Important Instruction to Examiners:-

1) The answers should be examined by key words & not as word to word as given in the model answers scheme.

2) The model answers & answers written by the candidate may vary but the examiner may try to access the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more importance.

4) While assessing figures, examiners, may give credit for principle components indicated in the figure.

5) The figures drawn by candidate & model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credit may be given step wise for numerical problems. In some cases, the assumed contact values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.

7) For programming language papers, credit may be given to any other programme based on equivalent concept.

Q .NO	SOLUTION	MARKS
Q1. a)	**A) Attempt any THREE of the following.**	**12**
a)	**State the meaning of the term estimating and costing.**	**02**
	Estmating : It the process of calculating the quqntities and costs of the various items required in connection with the work for its satisfactory completion. **Costing :** It the process of determining the actual cost of the work before the execution of work.	**02** **02**
b)	**State any four purposes of estimating and costing.**	**02**
	i) To know the approximate cost of proposed work. ii) To obtain administrative approval and technical sanction. iii) To know the requirements of tools, plants and equipments. iv) To fix up the completion period. v) To draw up a construction schedule and programme. vi) To invite tenders. vii) To keep control over expenditure during construction Valuation to know value of property.	**1M each for any Four points**
c)	**Explain plinth area rate method of approximate estimate.**	
	This estimate is prepared on the basis of plinth area of building. The rates are obtained from a similar building having similar specification, heights and construction in the locality. Plinth area estimate is calculated by finding the plinth area of the building and multiply by the plinth area rate. i.e. Approximate cost = Plinth area x Plinth area rate The plinth area should be calculated for the covered area by taking external dimensions of the building at the floor level. Courtyard and other open area should not be included in the plinth area.	**04**
d)	**What is revised and supplementary estimate?**	
	Revised estimate: Revised estimate is a detailed estimate and is required to be prepared under any one of the following circumstances. i) When the original sanctioned estimate is likely to exceed by more than 5%. ii) When the expenditure on a work exceeds or likely to exceeds the amount of administrative sanctioned by more than 10%. iii) If there is change of rate or quantity of materials. iv) Major additions or alterations are introduced in original work. **Supplementary estimate:** It is detailed estimate of additional work and is prepared when additional works or changes are required to supplement the original works, during the execution of work. Then a fresh detailed estimate of additional works is prepared in addition to the original works. The abstract should show the amount of the original estimate and the total amount including the Supplementary amount, for which sanctioned is required.	**02** **02**

Q .NO	SOLUTION	MARKS
Q.1. B)	**Attempt any ONE of the following.**	06
a)	**State the mode of measurements for following items of work.**	
	I) Honey combed brickwork : sq. m **II) Collapsible gate (steel) : sq. m** **III) Form work : sq. m** **IV) Brickwork(10 cm thick) in partition wall : sq. m** **V) Dado : sq. m** **VI) Wood work for door frame : cu. m**	**1M for each**
b)	**State the rules for deduction for openings as per IS-1200 for brickwork and plastering.**	
	Rules for deduction for openings as per IS-1200 for brickwork : No deduction is made for the following : i) Opening upto 0.1 sq. m ii) Ends of beam, posts, rafters, purlin etc. chajjas where thickness does not exceeds 10 cm. iii) Bed plates, wall plates, bearing of chajjas where thickness does not exceed 10 cm. iv) Bearing of floor and roof slabs are not deducted from masonry in superstructure. **Rules for deduction for openings as per IS-1200 for plastering :** Deduction in plastering are made in the following manner : i) No deduction is made for ends of beams, posts, rafters, purlin etc. ii) No deduction is made for opening upto 0.5 sq. m. and no addition is made for jambs, soffits, and sills of these openings. iii) For opening more than o.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 opening above 3 sq. m. deduction is made for both faces of openings and the jambs, soffits, and sills of shall be added.	**03** **03**

Q .NO	SOLUTION	MARKS
Q.2.	**Attempt any TWO of the following.**	16
a)	**Draw the standard formats of measurement sheet, abstract sheet and face sheet.**	

i) measurement sheet :

Item number	Description or particulars of items	Number	Length In m	Breadth In m	Height or depth In m	Quantity	Total quantity
1	2	3	4	5	6	7	8

ii) Abstract sheet :

Sr. number	Quantity	Description or particulars of items	Unit	Rate Rs. P.	Unit of rate	Amount Rs. P.
1	2	3	4	5	6	7

iii) Face sheet:

Sr. No.	Particulars	Amount
01	Estimated cost	Rs…….
02	Water supply and sanitary charges @... %	Rs…….
03	Electrification charges@...%	Rs…….
04	Contingencies@... (3 to 5 %)	Rs…….
05	Work charge establishment @.. (1 to 2 %)	Rs…….
	Total amount	
	In wards….	

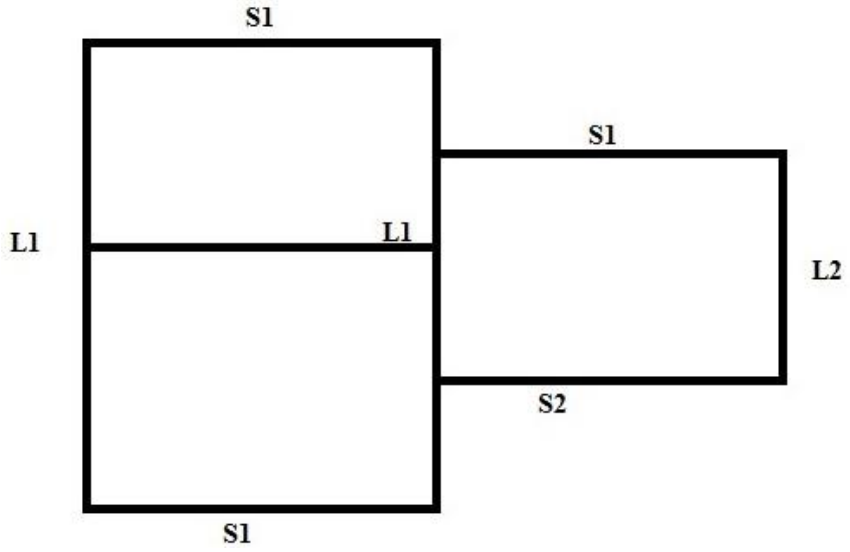
03

03

02

Q .NO	SOLUTION	MARKS
Q.2. b)	**Prepare approximate estimate of a public building having plinth area equal to1800 sq. m.** i) Plinth area rate as Rs. 3,500 / sq. m. ii) Special architectural treatment = 3% of cost of building. iii) Water supply and sanitary installation = 5% of cost of building. iv) Electric installation =14% of cost of building. v) Other services = 5% of cost of building. vi) Contingencies = 3% of overall cost of building. vii) Supervision charges = 8% of overall cost of building. i) Cost of construction : P x Plinth area rate = 1800 x 3,500 = Rs. 6,300,000 ii) Special architectural treatment = 3% of cost of building = 3/100 (6,300,000) =189,000 iii) Water supply and sanitary installation = 5% of cost of building = 5/100 (6,300,000) = 315,000 iv) Electric installation =14% of cost of building = 14 /100 (6,300,000) = 882,000 v) Other services = 5% of cost of building = 5/100 (6,300,000) = 315,000 Overall cost of building = 6,300,000 + 189,000 + 315,000 + 882,000 + 315,000 = 8,001,000 Add Contingencies = 3% of overall cost of building = 3/100 (8,001,000) =240,030	1M 1M 1M 1M 1M 1M

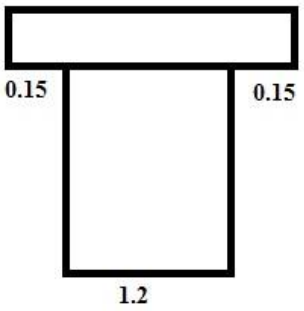
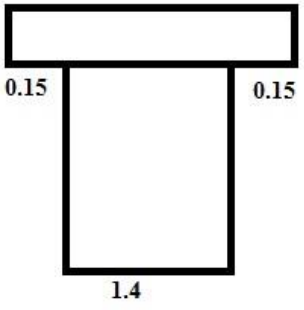
Q .NO	SOLUTION	MARKS
	Add Supervision charges = 8% of overall cost of building = 8/100 (8,001,000) = 640,080 Grand Total = 8,001,000 + 2,40,030 +6,40,080 = Rs. 8,881,110	1M 1M
Q.2. c)	**i) State the data required for preparing detailed estimate.**	
	i) **Drawing**: The drawing is the basis from which quantities of various items for a work are calculated. **ii) Specification :** a) General specification: In general specification the nature and class of work and the names of material to be used are described. It gives a general idea for the project. b) Detailed specification: Detailed specification gives detailed description of every item to be executed, with the qualities, quantities, proportion of materials, workmanship, the method of preparation and execution. Iii) **Rates:** The rates of various materials used in the construction and the wages of different categories of labour should be available for preparing estimate. The location of work and its distance from the source of materials and the cost of transport should be known. These rates may be obtained from P.W.D. schedule of rates book or the rates may be worked out the "Analysis of Rate" method. vi) **Modes of measurement:** Measurement for different items of work are different. These consider as per guideline of IS1200.	**01** **01** **01** **01**
	ii) State the steps in preparation of detailed estimate.	
	a) **Taking out quantities:** Divide the whole work into different items of works such as earthwork, concrete, brickwork etc. take the details of measurement of each items of work and enter the measurement of each item of work in measurement sheet. Once the measurement of each item of work is entered in measurement sheet, squaring of dimension is done. **b) Squaring:** Squaring is the calculation of numbers, length, area and volume and are entered in the last two column of measurement sheet. c) **Abstracting:** The cost of each item of work is calculated at the workable rates. The total cost is worked out and entered in the abstract of estimate form. A 3% to 5% is added for contingencies to allow for unforeseen expenses during the execution of work. A 1½% to 2% is added for work-charged establishment. The grand total thus obtained is the estimated cost of the project.	**04**

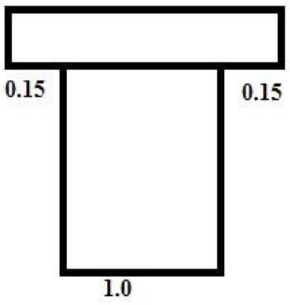
Q .NO	SOLUTION	MARKS
Q.3 A	**Attempt any Three**	**16**
1		1M for Centre Line

(Note : - Student may solve this numerical by Long Wall and Short Wall method and the examiner should give appropriate marks)

CENTRE LINE DIAGRAM:
Centreline Lengths of Walls = 18.2+ 4.2 + 18 =40.4m
L1 = 9.1 (2 nos);
L2 = 4.2M (1 nos);
S1 = 3.6m (5 nos);
Number of T-Junction = 4
Note:- (01 Mark for Centre line length of walls)
Measurement Sheet:-

Item	Description	No.	Length (m)	Breadth (m)	H.T (m)	Quantity (m^3)	Total Quantity	
1	**Excavation** TL = Center Line Length – ½ x Number of T Junction x One width if that item. T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 1.2)$	1	38	1.2	1.4		63.84	**3M**
2	U.C.R Masonry in Foundation (0.9m wide) T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 0.9)$	1	38.6	0.9	0.5	17.37		**1M**
	U.C.R Masonry in Foundation (0.7m wide) T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 0.7)$	1	39	0.7	0.6	16.38		**1M**

Q .NO	SOLUTION							MARKS
Q.3.A) 1		U.C.R Masonry in Foundation (0.5m wide) T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 0.5)$	1	39.4	0.5	0.15	2.955		**1M**
							Total U.C.R in Foundation	**36.705**	
		U.C.R Masonry in Plinth (0.5m wide) T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 0.5)$	1	39.4	0.5	0.6		**11.82**	**1M**
	3	B.B Masonry in Super Structure (0.3m wide) T.L = 40.4 – $(\frac{1}{2} x\ 4\ x\ 0.3)$ **Deduction**	1	39.8	0.3	3.2	38.208		**1M**
		1. Doors	3	1.2	0.3	2.1	2.268		
		2. Windows (W1)	2	1.4	0.3	1.2	1.008		**1M**
		3. Windows (W2)	5	1.0	0.3	1.2	1.8		
		Lintel **1.** Doors (0.15 x 0.3) 	3	1.5	0.3	0.15	0.2025		**1M**
		2. Windows (W1) 	2	1.7	0.3	0.15	0.153		

Q .NO	SOLUTION							MARKS
Q.3.A) 1		**3.** Window (W2)  	**5**	**1.3**	**0.3**	**0.15**	**0.2925**	
				Total Deduction			5.725	
				Total Brickwork				**32.483**
	4	Mosaic Tile Flooring 1. Room 1	1	3.3	4.5		14.85 m^2	
		2. Room 2	1	3.3	3.9		12.87 m^2	
		3. Room 3	1	3.3	4.0		13.2 m^2	
		4. Add for sill	3	1.2	0.3		1.08m2	
					Total Flooring			42.0

1M

1M

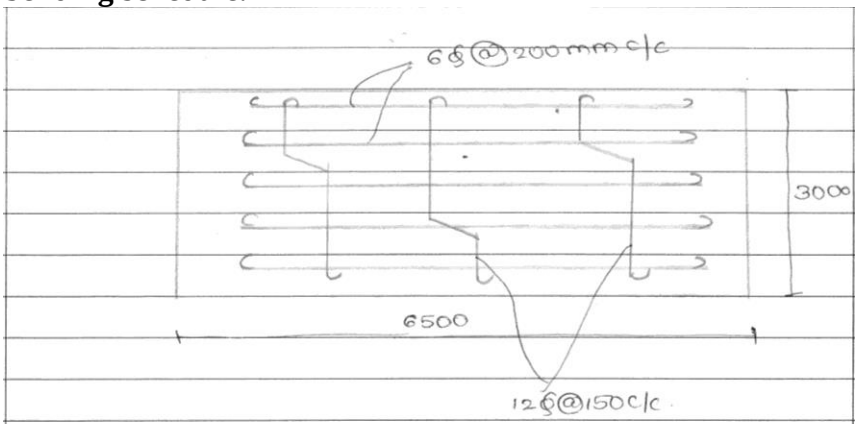
1M

1M

1M

Q3. B)	Attempt any one	(4M)
1.	**Centre Line Method of Calculation of Earthwork.** 1. In centre line method sum of total length of centre line of walls, long wall and short walls has to be found out. 2. In this method the Total Centre line length is calculated by subtracting the Centre line length by ½ x number of junction(Tee junctions or Cross Junctions x Width of required Item. 3. Total Centre Line Length = (Centre Line Length – ½ X Number of Junction x One Width of that Item) 4. This method is quick but required special attention at junction, meeting points of partition or cross walls. 5. For rectangular, circular, polygonal building having no cross walls, this method is simple. 6. For building having cross or partition walls for every junction or partition or cross walls with main wall special consideration shall have to be made to calculate the correct quantity.	1M each for any four Points.

Q .NO	SOLUTION	MARKS
Q.3.B) 2	**Explain various items of work for construction of R.C.C. Slab culvert.** Items of Work for Construction of R.C.C Slab Culvert: - 1. Earthwork Excavation for foundation (For Abutments and for Wing Walls) 2. Cement Concrete in foundation with stone ballast. 3. 1st Class Brickwork in Cement Mortar for Abutments./ P.C.C for Abutments 4. R.C.C work for Slab 5. Cement Concrete Wearing Coat 6. Cement pointing in walls 7. Steel Bar Bending in R.C.C work 8. Construction for Wing Wall 9. Construction for Parapet Wall	Any four points 1M each
Q.4. A)	**An R.C.C Roof Slab of overall size 6500 x 3000 mm and thickness 150mm is provided with 12mm diameter main bars bent alternately along shorter span and placed 150mmc/c. The distribution steel of 6mm diameter along longer span is provided at 200mm c/c. The all around cover is 15mm. Find out total quantity of steel. Prepare bar bending schedule.**	



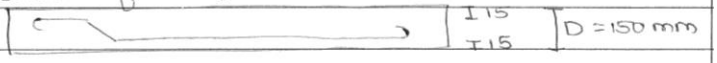
1M

a) Length of main bar.

= Total length of slab − (2 × cover) + (2 × 9 × ϕ) + (0.42 × d_1)

1M

Calculation of length d_1 :-



d_1 = 150 − 2 × cover (d_1 = D − 2 × cover)

d_1 = 120 mm

Total length of main bar

= 3000 − (2 × 15) + (2 × 9 × 12) + (0.42 × 120)

= 3236.4 mm

= 3.2364 m.

Q .NO	SOLUTION	MARKS
Q.4. A)	Number of main bars $= \frac{\text{J.L} - 2\times\text{covers}}{\text{Spacing}} + 1$ $= \frac{6500 - (2\times15)}{150} + 1$ $= 44.13$ bars $\cong$ 45 bars. (b) length of distribution bars. = Total length of beam $- (2\times\text{cover}) + (2\times9\times\phi)$ $= 6500 - (2\times15) + (2\times9\times6)$ $= 6578$ mm $= 6.578$ m No. of bars $= \frac{\text{J.L} - 2\times\text{cover}}{\text{Spacing}} + 1$ $= \frac{3000 - (2\times15)}{200} + 1$ $= 15.85 + 4$ bars $= 19.85$ bars $\cong$ 20 bars. Bar Bending Schedule	**1M**

SR. NO	Description	NO.	length (m)	Total length(m)	weight $\phi^2/162$	Total weight
1)	main bar (12mm ϕ)	45	3.2364	145.638	0.889	129.456 (Kg)
2).	distribution bar (6mm ϕ)	20	6.578	131.56	0.222	29.235

Total weight = 158.69

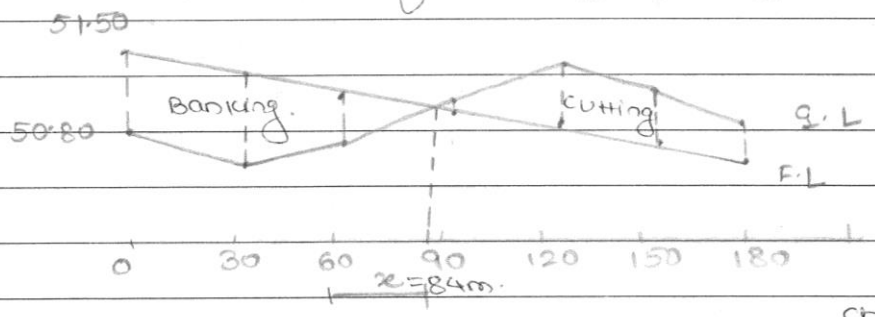
1M **1M** **1M**

Q .NO	SOLUTION	MARKS
Q. 4. b	Mid Sectional Area Method: -	

4) b) Formation width of road = 12m

Side slopes 1V : 2H in banking & 1V : 1.5H in cutting.

Formation level of starting chainage = 51.50 m.



1M

1) Formation level at ch. 30 = F.L of previous chainage − $\frac{1}{\text{gradient}}$ × difference in chainage

1M

$= 51.50 - \frac{1}{200} \times 30$

$= 51.35$ m.

2) F.L at ch. 60 $= 51.35 - \frac{1}{200} \times 30$

$= 51.20$ m

3) F.L at ch. 90 $= 51.20 - \frac{1}{200} \times 30$

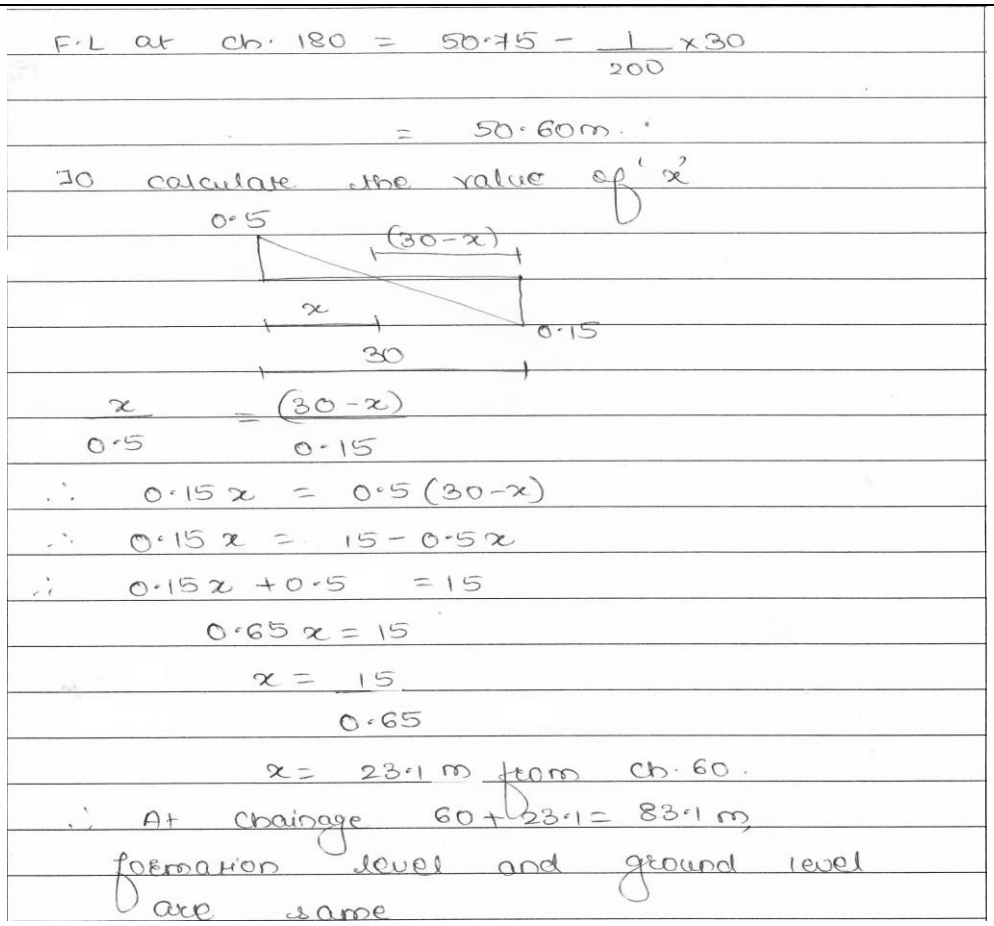
$= 51.05$ m

4) F.L at ch 120 $= 51.05 - \frac{1}{200} \times 30$

$= 50.90$

5) F.L at ch. 150 $= 50.90 - \frac{1}{200} \times 30$

$= 50.75$ m

Q .NO	SOLUTION	MARKS
Q. 4. b		1M

F.L at ch. 180 = $50.75 - \frac{1}{200} \times 30$

$= 50.60\,m$

To calculate the value of 'x'

$\frac{x}{0.5} = \frac{(30-x)}{0.15}$

$\therefore 0.15x = 0.5(30-x)$

$\therefore 0.15x = 15 - 0.5x$

$\therefore 0.15x + 0.5 = 15$

$0.65x = 15$

$x = \frac{15}{0.65}$

$x = 23.1\,m$ from ch. 60.

$\therefore$ At Chainage $60 + 23.1 = 83.1\,m$, formation level and ground level are same

Chainage	F.L	G.L	Depth (d)	Mean Depth (dm)	Bxdm B= 12m	Sxdm² S_c=1.5 S_f = 2	A= Bdm+Sdm²	Length	Quantity = AxL	
									Banking	Cutting
0	51.50	50.80	0.7							
				0.725	8.7	1.0512	9.7512	30	292.536	
30	51.35	50.60	0.75							
				0.625	7.5	0.781	8.281	30	248.43	
60	51.20	50.70	0.5							
				0.25	3	0.125	3.125	23.1	72.12	
83.1	00	00	0							
				0.075	0.9	0.00843	0.9084	6.9		6.27
90	51.05	51.20	-0.15							
				0.325	3.9	0.158	4.058	30		121.74
120	50.90	51.40	-0.5							
				0.525	6.3	0.4056	6.7056	30		201.168
150	50.75	51.30	-0.55							
				0.95	11.4	1.354	12.754	30		382.62
180	50.60	51.0	-0.4							
									613.086m^3	711.798 m^3

3M

Q.4. c

(Note: - Students may assume any different Rates for Materials and for Labour, Examiner should give proportionate makes for the answer)

Assume Area of Plaster = 100m^2 — 1M

Volume of mortar = 0.012 x 100 = 1.2 cu.m.

Increase by 20% for filling the joints etc = $1.2 + 1.2\ x\ (\frac{20}{100})$ =1.44 cum

Volume of wet mix = $1.44 + (1.44\ x\ (\frac{1}{3}))$= 1.92 cum.

Cement = $\frac{1.92}{1+4}\ x\ 1 = 0.384m^3$ — 1M

No. Of Cement Bags = $\frac{0.384}{0.035} = 10.97\ bags = 11bags$ — 1M

Sand = $\frac{1.92}{1+4}\ x\ 4 = 1.536m^3$

Particulars	Quantity	Rate	amount
A. Materials:			
Cement	11	350	3850
Sand	1.536	1200	1843.20
Scaffolding	LS	LS	500
B. Labours:			
Head mason	½	400	200
Mason	10	300	3000
Mazdoor	15	200	3000
Contingencies, Tools and Plants	LS	LS	200
		Total	12593.20
C. Water charges 1% of total			125.932
		Total	12719.132
D. Profit and Overhead charges 10% of total			1217.91
		Grand Total	**13991.045**

1M — 1M — 1M — 1M

Q .NO	SOLUTION	MARKS
Q.4.d)	**Rate Analysis:** The method of determining the rate of a particular item of work by Considering the quantities and cost of material and labour is called as rate analysis. **Factors affecting Rate Analysis:-** 1. Major Factors :- a) Material b) Labour 2. Minor Factors: -a) Special Equipment b) Place of work c) Nature of work d) Conditions of Contract e) Profit of the contractor f) Specification g) Site Condition h) Miscellaneous **Major Factor:-** **a) Materials:-** The material can be calculated by knowing the specification of the items. The price of various materials depends upon market conditions. The cost of material is taken as delivered at site inclusive of transport, local taxes, and other charges. For tools and plants and miscellaneous petty item which cannot be accounted in details lump sum provision is made. It is also necessary to include a certain percentage of waste of all materials to cover breakage, losses, cutting waste etc. **b) Labour: -** The labour force will be necessary to arrange the materials in proper way so that the items can be completed. The amount of labour force required to carry out a unit of a particular item is decided from past experience or in case of Complicated items it is decided by carrying out a sample of that item. The labour force required depends upon the efficiency of labourer hence this force will vary From place to place and also there prices. By knowing the amount of labour force and wages of laborer the cost of labour can be calculated	**3M** **3M**
Q.5	Attempt **any two** of the following:	**8 X 2=16**
a)	Explain the terms:	8 M
	i) **Lead:** The horizontal distance between the trench pit and the place where excavated earth is placed is called as **lead**. The unit of lead is 50 m for a distance upto 500 m, 500 m for a distance exceeding 500 m upto 5 km and 1 km for distance exceeds 5 km. ii) **Lift:** It is the depth of excavation or the vertical movement of material. Generally lift is taken as 1.5 m below ground level. Extra lift shall be measured in unit of 1.5 m or part thereof. **iii) Task work:** The capacity of a skilled labour to do the quantity of work per day called task work. Task work is depends on the nature, size, height, situation, location, climate condition, techniques adopted, wages paid.	**02** **02** **02**

Q.5. a)

Particulars of Item	Quantity	Per Day
P.C.C (1:4:8) in foundation	5 cubic meter	Per Mason
B.B. Masonry in Super Structure	1 cubic meter	Per Mason
R.C.C Slab in C.C 1:1.5:3	3 cubic meter	Per Mason
20mm thick Cement Plaster in C.M 1:6	8 Square Meter	Per Mason

iv**) Work charge establishment:** It is the establishment which is charged to the works directly. During the construction of a building or a project, a certain number of work supervisors, chaukidaars, mates, munshies etc. are required to be employed and their salaries are to be paid from the amount of work-charged establishment provided in the estimate. A percentage of 1 ½ to 2 % of the estimate is included in the estimate. The work-charged employees are temporary staff and their appointment shall have to be sanctioned by competent authority for a specific period. **02**

Q.5. b) Prepare rate analysis for brickwork in superstructure in c.m. 1:6 for 10 cu.m. 8 M

Solution:

A) Calculation of materials:

i) Dry volume (consider frog filling, wastage etc.) = 35% of volume of brick masonry ,

= (35/100) x 10 = 3.5 cu.m 01

ii) Volume of cement = [3.5/(1+6)] x 1 = 0.5 cu.m

Number of bags = 0.5/0.035 = 14.28 = 14.5 bags. 01

iii) Volume of sand = [3.5/(1+6)] x 6 = 3 cu.m 01

iv) Number of bricks:

Size of brick with joint = 20 cm x 10 cm x 10 cm.

= 0.2 m x 0.1 m x 0.1 m.

= [10/ (0.2 x 0.1 x 0.1)] = 5000 Nos.

Assume 5 % of wastage = (5/100) x 5000 = 250

Q.5. b) Number of bricks = 5000 + 250 = 5250 Nos. — 01

B) Rate analysis

Particulars	Quantity	Rate		Per	Amount	
		Rs.	Ps.	Unit	Rs.	Ps.
1. Materials:						
Cement	14.5 Bags	300	00	Bag	4350	00
Sand	3 cu.m	800	00	Cu.m	2400	00
Bricks	5250 Nos	7	00	Nos.	36750	00
Scaffolding	L.S	200	00	L.S	200	00
2. Labours:						
Head Mason	½ Nos.	325	00	Day	162	50
Mason	8 Nos.	314	00	Day	2512	00
Male Mazdoor	5 Nos.	273	00	Day	1365	00
Female Mazdoor	3 Nos.	269	00	Day	807	00
Bhisti	2 Nos.	273	00	Day	546	00
Contingencies, T & P etc	L.S	L.S	L.S	---	250	00
				Total	49342	50

— 03

3. Add 1.5 % water charges = 740.13

4. Add contractor's profit @ 10 % of total = 4934.25

Grand total = 55016.38

Rate per cu.m = 55016.38/10 = Rs. 5501.64/- — 01

Note : Examiner should keep in mind that rates of materials and labours differs from place to place and time to time, marks should be given for proper problem solving sequence.

Q .NO	SOLUTION	MARKS
Q.5. c)	A RCC beam 230x300 mm and length 3000 mm is reinforced with 3 no. of 12 mm ø main bar placed in one row out of 3,2 bars are straight and one bar is bent up respectively. In addition to this 2 anchor bars of 10 mm dia. are provided at top. 6 mm ø stirrups are provided at 150mm c/c. The overall cover provided to beam is 20 mm. Calculate total quantity of reinforcement (steel).	08 M

Solution:

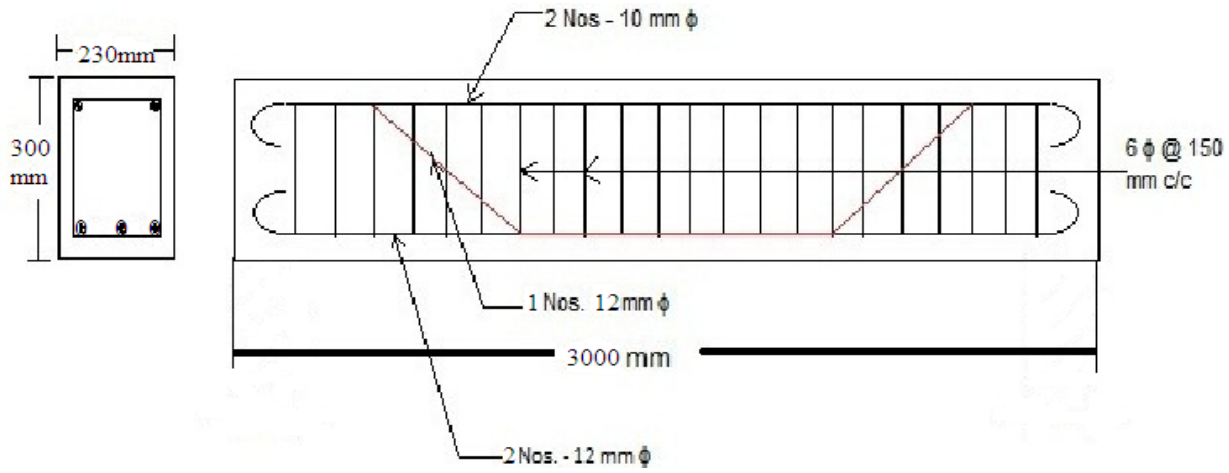
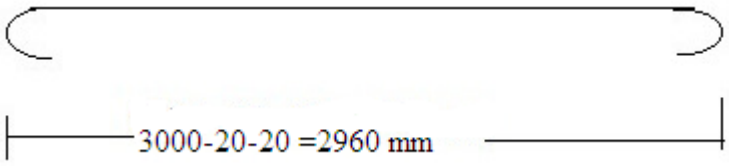


Fig : Cross section and Longitudinal section of the beam given.

Calculation of quantity of steel:

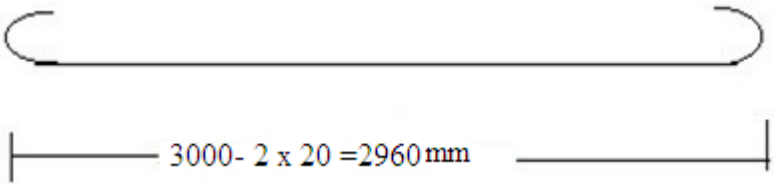
1) Top bars – 2 Nos.- 10 mm ϕ



Length of top bar = (Length- 2 x cover + 18 x hooks dia.)

= (3000-2x20)+18x10 = 3140 mm ½

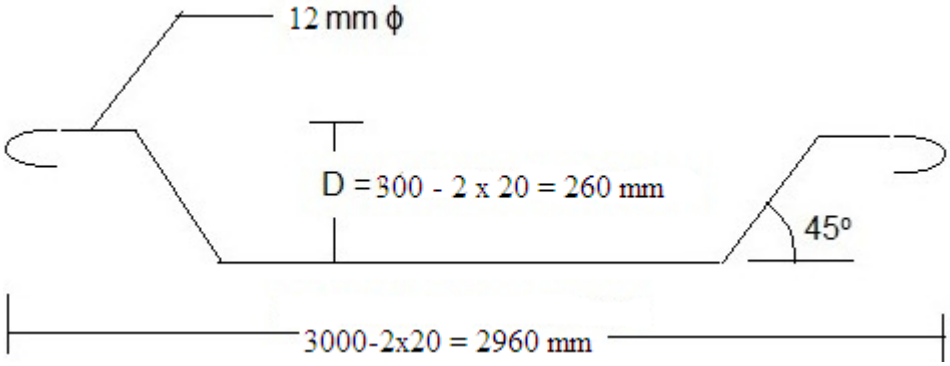
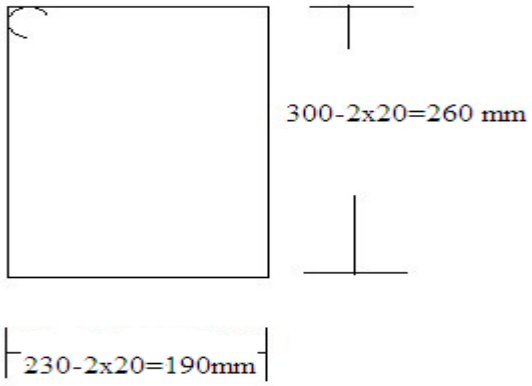
2) Bottom bars – 2 Nos. – 12 mm ϕ



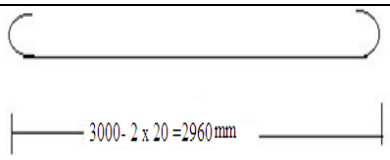
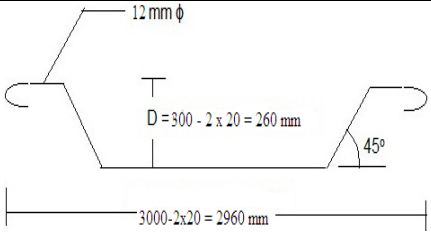
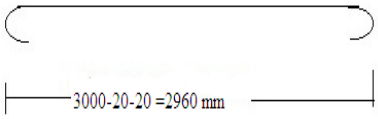
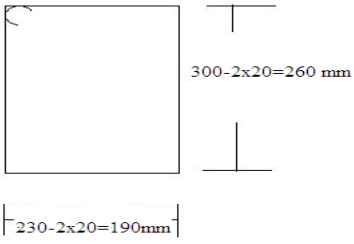
Length of bottom bar = (Length- 2 x cover + 18 x hooks dia.)

= (3000-2x20)+18x12 = 3176 mm ½

3) Bent up bars – 1 Nos. – 12 mm ϕ

Q .NO	SOLUTION	MARKS
Q.5. c)	 Length of bent up bars = (length -2 x cover) + (2 x 0.42x D) + (18 x dia) = (3000 – 2 x 20) + (2 x 0.42 X 260) +(18 x 12) = 3394.4 mm 4) Stirrups – 6 mm ϕ 150mm c/c  Length of 1 stirrup = (perimeter i.e. sum of all sides) + 24 d = (190x2+260x2) + 24x6 = 1044 mm. No. Of stirrups = $\frac{\text{Length / span over which stirrups are spread}}{\text{c/c distance between the stirrups}} + 1$ = $\frac{(3000) - (2 \times 20)}{150} + 1$ = 20.73 = 21 Nos	01 01

Q .NO	SOLUTION	MARKS
Q.5. c)	Bar bending schedule:	

Sr. No.	Description of bars	Dia.Of bar **mm**	Shape of bar	Length of each bar **m**	No.	Total length m	Unit wt **Kg / mtr**	Total wt. **kg**	
1	Bottom bars	12		3.176	2	6.352	$12^2/162$ =0.88	5.589	01
2	Bent up bars	12		3.394	1	3.394	$12^2/162$ =0.88	2.986	01
3	Top Bars	10		3.140	2	6.28	$10^2/162$ =0.62	3.893	01
4	Stirrups	6		1.044	21	21.93	$6^2/162$ =0.22	4.823	01 01
						Total wt.(kg)		**17.29**	

Q .NO	SOLUTION	MARKS
Q.6	Attempt **any two** of the following:	8X2=16
a)	Work out the quantity of following items for septic tank refer figure No.3.	08 M

Solution:

Sr. No	Description of items and details of work	No.	Length (m)	Width (m)	Depth (m)	Qty	Explanatory notes	
1	**Earth work in Excavation**							
	Septic tank soak-pit up to 3m depth	1	2.80	1.70	1.95	9.28	Ht.=140+30+20+5	
		1	$(\pi x 2^2)/4$	X	3.00	9.42	=1.95	02
	Soak pit lower portion	1	$(\pi x 1.4^2)/4$	X	0.20	0.30	Below dry brick work	
					Total	19cu.m		
2	**Cement concrete**							
	1:3:6- floor and foundation	1	2.80	1.70	0.20	0.95		
	sloping floor						Average thickness	
		1	2.00	0.90	0.05	0.09	(10+0) / 2 =5	02
					Total	1.04		
						Cu.m		
3	**First class brickwork** in 1:4 cement mortor in septic tank-							
	Long wall							
	1 st step	2	2.60	0.30	0.60	0.94		01
	2 nd step	2	2.40	0.20	1.15	1.10		
	Short wall							
	1 st step	2	0.90	0.30	0.60	0.32		
	2 nd step	2	0.90	0.20	1.15	0.42		
					Total	2.78	Cu.m	$^1/_2$

Q .NO	SOLUTION	MARKS

Q.6 a)

Sr. No	Description of items and details of work	No.	Length (m)	Width (m)	Depth (m)	Qty	Explainatory notes	
	2 nd class brick work in 1:6 cement mortor in soak pit							**1/2**
	In upper portion	1	(π x 1.20)	X 0.20	0.50	0.38		
	Lower portion	1	(π x 1.20)	X 0.20	0.20	0.15		
					Total	0.53	Cu.m	
	2 nd class dry brick work in soak pit	1	(π x 1.20)	X 0.20	2.50	1.88	Cu.m	**1/2**
4	**Slab on septic tank 75 mm thick**							
	Finished smooth including steel reinforcement complete laid in position-							**02**
	Roof cover slab of septic tank	1	2.40	1.30	0.075	0.234	7.5 cm thickness	
	Roof cover slab of soak pit	1	$(\pi x 1.40^2)/4$	X	0.075	0.115		
	baffle wall in septic tank	1	1.00	0.04	0.45	0.018		
					Total	0.367	Cu.m	

Q .NO	SOLUTION	MARKS
Q6.b)	Prepare rate analysis for P.C.C of grade M15.	08 M

Solution:

Consider 10 m^3 of P. C. C. (1:2:4)
Volume of wet concrete =10 m^3
Total dry volume of concrete = 1.52 x 10 m^3 = 15.2 m^3
Quantity of materials:

i) Aggregate quantity = [15.2/(1+2+4)] X 4 =8.68 m^3 — 01

ii) Sand quantity = [15.2/(1+2+4)] X 2 = 4.34 m^3 — 01

iii) Quantity of cement = =[15.2/(1+2+4)] X 1= 1.085 m^3 — 01

No of bags of cement = 1.085/0.035 =31 bags

Rate analysis:

Particulars	Quantity	Rate		Per	Amount	
		Rs.	Ps.	Unit	Rs.	Ps.
1. Materials:						
Cement	31 Bags	300	00	Bag	9300	00
Sand	4.34 m^3	800	00	Cu.m	3472	00
Coarse aggregate	8.68 m^3	510	00	Cu.m	4426	80
2. Labours:						
Head Mason	½ Nos.	500	00	Day	250	00
Mason	2 Nos.	400	00	Day	800	00
Male Mazdoor	12 Nos.	250	00	Day	3000	00
Female Mazdoor	20 Nos.	200	00	Day	4000	00
Bhisti	4 Nos.	250	00	Day	1000	00
Sundries, T & P etc	L.S	L.S	L.S	---	1000	00
				Total	27248	80

03

1. Add 1.5 % water charges = 408.72 — ½

<table>
<tr><th>Q .NO</th><th>SOLUTION</th><th>MARKS</th></tr>
<tr><td>Q6.b)</td><td>2. Add contractor’s profit @ 10 % of total = 2724.8

Grand total = 30381.52

Rate per cu.m = 30381.52/10 = Rs. 3038.15/-

Note : Examiner should keep in mind that rates of materials and labours differs from place to place and time to time, marks should be given for proper problem solving sequence.</td><td>$^1/_2$

01</td></tr>
<tr><td>Q6.c)</td><td>Calculate the quantity of excavation and UCR masonry work and enter in standard measurement sheet with brief description of item of work for community well as shown fig. No.2</td><td>08 M</td></tr>
<tr><td></td><td>Solution:

As width is not given, consider given well as circular well.

Standard Measurement sheet:

<table>
<tr><th>Sr No</th><th>Description</th><th>No.</th><th>Length (m)</th><th>Width (m)</th><th>Depth (m)</th><th>Qty (m^3)</th><th>Total Qty</th><th>Explainatory notes</th></tr>
<tr><td>1</td><td>Earth work in Excavation in Soft soil below ground level
a) 0-1.5 m
b) 1.5- 3 m</td><td>
1
1</td><td>
$(\pi/4)x9.6^2$
$(\pi/4)x9.6^2$</td><td>
X
X</td><td>
1.5
1.5</td><td>
108.57
108.57</td><td rowspan="3">

817.67
Cu.m</td><td>9.6=8.4+0.6x2
Soil 3m from G.L</td></tr>
<tr><td></td><td>Earth work in Excavation in Hard murrum
a)3 m to 4.5 m
b)4.5 m to 6 m</td><td>
1
1</td><td>
$(\pi/4)x9.6^2$
$(\pi/4)x9.6^2$</td><td>
X
X</td><td>
1.5
1.5</td><td>
108.57
108.57</td><td></td></tr>
<tr><td></td><td>Earth work in Excavation in soft rock
a) 6 – 7.5 m
b) 7.5 – 9 m</td><td>
1
1</td><td>
$(\pi/4)x9.6^2$
$(\pi/4)x9.6^2$</td><td>
X
X</td><td>
1.5
1.5</td><td>
108.57
108.57</td><td></td></tr>
</table>
</td><td>$1^1/_2$

$1^1/_2$

$1^1/_2$</td></tr>
</table>

Q .NO	SOLUTION	MARKS

Q.6 c)

Sr No	Description	No.	Length (m)	Width (m)	Depth (m)	Qty (m^3)	Total Qty	Explainatory notes	
	Earth work in Excavation in hard rock						**817.67 Cu.m**		
	a)9- 10.5 m	1	$(\pi/4)x8.4^2$	X	1.5	83.12			$1^1/_2$
	b)10.5 – 12m	1	$(\pi/4)x8.4^2$	X	1.5	83.12			
2	UCR Masonry								
	a)60 cm thick portion	1	π x 9	x0.60 x	X 2.7	45.80		9=(8.4+9.6)/2	01
	b)30 cm thick portion	1	π x 8.7	x0.30x	X 7	57.39	**103.19 cu.m**	8.7=(8.4+9)/2 7 = 6+1	01