INTRODUCTION:

Estimating:-

An estimating is the computation or calculation of the quantities required and the expenditure likely to be incurred in construction work of a project. It is determined theoratically by mathematical calculation based on the planes, drawing & current rates.

costing:-

It is the method of finding out the actual cost of work before its execution. this is done with the help of measurement sheet & abstract

valuation:-

It is the method for determining the present value of a property.

purpose of estimating & costing:-

(1) To have a fairly accurate idea of cost of project undertaken.
(2) To have a knowledge of material, labour and plants required for project.
(3) It acts as a guides for tenderers for filling the tenders.
(4) It helps in deciding the time limit of a project.
(5) It helps in obtaining the necessary Govt. sanctions for starting the project.

ESTIMATING

Estimating is a probable cost of project. It is the process of calculating the required quantity for various items & probable expen-diture. likely to be required for the construct^n of a perticular project.

Types:- 1 Approximate estimate.
2 Detailed —"—
3 (a) Supplimentry —"—
4 (b) Revised —"—
5 (c) Repair & maintanance.

1) Approximate estimate:-
It is the required estimate prepaired to know the approximate cost of a work in a very shor time. This type of estimate is prepaired on the basis of actual cost of similar existing structure. the factor of compairision is cubic content per capta, per km, service unit etc. These estimates are useful in initial stage to design the fihysibly of work or for approva of project.

2) Detailed estimate:-

It is prepared by finding out the actual quantity of different items of works & then cost per unit item cost of each item of work is added together & then suitable % for work charge establishment (WCE) contengencies is added to it (a) Detailed estimate is prepaired in two steps :- Detail of measurment & calculation of quantity whole work is divided into different items of work then quantities are work out in details & computed in measurment sheet

itemNO	Descriptn or perticular	Nos	L (m)	B (m)	H/D (m)	Qty	Total

(b) Abstract of estimated cost:-

It is prepaired by working out by estimated cost of work by multiplying the resp quantities with revalling rate.

Abstract:

itemNO	Particular or discriptn	Qty	Rate Rs	Perunit Pc	Amount Rs	Pc

cu.ft - 4000

(3) Supplementry Estimate:-

It is a detailed estimate prepaired when additional work are required to supplement the original work or when further developmen required during the progress work. A fresh detail estimate is prepaired for the addit item of work & in addit to original work the abstract can show the original amount original estimate & total amount included i supplementry amount for which the sanctio is required

(4) Revised estimate:-

It is a type of detailed estimate which is required to be prepaired under any one of the following circumstances.

1) When original sanctioned estimate is exceed or likely to exceed by more than 5%.
2) When the expenditure on work exceeds or likely t exeed the amount of administritive sanct by more than 10%.
3) When there are material deviat from original proposal even though the cost may be meet fro sanct amount.

4 The revised estimate should be compairitive statement showing the variat of each item of work

its quantity, rate & cost under original & revised side by side the excess or saving or reason for variation.

5) Annual repair & Maintainance Estimate:—
It is the detailed estimate. It is prepaired to maintained the structure or work in proper order or in safe condition. It includes the items like white wash, painting, minor repair etc. A detail estimate of this items are prepair & submitted to the competant authority for approval.

Technical terms:—

1) Contengencies:—
Incidental expenses of the missileneous characters which cannot be accomodated in any specific item are called contengencies. Usually a provision of 3 to 5% of estimate cost of work is made for contengenices.

2) Work charge establishment (W.C.E):—
It is the establishment which is charge to work directly. During the constructn work supervising staff like watchmen etc are required to be appointed on temporary basis & their

salaries are paid from the amount of W.C.E provided in the estimate. Usually 2-1. of the estimated cost is provided fro W.C.E.

3) Centage charge or departmental charges:—
When the C.Engg dept takes up the work of other deptt a % amount of 10 to 15% of estimated cost is charged to meet the expances of establis-ment, planning, designing, supervision etc. this % charges are known as centagecharge.

4) check list:—
Estimater should prepaired a list of items of work before prepairing detail estimate. this list is called check list. It helps the estimater weather all items of works are covered up in the estimate or not.

Principles of taking out quantities:—

1) Study of drawing.
2) visit to site.
3) Sequence of operatn.
4) Accuracy → As per IS 1200.
5) Deductn of opening → —11——
6) Descriptn.
7) lumpsum items.
8) provisional items.

9) Provisional sum.
10) Prim cost.
11) Provision for electrificat → 8% of estimated cost
12) Provision for water supply & sanitary work.
→ 8% of estimated cost is provided for each work.

lumpsum items :—

These are the works of items which are difficults to measure or asses during the execution of work & a lumpsum amount is provided in estimate
Eg:- site cleaning, surface cleaning, dewatering of trenches etc.

Provisional items :—

when the quantities of a particular items are not certain provisional quantities are provided for such items in estimate. These items are usually of specilized nature like electric fitting, A.C etc.

Provisional sum :—

It is the amount provided in estimate for items of specilized nature whose details are not known at the time of prepairing estimate.

Prim cost :—

It is the actual cost of an article at shop or provided. refers to supply of an articles only & not to the execution of work. It is not always possible all time of preparing the estimate of specify the exact type of an item required.

Eg:- Door, Window fitting etc.

Hence a certain fix amount is shown against such items this amount is called as prime cost.

Unit of measurment
(As per IS 1200)

Principle of units:—

(1) Thick voluminous items → cubic meter (Ex: Excavat° masonry
(2) Thick shallow items → square meter
(3) Eg:- Plastering, flooring & painting etc
Thin long work → Running meter (Eg:- Sewer line, pipe line)
(4) Piece work, job work → Numbers.

Desired accuracy:—

(1) All volm should be measured nearest to $0.01 m^3$.
(2) All area should be measured nearest to $0.01 m^2$.
(3) All length should be measured nearest to 0.01 m.
(4) All the measurement should be item wise, & describ
of each item shall be included materials, labou

tools & plants other missilencous charges

5) same type of items under different conditions shall be measured seprately under seprate items.

V. Imp :—

Rules of deduction :- (As per IS 1200)

1) Masonry work :—

a) No deduction for opening having each up to 0.1 sq meter in sect^n.

b) No deduction for ends of beam post, rafter purlins etc. upto 0.03 sqm. in section.

c) No deduction for bed plate, wall plate, bearing of chajja & like upto 10cm depth.

d) No deduction for bearing of floor & roof slab from the wall masonry.

2) Plastering & painting :—

a) No deduction made for end of beam, rafter board etc.

b) For small opening upto 0.5 m^2 no deduct^n is made & at the same time no addit^n is made for jams, sofits & sills of openings.

c) For opening exceeding 0.5 m^2 but not exceeding 3 m^2 deduction is made for one face only. The other face is allow for sill, sofit & jams of opening.

tools & plants other missileneous charges

5) same type of items under different conditions shall be measured seprately under seprate items.

V. Imp :—

Rules of deduction :- (As per IS 1200)

1) Masonry work :—

a) No deduction for opening having each up to 0.1 sq meter in sectn.

b) No deduction for ends of beam post, rafter purlins etc. upto 0.05 sqm. in section.

c) No deduction for bed plate, wall plate, bearing of chajja & like upto 10cm depth.

d) No deduction for bearing of floor & roof slab from the wall masonry.

2) Plastering & painting :—

a) No deduction made for end of beam, rafter board etc.

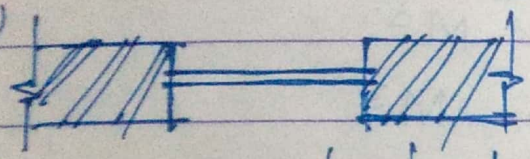
b) For small opening upto $0.5 m^2$ no deductn is made & at the same time no additn is made for jams, sofits & sills of openings.

c) For opening exceeding $0.5 m^2$ but not exceeding $3 m^2$ deduction is made for one face only. The other face is allow for sill, sofit & jams of opening.

d) For opening greater than $3m^2$ deduction made for all the faces of opening & jambs, sofits & sills are taken into account & added.

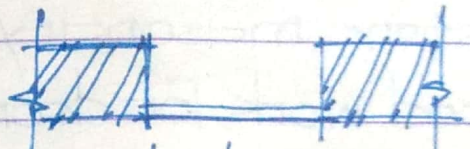
Note:- For opening $> 0.5m^2$ but $< 3m^2$

(a)



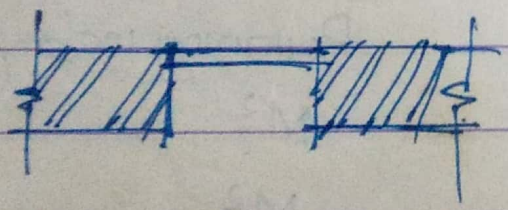
Remaining deduct^n of half opening for outer plaster & remaining half for inner plaster.

(b)



Deduction of opening in outer portion only.

(c)



Deduction of opening in inner portion.

(chart 1)

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NO	Items	units of measurement
1	Earthwork (Excavation)	cubic meter
2	P.C.C	M^3
3	R.C.C	M^3
4	Brick work	M^3
5	stone masonary	M^3
6	wood work for door & window	M^3
7	Door window shutter	M^2
8	R.C.C grill	M^2
9	Partition wall	M^2
10	D.P.C	M^2
11	Plastering & painting	M^2
12	flooring	M^2
13	skirting	Running meter / M^2
14	Dado	M^2
15	Tile flooring or A.C sheet	M^2
16	Form work (centering)	M^2
17	Painting	M^2
18	wire fencing	Running meter
19	Railing	Running meter
20	Pipe	Running meter
21	wash basin, W/C pan	Per unit
22	Main hole cover	Per unit
23	site clearance	lump sump item (Job)
24	Electric fitting	Point
25	steel (Reinforcement)	key, quental or tonns
26	Honey comb brick work	

27 Glass. M^2

28 Fencing wire. o

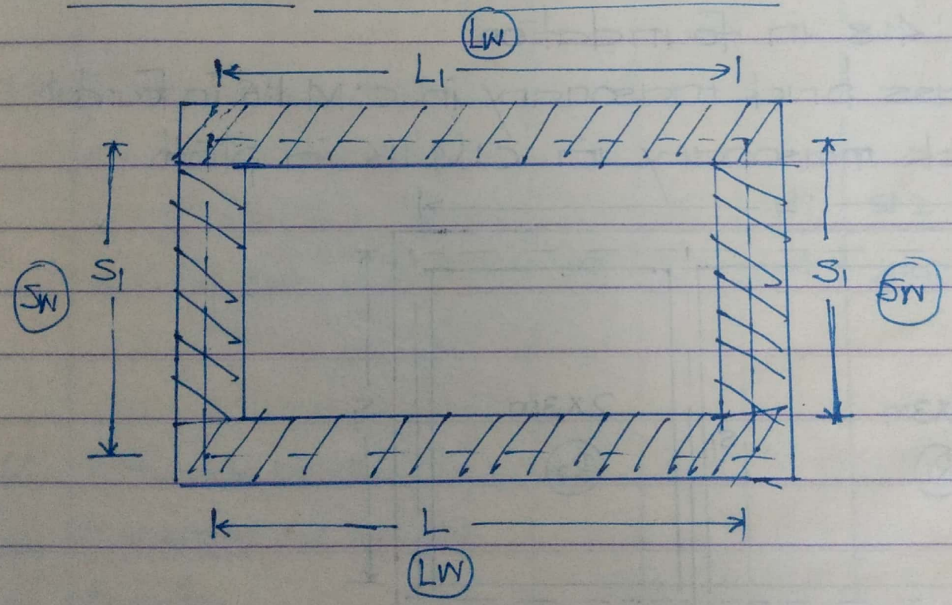
Methods of taking out the quantity.

There are two methods of taking out qts.

(1) long wall & short wall method.

(2) centre line method.

long wall & short wall method:—



Length of long wall:—

l_W = c/c dist betn two short wall (SW) + half width on either side.

ork) $= L_1 + t/2 + t/2$

$\therefore L_W = L_1 + t$.

length of short wall.

l_s = c/c dist betn two long wall (LW) - half width on either side.

$= L_2 - t/2 - t/2$

$\therefore l_s = L_2 - t_2$

Problems:

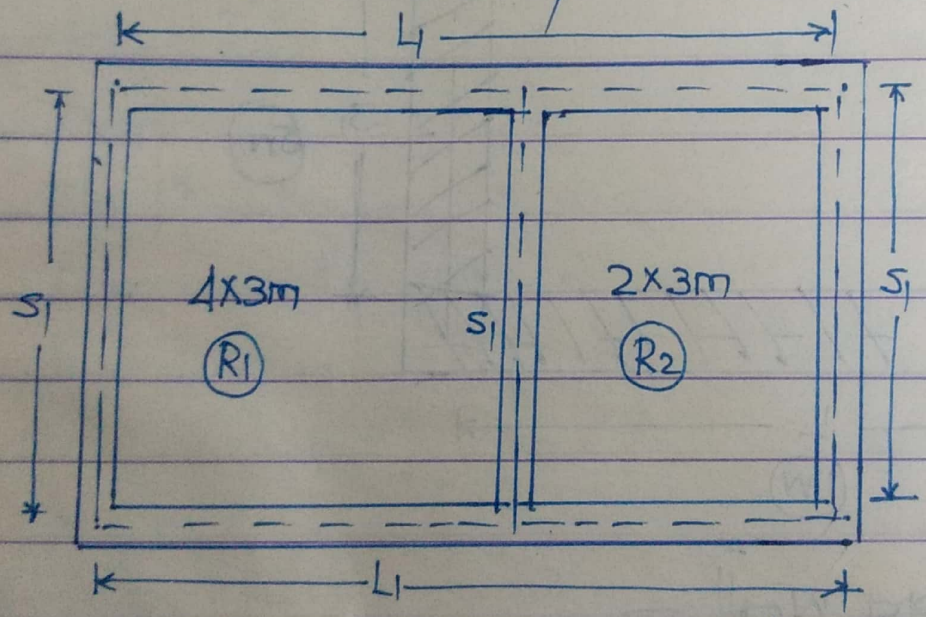
Q.1) Find the qty of following items of works from the plan given below.

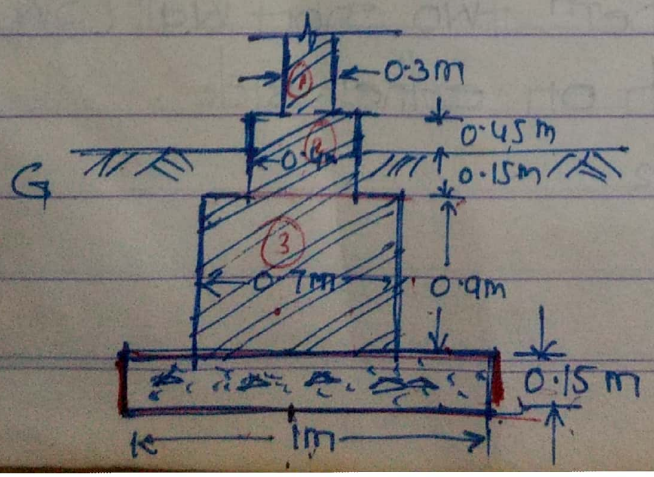
(a) Excavation for foundation.

(b) P.C.C 1:4:8 in foundation.

(c) IInd class brick masonary in C:M 1:6 in foundat

(d) IInd" brick masonary in C:M 1:6 in plinth.





c/c to c/c dist:-

For $L_1 = \frac{0.3}{2} + 4 + 0.3 + 2 + \frac{0.3}{2} = 6.6m$

For $S_1 = \frac{0.3}{2} + 3 + \frac{0.3}{2} = 3.3m$

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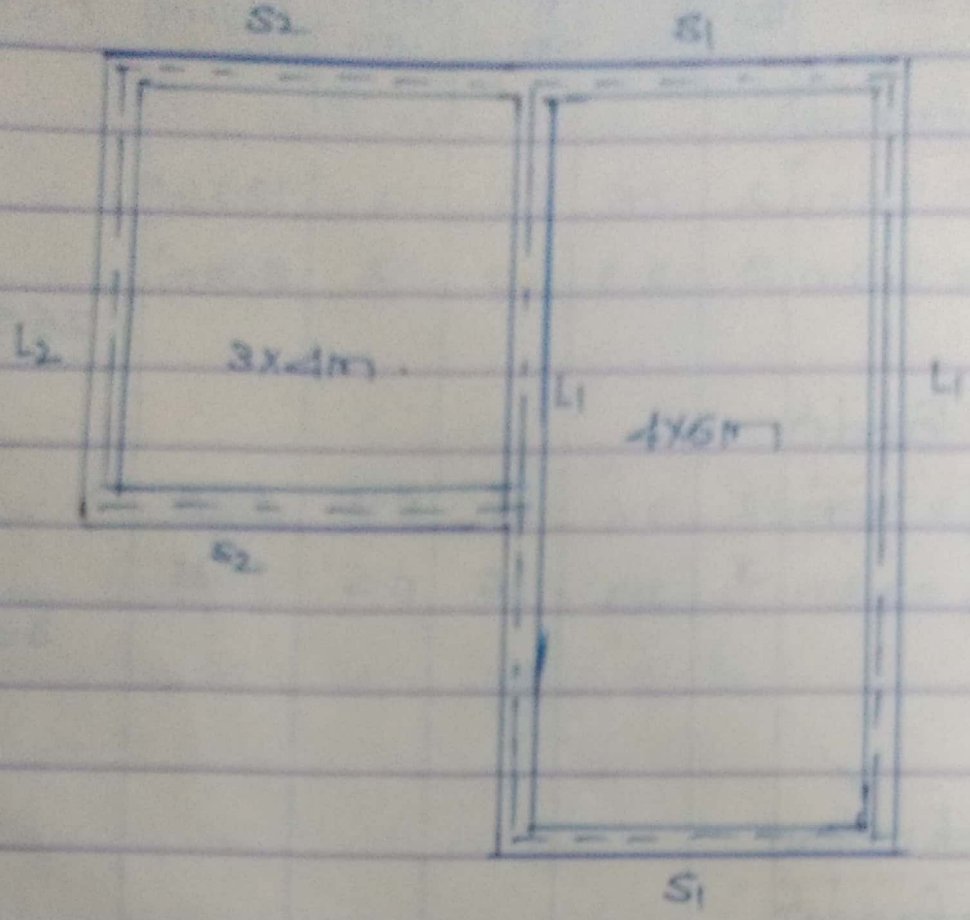
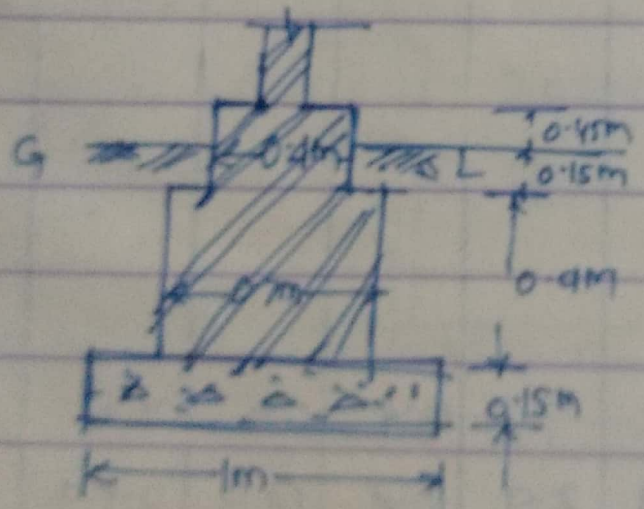
Measurement sheet

Item No	Description or particulars	Nos	L (m)	B (m)	H/D (m)	Qtys (m^3)	Total.
(1)	**Excavation for foundation**						
long wall	$L_1 = 6.6 + \frac{1}{2} + \frac{1}{2} = 7.6\,m$	2	7.6	1.0	1.2	$18.24\,m^3$	
short wall	$S_1 = 3.3 - \frac{1}{2} - \frac{1}{2} = 2.3\,m$	3	2.3	1.0	1.2	$8.28\,m^3$	
							$26.52\,m^3$
(2)	**P.C.C 1:4:8 in foundation**						
〃	$L_1 = 6.6 + \frac{1}{2} + \frac{1}{2} = 7.6\,m$	2	7.6	1.0	0.15	2.28	
〃	$S_1 = 3.3 - \frac{1}{2} - \frac{1}{2} = 2.3\,m$	3	2.3	1.0	0.15	1.035	
							$3.32\,m^3$
(3)	**IInd class brick masonary in C:M 1:6 in foundation**						
	$L_1 = 6.6 + \frac{0.7}{2} + \frac{0.7}{2} = 7.3\,m$	2	7.3	0.7	0.9	9.2	
	$S_1 = 3.3 - \frac{0.7}{2} - \frac{0.7}{2} = 2.6\,m$	3	2.6	0.7	0.9	4.91	
							$14.11\,m^3$
(4)	**IInd class brick masonary in C:M 1:6 in plinth.**						
	$L_1 = 6.6 + \frac{0.4}{2} + \frac{0.4}{2} = 7\,m$	2	7	0.4	0.6	3.36	
	$S_1 = 3.3 - \frac{0.4}{2} + \frac{0.4}{2} = 2.9\,m$	3	2.9	0.4	0.6	2.09	
							$5.45\,m^3$





centre to centre dist of :—

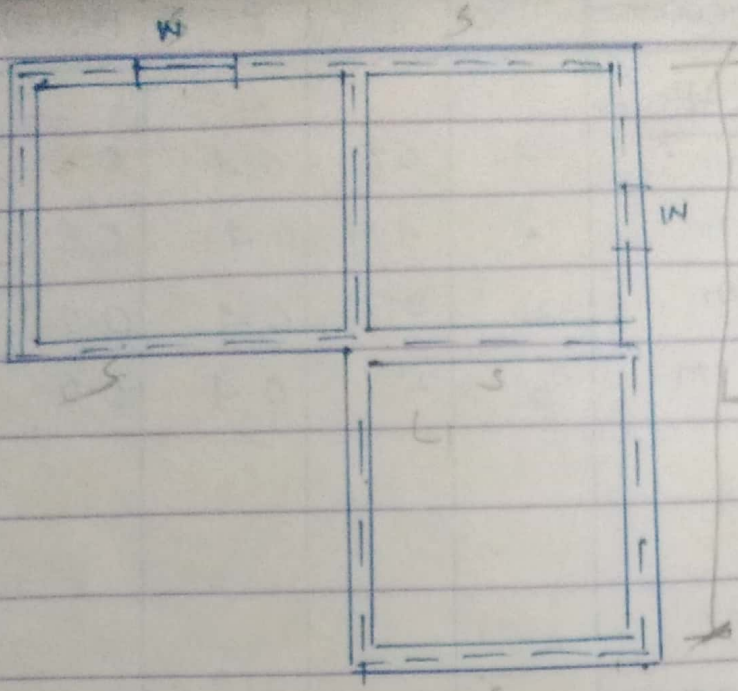
$L_1 = 0.3/2 + 6 + 0.3/2 = 6.3\,m$

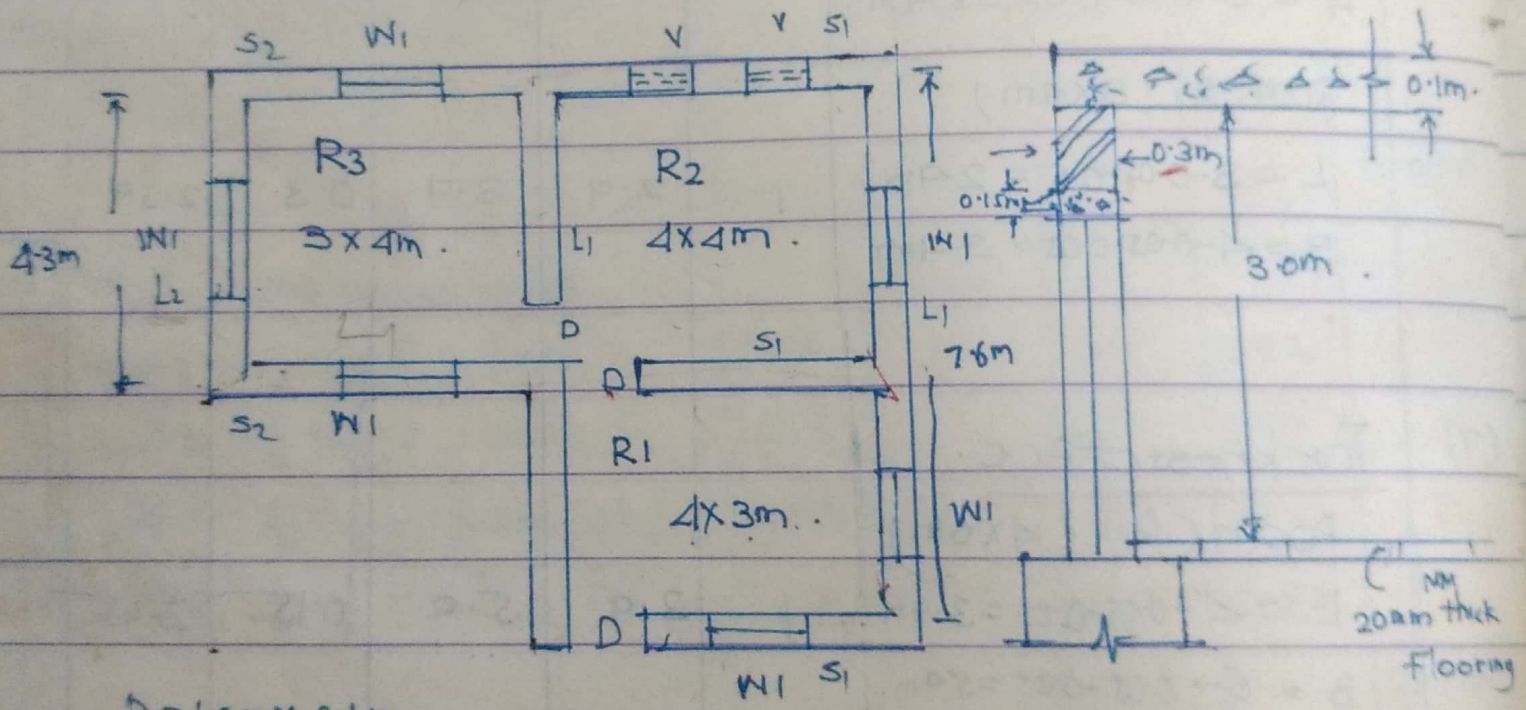
$L_2 = 0.3/2 + 4 + 0.3/2 = 4.3\,m$

$S_1 = 0.3/2 + 4 + 0.3/2 = 4.3\,m$

$S_2 = 0.3/2 + 3 + 0.3/2 = 3.3\,m$

Item NO	Description or perticular	NOs	L (m)	B (m)	H/D (m)	Qty (m^3)	Total
(1)	**Excavatn for foundatn**						
	$L_1 = 6.3 + \frac{1}{2} + \frac{1}{2} = 7.3m$	2	7.3	1	1.2	17.52	
	$L_2 = 4.3 + \frac{1}{2} + \frac{1}{2} = 5.3m$	1	5.3	1	1.2	6.36	
	$S_1 = 4.3 - \frac{1}{2} - \frac{1}{2} = 3.3m$	2	3.3	1	1.2	7.92	
	$S_2 = 3.3 - \frac{1}{2} - \frac{1}{2} = 2.3m$	2	2.3	1	1.2	5.52	
							37.32 m^3
(2)	**P.C.C 1:4:8 in foundatn**	2					
	$L_1 = 6.3 + \frac{1}{2} + \frac{1}{2} = 7.3m$	2	7.3	1	0.15	2.19	
	$L_2 = 4.3 + \frac{1}{2} + \frac{1}{2} = 5.3m$	1	5.3	1	0.15	0.80	
	$S_1 = 4.3 - \frac{1}{2} - \frac{1}{2} = 3.3m$	2	3.3	1	0.15	0.94	
	$S_2 = 3.3 - \frac{1}{2} - \frac{1}{2} = 2.3m$	2	2.3	1	0.15	0.69	
							4.67 m^3
(3)	**IInd class B.M in C:M 1:4 in F**						
	$L_1 = 6.3 + \frac{0.7}{2} + \frac{0.7}{2} = 7m$	2	7	0.7	0.9	8.82	
	$L_2 = 4.3 + \frac{0.7}{2} + \frac{0.7}{2} = 5m$	1	5	0.7	0.9	3.15	
	$S_1 = 4.3 - \frac{0.7}{2} - \frac{0.7}{2} = 3.6m$	2	3.6	0.7	0.9	4.54	
	$S_2 = 3.3 - \frac{0.7}{2} - \frac{0.7}{2} = 2.6$	2	2.6	0.7	0.9	3.28	
							19.78 m^3
(4)	**IInd class B.M in C:M 1:4 in Plth.**						
	$L_1 = 6.3 + \frac{0.4}{2} + \frac{0.4}{2} = 6.7$	2	6.7	0.4	0.6	3.22	
	$L_2 = 4.3 + \frac{0.4}{2} + \frac{0.4}{2} = 4.7$	1	4.7	0.4	0.6	1.13	
	$S_1 = 4.3 - \frac{0.4}{2} - \frac{0.4}{2} = 3.9$	2	3.9	0.4	0.6	1.87	
	$S_2 = 3.3 - \frac{0.4}{2} - \frac{0.4}{2} = 2.9$	2	2.9	0.4	0.6	1.39	
							7.61 m^3





D = 1.0m x 2.1m .

W1 = 0.9 x 1.2m .

V = 0.2 x 0.45m .

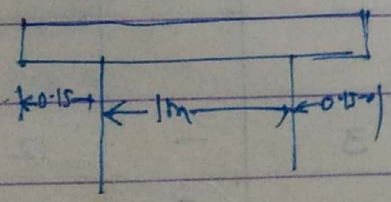
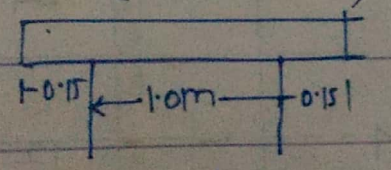
centre to centre dist :-

L_1 = 7.6m .

L_2 = 4.3m .

S_1 = 4.3m .

S_2 = 3.3m .

I+NO.	Description or perticulars	Nos	L(m)	B(m)	H/D	Qty	Total
(1)	**IInd class Bk work in super structure in C:M (1:5)**						
	$L_1 = 7.6 + \frac{0.3}{2} + \frac{0.3}{2} = 7.9m$	2	7.9	0.3	3.02	14.31	
	$L_2 = 4.3 + \frac{0.3}{2} + \frac{0.3}{2} = 4.6m$	1	4.6	0.3	3.02	4.17	
	$S_1 = 4.3 - \frac{0.3}{2} - \frac{0.3}{2} = 4.0m$	3	4.0	0.3	3.02	10.87	
	$S_2 = 3.3 - \frac{0.3}{2} - \frac{0.3}{2} = 3.0m$	2	3.0	0.3	3.02	5.44	
	Deductions:-						
(1)	Door opening (1X2.1m)	3	1	0.3	2.1	-1.89	
(2)	window opening (0.9mX1.2m)	6	0.9	0.3	1.2	-1.94	
(3)	ventilator (0.2X0.45m)	No deductn as per (IS1800)					
(4)	**Lintel**						
(a)	over door D(1X2.1m)	3	1.30	0.3	0.15	-0.18	
							
(b)	over window W(0.9X1.2m)	6	1.2	0.3	0.15	-0.32	
(c)	over ventilator V(0.2X0.45m)	2	0.5	0.3	0.15	-0.05	
							30.41 m³
(2)	**concreting:- (R.C.C work)**						
(a)	Lintel (over door)	3	1.3	0.3	0.15	0.18	
							
(b)	over window	6	1.2	0.3	0.15	0.32	
(c)	over ventilator	2	0.5	0.3	0.15	0.05	

Note:- ∴ Density of steel = 7850 kg/m³
= 78.5 qts/m³
= 7.85 t/m³.

∴ 1m³ = 78.50 qts.

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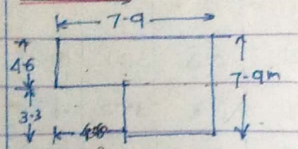
I.t.NO	Description or particular	NO	L(m)	B(m)	H/D	Qty	Total
(3)	**Slab:-**						
		1	7.9	7.9	0.1	6.24	
		1	3.3	4.6 3.3	0.1	-1.51	
							4.72m³
	Deduction.						5.15
(4)	**Reinforcement**						
	= % of volⁿ of concrete x qty of steel x density of steel						
	= $\frac{1}{100} \times 4.72 \times 78.5$						
	= 3.705 Quintals.						3.705 qts.
(5)	**Internal plaster**						
	R_1 = 4x3m.						
(a)	ceiling =	1	4	3	—	12	
(b)	Wall L_1 = 4m	2	4	—	3	24	
	L_2 = 3m.	2	3	—	3	18	
	R_2 = 4x4m.						
(a)	ceiling =	1	4	4	—	16	
(b)	Wall L_1 = 4m.	2	4	—	3	24	
	L_2 = 4m	2	4	—	3	24	
	R_3 = 3x4m.						
(a)	ceiling =	1	3	4	—	12	
(b)	Wall L_1 = 3M	2	3	—	3	18	
	L_2 = 4 M	2	4	—	3	24	

I.t.NO	D
	D
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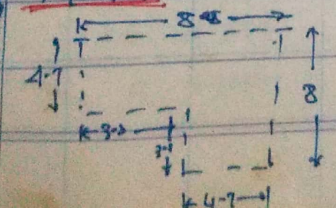
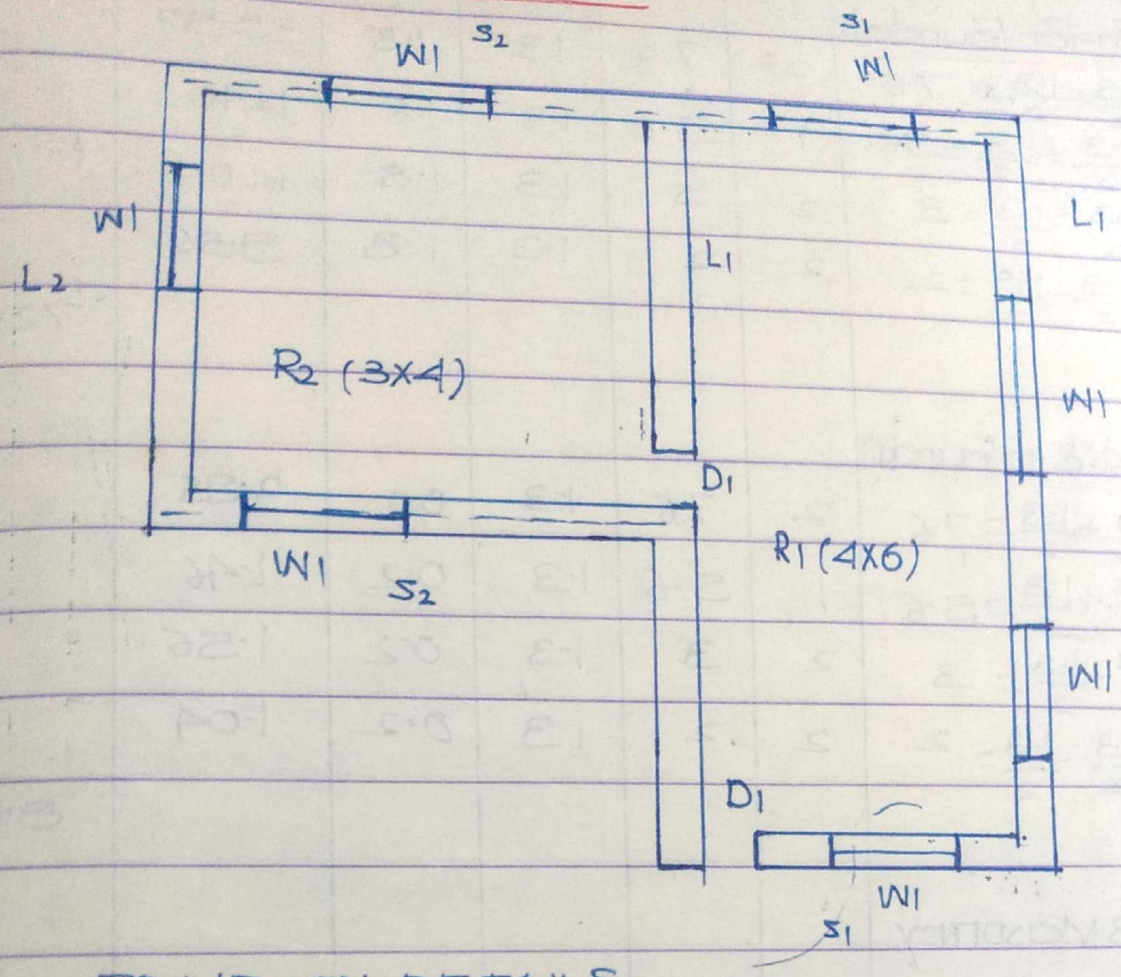
	∴
(6)	E
(a)	
(b)	
(c)	
	1.72m3

If NO	Description or particular	NO	L(m)	B(m)	H/D	Qty	Total
	Deductions:-						
	For Doors	2 1/2	1.0	-	2.1	-5.25	
	For windows:	6 1/2	0.9	-	1.2	-3.24	
							-8.49m³
	∴ Total Qts of inner plaster = 172 - 8.49 = 163.51 m³.						
(6)	External plaster:-						
	Superstructure.						
(a)	Front wall of R1 & R2.						
	l = 4.6m.	1	4.6	-	3.12	14.25	
	H = 0.1 + 3.0 + 0.02 = 3.12						
(b)	R.H.S wall of R1 & R2	1	7.9	-	3.12	24.64	
	l = 7.9m.						
(c)	Rare wall of R1 & R2.	1	7.9	-	3.12	24.64.	
	l = 7.9m.						
(d)	L.H.S wall of R3.	1	4.6	-	3.12	14.25	
	l = 4.6						
(e)	Front wall of R2	1	3.3	-	3.12	10.29	
	l = 3.3						
(f)	wall of R1	1	3.3	-	3.12	10.29	
							98.36
(7)	Plinth :-						

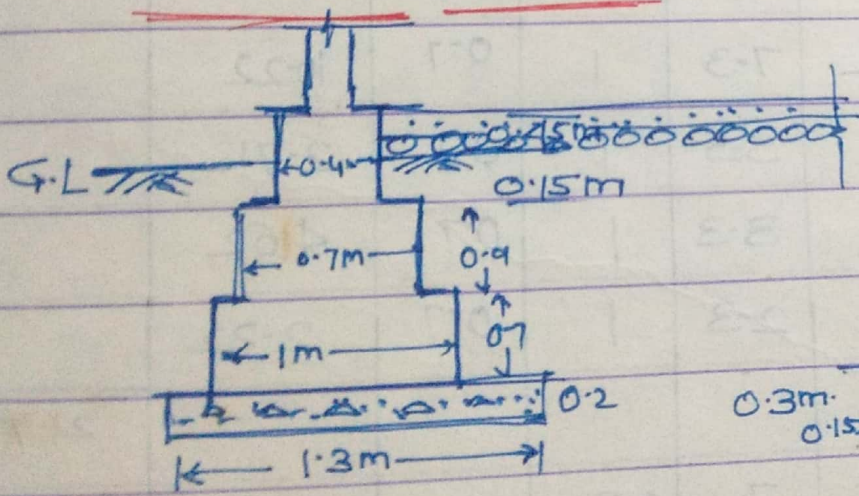


T.NO	Description or perticular	No	L(m)	B(m)	H/D	Qty	total
	L = 4.7+8+8+4.7+3.3+3.3 L = 32m. H = 0.45+0.05+0.05 H = 0.55m.	1	32	–	0.55	17.6	
	Deductions :–						
	For Doors	1x1/2	1.0	–	2.1	1.05	
	For windows	6x1/2	0.9	–	1.2	3.24	
	∴ Total = 17.6 - 4.29 =	12.31 m^3					
(8)	**Flooring :–**						
	R1 (4x3m)	1	4	3	–	12	
	R2 (4x4m)	1	4	4	–	16	
	R3 (3x4m)	1	3	4	–	12	
	Add Door opening D = (1.0x2.1)	3	1.0	0.3	2.1	0.9	40.9 m^2
9)	**Painting :–**						
	Distamper to inner wall.	SAME AS IN ITEM NO (5)					163.51 m^2.
	Snowsam to outer wall	SAME AS IN ITEM NO (6)					98.36 m^2.

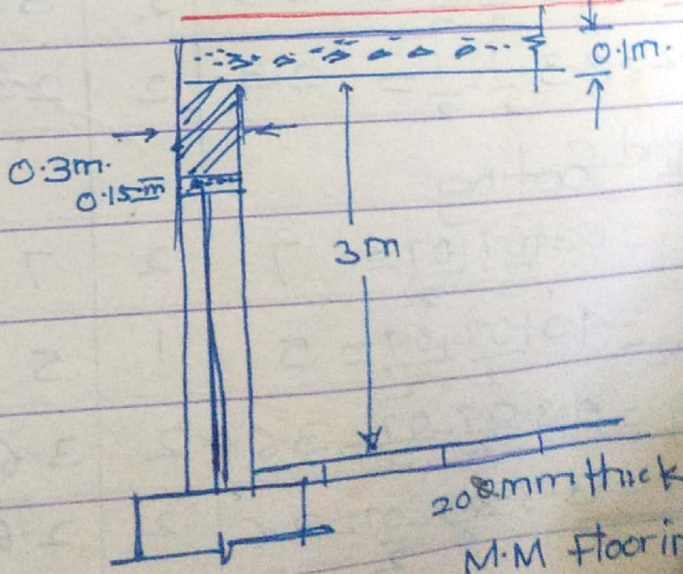
PLAN



FOUNDATN DETAILS.



SUPERSTRUCTURE DETAI



C.C dist:-

$L_1 = 6.3m.$

$L_2 = 4.3m.$

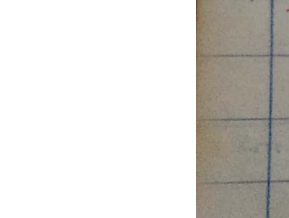
$S_1 = 4.3m.$

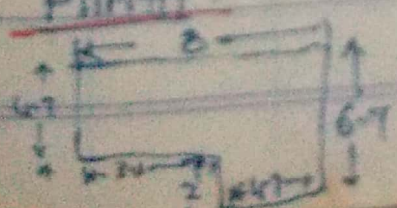
$S_2 = 3.3m.$

S.NO	Description	NO	L(m)	B(m)	H/D	Qty	Total
(1)	**Excavatn for foundatn**						
	$L_1 = 6.3 + \frac{1.3}{2} + \frac{1.3}{2} = 7.6$	2	7.6	1.3	1.8	35.57	
	$L_2 = 4.3 + \frac{1.3}{2} + \frac{1.3}{2} = 5.6$	1	5.6	1.3	1.8	12.10	
	$S_1 = 4.3 - \frac{1.3}{2} - \frac{1.3}{2} = 3$	2	3	1.3	1.8	14.04	
	$S_2 = 3.3 - \frac{1.3}{2} - \frac{1.3}{2} = 2$	2	2	1.3	1.8	9.36	
							72.07 m³
(2)	**P.C.C in 1:4:8 in foundn**						
	$L_1 = 6.3 + \frac{1.3}{2} + \frac{1.3}{2} = 7.6$	2	7.6	1.3	0.2	2.95	
	$L_2 = 4.3 + \frac{1.3}{2} + \frac{1.3}{2} = 5.6$	1	5.6	1.3	0.2	1.46	
	$S_1 = 4.3 - \frac{1.3}{2} - \frac{1.3}{2} = 3$	2	3	1.3	0.2	1.56	
	$S_2 = 3.3 - \frac{1.3}{2} - \frac{1.3}{2} = 2$	2	2	1.3	0.2	1.04	
							8.01 m³
3)	**IIrd class B.B Masonry**						
	1st footing						
	$L_1 = 6.3 + \frac{1}{2} + \frac{1}{2} = 7.3$	2	7.3	1	0.7	10.22	
	$L_2 = 4.3 + \frac{1}{2} + \frac{1}{2} = 5.3$	1	5.3	1	07	2.71	
	$S_1 = 4.3 - \frac{1}{2} - \frac{1}{2} = 3.3$	2	3.3	1	07	4.62	
	$S_2 = 3.3 - \frac{1}{2} - \frac{1}{2} = 2.3$	2	2.3	1	07	2.22	
							21.77 m³
	IInd footing						
	$L_1 = 6.3 + \frac{0.7}{2} + \frac{0.7}{2} = 7$	2	7	0.7	0.9	3.82	
	$L_2 = 4.3 + \frac{0.7}{2} + \frac{0.7}{2} = 5$	1	5	07	0.9	2.15	
	$S_1 = 4.3 - \frac{0.7}{2} - \frac{0.7}{2} = 3.6$	2	3.6	07	0.9	4.54	
	$S_2 = 3.3 - \frac{0.7}{2} - \frac{0.7}{2} = 2.6$	2	2.6	0.7	0.9	2.28	
							19.78 m³

DATE / /

S#NO	Descriptn.	NO	L(m)	B(m)	H/D	Qty	Total
(4)	**IInd class Brick for plinth**						
	$L_1 = 6.3 + 0.6 = 6.9$	2	6.9	0.4	0.6	2.31	
	$L_2 = 4.3 + 0.6 = 4.9$	1	4.9	0.4	0.6	1.18	
	$S_1 = 4.3 - 0.6 = 3.7$	2	3.7	0.4	0.6	1.78	
	$S_2 = 3.3 - 0.6 = 2.7$	2	2.7	0.4	0.6	1.30	
							$7.56\ m^3$
(5)	**soling :—**						
	R_1 (4x6m)						
	$L = 4 - 0.05 - 0.05 = 3.9$	1	3.9	5.9	0.3	7.90	
	$B = 6 - 0.05 - 0.05 = 5.9$						
	R_2 (3x4m)						
	$L = 3 - 0.05 - 0.05 = 2.9$	1	2.9	3.9	0.3	2.39	
	$B = 4 - 0.05 - 0.05 = 3.9$						$11.30\ m^3$
(6)	**Thickness of P.C.C**						
	R_1 (4x6m)						
	$L = 3.9$	1	3.9	5.9	0.15	2.45	
	$B = 5.9$						
	R_2 (3x4m)						
	$L = 2.9$	1	2.9	3.9	0.15	1.70	
	$B = 3.9$						$5.15\ m^3$

I/No	Descriptn.	No	L(m)	B(m)	H/D	Qty	Total
(7)	IInd class B.B in superstructure.						
	$L_1 = 6.3 + \frac{0.3}{2} + \frac{0.3}{2} = 6.6$	2	6.6	0.3	3.02	11.95	
	$L_2 = 4.3 + \frac{0.3}{2} + \frac{0.3}{2} = 4.6$	1	4.6	0.3	3.02	4.16	
	$S_1 = 4.3 - \frac{0.3}{2} - \frac{0.3}{2} = 4$	2	4	0.3	3.02	7.24	
	$S_2 = 3.3 - \frac{0.3}{2} - \frac{0.3}{2} = 3$	2	3	0.3	3.02	5.43	
	Deductions :—						
	Door opening (1 x 2.1m)	2	1	0.3	2.1	−1.26	
	window opening (0.9x1.2)	7	0.9	0.3	1.2	−2.26	
							25.26 m^3
(8)	Lintel :—						
	over door D(1x2.1)	2	1.30	0.3	0.15	−0.11	
	over window (0.9x1.2)	7	1.2	0.3	0.15	−0.27	
							0.48 m^3
(9)	concreting :—						
	Lintel(overdoor)	2	1.3	0.3	0.15	0.117	
	over window.	7	1.2	0.3	0.15	0.278	
							0.49 m^3
(10)	Slab						
		1	7.9	6.6	0.1	5.21	
	Deduct	1	2	3.3	0.1	−0.66	
							4.55 m^3
(11)	Reinforcement.						
	$\frac{1}{100} \times 4.55 \times 78.5$						
	= 3.57 Qts.						

S.No	Description	NOS	LENGTH	BREADTH	HEIGHT	QTY	Total
(12)	**Internal plaster:**						
	R_1 = 4x6m.						
	ceiling	1	4	6	-	24	
	wall L_1 = 4 m	2	4	-	3	24	
	L_2 = 6 m	1	6	-	3	18	
	R_2 = 3x4m.						
	ceiling	1	3	4	-	12	
	wall L_1 = 3	2	3	-	3	18	
	L_2 = 4	1	4	-	3	12	
							108m²
	Deduction:-						
	Doors (1.0x2.1)	1½	1	-	2.1	2.15	
	Windows (0.9x1.2)	7½	0.9	-	1.2	8.1	
							37.75m²
	∴ Total Qty of inner plaster = 37.75 m².						
(13)	**External plaster:-**						
	superstructure						
	Front wall R_1&R_2 l=4.6m	1	4.6	-	3.12	14.25	
	H = 0.1 + 3.0 + 0.02 = 3.12	1	6.6	-	3.12	20.59	
	Rhs wall of R_1&R_2 l=6.6m						
	Lhs wall of R_2	1	4.6	-	3.12	14.25	
	FRONT WALL OF R_2	1	2	-	3.12	6.24	
	WALL OF R_1	1	3.3	-	3.12	10.29	
							65.62m²
(14)	**Plinth:** 	1	29.5		0.55		

IT NO	Description	NO	L(m)	B(m)	H/D	Qty	Total
	Deduction :—						
	For door (1.0 x 2.1 m)	1 x 1/2	1	—	2.1	1.05	
	For window (0.9 x 1.2 m)	7 x 1/2	0.9	—	1.2	3.78	
	∴ Total Qty for plinth =		11.39 m^3.				
(15)	Flooring :—						
	R_1 = 4 x 6 m	1	4	6	—	24	
	R_2 = 3 x 4 m	1	3	4	-	12	
	Add Door opening	2	1.0	0.3		0.6	
	D = (1.0 x 2.1)						36.6 m^3.
(16)	Painting :—						
	Distemper :—	SAME AS IN IT NO :- (12)					97.75 m^3
	3 row 3 cm to outer -wall	SAME AS IN IT NO :- (13)					62.62 m^3

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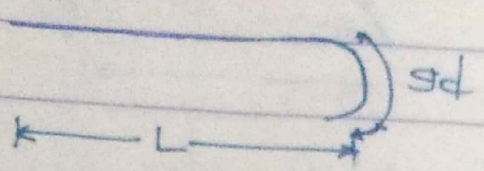
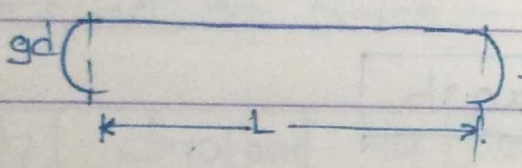
REINFORCEMENT

(1) straight bar with one end hooked.



$l = L + 9d$ Where L = Effective length
$= 0.L - covers.$
d = dia of bar.

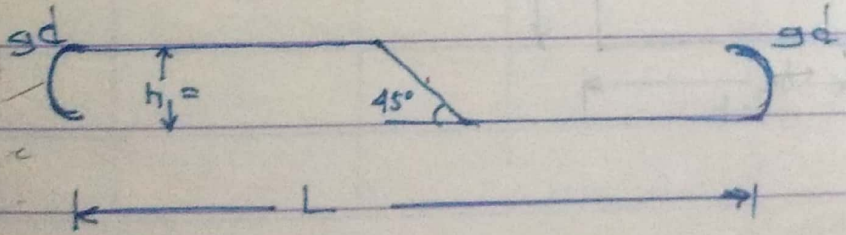
(2) straight bar with two end hooked.

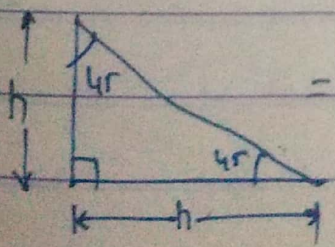


$l = L + 18d$

(3) Bent up bar. (crank bar)

(a) single bent up bar



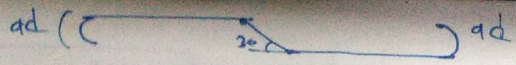


$= \sqrt{2h^2}$
$= 1.414h.$

$1.414 - 1h = 0.414h$
$= 0.42h.$

$l = L + 18d + 0.42h$

h = Effective depth.
$= 0.D - cover.$



$l = L + 18d + 0.3h$

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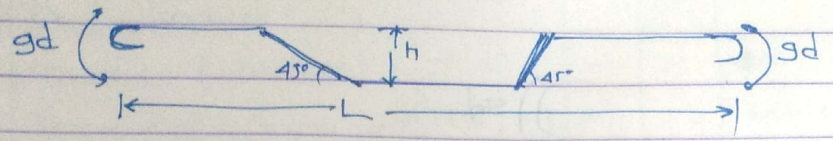
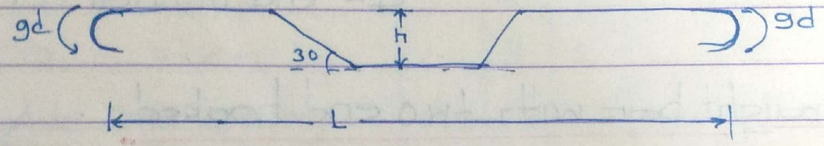
(b) Double bent up bar:-



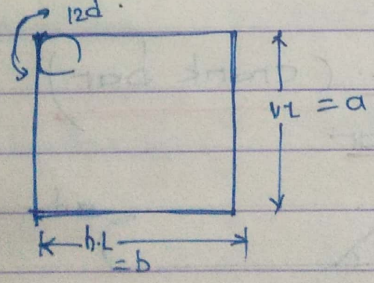
$l = L + 18d + 2 \times 0.42h$

$\boxed{l = L + 18d + 2 \times 0.42h}$



$\boxed{l = L + 18d + 2 \times 0.3h}$

(4) Stirrups.



$l = 2V \cdot L + 2 \cdot H \cdot L + 24d$

$l = 2a + 2b + 24d$

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STANDARD FOR IM LENGTH OF BAR

Dia of bar in (mm)	Wt of bar (kg/m)
6	0.22
8	0.39
10	0.62
12	0.89
16	1.58
20	2.47

scheduled of bars:—

I-No	Descriptn	dia of bar (mm)	Nos	Total length (m)	wt of bar kg/m.	Qty (kg)

4) R.C.C beam 5000mm x 300mm x 450mm based following reinforcement details. (8 marks)

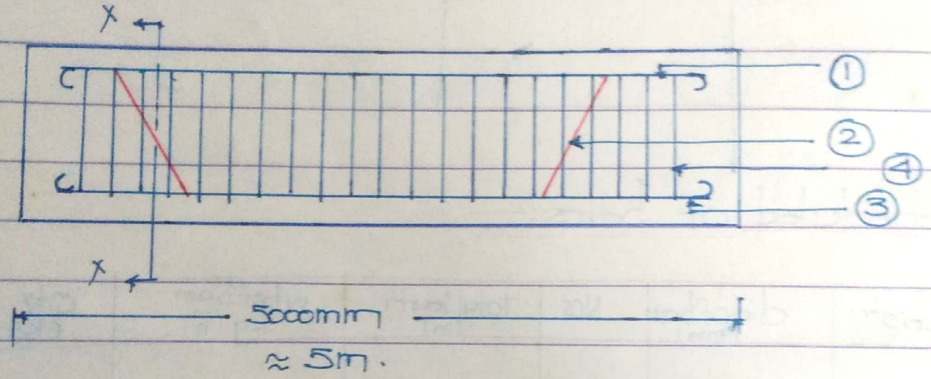
(1) Nominal bars :- 10mm ϕ :- Nos :-2

(2) Main bars :- 16 mm ϕ :- No :-3 of which one bentup at

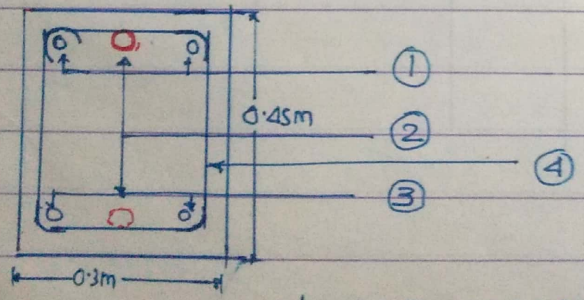
(3) stirrups :- 6mm ϕ :- at 200mm c/c.

(4) All round cover :- 25mm

Calculate the qty of steel & prepair a scheduled of bar.



L-SECTION



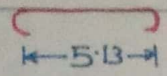
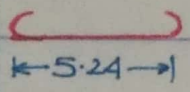
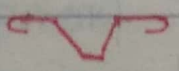
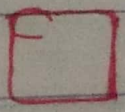
C/S @ SECTION AT XX

Where :- (1) Nominal bar (Anchor bar) 10mm ϕ No :-2

(2) Main bar (Bent up bar) 16mm ϕ No :-2

(3) Main bar (Bottom straight) 16mm ϕ No :-1

(4) stirrups 16mm ϕ at 200mm c/c.

I# NO	Description	Shape of Bar.	d(mm)	Nos	L(m)	Wt (kg/m)	Qty.
(1)	**Nominal bar :-**		10	2	5.13	0.62	6.361
	10mmϕ :- 2 NOs.						
	$l = L + 18d$.						
	$l = (5 - 2 \times 0.025) + 18(0.01)$						
	$l = 5.13m$.						
(2)	**Main bar :-**						
	16mmϕ :- 3NOs:-						
(a)	**Bottom straight.**						
	16mmϕ :- 2NOs		16	2	5.24	1.58	16.558
	$l = L + 18d$.						
	$l = (5 - 2 \times 0.025) + 18(0.016)$						
	$l = 5.24m$.						
(b)	**Bent up bars:-**						
	16mmϕ & 1NO		16	1	5.57	1.58	8.807
	$l = L + 18d + 0.42h$						
	$l = (5 - 2 \times 0.025) + 18(0.016) + 0.42 \times 2 \times h$						
	$l = 5.24 + 0.42 \times 2 \times (0.025 \times 2 - 0.45)$						
	$l = 5.24 + 0.326$						
	$l = 5.576m$.						
(3)	**Stirrups :- 6mmϕ @200c/c**		6	26	1.44	0.22	8.237
	$l = 2V.L + 2H.L + 24d$.						
	$V.L = 0.45 - 2 \times 0.025 = 0.4m$.						
	$H.L = 0.3 - 2 \times 0.025 = 0.25m$.						
	$l = 2 \times 0.4 + 2 \times 0.25 + 24 \times 0.006$						
	$l = 1.44$.						

No of stirrups:-

$= \frac{\text{Span}}{\text{spacing}} + 1$

$= \frac{4.95}{200} + 1$

$= 0.2$

$= 25.75$

$= 26.$

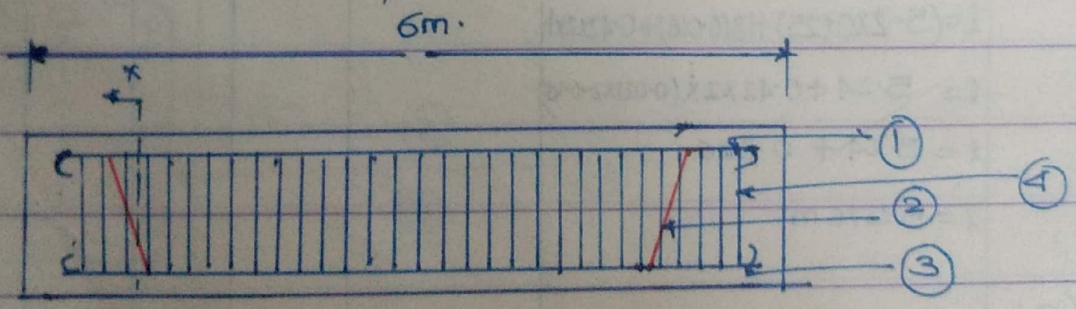
∴ Total qty of steel used = 39.963 kg.

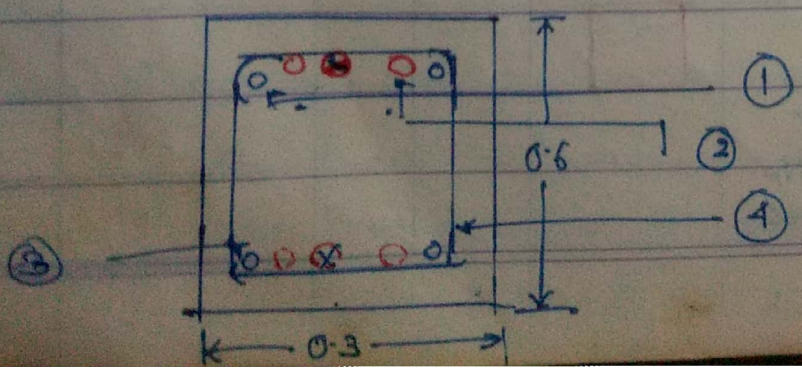
= 0.399 quintals.

= 0.039 tonnes.

(12) A RCC beam 6m x 0.3m x 0.6m is reinforced with two anchor bars of 10mm ϕ. It has 5 main bars of 20mm ϕ of which two are bent up at support. Stirrups of 8mm ϕ are provided at 180mm c/c. Calculate the quantity of steel. All round cover is 25mm.

Sol^n:-





Where:-

① Anchor bars 10mm ϕ.

② Main bar (bent up) 20mm ϕ 2 Nos

③ Main bar (Bottom straight) 20mm ϕ 3 NOS.

④ Stirrups 8mm ϕ 180mm c/c

For cover.
Beam & lintel ⟩ 25mm
slab ⟩ 15mm.
Footing ⟩ 40mm.

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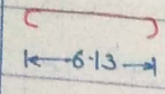
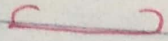
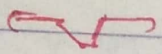
S.No	Description	shape	dia(m)	Nos	L(m)	Wt(kg/m)	Qty.
(1)	**ANCHOR BAR.**		10mm	2	6.13	0.62	7.601 kg
	$l = L + 18d$						
	$= (6 - 2\times0.025) + 18(0.01)$						
	$= 5.95 + 0.18$						
	$= 6.13$ m						
(2)	**Main bar :–**						
(a)	**Bottom straight:**		20mm	3	6.31	2.47	46.757
	$l = L + 18d$						
	$l = (6 - 2\times0.025) + 18(0.02)$						
	$l = 6.31$ m						
(b)	**Bent up**		20mm	2	6.77	2.47	33.442
	$l = L + 18d + 0.42h$						
	$l = (6 - 2\times0.025) + 18(0.02) + 0.42(0.6 - 2\times0.025)$						
	$l = 6.31 + 0.46$						
	$l = 6.77$						
(3)	**stirrups**		8mm	35	1.79	0.39	24.432
	$l = 2\cdot V\cdot L + 2\cdot H\cdot L + 24d$						
	$V\cdot L = 0.6 - 2\times0.025 = 0.55$						
	$H\cdot L = 0.3 - 2\times0.025 = 0.25$						
	$\therefore l = 2\times0.55 + 2\times0.25 + 24\times(0.008)$						
	$l = 1.1 + 0.5 + 0.192$						
	$l = 1.79$						

No of stirrups $= \frac{5.95}{0.180} + 1$

$= 34.05$

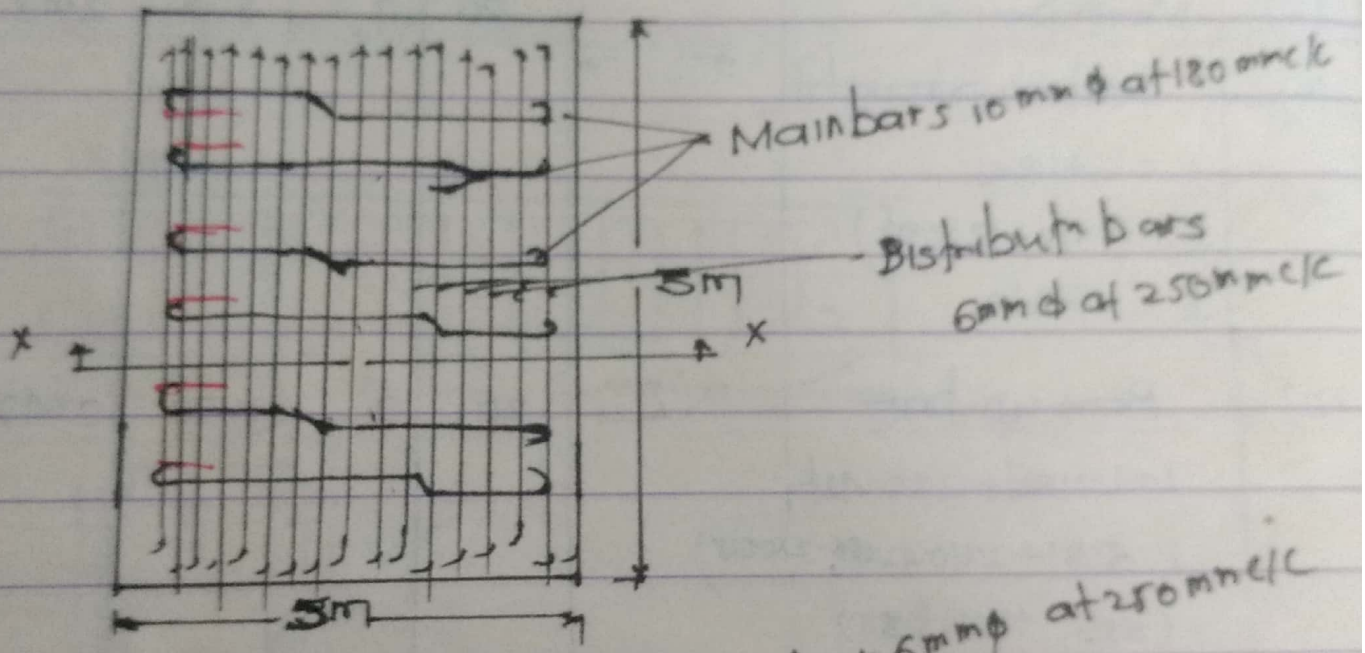
$\therefore$ Total Qty = 112.233 kg = 1.123 Quintals = 0.112 tonnes

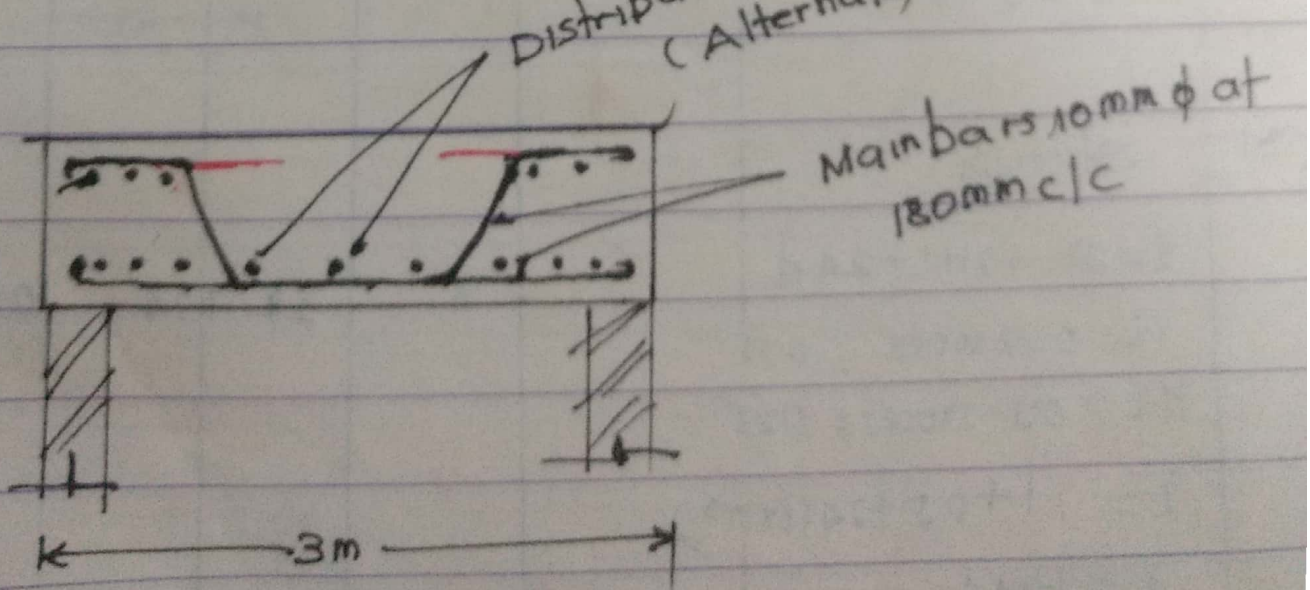
Q) A R.C.C slab 3m x 5m has the following reinforcement details:

(1) Main bars 10mm ϕ at 180mm c/c alternately bent
(2) Destribution bar 6mm ϕ at 250mm c/c
(3) slab thickness 100mm.
(4) All round cover 15mm.

calculate the quantity of steel.

Soln:-





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#NO	Descripto	shape	d(mm)	NO	L(m)	wt(kg/m)	Qty
(1)	Main bars		10	29	3.18	0.62	57.196

10mm ϕ @ 180mm c/c Alternalty bent up.

$l = L + 18d + 0.42h$

$l = (3 - 2 \times 0.015) + 18(0.01) + 0.42h$

$l = 2.97 + 0.18 + 0.42(0.1 - 2 \times 0.015)$

$l = 2.97 + 0.18 + 0.42(0.07)$

$l = 3.184$

No of bars

$\frac{\text{span}}{\text{spacing}} + 1$

$= \frac{(5 - 2 \times 0.015)}{0.180} + 1$

$= 28.61$

$\approx 29.$

Distribution bar:

$l = L + 18d$

$= (5 - 2 \times 0.015) + 18 \times 0.05$

$= 5.08$

6	21	5.08	0.22	23.470 kg.	

$\frac{(3 - 2 \times 0.015)}{0.25} + 1$

$= 13$ Nos

$= 13 + 8 = 21$ Nos

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(3) Extra top: ——— 10 29 0·84 0·62 15·103

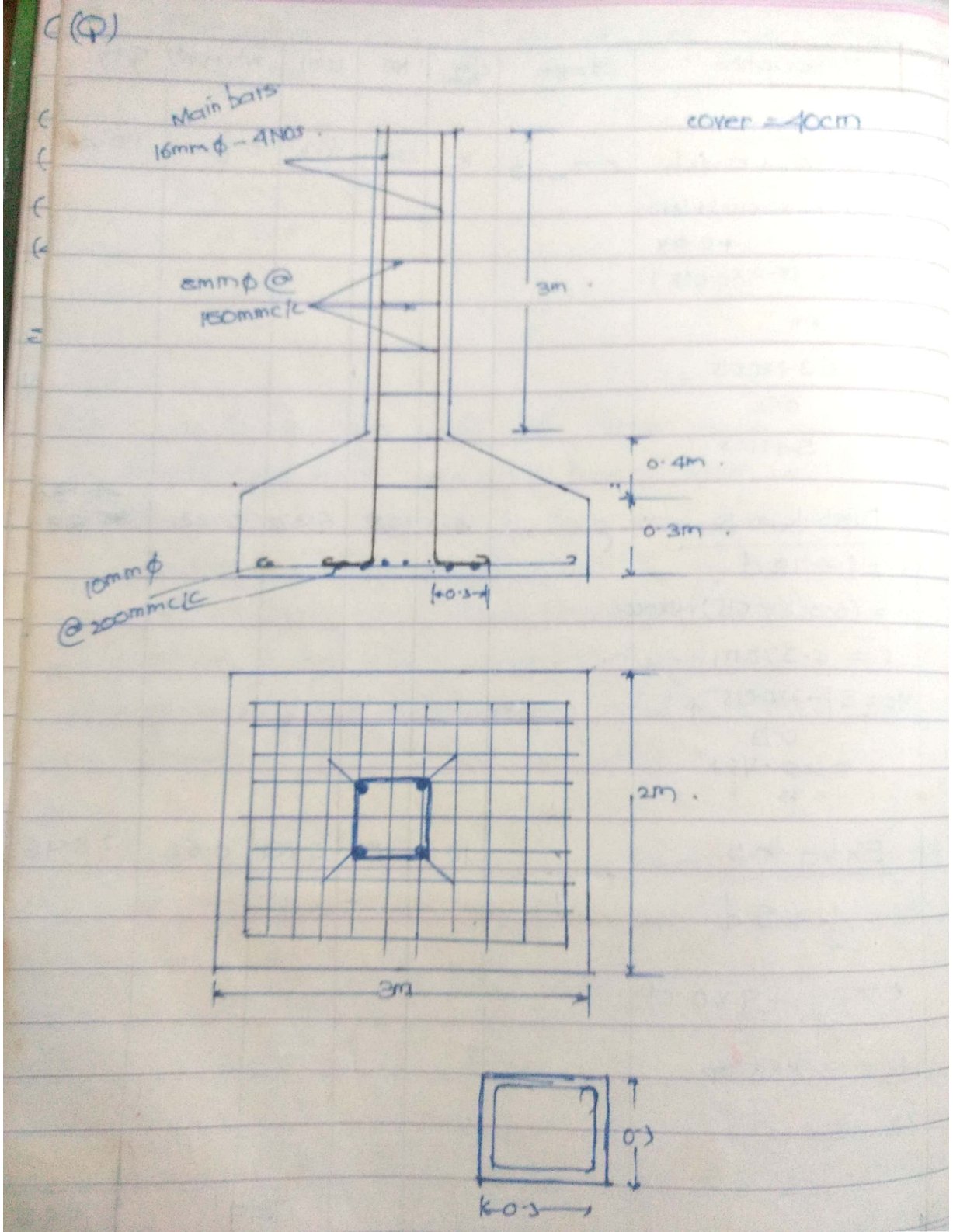
$l = \frac{L}{4} + 9d$

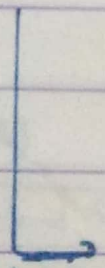
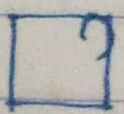
$l = (\frac{3}{4} - 0.15) + 9(0.010)$

$= 0.735 + 0.090$

$= 0.825$.

(Q)



I/No	Description	shape	dia (mm)	L (m)	NO	wt (kg/m)	Qty
(1)	**Footing Mesh.**						
	Main bars :- 10mm ϕ @ 200mm c/c	⟷	10	3.1	11	0.62	21.142
	(a) Long span :-						
	$l = L + 18d$						
	$= (3 - 2\times0.04) + 18\times0.01$						
	$l = 3.1$ m.						
	$Nos = \frac{2 - 2\times0.04}{0.2} + 1$						
	$= 11$ Nos						
	(b) smaller span :-		10	2.1	16	0.62	20.832
	$l = L + 18d$						
	$= (2 - 2\times0.04) + 18\times0.01$						
	$l = 2.1$ m						
	$NO = \frac{3 - 2\times0.04}{0.2} + 1$						
	$= 16$ Nos						
(2)	**columns :-**						
	Main bars :- 16mm ϕ - 4 Nos		16	4.05	4	1.58	25.628
	$l = V.L + H.L$						
	$V.L = (3.7 - 0.025 - 0.04 + 0.01 - 0.01)$						
	$= 3.61$ m.						
	$H.L = L + 9d$.						
	$= 0.3 + 9\times0.016$						
	$= 0.44$ m.						
	$l = 4.05$ m.						
(3)	Lateral ties :- (stirrups)		8	1.79	26	0.39	12.05
	$l = 2V.L + 2H.L + 24d$						
	$V.L = (3.4 - 2\times0.025) = 3.35$						
	$H.L = 0.3 - 2\times0.025 = 0.25$						
	$l = 7.9$ m						

Total Qty = 79.64 kg

Scanned by CamScanner

V.L = 0.3 - 2 X 0.025

= 0.25

H.L = 0.3 - 2 X 0.025

= 0.25

$$\text{Nos} = \frac{\text{V.L of col/m}}{\text{spacing}} + 1$$

$$= \frac{3.615}{0.15} + 1$$

= 25.100

= 26 Nos

EARTH WORK.

Methods of calculating earth works.

(1) Mid section formula.

(2) Mean sectional area method

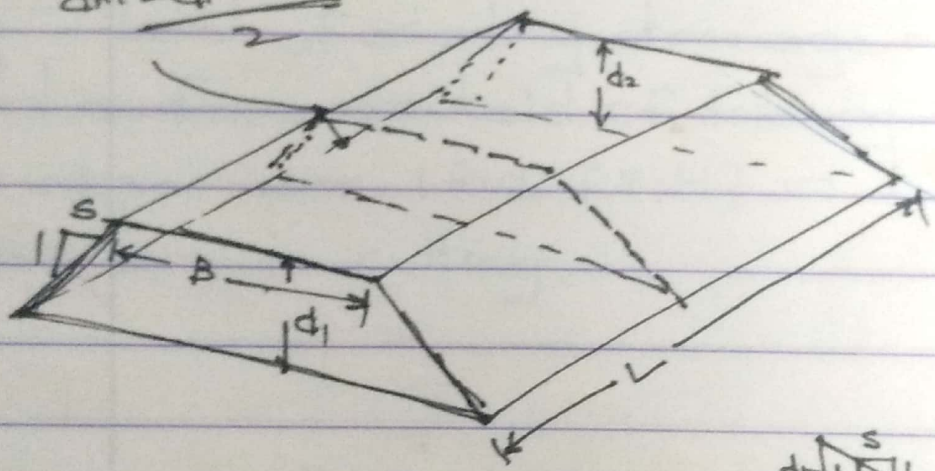
or

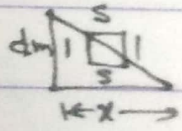
Trapezoidal formula.

(3) Prismoidal formula.

(1) Mid sectional formula:—

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

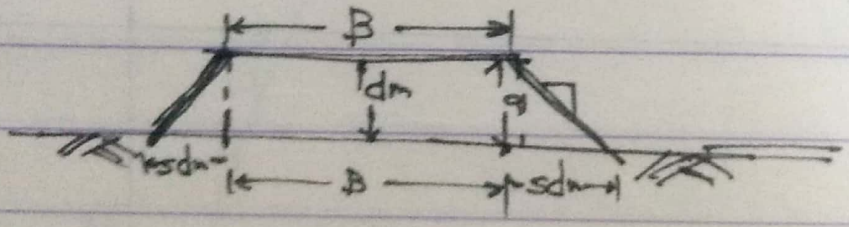




$1 = S$

$dm = x$

$\boxed{x = S \times dm}$



Qty of earth work = Mean c/s area x L

$= (B \times dm) + (\frac{1}{2} \times sdm \times sdm)$

$\boxed{\text{Qty of earth work} = (Bdm + sdm^2) \times L}$

(1) calculate the quantity of earth work in cutting & banking for a portn of road having Length 120m, with following data

chainage (m)	0	20	40	60	80	100	120
G.L (m)	51.1m	50.9m	50.6m	51.3m	51.8m	52.1m	52.3m

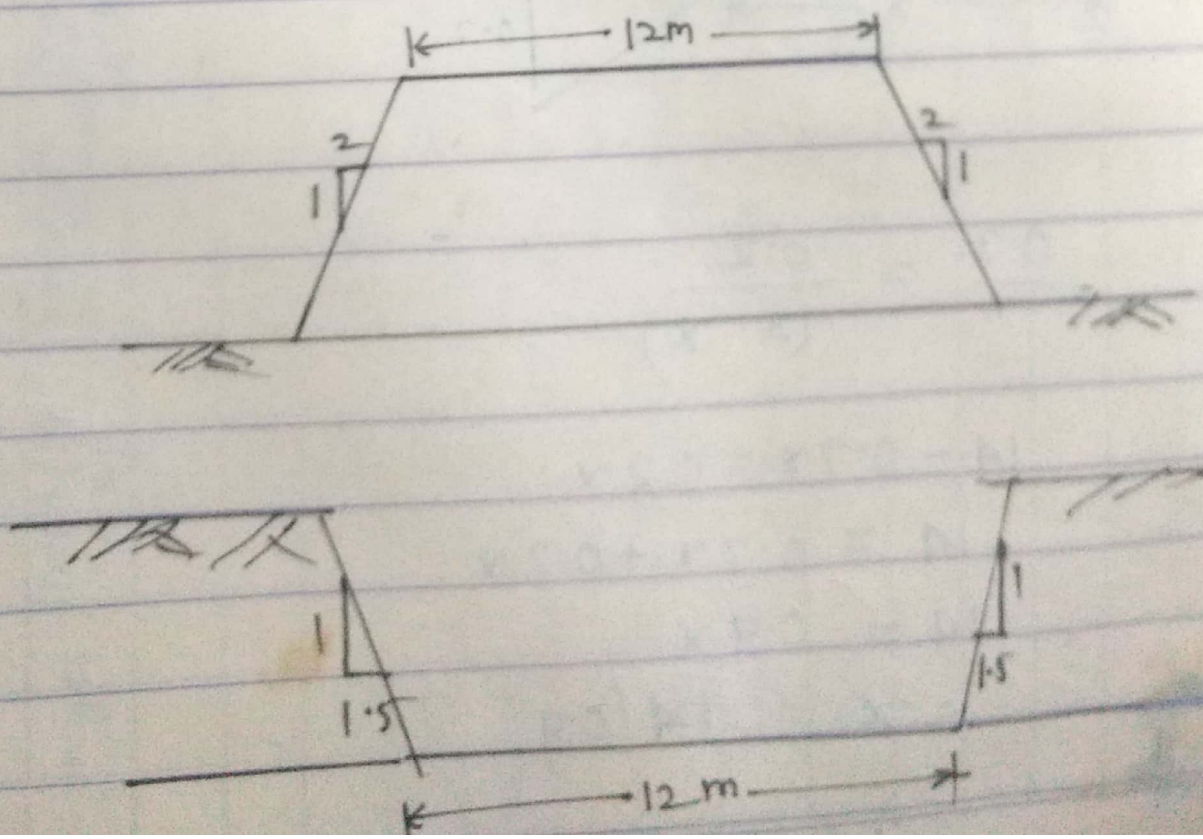
Formatn Width = 12m.

Level of starting chainage = 51.7m.

Road

Ground surface are held of following gradient 1 in 100 sides slopes are 1 in 2 (V:H) in banking & 1 in 1.5 (V:H) in cutting.

Soln:-



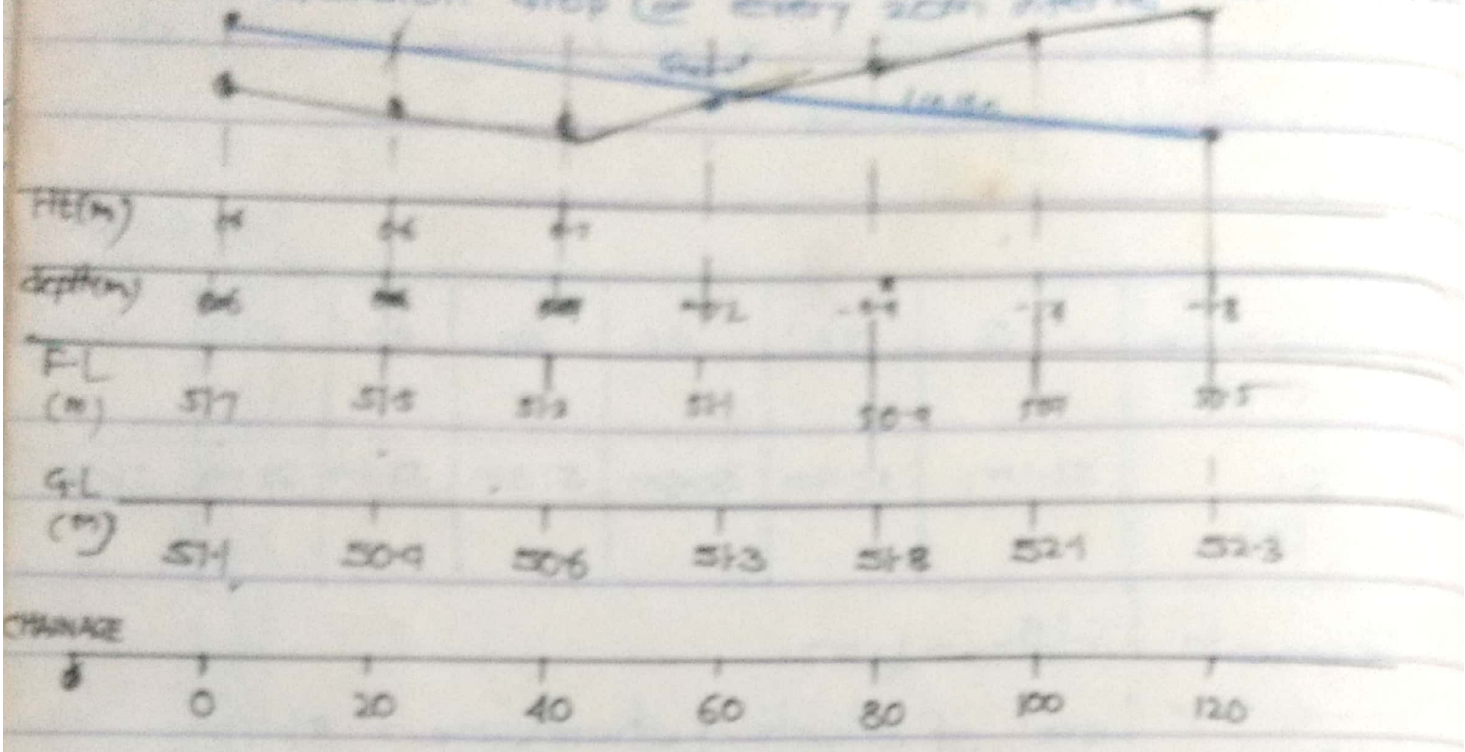
B = 12m

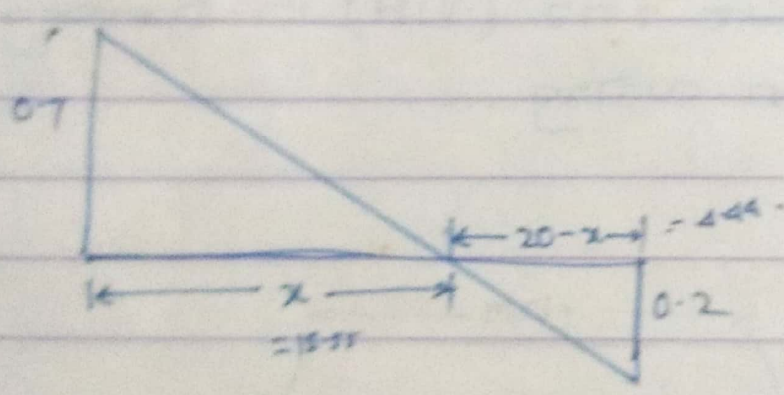
s in cutting = 1:1

s in embankment = 2

Rising Gradient of road = 1 in 100

∴ Gradient drop @ every 20m interval = 20/100 = 0.2m.





$$\frac{0.7}{x} = \frac{0.2}{(20-x)}$$

$$14 - 0.7x = 0.2x$$

$$14 = 0.7x + 0.2x$$

$$14 = 0.9x$$

$$\therefore x = 14/0.9$$

Chainages (m)	Depth / Ht d (m)	Mean depth dm=(d1+d2)/2	C/s area of C/P B×dm (m²)	C/s Area of side slopes sdm^2 (m²)	Total c/s area Am=Bdm+sdm² (m²)	Distbetn two stats (L) (m)	Qty of earth work Am×L (m³) BANKING	Qty of earth work Am×L (m³) CUTTING.
							—	—
0	0·6	—	—	—	—	—		
20	0·6	$\frac{0.6+0.6}{2}=0.6$	7·2	$2\times(0.6)^2=0.72$	7·92	20	158·40	
40	0·7	$\frac{0.6+0.7}{2}=0.65$	7·8	$2\times(0.65)^2=0.85$	8·65	20	173·00	
PASSES	0·0	$\frac{0.7+0}{2}=0.35$	4·2	$2\times(0.35)^2=0.25$	4·45	15·5	68·98	
60	−0·2	$\frac{0-0.2}{2}=-0.1$	1·2	$1.5\times(-0.1)^2=0.02$	1·22	4·5		5·49
80	−0·9	$\frac{-0.2-0.9}{2}=-0.55$	+6·6	$1.5\times(0.55)^2=0.45$	7·05	20		141·00
100	−1·4	$\frac{-0.9-1.4}{2}=-1.15$	+13·8	$1.5\times(1.15)^2=1.98$	15·78	20		315·60
120	−1·8	−1·6	+19·2	$1.5\times(1.6)^2=3.84$	23·04	20		460·80
							400·38	922·89

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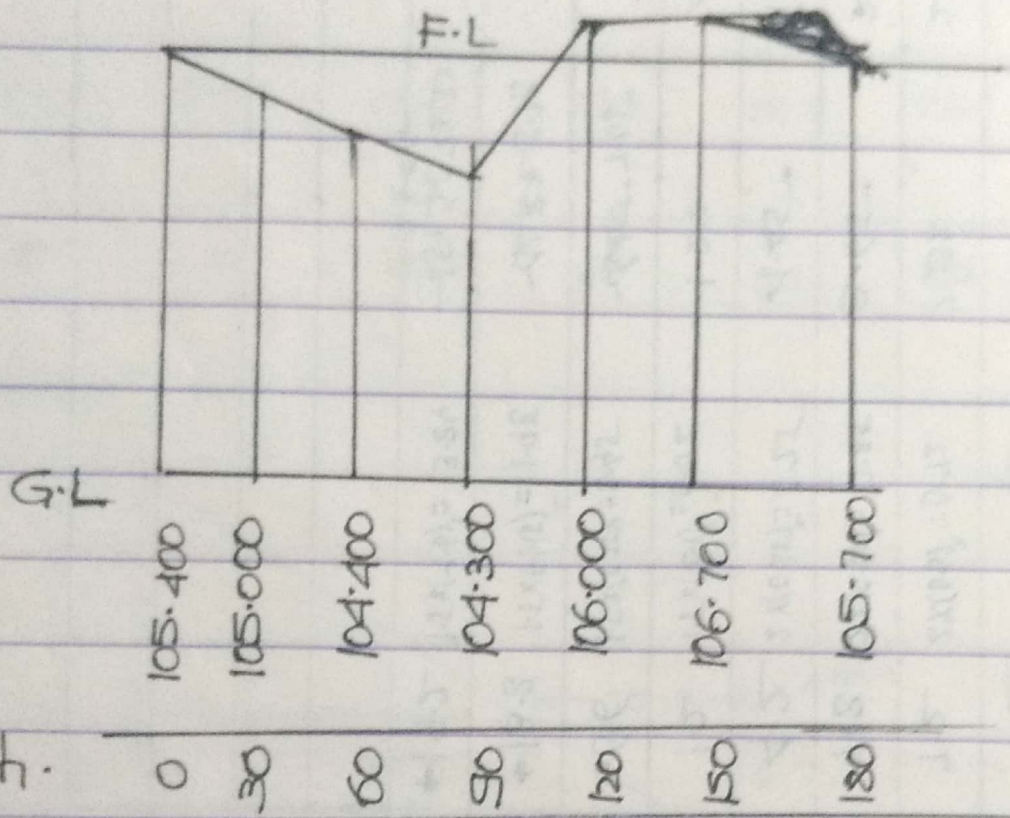
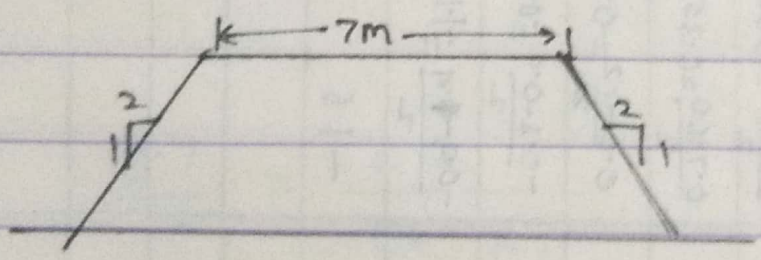
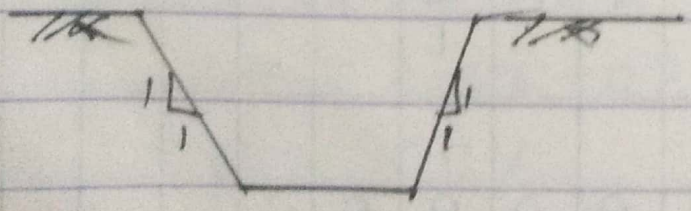
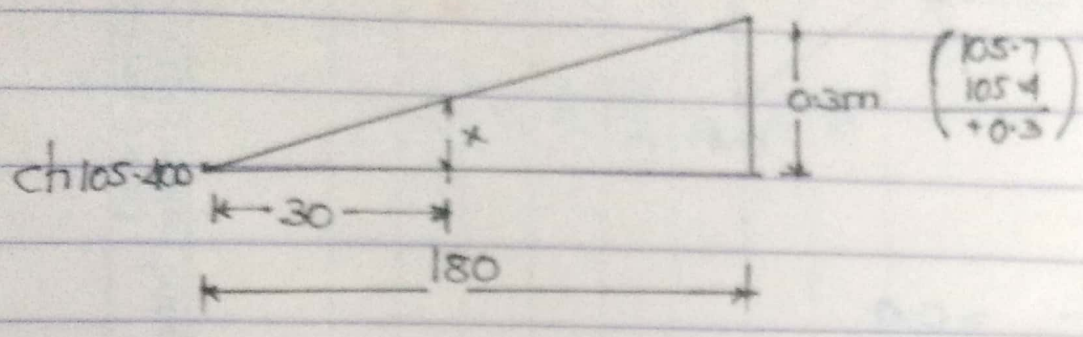
(2) Find the quantity for embankment & cutting for a road having top width 7m & side slope 2:1 for embankment & 1:1 for cutting refer the fig given below.





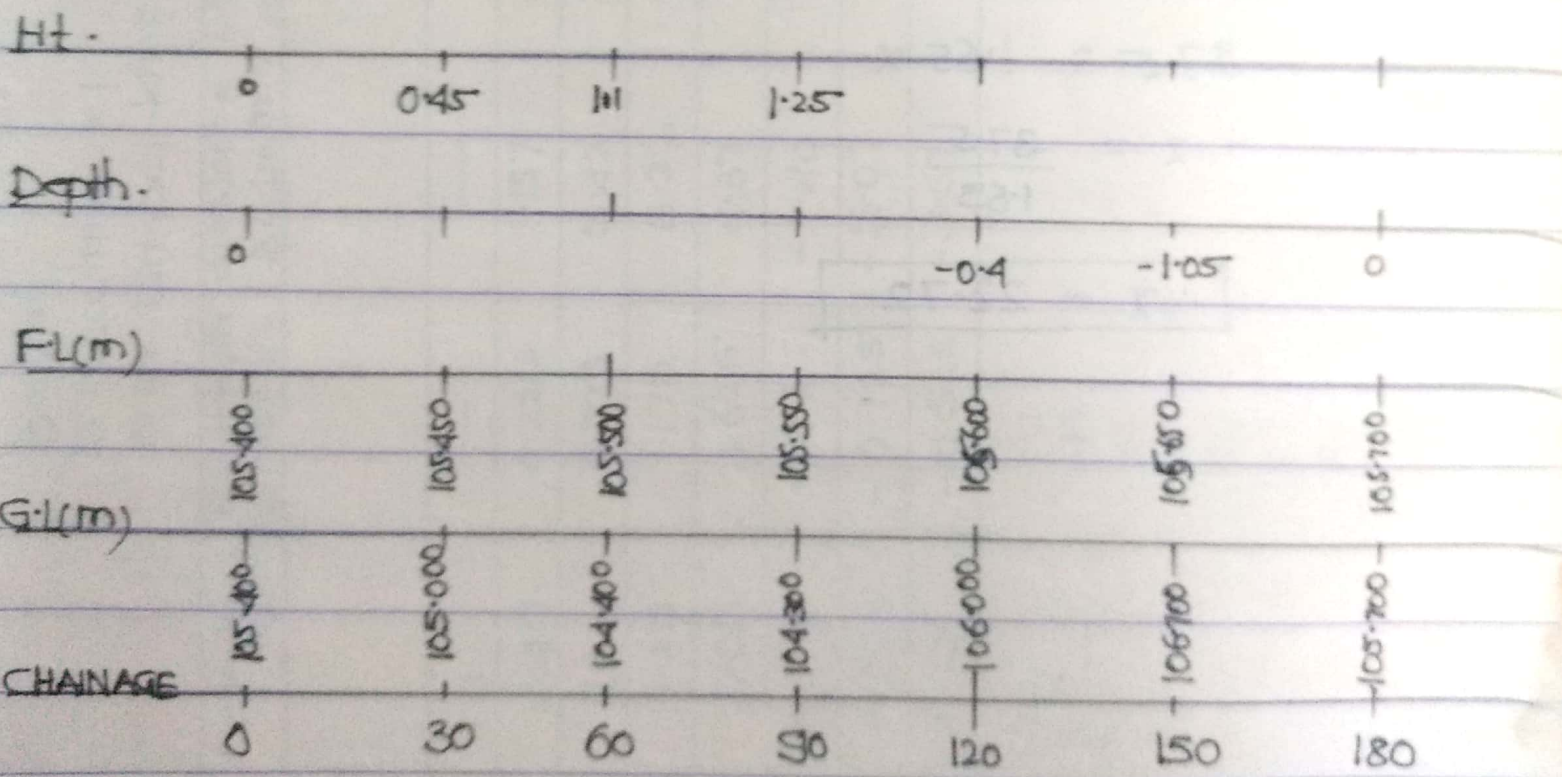


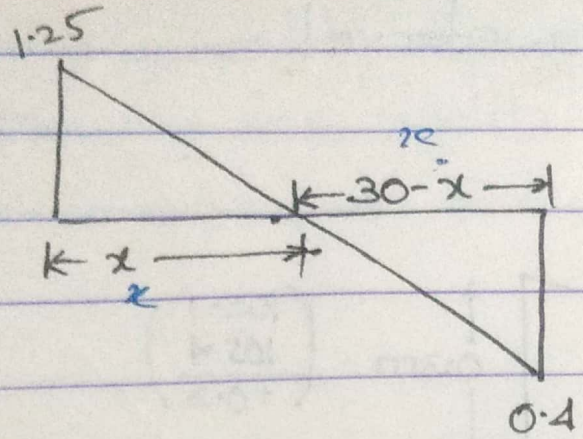
Rise in Gradient @ 30m interval.



$$\therefore \frac{x}{30} = \frac{0.3}{180}$$

$$\therefore x = 0.05$$





$$\frac{1.25}{x} = \frac{0.4}{30-x}$$

$$1.25(30-x) = 0.4x$$

$$37.5 - 1.25x = 0.4x$$

$$37.5 = 1.25x + 0.4x$$

$$37.5 = 1.65x$$

$$\therefore x = \frac{37.5}{1.65}$$

$$\boxed{\therefore x = 22.72}$$

B = 7m
S in cutting = 1
S in Embankment = 2

Chainage(m)	Depth / Ht (M)	Mean depth $d_m = d_1 + d_2/2$	C/S(A) of C.P $B \times d_m$ (m^2)	C/S(A) of side $S d_m^2$ (m^2)	Total C/S(A) $A_m = B d_m + S d_m^2$	Dist betn two stat. (L) (m)	Qty of earth Work. ($A_m \times L$) (m^3) Banking(+)	Qty of earth Work. ($A_m \times L$) (m^3) cutting(-)
0	0	—	—	—	—	—	—	—
30	0.45	0.225	1.57	0.10	1.67	30	50.1	—
60	1.1	0.775	5.42	1.20	6.62	30	198.6	—
90	1.25	1.175	8.22	2.76	10.98	30	329.4	—
PASSES	0.00	0.625	4.37	0.78	5.15	22.72	117.00	
120	- 0.4	- 0.2	- 1.40	0.04	1.44	30	—	43.2
150	- 1.05	- 0.725	- 5.07	0.52	5.59	30		167.7
180	- 0	- 0.525	- 3.67	0.27	3.94	30		118.2
							TOTAL 695.1	329

1.23
0.78
1.18
0.63
0.3
0.73
0.53

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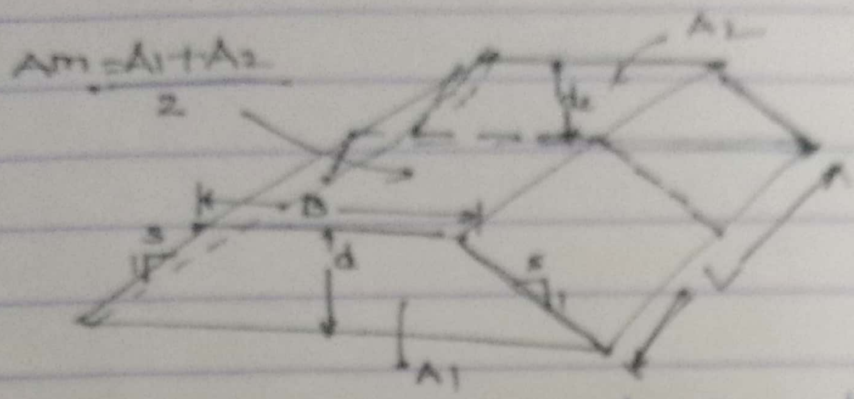
Mean sectional area method.



$\therefore Q =$ Mean c/s area x length of sectn.

$= A_m \times L$

B =

S in Banking =

S in cutting =

Chainages (m)	Ht of Banking or Depth of cutting d(m)	c/s area of c.p. B x d (m²)	Area of sides Sd² (m²)	Total area A = Bd + Sd² (m²)	Mean area $A_m = \frac{(A_1+A_2)}{2}$ (m²)	Dist. betn two stn. L (m)	Quantity of earth work Banking	Cutting
						Total =		