framing a correct estimate, care, should be taken to find out the dimensions of all the items correctly, and to avoid emissions of any kind of works or part thereof. The rate of each item should also be reasonable and workable. The rates in the estimate provide for the complete work, which consist of the cost of materials, cost of transport, cost of labour, cost of scaffolding, cost of tools and plants, cost of water, taxes, establishment and supervision cost, reasonable profit of contractor etc.

An uniformity in units for all item of works should be maintained throughout the country based on the Indian standard Institution, in preparing estimate the principle to be followed is to make each item or dimension clear and intelligible. So that they can be understood, checked or verified by anybody. A remark column may be introduced and notes may be given where necessary.

Estimating is the technique of calculating or computing the various quantities and the expected expenditure to be incurred on a particular work or project.

- (a) Drawing like plan, elevation and section of important point.
- (b) Detail specification about work ships properties of material.
- (c) Standard Schedule of rates of the current year.

1.2 | NEED FOR ESTIMATION AND COSTING

Estimate prepare for following purpose.

- (a) Estimation give an idea of cost of the work and hence it's feasibility can be determined.
- (b) Estimate gives an idea of time required for the completion of the work.
- (c) Estimate is required to invite the tender's and quotations and to arrange contact.
- (d) Estimate is also required to control the expenditure during the execution of work.
- (e) Estimate decides whether the proposed plan matches the funds available or not.

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1.3 | PROCEDURE OF ESTIMATING OR METHOD OF ESTIMATING

- (a) Preparing detailed estimate
- (b) Calculation in rate of each unit of work
- (c) Preparing abstract of estimate

1.4 | DATA REQUIRED TO PREPARE AN ESTIMATE

1.4.1 | Drawing

If the drawing are not clear and without complete dimensions and specification the preparation of estimation become very difficult, so, it is very essential before preparing estimate.

1.4.2 | Specifications

- (a) **General Specification :** This give the nature, quality, class and work and materials in general terms to be used in various part's of work. It help number form a general idea of building.
- (b) **Detail Specification :** These give's the detailed description of the various items of work laying down the quantities and qualities of materials their proportions the method of preparation workshop and execution of work.

1.4.3 | Rates

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

- (a) For arriving the unit rates each item.
- (b) The rates of various material to be used in the construction.
- (c) Transport costing of material.
- (d) The wages labour, skilled or unskilled of mason, carpenters, mazdor.

1.5 | DEGREE OF ACCURACY IN ESTIMATING

The accuracy to be observed in preparing an estimate depends on the rate of the item and the unit of payment. The higher the rates the greater should be the accuracy with which the quantities are calculated. Where rates are high and paid per unit, dimension should be absolutely correct, through taking dimensions to the nearest 1 cm to 0.5 cm may be allowed for practical purposes. The quantities in such cases should be worked out to atleast two places of decimal but where rates are low.

1.6 | ESTIMATE

Before undertaking the construction of a project it is necessary to know its probable cost which is worked out by estimating. An estimate is a computation or calculation of the quantities required and expenditure likely to be incurred in the construction of a work. The primary object of the estimate is to enable one to know beforehand, the cost of the work (building, structures, etc.). The estimate is the probable cost of a work and is determined theoretically by mathematical calculations based on the plans and drawing and current rates. Approximate estimate may be prepared by various methods but accurate estimate is prepared by detailed estimate method.

1.7 | ACTUAL COST

The actual cost of a work is determine at the completion of the work. Account of all expenditure is maintained day-to-day during the execution of work in the account section and at the end of the completion of the work when the account is completed, the actual cost is known. The actual cost should not different much from the estimated cost worked out at the beginning.

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1.8 | DETAILED ESTIMATE

Preparation of detailed estimate consists of working out the quantities of different item of work and then working out of the cost i.e. the estimate is prepared in two stages:

1.8.1 | Details of Measurements and Calculation of Quantities

The whole work is divided into different items of work as earthwork, concrete, brickwork, etc. and the items are classified and grouped under different sub-heads, and details of measurement of each item of work are taken out and quantities under each item are computed in prescribed form details of measurement form.

Details of Measurement Form

Item No.	Description or Particulars	No.	Length	Width	Height or Depth	Quantity

1.8.2 | Abstract of Estimated Cost

The cost under item of work is calculated from the quantities already computed at workable rate, and the total cost is worked out in a prescribed form, abstract of estimate form. A percentage of 3 to 5 percent is added for contingencies, to allow for petty contingent expenditures, unforeseen expenditures, changes in design, changes in rates etc. which may occur during the execution of the work. A percentage of 1.5 to 2 percent is also added to meet the expenditure of work charged establishment.

The grand total thus obtained is the estimated cost of the work.

Abstract of Estimate Form

Item No.	Description or Particulars	Quantity	Unit	Rate	Amount

In the above forms the description of each item should be such as to express exactly what work, material proportional of mortar etc. have been provided for.

In preparing an estimate items are usually classified and grouped sub-head wise but for beginners it is convenient to make up the items in the same order as far as possible, as they would be executed or constructed. If the principle of following the order of construction from foundation to upward direction is followed there is little chance of omission of items.

1.9 | UNIT'S OF MEASUREMENTS

The unit's of measurement are mainly categorised for their nature, shape and size and for making payments to the contractor and also. The principle of unit's of measurement normally consist's the following.

- Single unit work like door windows, trusses etc. are expressed in numbers.
- Work's consist's linear measurement's involve length like cornice, fencing hand rail, band's of specified width etc, are expressed in running meter's.
- Work consist's cubical content's which involve volume like earth work, cement concrete, masonry etc. are expressed in cubic meter's.

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The units of dimensions for materials and works according to IS 1200 are as follows :-

Particulars of Materials and Works	Dimensions
1. Bricks, stone blocks, etc.	All dimensions in cm
2. Files, slates, wall beard, glass panes, AC sheets, sheets, etc.	Length and width in cm or metre. Thickness in mm.
3. Door, windows etc.	Height and width in cm or metre
4. Parts of doors and windows as panels, shutters.	cm or mm.
5. Timber	Length in metre and cross-sectional dimensions are in cm or mm.
6. Masonry (Brickwork, Stone masonry etc.)	Length and Height in metre Thickness or width in cm.
7. Cement concrete, lime concrete RCC flooring etc.	Length and width in metre Thickness in cm.
8. White washing, colour washing, distempering, painting etc.	Length, width or height in metre
9. Aggregates, ballast, grit, sand etc.	Size in mm.
10. Rolled steel section as I-beam, channel, angle etc.	Length in meter, section in mm.

Earth work

11. Earth work in excavation in ordinary soil, earthwork in mixed soil with Kankar, bajri, etc. earth in hard soil.	cubic metre
12. Rock excavation	cubic metre
13. Earth filling in excavation in foundation.	cubic metre
14. Earth filling in foundation trenches (Usually not measured and not paid separately).	cubic metre
15. Earth filling in foundation trenches (usually not measured and not paid separately).	cubic metre
16. Earth work in banking, cutting in road and irrigation channel.	cubic metre
17. Surface dressing and levelling, cleaning etc.	square metre
18. Cutting of trees (Girth specified).	numbers
19. Pudding, puddle clay core	cubic metre
20. Sand filling	cubic metre
21. Quarrying of stone	cubic metre
22. Blasting of rock (Blasted stone stacked and then measured)	cubic metre

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Particulars of Materials and Works	Dimensions
Concrete	
23. Lime concrete (L.C.) in foundation	cubic metre
24. Lime concrete (L.C.) in roof terracing thickness specified.	square metre
25. Cement concrete (C.C.)	cubic metre
26. Reinforced cement concrete (R.C.C.)	cubic metre
27. C.C. or R.C.C. Chujja, Sun shade	cubic metre
28. Jali work or jaffri work or C.C. tracery panels (thickness specified)	square metre
29. Cement concrete bed (foundation of floor)	cubic metre
D.P.C.	
30. Dam Proof Course : Cement Concrete, Rich Cement Mortar, Asphalt, etc. (Thickness Specified).	square metre
Brick Work	
31. Brickwork in foundation and plinth, in super-structure, in arches etc. in cement, lime or mud mortar.	cubic metre
32. Sun dried brick work.	cubic metre
33. Honey comb brick work, thickness specified	square metre
34. Brick work in jack arches, if measured separately.	cubic metre
35. Jack arch roofing including POP finishing.	square metre
36. Brickwork in well steining.	cubic metre
37. Half-brickwork with or without reinforcement.	square metre
38. Thin partition wall (maximum thickness 10 cm)	square metre
39. Reinforced brick work (R.B. work)	cubic metre
40. String course, drip course, weather course, coping etc. (projection specified)	running metre
41. Cornice (Projection and type specified).	running metre
42. Brickwork on fire place, chulla, chimney (in building)	running metre
43. Pargetting chimney, fire place flue	running metre
44. Brick edging (by road side)	running metre

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Particulars of Materials and Works	Dimensions
171. Supply of water closet, W.C. (Size specified)	numbers
172. Supply of wash hand basin (size specified)	numbers
173. Supply of cowl, Mica valve, Intercepting trap etc. (size specified)	numbers
174. Supply of Bib cock, stop cock, ball cock etc. (size specified)	numbers
175. Supply of Ferrule, C.I. Tank, Water meter etc. [Size specified]	numbers
176. Supply of Pipe, C.I. Pipe, S.W. pipe, Hume pipe, A.C. Pipe, G.I. pipe etc. [Dia. specified]	running metre
177. Supply of lead, lead wool	kg or quintal
178. Spun yarn	kg
179. Supply of varnish, oil etc.	litre
180. Supply of paint ready mix	litre
181. Supply of stiff paint	kg
182. Explosive for Blasting	kg

1.10 | MAIN ITEMS OF WORK

1.10.1 | Earthwork

Earthwork in excavation and earthwork in filling are usually taken out separately under different items and quantities are calculated in cubic metre. Foundation trenches are usually dug to the exact width of foundation with vertical sides. Earthwork in excavation in foundation is calculated by taking the dimensions of each trench length $\times$ width $\times$ depth. Filling in trenches after the construction of foundation masonry is ordinary neglected. If the trench filling is accounted, this may be calculated by deducting the masonry from the excavation.

Earth work in plinth filling is calculated by taking the internal dimensions in between plinth wall (length $\times$ width) which are usually less than the internal dimensions of the room by two off-sets of plinth wall i.e. 10 cm and height is taken after deduction the thickness of concrete in floor, usually 7.5 cm. If sand filling is done in plinth, this should be taken separately. The length and width for each filling may be same as the internal dimensions of the room if there is no off-set in plinth wall.

Excavated earth is used in plinth wall. Excavated earth is used in trench filling and usually not paid for separately, but may also be included under a separate item "Return fill" paid at a lesser rate. Extra earth if required for filling is brought from outside. If there is surplus earth after trench and plinth filling, this may be utilised in levelling and dressing of site or datted away and removed.

1.10.2 | Concrete in Foundation

The concrete is taken out in cubic metre by length $\times$ width $\times$ thickness. The length and width of foundation concrete are usually the same as for excavation, only the depth or thickness differs. The thickness of concrete varies from 20 cm to 45 cm, usually 30 cm. Foundation concrete consists of lime concrete or weak cement concrete. The proportional of cement concrete consists of lime concrete or weak cement concrete. The proportion of cement concrete in foundation may be 1 : 3 : 6 or 1 : 4 : 8.

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1.10.3| Soiling

When the soil is soft or bad, one layer of dry brick or stone soiling is applied below the foundation concrete. The soiling layer is computed in square metre (length $\times$ width) specifying the thickness.

1.10.4| Damp Proof Course

D.P.C. usually of 2.5 cm thick rich cement concrete 1 : 1.5 : 3 or 2 cm, thick rich cement mortar 1 : 2, mixed with standard water proofing material, is provided at the plinth level of full width of plinth wall, and the quantities are computed in square metre, (length $\times$ width). Usually D.P.C. is not provided at the sills of doors and verandah openings, for which deduction are made. (One kg of cem-seal or impermo or other standard waterproofing compound per bag of cement is generally used).

1.10.5| Masonry

Masonry is computed in cubic metre (length $\times$ width $\times$ height). Foundation and plinth masonry is taken under one item and masonry superstructure is taken under a separate item. In storeyed building the masonry in each storey as ground floor above plinth level, first floor, etc. is computed separately. In taking out quantities the walls are measured as solid and then deduction are made for openings as doors, windows etc. and such other portions as necessary.

Masonry of different types or classes, masonry with different mortar, etc. are taken out under separate items. Arch masonry work is taken out separately. Splayed or rounded sides of wall are considered as rectangular and extreme dimensions are taken to find out the quantities, thin partition wall is measured in square metre. Honey comb brick wall is taken under a separate item in square metre, no deduction is made for holes. Stone masonry is calculated in the same manner as for brick masonry.

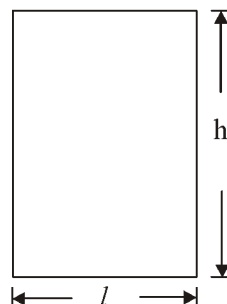
Deduction for opening, Bearings etc. in Masonry No deduction is made for following:

- (i) Opening each up to 1000 square cm
- (ii) Ends of beams, posts, rafters, purlins, etc. upto 500 square cm or 0.05 square metre in section.
- (iii) Bed plate, wall plate, bearing of chajja and the like upto 10 cm depth.

Bearings of floor and roof slabs are not deducted from masonry.

For other openings deduction are made in the following manner:

- (i) **Rectangular Openings** : Full deduction is made.



Deduction : $l \times h \times \text{thickness of wall}$.

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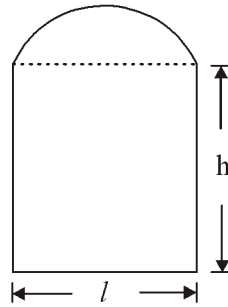


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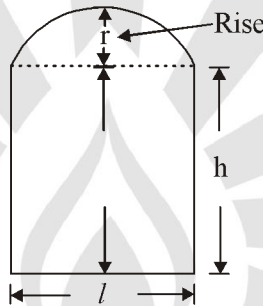
(ii) Doors and Windows with small segmental arches.



Deduction is made for rectangular portion only upto the spring line. The segmental portion is considered as solid to allow for the extra expenses in constructing the arch, and the filling up with thin wall.

Deduction : $l \times h \times \text{thickness of wall}$.

(iii) Segmental Arch Opening :



Deduction is made for the whole opening, the rectangular portion as well as the segmental portion.

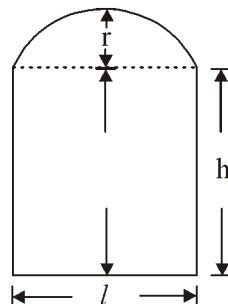
The area of segmental portion = $\frac{2}{3}lr + \frac{r^3}{2l}$

But for deduction the area of the segmental portion is obtained approximately by taking $\frac{2}{3}$ of span $\times$ rise,

$\left(\frac{2}{3} \times l \times r\right)$ and the quantity for deduction is $\frac{2}{3} \times l \times r \times \text{thickness of wall}$.

The total deduction will be = $\left[(l \times h) + \left(\frac{2}{3} \times l \times r\right) \right] \times \text{Thickness of wall}$.

(iv) Semi-circular arch opening



The area of semi-circular portion = $\frac{l}{2} \pi r^2$

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But for the deduction, the area of the semi-circular portion is obtained approximately by $\frac{3}{4}$ of span $\times$ rise

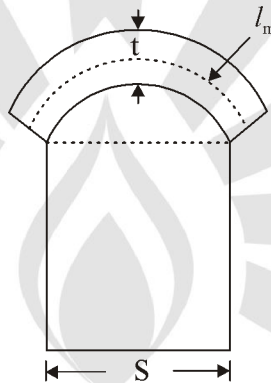
$$\left(\frac{3}{4} \times l \times r \right).$$

$$\text{Total Deduction} = \left[(l \times h) + \frac{3}{4} \times l \times r \right] \times \text{thickness of wall}.$$

Elliptical arches may be considered as semi-circular arches and may be dealt in the same manner. For large arches the actual area of opening should be calculated correctly by mensuration formula, and deduction should be made for actual area.

1.10.6 | Arch Masonry Work

Masonry work in arches is calculated in cubic metre separately by multiplying the mean length of the arch by the thickness of arch and by the width of the wall.

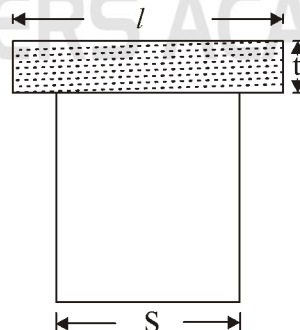


$$\text{Quantity of arch masonry} = l_m \times t \times \text{thickness of wall}.$$

$$\text{Deduction : } l_m \times t \times \text{thickness of wall}.$$

1.10.7 | Lintels Over Openings

Lintels are either of RCC or of R.B., quantities are calculated in cubic metre. Length of the lintel is equal to the bearing may be taken as same as the thickness of lintel with a minimum of 12 cm.



Thus the length of the lintel, $l = s + 2t$, i.e. clear span plus two bearings.

$$\text{Quantity of lintel} = l \times t \times \text{thickness of wall}.$$

$$\text{Deduction} = l \times t \times \text{thickness of wall}.$$

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1.10.8 | RCC and RB Work

RCC and RB work may be roof or floor slab, in beams, lintels, columns, foundation, etc. and the quantities are calculated in cubic metre. Length, width and thickness are found correctly from the plan, elevation and section or from other detailed drawings. Bearings are added with the clear span to get the dimensions. The quantities are calculated in cubic metre exclusive of steel reinforcement and its bending but inclusive of centering and shuttering and fixing and binding reinforcement in position. The reinforcement including its bending is taken up separately under steel works in quintal. For this purpose 0.6% to 1.1% [usually 1%] of RCC or RB work by volume may be taken for steel, if other details are not given. The volume of steel is not required to be deducted from the RCC or RB work.

RCC and RB work may also be estimated inclusive of steel and shuttering for the complete works, if specified.

Shuttering (form work) are usually included in the RCC or RB work, but may also be taken separately in square metre of surface in contact with concrete.

In RCC work plastering is not taken separately but the exposed surface are finished with thin rich cement sand mortar plastering to give smooth and even surface which usually is not taken into consideration.

1.10.9 | Flooring and Roofing

(i) **Ground Floor :** The base lime concrete and floor finishing of cement concrete or stone or marble or mosaic etc. are usually taken as one job or one item (combined in one item), and the quantity is calculated in square metre, multiplying the length by the width. The length and width are measured as inside dimensions from wall to wall of superstructure. Both the works of base concrete and floor finishing are paid under one item.

(ii) **1st Floor, 2nd Floor etc. :** Supporting structure is taken separately in cubic metre as RCC, RB etc. and the floor finishing is taken separately in square metre as 2.5 cm or 4 cm cement concrete or marble or mosaic etc.

If a cushioning layer of lime concrete is given in between the slab and the floor, the cushion concrete may be measured with the floor under one item or taken separately.

(iii) **Roof :** Supporting structure is taken separately in cubic metre and the lime concrete terracing is computed in square metre with thickness specified, under a separate item including surface rendering smooth. The compacted thickness of lime concrete terracing is 7.5 cm to 12 cm average, L.C. terracing may also be calculated in cubic metre with average thickness.

The bearing of roof or floor slab is given same as the thickness of slab, usually 10 cm to 15 cm.

In case of tiled, galvanised iron sheet, or asbestos cement sheet roofing the roof covering are taken out in square metre and measured flat including overlaps with all fittings and supporting trusses and members are taken under separate item.

Floor of door sills and sills of opening, should also be taken into account. In the case of ground floor sills should be taken, separately as there is no lime concrete in sills.

1.10.10 | Plastering and Pointing

Plastering usually 12 mm thick is calculated in square metre For walls the measurements are taken for the whole face of the wall for sides as solid and deduction for openings are made in the following manner:

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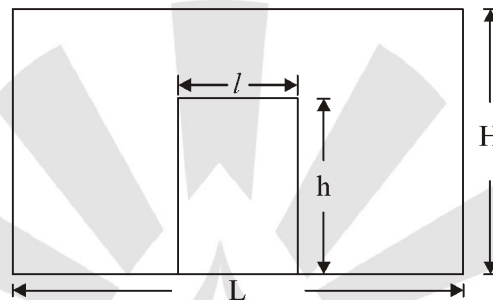
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- (i) No deduction is made for ends of beams, posts, rafters, etc.
- (ii) For small opening up to 0.5 square metre no deduction is made, and at the same time no additions are made for jambs, soffits and of sills of these openings.
- (iii) For opening exceeding 0.5 square metre but not exceeding 3 square metre deduction is made for one face only and the other face is allowed for jambs, soffits and sills which are not taken into account separately.
- (iv) For openings above 3 square metre deduction is made for both faces of the opening and the jambs, soffits and sills are taken into account and added.

As the outer jambs, etc. are much smaller than the inner ones, the deduction is usually made from the outer face.



$$\text{Inside Plaster} = L \times H$$

$$\text{Outside Plaster} = (L \times H) - (l \times h)$$

For deduction for arch opening the same principle as for masonry work is followed.

Plastering of ceiling usually of 6-10 mm thick is computed in square metre under a separate head as this work is done with richer mortar. For RCC work usually no plastering is allowed but for fair finish a thin plaster of rich cement mortar may be allowed which should not be taken in the measurement separately. Thin rich cement mortar plastering in RCC work may also be taken under a separate item, specially in the ceiling inside room.

Pointing : Pointing in walls is calculated in square metre for whole surface and deductions similar to plastering are made. Task work for pointing is 10 m²/mason/day.

1.10.11 | Cornice

Ornamental or large cornice is measured in running metre for the complete work, which includes masonry, plastering, mouldings, etc and paid for in running metre.

Similarly, string course, drip course, cor-belling, coping etc. are measured and paid for in running metre for the complete work.

1.10.12 | Pillars

Pillars are taken separately in cubic metre. For their net volume and quantities are calculated by correct geometrical measurements by simple mensuration method.

$$\text{Quantity} = \text{Cross-sectional area} \times \text{ht} = \pi \frac{d^2}{4} \times \text{ht}$$

cubic metre for round pillars, d is the diameter, a² × ht. Cubic metre for square pillars a is the side.

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Hexagonal, octagonal etc, pillars are dealt similarly. Plastering in the pillars are calculated in square metre multiplying the circumference of perimeter by the height.

1.10.13 | Door and Window

- (i) **Chowkhat or Frame :** Door and window frames or chowkhats are computed in cubic metre. Length is obtained by adding the length of all the members of the chowkhat, top and two verticals if there is no sill member and adding bottom also if there is sill and this length is multiplied by the two dimensions of the cross-section of the member. If there is horn projections also should be added to the length. If there is no sill member, vertical members should be inserted into the floor by about 2.5 cm to 4 cm.
- (ii) **Door or window leaves or shutter :** They are computed in square metre by multiplying the width by the height of the shutters, the rebates in the chowkhat should be taken into consideration in finding the width and the height. A clearance of 6 mm may be allowed at the bottom of door. If there is no sill member. For estimate the clearance may not be taken into consideration, this may be neglected. But for measurement. For payment the clearance should be taken into account. The rebates in the chowkhats may be taken as 12 mm to 20 mm. The central overlap is not taken into account.

The name of the timber used to thickness of shutters, type of shutters and the nature of fitting (iron, brass, etc) should be noted in the item. Shutters of different types as panelled, glazed; partly panned and partly glazed, venetian, etc. should be computed separately as the rates differ.

Fittings are computed by number i.e. enumerated. Fittings may also be included in the square metre rate of shutters. For estimate, the fitting may be taken under a separate item in square metre basis of shutters, or a lump-sum provision may be made. Hold fasts are taken separately under a separate item by weight or by number.

It is better to purchase the fittings by the department to the choice and requirement, and to get them fitted by the contractor. Whose rate for shutters shall include the labour for fixing the fittings. In such case the rates of shutters will exclude the cost of fittings but will include the cost of fixing them. In estimating the cost of fittings will be provided under a separate item fittings of doors and windows on area basis or on lumpsum basis for the purchase of fitting.

1.10.14 | Wood Work

Wooden beams, burgahs, posts, wooden roof trusses, chowkhats etc. come under this item, and the quantities are computed in cubic metre. The dimensions of finished work shall be taken.

1.10.15 | Iron Work

This is computed weight in kg or quintal and the quantities are calculated correctly by multiplying the weights per running metre by the length per running metre can be obtained from the steel section book. For steel joint length is equal to the clear span plus two bearing may be taken $\frac{3}{4}$ thickness of wall or 20 cm to 30 cm.

Density of mild steel is equal to 7850 kg/cubic metre. Weight of iron hold fast may be taken as $\frac{1}{2}$ kg each. For doors 6 hold fast (three on each side), and for windows 4 hold. Fasts may be provided if not specified.

The weight of bolts and nuts and rivets with heads can be calculated by counting their numbers and size and consulting steel table. Some time certain percentage of the whole steel work is provided for rivets and bolts and nuts. For steel roof truss 5 percent of the steel work is usually provided for rivets and bolts and nuts.

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1.10.16 | White Washing or Colour-Washing or Distemping

The quantities are computed in square metre and are usually same as for plastering. The inside is usually white washed or distemped and this item will be same as for inside plaster. The outside is colour-washed and the quantities of colour-washing will be same as for out-side plaster. These items need not be calculated separately, but simply. Written as same as for inside plaster or outside plaster. Number of coats of white-washing or colour-washing are taken as one job or work and the rates cover for the number of coats which should not be multiplying factor. The number of coats should be mentioned in the item. Deductions are dealt in the same manner as for plastering. Other type of surface finishing may also be done and may be taken accordingly.

1.10.17 | Painting

Painting or varnishing of doors and windows are computed in square metre, the dimensions should be taken for outer dimensions of the chowkhat i.e., outer dimensions of doors and windows. The area is measured flat. No separate measured is taken for the chowkhat, the area is same as the area of wall opening. For iron bars, grills etc., the area of the clear opening inside, the chowkhat is taken. For both faces of doors and windows, the simple area as measured above is multiplied by appropriate numbers are below –

- | | |
|---|---|
| (i) Panelled, framed and braced ledged and battened
or ledged battened and braced. | – 2.25 times one surface area, for both sides. |
| (ii) Fully glazed or gauged | – 1 time one surface area, for both sides. |
| (iii) Partly panelled and partly glazed and gauged. | – 2 time one surface area, for both sides. |
| (iv) Flush door | – 2 time one surface area, for both sides. |
| (v) Venetian | – 3 times one surface area, for both sides. |
| (vi) Iron bars, grills in windows | – 1 time the area of clear opening in
between chowkhat for over all. |

The covers also for chowkhats on three faces. Painting is done in two or three coats, usually over a coat of priming. The rate covers for the number of coats under one item. The number of coats should be mentioned in the description of item. (The multiplying factors differ slightly from state to state. IS 1200 should be followed.)

The concealed surface of the chowkhat which is in contact with the jamb of the wall is usually painted with two coats of coaltar or solignum, and this item is computed separately.

For beams, rafters, purlins, posts etc. of timber or iron, the area of actual exposed surface is taken for painting.

Corrugated surface is taken as flat and a percentage increase is allowed.

Lump-sum Item : Sometimes a lump-sum rate is provided for certain small items for which detailed quantities cannot be taken out easily or it takes sufficient time to find the detail, as front architectural or decoration work of a building, fire-place, site cleaning and dressing etc.

1.10.18 | Other Items

The units being known, it will not be difficult to estimate the quantities of different items of work.

1.10.19 | Electrification and Sanitary and Water Supply Works

For sanitary and water supply works 8% and for electrification 8% of the estimated cost of the building works are usually provided in estimate and added 4% for fan.

1.10.20 | Nomenclature of Items

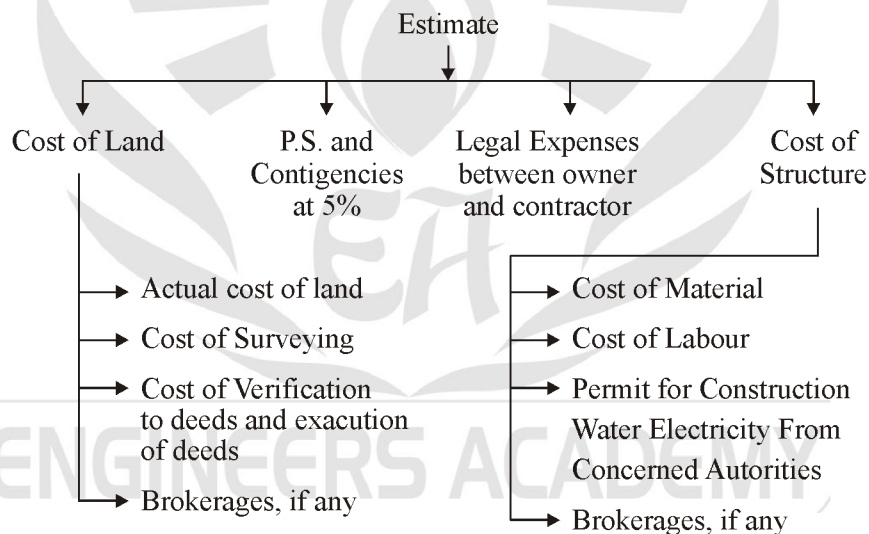
The nomenclature of items are fully described so that each item is clear and there is no ambiguity. Type and quality of materials, proportion of mortar, method of construction etc. are included in the description of the items. Nomenclatures of item in the solved examples in this book are given in brief, for detailed nomenclatures P.W.D. schedule of rates may be consulted.

1.10.21 | Rates

Rates of different items in the estimate are the current rates for the completion of the items of work which include supply of materials, transport, labour scaffolding, over heads, contractor's profit, taxes etc. The rates are usually taken from the "P.W.D. Schedule of Rates."

1.11 | COMPLETE ESTIMATE

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

**1.12 | LUMP-SUM ESTIMATE**

While preparing an estimate, it is an possible to workout in details in case of pitty item's other then civil engineering. Such item's are called lumpsum. Item's or simply L.S. item's.

The following are some of L.S. item's in the estimate.

- Water supply and sanitary arrangement.
- Electrical installations like meter motor etc.
- Architectural features.
- Contingencies and unforeseen item's.

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1.13 | 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 1.5% to 2% of the estimate cost is provided towards to work charged establishment.

□□□

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Objective Questions

PRACTICE SHEET

1. Calculate weight of steel bar if diameter of steel bar 20 mm.
(a) 2.47 kg (b) 2.98 kg
(c) 2.85 kg (d) 1.85 kg
2. Frame of door and window are measured
(a) m (b) m²
(c) m³ (d) Lumpsum
3. Calculate required distemper for 100 m² single coat painting –
(a) 6.5 kg (b) 5 kg
(c) 8 kg (d) 10 kg
4. Nearest value for wood work measurement
(a) 0.001 m (b) 0.002 m
(c) 0.003 m (d) 0.004 m
5. Rivet's are measured in
(a) Bag's (b) m³
(c) Number's (d) Ton
6. Threading in iron are measured
(a) cm (b) km
(c) m² (d) Number's
7. Task work for brick supply up to 10 m distance
(a) 1500 bricks (b) 4200 bricks
(c) 5500 bricks (d) 2200 bricks
8. Scrap value of building about original cost of building –
(a) 30% (b) 10%
(c) 2% (d) 30%
9. Depreciation of building in starting up to 5 year's is –
(a) 0% (b) 10%
(c) 20% (d) 8%
10. In the rough cost estimate added contingencies charges is about
(a) 3 – 5% (b) 10 – 15%
(c) 15 – 20% (d) 20 – 25%
11. In the detail estimate work charge establishment is
(a) 1.5% to 2% (b) 5% to 7%
(c) 10% (d) 10% to 15%
12. Carpet area of office building about plinth area is–
(a) 30% to 50% (b) 50% to 80%
(c) 60% to 75% (d) 40% to 70%
13. Carpet area of residential building about plinth area is –
(a) 50% to 65% (b) 70% to 85%
(c) 60% to 75% (d) 70% to 90%
14. Cornice work are measured in
(a) Square meter (b) Cubic meter
(c) Running meter (d) Number's
15. Brick masonry in arch is measured in
(a) Square meter (b) Cubic meter
(c) Number's (d) None of these
16. G.I. Sheet's are measured in
(a) Square meter (b) Cubic meter
(c) Running meter (d) All of these
17. Gusset Plate and nut washer's are measured in
(a) Ton or kg (b) Square meter
(c) Number's (d) Cubic meter
18. Deduction in Plaster work made 100%, if size of opening more than
(a) 2m² (b) 3m²
(c) 5m² (d) 9m²

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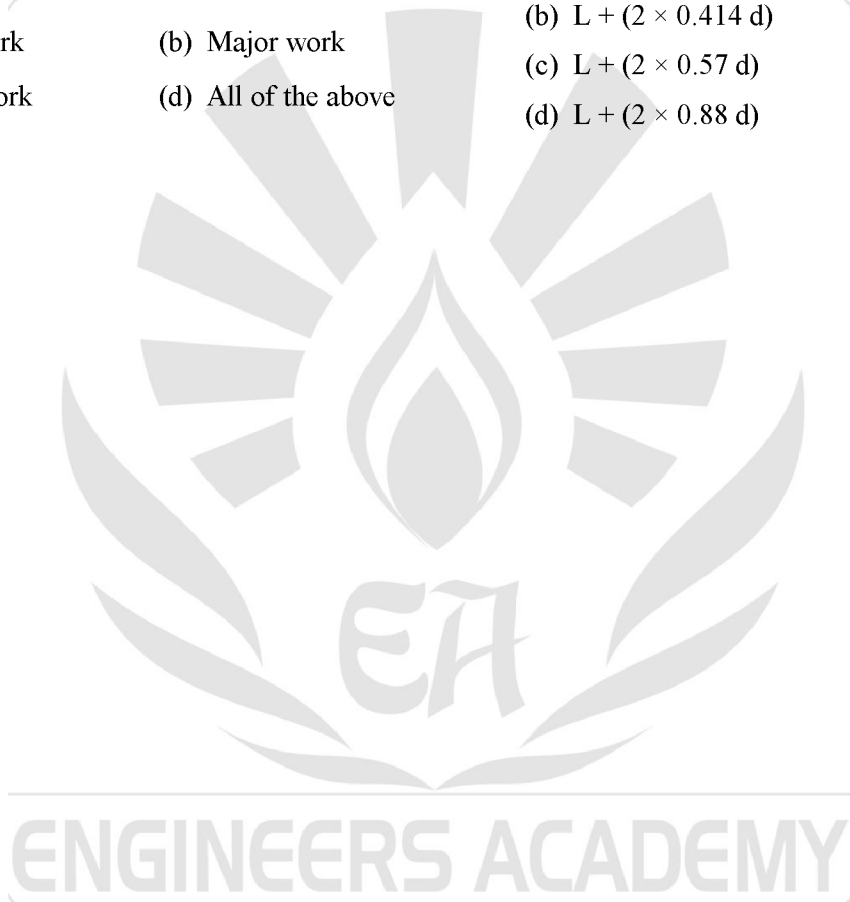
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179. Calculate required quantity of lime in single coat for 100 m² area?
- (a) 2 kg (b) 3 kg (c) 5 kg (d) 10 kg
180. Calculate quantity of cement for finishing of 100 square meter area of floor?
- (a) 2 bag's (b) 3 bag's (c) 4 bag's (d) 6 bag's
181. If cost of work more than 2 lakh then it's work type is?
- (a) Petty work (b) Major work (c) Minor work (d) All of the above
182. Prepared revised estimate if cost of construction increase?
- (a) 10% (b) 20% (c) 15% (d) 30%
183. Surface dressing and levelling are measured in
- (a) Cubic meter (b) Square meter (c) Running meter (d) None of these
184. Crank length of 45° is
- (a) $L + (2 \times 0.268 d)$ (b) $L + (2 \times 0.414 d)$ (c) $L + (2 \times 0.57 d)$ (d) $L + (2 \times 0.88 d)$

□□□



ANSWERS SHEET

- | | | | |
|---------------------|---------------------|---------------------|----------------------|
| 1. <i>Ans. (a)</i> | 26. <i>Ans. (a)</i> | 51. <i>Ans. (c)</i> | 76. <i>Ans. (b)</i> |
| 2. <i>Ans. (c)</i> | 27. <i>Ans. (b)</i> | 52. <i>Ans. (a)</i> | 77. <i>Ans. (c)</i> |
| 3. <i>Ans. (d)</i> | 28. <i>Ans. (a)</i> | 53. <i>Ans. (a)</i> | 78. <i>Ans. (c)</i> |
| 4. <i>Ans. (b)</i> | 29. <i>Ans. (d)</i> | 54. <i>Ans. (c)</i> | 79. <i>Ans. (a)</i> |
| 5. <i>Ans. (d)</i> | 30. <i>Ans. (a)</i> | 55. <i>Ans. (d)</i> | 80. <i>Ans. (b)</i> |
| 6. <i>Ans. (a)</i> | 31. <i>Ans. (b)</i> | 56. <i>Ans. (c)</i> | 81. <i>Ans. (d)</i> |
| 7. <i>Ans. (b)</i> | 32. <i>Ans. (a)</i> | 57. <i>Ans. (c)</i> | 82. <i>Ans. (c)</i> |
| 8. <i>Ans. (b)</i> | 33. <i>Ans. (c)</i> | 58. <i>Ans. (b)</i> | 83. <i>Ans. (a)</i> |
| 9. <i>Ans. (a)</i> | 34. <i>Ans. (a)</i> | 59. <i>Ans. (b)</i> | 84. <i>Ans. (b)</i> |
| 10. <i>Ans. (a)</i> | 35. <i>Ans. (d)</i> | 60. <i>Ans. (d)</i> | 85. <i>Ans. (d)</i> |
| 11. <i>Ans. (a)</i> | 36. <i>Ans. (a)</i> | 61. <i>Ans. (a)</i> | 86. <i>Ans. (a)</i> |
| 12. <i>Ans. (c)</i> | 37. <i>Ans. (b)</i> | 62. <i>Ans. (c)</i> | 87. <i>Ans. (b)</i> |
| 13. <i>Ans. (a)</i> | 38. <i>Ans. (c)</i> | 63. <i>Ans. (a)</i> | 88. <i>Ans. (b)</i> |
| 14. <i>Ans. (c)</i> | 39. <i>Ans. (b)</i> | 64. <i>Ans. (b)</i> | 89. <i>Ans. (c)</i> |
| 15. <i>Ans. (b)</i> | 40. <i>Ans. (b)</i> | 65. <i>Ans. (a)</i> | 90. <i>Ans. (c)</i> |
| 16. <i>Ans. (a)</i> | 41. <i>Ans. (c)</i> | 66. <i>Ans. (c)</i> | 91. <i>Ans. (b)</i> |
| 17. <i>Ans. (a)</i> | 42. <i>Ans. (a)</i> | 67. <i>Ans. (c)</i> | 92. <i>Ans. (c)</i> |
| 18. <i>Ans. (b)</i> | 43. <i>Ans. (d)</i> | 68. <i>Ans. (a)</i> | 93. <i>Ans. (d)</i> |
| 19. <i>Ans. (a)</i> | 44. <i>Ans. (d)</i> | 69. <i>Ans. (c)</i> | 94. <i>Ans. (b)</i> |
| 20. <i>Ans. (b)</i> | 45. <i>Ans. (c)</i> | 70. <i>Ans. (c)</i> | 95. <i>Ans. (c)</i> |
| 21. <i>Ans. (d)</i> | 46. <i>Ans. (b)</i> | 71. <i>Ans. (c)</i> | 96. <i>Ans. (c)</i> |
| 22. <i>Ans. (b)</i> | 47. <i>Ans. (a)</i> | 72. <i>Ans. (b)</i> | 97. <i>Ans. (b)</i> |
| 23. <i>Ans. (b)</i> | 48. <i>Ans. (b)</i> | 73. <i>Ans. (a)</i> | 98. <i>Ans. (a)</i> |
| 24. <i>Ans. (a)</i> | 49. <i>Ans. (a)</i> | 74. <i>Ans. (d)</i> | 99. <i>Ans. (a)</i> |
| 25. <i>Ans. (a)</i> | 50. <i>Ans. (c)</i> | 75. <i>Ans. (b)</i> | 100. <i>Ans. (c)</i> |

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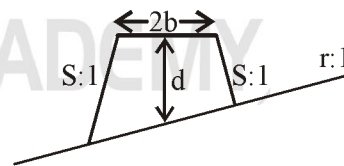
- | | | | |
|---------------|---------------|---------------|---------------|
| 101. Ans. (a) | 122. Ans. (d) | 143. Ans. (b) | 164. Ans. (b) |
| 102. Ans. (c) | 123. Ans. (c) | 144. Ans. (b) | 165. Ans. (d) |
| 103. Ans. (d) | 124. Ans. (b) | 145. Ans. (c) | 166. Ans. (d) |
| 104. Ans. (b) | 125. Ans. (c) | 146. Ans. (a) | 167. Ans. (b) |
| 105. Ans. (c) | 126. Ans. (a) | 147. Ans. (a) | 168. Ans. (a) |
| 106. Ans. (b) | 127. Ans. (a) | 148. Ans. (d) | 169. Ans. (b) |
| 107. Ans. (c) | 128. Ans. (c) | 149. Ans. (c) | 170. Ans. (c) |
| 108. Ans. (d) | 129. Ans. (a) | 150. Ans. (a) | 171. Ans. (d) |
| 109. Ans. (b) | 130. Ans. (c) | 151. Ans. (d) | 172. Ans. (d) |
| 110. Ans. (b) | 131. Ans. (d) | 152. Ans. (b) | 173. Ans. (b) |
| 111. Ans. (a) | 132. Ans. (d) | 153. Ans. (b) | 174. Ans. (c) |
| 112. Ans. (a) | 133. Ans. (d) | 154. Ans. (c) | 175. Ans. (c) |
| 113. Ans. (c) | 134. Ans. (b) | 155. Ans. (c) | 176. Ans. (b) |
| 114. Ans. (a) | 135. Ans. (a) | 156. Ans. (d) | 177. Ans. (b) |
| 115. Ans. (a) | 136. Ans. (d) | 157. Ans. (d) | 178. Ans. (a) |
| 116. Ans. (a) | 137. Ans. (b) | 158. Ans. (c) | 179. Ans. (d) |
| 117. Ans. (a) | 138. Ans. (b) | 159. Ans. (d) | 180. Ans. (d) |
| 118. Ans. (b) | 139. Ans. (d) | 160. Ans. (d) | 181. Ans. (b) |
| 119. Ans. (c) | 140. Ans. (a) | 161. Ans. (d) | 182. Ans. (a) |
| 120. Ans. (d) | 141. Ans. (a) | 162. Ans. (b) | 183. Ans. (b) |
| 121. Ans. (b) | 142. Ans. (b) | 163. Ans. (a) | 184. Ans. (b) |

□□□

Objective Questions

PREVIOUS YEAR'S QUESTIONS

1. In road estimation, the earthwork is estimated for ____ lead for distance and ____ lift for height.
 (a) 30 m, 1.5m (b) 30m, 1.75m
 (c) 25m, 1.75m (d) 25m, 1.5m
[PEB-SUB ER.-2017]
2. While estimating for plastering, usually no deduction is made for which of the following ?
 (a) End of rafters only
 (b) Small openings up to 0.5 sq.m only
 (c) Ends of beams only
 (d) All of the above
[PEB-SUB ER.-2017]
3. A record of receipts, issues and running balance of certain articles of stock kept in
 (a) M-Book
 (b) Stock Account
 (c) Road Metal Book
 (d) Bin Card
4. The estimate prepared for technical sanction of the competent authority should attached with
 (a) Detailed specification
 (b) Report
 (c) Abstract
 (d) Both detailed specification and report
5. Depreciated value of a building can be found out by using the formula
 (a) $D = \left(\frac{100 - rd}{100} \right)^n$
 (b) $D = P \left(\frac{100 - rd}{100} \right)^n$
 (c) $D = P(100 - rd)^n$
 (d) $D = (100 - rd)^n$
[MPSC-2012]
6. What is the minimum size of the bathroom and W.C.?
 (a) 5.5 sq.m. (b) 5.8 sq.m.
 (c) 6.2 sq.m. (d) 5.2 sq.m.
[Haryana JRE-2018]
7. In which of this system the payments to individual workers are done according to the amount of work done ?
 (a) Piece work System
 (b) Time work system
 (c) Quality work system
 (d) Quantity work system
[Haryana JE-2018]
8. In estimation, deduction for opening with small segmental arches are taken as :
 (a) $(l \times h + \frac{1}{2} \times l \times R) \times \text{thickness of wall}$
 (b) $(l \times h + \frac{2}{3} \times l \times R) \times \text{thickness of wall}$
 (c) $(l \times h + \frac{3}{4} \times l \times R) \times \text{thickness of wall}$
 (d) $l \times h \times \text{thickness of wall}$
[DMRC-2018]
9. The area of cross section of a road fully is banking shown in the given figure, is



- (a) $\frac{Sb^2 + r^2(2bd + sd)^2}{r^2 - S^2}$
 (b) $\frac{Sb^2 + r^2(2bd + sd)^2}{r^2 - S^5}$
 (c) $\frac{Sb^2 + r^2(2bd + Sd)^2}{r - S}$
 (d) None of the above

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ANSWERS AND EXPLANATIONS1. *Ans. (a)*2. *Ans. (d)*3. *Ans. (d)*4. *Ans. (d)*5. *Ans. (b)*6. *Ans. (b)*7. *Ans. (a)*8. *Ans. (d)*9. *Ans. (a)*10. *Ans. (d)*11. *Ans. (a)*12. *Ans. (c)*

$$D = \frac{S - C}{N} = \frac{1500000 - 225000}{15}$$

$$= 85000$$

$$\text{Cost after 6 years} = 1500000 - 6 \times 85000$$

$$= 9,90,000$$

13. *Ans. (a)*14. *Ans. (a)*15. *Ans. (c)*16. *Ans. (c)*

$$\text{Volume of B.F.S.} = l \times b \times h$$

$$= 0.75 \times 1 \times 0.075$$

$$= 0.05625 \text{ cum}$$

$$\cong 0.056 \text{ cum}$$

17. *Ans. (d)*18. *Ans. (d)*19. *Ans. (a)*20. *Ans. (d)*21. *Ans. (a)*

$$\text{Length of intel (L)} = s + 2t$$

where S = clear span

$$t \left\{ \begin{array}{l} \text{thickness of lintel} \\ 12 \text{ cm} \end{array} \right\} \text{ which is minimum}$$

22. *Ans. (b)*

$$\text{Volume of concrete} = 100 \text{ m}^3$$

$$\text{Dry volume of concrete} = 153 \text{ m}^3$$

$$\text{Volume of coarse aggregate}$$

$$= \frac{4}{7} \times 153$$

$$= 87.42 \approx 88 \text{ m}^3$$

23. *Ans. (c)*

$$\text{Numbers of bricks} = \frac{20}{(0.20) \times (0.10) \times (0.10)}$$

$$= 10,000 \text{ bricks}$$

24. *Ans. (c)*

$$Q_1 = \frac{L}{6} [A_1 + A_2 + 4A_{\text{mean}}] = \frac{40}{6} [10 + 15 + 4 \times 12.5] = 500 \text{ m}^3$$

$$Q_2 = \frac{L}{6} [A_1 + A_2 + 4A_{\text{mean}}] = \frac{40}{6} [15 + 35 + 4 \times 25] = 1000 \text{ m}^3$$

$$\text{Total Quantity} = Q_1 + Q_2 = 500 + 1000 = 1500 \text{ m}^3$$

25. *Ans. (d)*26. *Ans. (b)*

$$\text{Length of tank (L)} = 6 \text{ m}$$

$$\text{Width of tank (B)} = 4 \text{ m}$$

$$\text{Height of tank (H)} = 1 \text{ m}$$

$$\text{Surface area to be plastered}$$

$$= 2(L + B) \times H = 40 \text{ m}^2$$

$$\text{Quantity of plaster} = 40 \times 0.012 = 0.48 \text{ m}^3$$

$$\text{Dry volume of mortar for plaster}$$

$$= 0.48 \times 1.3 = 0.624$$

$$\text{Quantity of cement}$$

$$= \frac{0.624 + 1}{5} = 0.124 \approx 0.115 \text{ m}^3$$

27. *Ans. (b)*28. *Ans. (d)*29. *Ans. (d)*30. *Ans. (d)*31. *Ans. (d)*

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