MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC-27001-2005 Certified)

SUMMER-13 EXAMINATION

Subject Code: 12137 **Model Answer (Estimating & Costing)**

Q. No. 1 Attempt any Five of the following **20M**

a) Estimating :

An estimate is a computation or calculation of the quantities required and expenditure likely to be incurred in the construction of a work. **(1M)**

Costing :

Costing is defined as the determination of cost of the work before its execution. **(1M)**

Purpose of estimating and costing: **(any 4 x ½ = 2M)**

i) To ascertain necessary amount of money required by owner to complete the proposed work.
ii) To ascertain quantities of materials required in order to programme their timely procurement.
iii) To calculate the no. of different categories of workers required for work.
iv) To assess the requirements of tools, plants and equipments required for work.
v) To fix up completion period from volume of works involved in the estimate.
vi) To draw up a construction schedule and programme and also to arrange the funds required according to the programming.
vii) To justify the investment from benefit-cost ratio.
viii) To invite tenders and prepare bills for payment.

b) Types of approximate estimates: **(Any 4 X ½ = 2 M)**

i) Plinth area method
ii) Cubical content method
iii) Service unit method
iv) Typical bay method
v) Approximate quantity method

The description of any one of the above method. **(2M)**

For Example :
(Explanation should carry brief method and an example)

Plinth area estimate :

This estimate is prepared by multiplying the plinth area of the proposed building by the plinth area rate of similar building having same specifications and height that is constructed very recently in the same locality.

The plinth area of the proposed building is calculated for the covered i.e. roofed portion by measuring the outer dimensions at plinth level. The area of courtyards and other open areas are not to be included while calculating the plinth area.

For a multistoried building the plinth area estimate is prepared for each storey separately.

Plinth area rate of existing building =

$$\frac{\text{Cost of construction of existing building}}{\text{Plinth area of same building}}$$

Therefore,
Approximate Estimate for a proposed building =

Plinth area rate of existing building **X** Plinth area of proposed buiding.

Ex : Approximate cost of a proposed building having plinth area of 100 Sq.m @ Rs. 900/Sq.m (Existing buildings plinth area rate) works out as Rs. 90,000/-

c) Abstract Sheet **(2M)**

Item No.	Description of Item	Quantity	Unit	Rate	Per	Amount

Measurement Sheet **(2M)**

Item No.	Description of Item	No.s	Length	Breadth	Height	Quantity	Note/Remark

d) Rate Analysis : **(2M)**

The process of determining the rate per unit of a particular item of construction after taking into consideration the cost of quantities of materials required, the cost of labour to be employed, the cost of hire charges of tools and plants required, overhead charges, other miscellaneous petty expenses and a contractor's reasonable profit, is known as Rate Analysis.

Factors affecting rate analysis: **(Any 4 X ½ = 2M)**

i) Specifications of items of work and materials.
ii) Quantity of materials and their rates.
iii) Number of labours required and their rates.
iv) Location of site of work and its distance from the source of materials.
v) Profits and overhead expenses of contractor.
vi) Tools and plants required, if any.

e) Mode of measurement :

Mode of measurement : **(Each 1 Mark = 4M)**

i) Wood work for door frame : m^3
ii) 10 cm thick brick wall : m^2
iii) Neeru Plaster : m^2
iv) Barbed wire fencing : Running meter (RMT)

f) i) Prime Cost : **(2M)**

Prime cost is the actual cost of articles at shop and refers to the supply of articles only and not to carrying out work.

During preparation of an estimate , it is not always possible to specify the exact types of articles required, for ex: water supply fittings, sanitary fittings, doors and window fittings etc. are to be decided during the time of actual fitting according to the choice of the owner or Engineer-In-Charge. For the execution of such items reasonable amount is kept in the estimate as Prime Cost.

ii) Day Work : **(2M)**

The term Day Work is used to denote a procedure of costing or valuing an item of work on the basis of actual labourers and materials required.

Certain types of work cannot be paid by the measurements viz. special types of architectural works, dismantling partition walls under water, taking out root of trees during earthwork in excavation for foundation

trenches etc. are paid on the basis of actual quantity of materials and labour hours required to complete the job and is denoted by Day Work.

g) The most accurate method for calculation of earthwork is 'Prismoidal Formula' method. **(2M)**

$$\text{Volume} = \frac{L\,(A1 + A2 + 4Am)}{6}$$

Reason : **(2M)**

Most of the earth volumes are prismoids . The formula for this method is based on the assumption that A1 and A2 are the areas at the ends and Am is the area of mid section parallel to ends and L = Length between the ends.

The earthwork is calculated by considering the linear series of cross sections as a prismoid having parallel end faces having equal sides. Unlike in Mid sectional area method and Mean sectional area method, which uses mean depth and mean cross sectional area respectively for calculation of earthwork, here in this method the whole linear solid section is considered as a prismoid, which avoids errors occurred in rest methods while calculating earthwork and results obtained by this method proves to be more accurate.

Q. No. 2 Attempt any Two of the following 16M

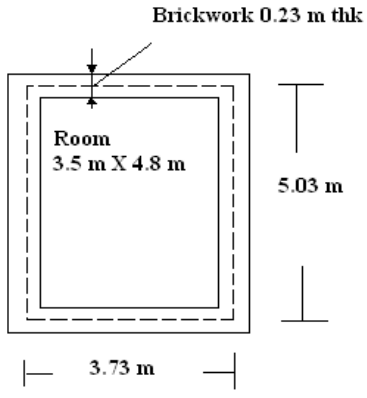
a)

Cost of building having plinth area 1500 m2 @ Rs. 3200/sq.m =	Rs.48,00,000	**(1M)**
Cost of special architectural treatment @ 2% of cost of building =	Rs. 96,000	**(1M)**
Cost for water supply and sanitary installation @ 5% of cost of building =	Rs. 2,40,000	**(1M)**
Cost of Electric installation @ 14% of cost of building =	Rs. 6,72,000	**(1M)**
Cost for other services @ 6% of cost of building =	Rs. 2,88,000	**(1M)**
Overall cost of building =	**Rs. 60,96,000**	
Add contingencies @ 3% of overall cost of building =	Rs. 1,82,880	**(1M)**
Add supervision charges @ 8% of overall cost of building =	Rs. 4,87,680	**(1M)**
Grand Total of estimated cost =	**Rs. 67,66,560**	**(1M)**

b) Brickwork quantity can be found by two methods viz. i) Center Line Method OR ii) Long Wall Short Wall Method.
(Answer derived by any of these method shall be considered for evaluation.)

I) Solution by Center line method :

Center line plan of given room will be as below : **(1M for center line plan)**



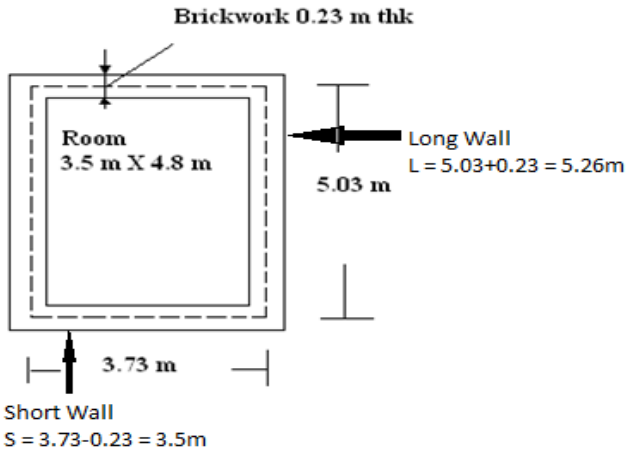
Centre Line length = 3.73+3.73+5.03+5.03 = 17.52 m **(1M for length calculation)**

Calculation of quantities of brickwork is done in measurement sheet as below :

Sr. No.	Particulars of Item	No. s	Length (m)	Breadth (m)	Height (m)	Quantity (m^3)	Remark
1	230 mm thick brickwork in CM (1:5) in superstructure.	1	17.52	0.23	3.3	**13.297**	Center line length L= 3.73+5.03+ 3.73+5.03 =17.52m
	Deductions for openings						
	D	1	0.9	0.23	2.1	0.4347	
	W	2	1.4	0.23	1.2	0.7728	
	V	1	0.45	0.23	0.6	0.0621	
	Total Deductions =					**1.2696**	
	Net Quantity of Brickwork =					**12.0274 m^3**	13.297-1.2696

Note : For calculation of quantity of brickwork without deductions = 2 M
For calculation of total deductions = 2M
For Net Quantity of brickwork = 2M

II) Solution by Long Wall Short Wall method.



Here walls spanning parallel to the shorter dimension of room (3.5m) are considered as short walls and denoted by S and the walls spanning parallel to the larger dimensions of room (4.8m) are considered as Long Walls and are denoted by L.

Note : The walls spanning to the shorter dimension can be considered as long walls and those are spanning to the larger dimension can be considered as Short walls.

According to our assumption :

Length of long wall = Center line length of long wall + width of item

L = 5.03 + 0.23 = 5.26m **(1M)**

Length of Short Wall = Center line length of short wall – width of item

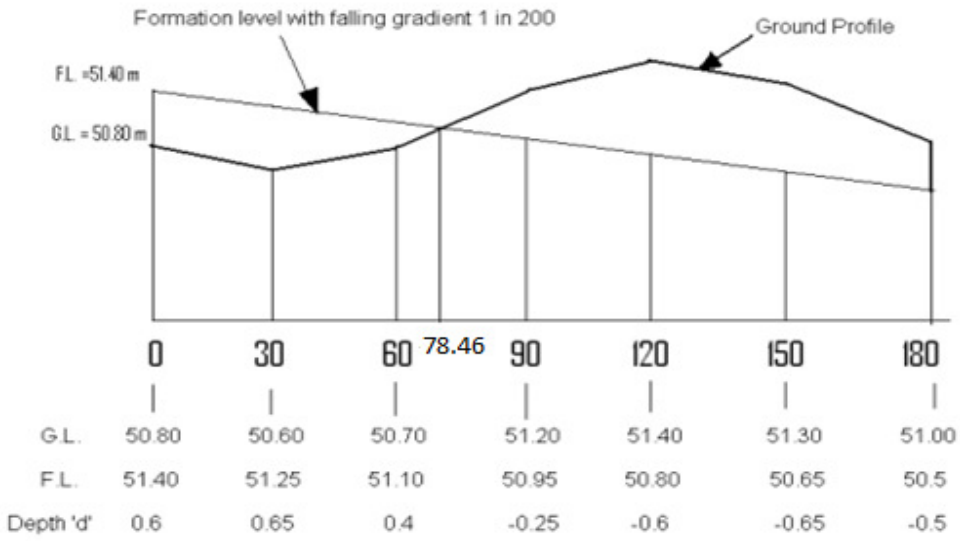
S = 3.73 – 0.23 = 3.5m **(1M)**

Calculation of quantities of brickwork is done in measurement sheet as below :

Sr. No.	Particulars of Item	No. s	Length (m)	Breadth (m)	Height (m)	Quantity (m^3)	Remark
1	230 mm thick brickwork in CM (1:5) in superstructure.						
	Long Walls	2	5.26	0.23	3.3	**7.98468**	L= 5.03+0.23=5.26m
	Short Walls	2	3.5	0.23	3.3	**5.313**	S = 3.73-0.23=3.5m
	Total Volume of brickwork without deductions					**13.297**	
	Deductions for openings						
	D	1	0.9	0.23	2.1	0.4347	
	W	2	1.4	0.23	1.2	0.7728	
	V	1	0.45	0.23	0.6	0.0621	
	Total Deductions =					**1.2696**	
	Net Quantity of Brickwork =					**12.0274 m^3**	13.297-1.2696

Note : For calculation of quantity of brickwork without deductions = 2 M
For calculation of total deductions = 2M
For Net Quantity of brickwork = 2M

c) **(Figure 1M)**



To find Formation levels : **(For finding all F.L.'s 1M)**
Use

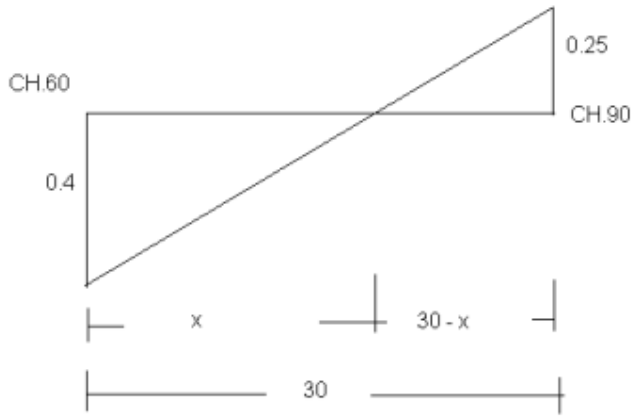
F.L. of chainage =

F.L. of previous chainage – (1/gradient) x Difference between Chainages considered.

F.L. at Ch. 30 = 51.40 – (1/200)X 30 =51.25 m
(Successively find F.L. for remaining Chainages)

Depth of section = F.L. – G.L. ……. Positive values indicate filling **(For finding all depths 1 M)**
……. Negative values indicate cutting
(Find depths for all the sections)

Location of point of Zero depth : **(For locating the point of 0 depth 1M)**
The point of zero depth is located between chainage 60 and 90



From similar Triangles

(0.4/x) = (0.25/30-x)
Which gives x = 18.46 m
i.e. Point of zero depth is located at 60+18.46 = 78.46 m Chainage.
(Before this chainage there is embankment and after this chainage there is cutting in L section.)

Detailed Earthwork Quantity computation by mean sectional area is given in table below :
(Points to be noted : Formation width B =12m, S = 1V:2H in Banking and S = 1V:1.5H in cutting.)

Station or Chainage	Height or Depth 'd'	Area of central portion B.d	Area of sides $S.d^2$	Total Sectional area $B.d + S.d^2$	Mean Sectional area A_m	Length between stations L	Quantity = A_m X L	
							Embankment	Cutting
0	0.6	7.2	0.72	7.92				
30	0.65	7.8	0.845	8.645	8.2825	30	248.475	
60	0.4	4.8	0.32	5.12	6.8825	30	206.475	
78.46	0	0	0	0	2.56	18.46	47.2576	
90	0.25	3.0	0.09375	3.09375	1.546875	11.54		17.8509
120	0.6	7.2	0.54	7.74	5.416875	30		162.506
150	0.65	7.8	0.63375	8.43375	8.086875	30		242.606
180	0.5	6.0	0.375	6.375	7.404375	30		222.1313
Total Earthwork Quantity							502.2076 m^3	645.0939 m^3

Answer :

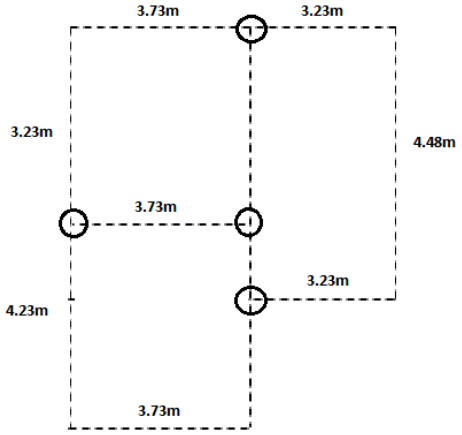
i) Quantity of earthwork in cutting = 645.0939 m^3

ii) Quantity of earthwork in banking = 502.2076 m^3

Note : For calculation of earthwork in cutting 2M
For calculation of earthwork in banking 2M

Q. No. 3. Attempt any two of the following **(16)**

Q. No. 3. a)
By Using Center Line Method



Center Line Plan

Total length of center line= (3.73x3) + (3.23x4) + (4.23x2) + (4.48x1)
= 37.05m

No. of T-junction = n=4

Deductions= ½ nB = ½ x 4 x B = 2B

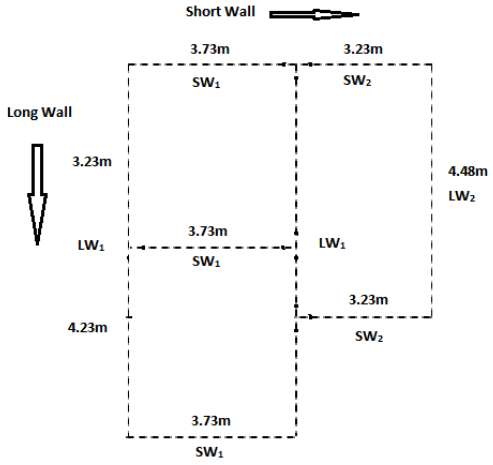
Measurement sheet

Item No	Description	No	L	B	H	Qty	Total Qty
1.	**Excavation in Foundation** L= TCL – Deduction = 37.05-2B = 37.05-(2x1.2) = 34.65 m	1	34.65	1.2	1.2	49.896	**49.896 m^3**

For Total length of center line = **2 Marks**
For Excavation Quantity = **6 Marks**

[OR]

By Using Long Wall And Short Wall Method
Assuming vertical wall as a long wall and horizontal as a short wall



Center Line Plan

Center to center length of wall

a) Long Wall
   i. LW_1 = 3.23 + 4.23 =7.46 m
   ii. LW_2 = 4.48m
b) Short wall
   i. SW_1 = 3.73 m
   ii. SW_2 = 3.23 m

Measurement sheet

Item No.	Description	No	L	B	H	Qyt	Total Qyt
1.	**Excavation in Foundation**						
	Lw_1= 7.46 + 1.2 = 8.66	2	8.66	1.2	1.2	24.9408	
	Lw_2= 4.48 +1.2 = 5.68	1	5.68	1.2	1.2	8.1792	
	Sw_1= 3.73 – 1.2 = 2.53	3	2.53	1.2	1.2	10.9296	
	SW_2= 3.23-1.2 = 2.03	2	2.03	1.2	1.2	5.8464	
							49.896 m^3

For center to center length of walls = **2 Marks**
For Excavation Quantity = **6 Marks**

Q. No. 3. b)
Area of plastering = 100 m^2
Volume of plaster = volume of wet mortar
= 100 x 0.012 = 1.2 m^3
Add 50% for voids and 10% for unevenness
So, Volume of Dry mortar = 1.2 x 1.6
= 1.92 m^3
Using CM 1:6 proportion
So, Quantity of cement = 1.92/(1+6)
= 0.2742 m^3 **(2M)**
Number of Cement Bags = 0.2742/0.035
= 7.83 Nos. ~ 8 Nos. **(2M)**
Now, Quantity of Sand = (1.92x6) / (1+6)
= 0.2742 x 6
= 1.6452 m^3 **(4M)**

Q. No. 3. c)
By Using Mean Sectional Method
Quantity of Earthwork in hearting
B = 1.2 m, S_1 = 1 & S_2 = 1
A = Bd + ½ S_1d^2 + ½ S_2d^2

Ch.	**F.L.**	**G.L.**	**d**	**Bd**	**½ S_1d^2**	**½ S_2d^2**	**A**	**Am**	**L**	**Quantity**	
										+	-
60	119.5	101.50	18	21.6	162	162	345.6				
80	119.5	107.50	12	14.4	72	72	158.4	252	20	**5040**	

Quantity of Earthwork in Hearting = **5040 m^3** **(4M)**
Quantity of Earthwork in Casing and Hearting Both
B = 3m, S_1 = 2, S_2 = 3
A = Bd + ½ S_1d^2 + ½ S_2d^2

Ch.	**F.L.**	**G.L.**	**d**	**Bd**	**½ S_1d^2**	**½ S_2d^2**	**A**	**Am**	**L**	**Quantity**	
										+	-
60	123.5	101.5	22	66	484	726	1276				
80	123.5	107.5	16	48	256	384	688	982	20	19640	

Quantity of Earthwork in Casing and Hearting both = 19640 m^3
Quantity of casing = 19640-5040 = **14600 m^3** **(4M)**

[OR]

By Using Mid- Sectional Area Method
Quantity of Earthwork in hearting
B = 1.2 m, S_1 = 1 & S_2 = 1
A = Bd_m + ½ $S_1d_m^2$ + ½ $S_2d_m^2$

Ch.	**F.L.**	**G.L.**	**d**	**d_m**	**Bd_m**	**½ $S_1d_m^2$**	**½ $S_2d_m^2$**	**A**	**L**	**Quantity**	
										+	-
60	119.5	101.50	18								
80	119.5	107.50	12	15	18	112.5	112.5	243	20	**4860**	

Quantity of Earthwork in Hearting = **4860 m^3** **(4M)**
Quantity of Earthwork in Casing and Hearting Both
B = 3m, $S_1 = 2$, $S_2 = 3$
$A = Bd_m + ½ S_1 d_m^2 + ½ S_2 d_m^2$

Ch.	F.L.	G.L.	d	d_m	Bd_m	$½ S_1 d_m^2$	$½ S_2 d_m^2$	A	L	Quantity	
										+	-
60	123.5	101.5	22								
80	123.5	107.5	16	19	57	361	541.5	959.5	20	19190	

Quantity of Earthwork in Casing and Hearting both = 19190 m^3
Quantity of casing = 19190-4860 = 1**4330 m^3** **(4M)**

Q. No. 4. Attempt any two of the following **(16)**

Q. No. 4. a)
Area of plastering = 100 m^2
Volume of plaster = volume of wet mortar
= 100 x 0.012 = 1.2 m^3
Add 52% for voids and 5% for finishing & 3% for wastage
So, Volume of Dry mortar = 1.2 x 1.6
= 1.92 m^3
Using CM 1:4 proportion
So, Quantity of cement = 1.92/(1+4)
= 0.384 m^3
And Number of Cement Bags = 0.384/0.035
= 10.97 Nos. ~ 11 Nos
Now, Quantity of Sand = (1.92x4) /(1+4)
= 0.384 x 4
= 1.536 m^3

A] Cost of Materials

Material	Quantity	Rate	Per	Amount Rs.
i. Cement	11	X_1	Bag	11x X_1
ii. Sand	1.536	X_2	M^3	1.536x X_2
			Total cost of material	**i + ii**

B] Cost of Labours

Type of Labour	Nos	Rate	Per	Amount Rs.
i. Head Mason	½	X_3	Day	½ x X_3
ii. Mason	10	X_4	Day	10 x X_4
iii. Male Mazdoor	15	X_5	Day	15 x X_5
iv. Bhisti	1	X_6	Day	1 x X_6
v. Scaffolding	Lumpsum	X_7		X_7
vi. Sundries T & P	-	X_8		X_8
			Total cost of labour	**i+ii+iii+iv+v+vi**

Total cost = A+B

C] Adding 1.5% for water charges
D] Adding 10 % for contractors profit

Net Total =A+B+C+D

So, Rate per m^2 = Net Total /100

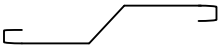
Note: The assessor has to see that student must have solved it using different rates for material and labours

For Cost of Materials **= 3 Marks**
For Cost of Labour **= 3 Marks**
For Net Total or Rate per m^2 **= 2 Marks**

Q. No. 4. b)

Thickness of slab = 150 mm
Cover = 15 mm
So, effective depth d = D-(2x15)= 150-30= 120mm

a) Length of Main bar (12mm Ø 150mm c/c)



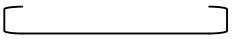
Length = Lx - (2xcover) + (2x9 Ø) + (0.42d)
Length = 2200 – (2x15) + (2x9x12) + (0.42x120) = 2436.4mm = 2.4364m **(01)**

$$\text{Number of main bars} = \frac{\text{Ly} - (2 \times \text{cover})}{\text{Spacing}} + 1$$

$$\text{Number of main bars} = \frac{6600 - (2 \times 15)}{150} + 1$$

= 44.8 Nos
= 45 Nos **(01)**

b) Length of Distribution bar (6mm Ø 200mm c/c)



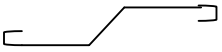
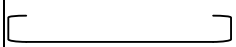
Length = Ly - (2xcover) + (2x9 Ø)
Length = 6600 – (2x15) + (2x9x6) = 6678mm = 6.678m **(01)**

$$\text{Number of bars} = \frac{\text{Lx} - (2 \times \text{cover})}{\text{Spacing}} + 1$$

$$\text{Number of bars} = \frac{2200 - (2 \times 15)}{200} + 1$$

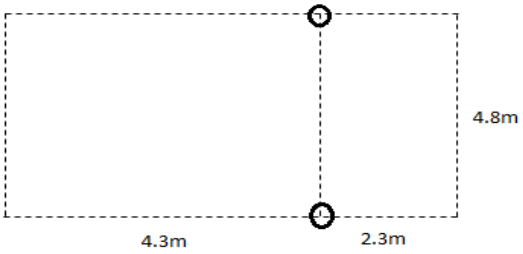
= 11.85 Nos
= 12 Nos **(01)**

Bar Bending Schedule

Sr. No.	Description	Shape	Nos	Ø	L(m)	Total Length	Wt in kg/m	Total Wt in kg
1.	Main Bar @ 0.89 kg/m		45	12	2.4364	109.64	0.89	97.58
2.	Distribution bar @ 0.22 kg/m		12	06	6.678	80.136	0.22	17.63

So, total Quantity of steel = 97.58 + 17.63 = 115.21 kg **= 116 kg** **(04)**

Q. No. 4. c) Solve any Two Quantities.
By Using Center Line Method



Center Line Plan

Total length of center line= (4.8x3)+(4.3x2)+(2.3x2)
= 27.6m

No. of T-junction = n=2

Deductions= ½ nB = ½ x 2 x B = B

Depth of excavation in soil = 1200/2 = 600 mm

Depth of excavation in hard murum below soil = 600+150 = 750mm

Measurement sheet

Item No	**Description**	**No**	**L**	**B**	**H**	**Qty**	**Total Qty**
1.	**Excavation in Foundation** L= TCL – Deduction = 27.6 -B = 27.6 -1.2 = 26.4 m	1	26.4	1.2	0.75	23.76	
							23.76 m^3
2.	**Murum Filling** For Room No. 1 L=4.5m & B= 4m	1	4.5	4	0.5	9	
	For Room No.2 L=4.5m & B= 2 m	1	4.5	2	0.5	4.5	
							13.5 m^3
3.	**Internal Plastering** **For Room No. 1** Wall, L = 2(4+4.5) =17 Ceiling	1 1	17 4.5	- 4	3.3 -	56.1 18	
	For Room No.2 Wall, L = 2(2+4.5) =13 Ceiling	1 1	13 4.5	- 2	3.3 -	42.9 9	
							126 m^2
	Deductions Door, No. =2, faces =3 Window, No.=4, faces =4	3/2 4/2	1.2 1.5	- -	2.1 1.2	3.78 3.6	
							-7.38 m^2
						Net Quantity = 126 -7.38	**118.62 m^2**

For Each Quantity = 4 Marks = 2 x 4 = 8 Marks

Q.No.5. Attempt any TWO of the following **16**

a) State rules for deduction for masonry and plastering.

Ans: Rules for **deduction of Masonry**

No deduction is made for the following

i) Openings upto 0.1 sq.m

ii) End of beams, posts, rafters, purlin etc. upto 0.05 sqm in section
iii) Bed plates, wall plates, bearing of chajjas where thickness doesnot exceeds 10cm.
iv) Bearing of floor and roof slab are not deducted from masonry in superstructure

(1/2 mark to each 1/2*4 = 2)

For opening deduction are made in following manner.

i) Rectangular opening :
Deduction = l x h x t where t = thickness of wall

ii) Openings with small segmental arch :
Deduction = l x h x t where t = thickness of wall

iii) Segmental arch openings :
Deduction = [l x h + 2/3 x l x r] x t where r = radius of segmental arch

iv) Semi-circular arch openings :
Deduction = [l x h + 3/4 x l x r] x t where r = radius of segmental arch

(1/2 mark to each 1/2*4 = 2)

Rules for **deduction of Plaster**

Deductions in plastering are done in following manner:

i) No deduction is made for end of beams, posts, rafters etc.
ii) No deduction is made for openings upto 0.5 sq.m and no addition is made for jambs, soffits and sills of these openings.
iii) For openings more than 0.5 sq.m and upto 3 sq.m deduction is made for one face only. No addition for jambs, soffits and sills of these openings.
iv) For openings above 3 sq.m deduction is made for both the faces of opening and the jambs, soffits and sills shall be added of these openings.

(1 mark to each 1*4 = 4)

b) Calculate the quantity of earthwork with Top width = 3 m, R. L. of top of embankment = 500 m, side slop U/s = 2 H : 1 V and D/s = 1.5 H : 1 V

Chainage	0	30	60	90	120	150	180
R. L. in (m)	498.50	496.00	493.50	491.75	494.00	495.00	497.75

Use prismoidal formula.

Ans: Given B = 3 m, Slope U/S, $S_1 = 2$ and D/S, $S_2 = 1.5$
Therefore $S = (S_1 + S_2) / 2 = (2+1.5)/2$
$S = 1.75$
Top of embankment = 500 m

Therefore @ 0 Chainage d_1 = Top R.L. – R.L. = 500 – 498.5 = 1.5
$A_1 = Bd_1 + Sd_1^2 = 3 \times 1.5 + 1.75 \times 1.5^2 = 8.44$

Therefore @ 30 Chainage d_2 = Top R.L. – R.L. = 500 – 496.0 = 4
$A_2 = Bd_2 + Sd_2^2 = 3 \times 4.0 + 1.75 \times 4.0^2 = 40$

Therefore @ 60 Chainage d_3 = Top R.L. – R.L. = 500 – 493.5 = 6.5
$A_3 = Bd_3 + Sd_3^2 = 3 \times 6.5 + 1.75 \times 6.5^2 = 93.44$

Therefore @ 90 Chainage d_4 = Top R.L. – R.L. = 500 – 491.75 = 8.25
$A_4 = Bd_4 + Sd_4^2 = 3 \times 8.25 + 1.75 \times 8.25^2 = 143.86$

Therefore @ 120 Chainage d_5 = Top R.L. – R.L. = 500 – 494.0 = 6
$A_5 = Bd_5 + Sd_5^2 = 3 \times 6.0 + 1.75 \times 6.0^2 = 81.00$

Therefore @ 150 Chainage d_6 = Top R.L. – R.L. = 500 – 495.0 = 5
$A_6 = Bd_6 + Sd_6^2 = 3 \times 5.0 + 1.75 \times 5.0^2 = 58.75$

Therefore @ 180 Chainage d_7 = Top R.L. – R.L. = 500 – 497.75 = 2.25
$A_7 = Bd_7 + Sd_7^2 = 3 \times 2.25 + 1.75 \times 2.25^2 = 15.61$

(1/2 mark to each 1*14 = 7)

Using Prismoidal formula

$Q = L/3\ (A_1 + A_7 + 4 \sum \text{even area} + 2 \sum \text{odd area})$

$= 30/3\ [8.44 + 15.61 + 4(40+143.86+58.75) + 2(93.44+81)]$

$= 13433.7$

(1 mark)

c) Explain : (i) Lead and lift, (ii) Explain Mid Sectional Area Method.

Ans: **i) Lead: -** It is defined as the horizontal distance up to which a contractor will haul the material excavated & is included in the rates of excavation. This lead is 30m & called as normal or standard lead. **(2 mark)**

Lift: - It is defined as the vertical distance travelled by material, normally lift is taken as 1.5m.

(2 mark)

ii) Explain Mid Sectional Area Method:- Method of calculating earth work.

In this method, first the area of the mid-section is calculated by taking into account the different heights of bank at the two end portions and then this is multiplied by the length of the section to get the volume of work. **(1 mark)**

Let B = width of formation

d_1 and d_2 = depth of embankment or cutting.

S : 1 the side slope.

Mean depth $d_m = (d_1 + d_2) / 2$

Area of mid section = $Bdm + Sd_m^2$ **(2 mark)**

Length or chainage	Depth or height (d) in m	Mean depth d_m	Area of central rectangular portion ($B*d_m$)	Area of side triangles Sd_m^2	Length between stations (L)	Quantity $(Bd_m+Sd_m^2)$ x L	
						Embankment (+)ve	Cutting (-)ve

(1 mark)

6. Attempt any FOUR of the following **16**

a) Explain factors to be considered in preparation of detail estimate.

Ans: Factors to be considered while preparing detailed estimate.

- Quantity of materials
- Availability of materials
- Transportation of materials
- Location of site
- Local labour charges.

(any four points: 4 x 1=04)

b) State the general rules of finding the units of measurement of items of work.

Ans: In general, the unit of different items of work are based on the following principles:

i) Mass, voluminous and thick work shall be taken in cubic units or volume.
ii) Shallow, thin and surface work shall be taken in square units or in area.
iii) Long and thin work shall be taken in linear or running units, and linear measurement shall be taken e.g. pipe
iv) Piece work, job work etc shall be taken in number e.g. W.C. pan, door handle etc.

(1 mark to each 1*4 = 4)

c) State the capacity of truck and tractor for brick and sand.

Sr. no.	Description	Truck	Tractor
1	Brick	2000 to 5000 Nos	1000 to 2000 Nos
2	Sand	2 to 4 Brass = 5.6 to 11.32 m^3	1 to 1.5 Brass = 2.8 to 4.2 m^3

Truck and tractor are available in various capacities therefore if answer is in range of the table shown

(1 mark to each 1*4 = 4)

d) Define "Task work". Enlist the factors affecting task work.

Ans: **Task work: -** The capacity of doing work by a skilled labour in the form of work per day is known as task work. **(2 mark)**

Factors affecting task work are nature, size, height situation, location climatic condition, technique adopted, wages paid. As per the types & experience of labour output of work is varying from skilled to unskilled worker. **(1/2 mark to each 1/2*4 = 2)**

e) Describe the center line method of estimating the quantity of items.

Ans: Center line Method :

- Draw the centerline plan
- Calculate the total length of centerline which remains constant.
- Calculate the number of T-Junctions carefully.
- Take number of junction for walls meeting for three directions = 1
- Number of junction for walls meeting from four directions = 2
- Calculate the length of item as :
- L = c/c length – ½ x Number of junction x Width of item
- Multiply the length by the width and depth to find the quantity of particular item.
- For building having different types of walls, each set of walls shall be taken separately.

(4 Marks)