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. 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.

Important notes to examiner

1. **In Question No- 4(a) Student may find quantity by centerline method. Final answer will be same by all methods.**
2. **In Question No- 5(a) if student have calculated the rate of sand and aggregates in brass instead of m3 marks should be given accordingly. Rates will be different at different places hence examiner should give proportionate marks. Marks should not be given according the GRAND TOTAL, marks should be given according to data entered by students i.e Material, Labour, Centering Shuttering etc.)**
3. **A) In Question No- 5(d) in this numerical depth of excavation is not mentioned hence if student have attempted this quantity full marks should be given.**

   B) Thickness of brick work is not given if students have assumed thickness of brickwork 0.23m thick or 0.3m thick or have attempted this question full marks should be given to students by examiner.

   C) P.C.C is calculated considering thickness of BBM as 0.3m. If students have considered thickness as 0.23m thick proportionate marks should be given.

   D) R.C.C slab is calculated considering thickness of BBM as 0.3m. If students have considered thickness as 0.23m thick proportionate marks should be given.

Q .NO	SOLUTION	MARKS
Q.1	**Attempt Any Three of the following:**	12 M
a)	**State different types of estimates and explain any one in detail.**	04 M
	• **There are two types of estimates:** **1) Approximate estimate or preliminary estimate** **2) Detailed estimate** **1) Approximate estimate or preliminary estimate:** • This estimate is required for preliminary studies of various aspects of work or project, to decide the financial position and policy for administrative sanction by the competent authority. In case of commercial projects as irrigation projects, residential, building project and similar project which earn revenue, the probable income may be work out. To prepare the approximate estimate less skill and time is required. **3) Detailed estimate or item rate estimate:** • Detailed estimate is an accurate estimate and consists of working out the quantities of each item of work. The dimensions, length, breadth and height of each item are taken out correctly from drawing and quantities of each item are calculate, and abstracting and billing are done. All other expenses required for satisfactory completion of project are added to the above cost to know the total cost of the detailed estimate.	**01M** **3M (for any one)**
b)	**Explain the lead and lift.**	04 M
	1. **Lead: -** It is the horizontal distance between the trench pit and the place where excavated earth is deposited. Normally lead is taken as 30m. Separate measurements are taken for every 30m lead. **Lift: -** It is the depth of excavation or the vertical movement of material is called Lift. Normally lift is taken as 1.5m. Separate measurements are taken for every 1.5m lift.	**02 M** **02M**
c)	**How will you prepare approximate estimate for roads and highways**	04 M
	Approximate estimate for roads and highways is prepared for per kilometer basis depending on the nature of road, width and thickness of metal etc. for roads and highways the factors to be considered area, land to be acquired, quantity of earthwork, type of road etc. 1. The cost of land acquired: The cost is variable if the route is passing through highly developed area, the cost of this item will be very high 2. The cost of excavation, embankment and drainage: The cost of this item depends on the topography of the country through which the highway runs. 3. The cost of road surface or pavement: the cost of this item is fairly constant for two different highways with same road surface. e.g. for 10 km of a state highway approximate cost @ Rs. 500000 per 1 km works out as Rs.50 lakhs.	**04 M**

d) Differentiate with respect to four points' unit quantity method and total quantity method. — **04 M**

1 M (for each point)

Sr.No	Unit quantity method	Total quantity method
1	In unit quantity method the work is divided into various items	In total quantity method item of work divided into the following five subdivisions a) Material, b) labour c) plant d) overheads e) profit.
2	The total quantity of work under each item is taken out in proper unit of measurement.	The total quantity of each kind or class of material or labour are found and multiplied by their individual unit cost.
3	The total cost per unit quantity of each item is analyzed and work out.	Similarly, the cost of plants, overhead expenses and profit are determined.
4	Then the total cost for the item is found by multiplying the cost per unit quantity by no. of units.	The cost of all the five sub-heads is summed up to give the estimated cost of the item of work.

1)B Attempt any ONE of the following — **6 M**

a) Describe 'provisional quantities' and 'provisional sum' — **6 M**

Provisional Sum: — **3M**

Certain amount provided by experience estimators in the estimated cost of the project for some special type of work whose details are not known at the time of preparing estimate called "provisional sum". Some special works are listed below.

Shifting of water lines, Installation of air conditioner and its fittings, sever lines such a work are done through licensed contractor or through respective department.

Provisional quantities: — **3M**

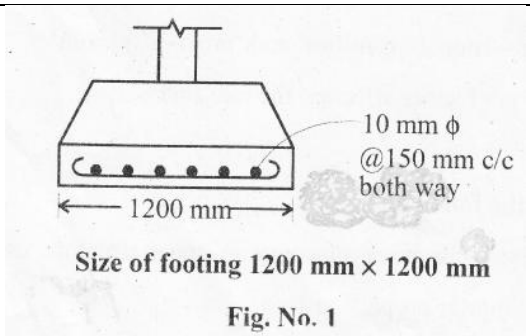
These are the additional quantities which are not included in estimate. It occurs due to variation of site condition. These quantities are work out separately from the dimension of drawing and kept in the bill of quantities under a heading "provisional quantities". When there is a possibility of certain concrete piles required to be lengthened in position, provisional quantities for the work shall be provided separately for the additional quantities.

b)	Explain any six factors affecting the rate analysis	6 M
	Factors affecting Rate Analysis:- **1. Major Factors :-** a) Material b) Labour **2. Minor Factors:** -a) Special Equipment b) Place of work c) Magnitude of work d) Conditions of Contract e) Profit of the contractor f) Specification g) 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 **Minor factors:-** **a) Special equipments: -** different types of tools and plants are necessary for execution of work. A good estimator will decide whether purchasing is more economical or hiring the tools and plants is advisable. **b) Place of work:-** if the site is in remote areas, transportation charges increases similarly labour charges also varies i.e. if site conditions are difficult, cost will be more. **c) Magnitude of work: -** greater the magnitude of work lesser will be the cost. **d) Conditions of Contract**:- if the condition of contract is very stiff the rates are high **e) Profit of the contractor: -** Normally 10% of actual cost of work is considered as contractor profit. **f) Specification: -** it shows the proportion of material, the method of construction and execution of work. If superior quality material issued rate will be higher. **g) Miscellaneous: -** time of completion, climatic condition, also affects the rate of item.	**1 M (for each factor)**

2)	**Attempt any TWO of the following**	**16 M**
a)	**Prepare the rate analysis for brick masonry in super-structure using traditional bricks and cement mortar proportion 1:6**	**8 M**
	Rate Analysis for Brick Work in Super Structure in C.M (1:6) in Super Structure Assume 1st Class Brickwork Assume Volume of Brick Masonry = 10m3 a) Dry Volume = 35% of volume of masonry $= \frac{35}{100} \times 10 = 3.5$ cu.m.	**1M**
	b) Volume of Cement $= \frac{\text{Dry Volume}}{\text{Sum of Mix Proportion}} \times$ Content of cement in proportion Volume of Cement $= \frac{3.5}{1+6} \times 1 = 0.5$ cu. m No. of Cement Bags $= \frac{0.5}{0.0347} = 14.409$ bags = approximately = 15 bags	**1M**
	c) Volume of Sand $= \frac{\text{Dry Volume}}{\text{Sum of Mix Proportion}} \times$ Content of Sand in proportion Volume of Sand $= \frac{3.5}{1+6} \times 6 = 3$ cu. m	**1M**
	d) Number of Bricks Size of one Brick = 19cm x 9cm x 9 cm = 0.19m x 0.9m x 0.9m Add thickness of Mortar through out = 1cm Size of Brick with mortar = 0.2m x 0.1m x 0.1m Number of Bricks $= \frac{10}{0.2 \times 0.1 \times 0.1} = 5000$ Nos. Assume 5% wastages $= \frac{5}{100} \times 5000 + 5000 = 5250$Nos.	**1M**

	Sr.No.	**Particulars**	**Quantity**	**Rate Rs.**	**Per**	**Amount Rs.**	
	1	Material					
		Cement	15	350	Bag	5250	
		Sand	3	650	M3	1950	
		Bricks	5250	5	No.	26250	
		Scaffolding	Lump Sum	Lump Sum	Lump Sum	100	**2M**
						33550	
	2	Labor					
		Head Mason	0.5	400	Day	200	
		Mason	9	300	Day	2700	
		Male Mazdoor	13	250	Day	3250	
		Female Mazdoor	5	200	Day	1000	
		Bhisti	2	200	Day	400	
		Contingencies T& P	Lump Sum	Lump Sum	Lump Sum	400	
						7950	
					Total	41500	
	3	Water Charges			1.5%	622.50	
						42122.50	
	4	Profit & Overhead			10%	4212.25	
					Grand Total	**46334.75**	**2M**
	Rate Per Cubic Meter = 46334.75/10 = 4633.4 Rs						
b)(i)	**The cost of construction of school building is 2.50 crores for a capacity of 600 students and area of construction is 1600 m2. Prepare approximate estimate of a newly proposed school building for 1500 students with the area of 5000 m^2 .Use plinth area method.**						**4M**
	Cost of plinth area of existing school building $= \frac{25000000}{1600}$ $= 15625$ Rs/m^2 Then, The approximate cost of Newly proposed school building =Total plinth area of proposed building X cost per plinth area of similar existing building = 15625 X 50000 = 7.8125 crores						**2M** **2M**

(ii)	**Describe 'typical bay' method for approximate estimate.**	**4M**
	Typical Bay Method: This method is used for the buildings have similar column spans over a larger area such as factory buildings, go-downs, railway platform. Cost of each bay is found out by using other method of estimation. Then the cost of whole factory building is worked out by multiplying the total number of bays by the cost of construction for each bay. **Approximate cost = no. of bays X cost of one bay**	**4M**
c)(i)	**State the desired accuracy in taking measurements of items of work as per IS-1200**	**4M**
	To achieve the desired accuracy in measurements, following points shall be observed, 1. Dimensions shall be measured to the nearest 0.01 m except the following: • Thickness of slab measured nearest to 0.005 m. • Wood work to nearest 0.002m. • Reinforcement to nearest 0.005 m. • Thickness of roadwork less than 20 cm, measured nearest to 0.005m. 2. Areas shall be measured to the nearest 0.01sq.m. 3. Cubic content shall be worked out nearest to 0.01cu.m. Wood work shall be measured nearest to 0.001cu.m. 4. Weights shall be workout to nearest 1 kg.	**1M (For each point)**
(ii)	**Give the market rates of the following materials.**	**4M**
	a) Cement bag:- 290-350 Rs/bag b) Reinforcing steel:- 32000-35000 per ton c) Teak wood:- 3000-3100 per ft^3 d) Coarse aggregate (20 mm to 22 mm):- 900-1000 m^3	**1M (For each)**
Q3.	**Attempt Any Four of the following:**	**16 M**
a)	**What are the advantages of using software (QE – Pro) in preparation of estimates of civil engineering works?**	**04 M**
	Following are the advantages of QE-Pro: 1) Fort of accurate quantity computation. 2) Calculates quantities from building plans. 3) Generation of measurement sheet in LBD format. 4) Cost break up for material, labour and machine. 5) Project planning and Gantt chart. 6) Interface with MS project.	**1 M Each give any four**
b)	**Enlist any four software used for estimation in civil engineering.**	**04 M**
	1) QE-Pro 2) 2002 CD Estimator. 3) Chief Estimator 4) ICE 2000. 5) TECS. 6) Estimator 2.0 7) Estimate Master 5.13 8) Build Soft 9) Plan Swift Software 10) EXTRAXION Estimating Software etc.	**1M for each give any four points**

c)	**State any four purposes of estimating and costing.**	**04 M**
	Purpose of Estimating 1) To know the approximate cost of proposed work. 2) To obtain administrative approval and technical sanction. 3) To know the requirement of tools, plants and equipment. 4) To fix up the completion period. 5) To draw up a construction schedule and programme. 6) To know value of property. 7) To invite tender. 8) To keep control over expenditure during construction. **Purpose of Costing** 1) To arrange the finance for proposed work. 2) To know the probable cost of project before the execution. 3) For valuation of existing property 4) To know the cost of various items, well in advance, to be constructed.	**1M for each give any four points**
d)	**State the rules for deduction in plastering as per IS - 1200.**	**04 M**
	Plastering usually 12mm thick is calculated in sq.m. Deduction in plastering are made in the following manner 1) No deduction is made for ends of beams, posts, rafters etc. 2) No deduction is made for opening up to 0.5 sq.m. And no addition is made for jambs, soffits and sill of these opening. 3) For opening more than 0.5 sq.m. And up to 3 sq.m. Deduction is made for one face only. No addition for jambs, soffits and sills. 4) For opening above 3 sq.m. Deduction is made for both faces of openings, and the jambs, soffits and sill shall be added.	**1 M Each**
e)	**Explain PWD method of taking out quantities.**	**04 M**
	PWD method is also called as Long wall and short wall or 'out-to-out' and 'in-to-in' method. For the accurate estimate the dimensions, length, breadth and height or depth are taken out correctly from drawings. Then the following steps are followed 1) Draw the center line plan. 2) Consider wall spanning in horizontal direction as 'long wall' and vertical direction as 'short wall' in plan or vice versa. 3) Calculate the center to center lengths of long wall and short wall 4) Calculate length of 'long wall' out to out Length of long wall = c/c length of long wall + width of item 5) Calculate length of 'short wall' in to in Length of short wall = c/c length of short wall - width of item 6) Multiply the length by the width and depth to find the quantity. Student should draw a diagram showing long wall and short wall or at least show sample calculation of long wall and short wall.	**04 M**
f)	**Find quantity of 10 mm ϕ reinforcement in footing shown in fig. no. 1 and prepare schedule of reinforcement.**	
	 **Size of footing 1200 mm × 1200 mm** **Fig. No. 1**	**04 M**

Assume cover (all round) = 50 mm **1M**

1) Length of main straight bar
   L = (*l* – cover) + 18d
   = (1200 – 50 – 50) + 18 (10) = 1280 mm
   L = 1.280 m

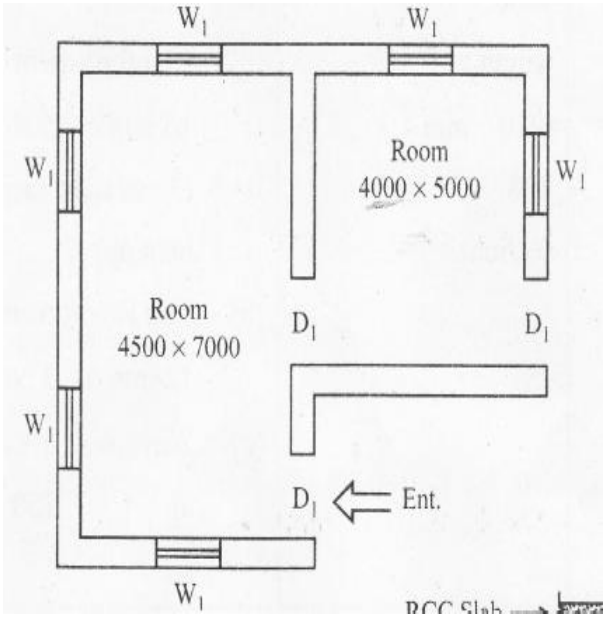
   No of bars $= \frac{\text{Span – Clear cover}}{\text{Spacing}} + 1$
   $= \frac{1200-100}{150} + 1$
   = 7.33 +1
   = 8.33 say 9 Nos.

2) Length of distribution bar
   Same as main bar as footing is square footing and steel same in both direction.
   So total bars = 18 Nos.

Bar Bending Schedule

Sr. No.	Description	Shape of Bar	No.	L (m)	Total length (m)	Dia. Of bar (mm)	Wt. kg/m ($\phi^2/162$)	Total wt. in kg
1	Main and distribution bar 10 mm ϕ		18	1.280	23.04	10	0.62	14.28

Q4. (A) **Work out quantities of following any three items from Fig No. 2:** **12 M**



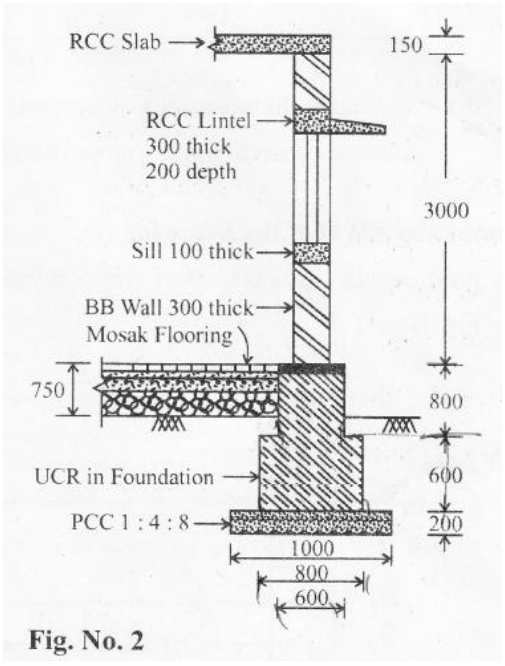
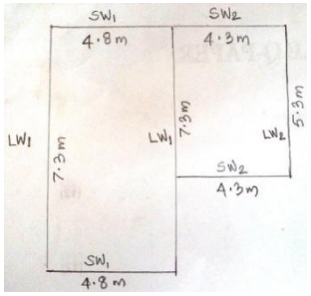


Fig. No. 2

i) Excavation in foundation — **4 M**

Item No.	Description or Particular of work	No	Length	Breadth	Depth	Quantity	Total Quantity
i)	**Excavation in foundation**						
	 Center line plan Long wall : LW1 = 7.3; LW2 = 5.3. Short Wall SW1 = 4.8; SW2 = 4.3						
	LW1 = 7.3 + 1 = 8.3m	2	8.300	1.000	0.850	14.110	
	LW2 = 5.3 + 1 = 6.3m	1	6.300	1.000	0.850	5.355	
	SW1 = 4.8 – 1 = 3.8m	2	3.800	1.000	0.850	6.460	
	SW2 = 4.3 – 1 = 3.3m	2	3.300	1.000	0.850	5.610	
							31.535m^3

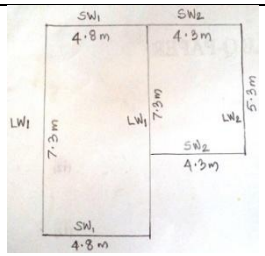
Note: Student may find quantity by centerline method. Final answer will be same by all methods.

1 M for center line calcula-tion

2 M for final correct answer

1 M for proper table work and calcula-tion

ii) PCC 1 : 4 : 8 in foundation — **4 M**

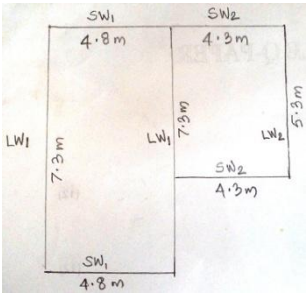
Item No.	Description or Particular of work	No	Length	Breadth	Depth	Quantity	Total Quantity
i)	**PCC 1 : 4 : 8 in foundation**						
	 Center line plan Long wall : LW1 = 7.3; LW2 = 5.3. Short Wall SW1 = 4.8; SW2 = 4.3						
	LW1 = 7.3 + 1 = 8.3m	2	8.300	1.000	0.200	3.320	
	LW2 = 5.3 + 1 = 6.3m	1	6.300	1.000	0.200	1.260	
	SW1 = 4.8 – 1 = 3.8m	2	3.800	1.000	0.200	1.520	
	SW2 = 4.3 – 1 = 3.3m	2	3.300	1.000	0.200	1.320	
							7.420 m3

1 M for center line calcula-tion

2 M for final correct answer

1 M for proper table work and calcula-tion

iii) UCR Masonry in foundation and plinth — **4 M**

Item No.	Description or Particular of work	No	Length	Breadth	Depth	Quantity	Total Quantity
i)	**UCR in foundation Step 1.**						
	 Center line plan Long wall : LW1 = 7.3; LW2 = 5.3. Short Wall SW1 = 4.8; SW2 = 4.3						
	LW1 = 7.3 + 0.8 = 8.1m	2	8.100	0.800	0.600	7.776	
	LW2 = 5.3 + 0.8 = 6.1m	1	6.100	0.800	0.600	2.928	
	SW1 = 4.8 – 0.8 = 4.0m	2	4.000	0.800	0.600	3.840	
	SW2 = 4.3 – 0.8 = 3.5m	2	3.500	0.800	0.600	3.360	
						17.904 m3	
ii)	**UCR in plinth Step 2.**						
	LW1 = 7.3 + 0.6 = 7.9m	2	7.900	0.600	0.800	7.584	
	LW2 = 5.3 + 0.6 = 5.9m	1	5.900	0.600	0.800	2.832	
	SW1 = 4.8 – 0.6 = 4.2m	2	4.200	0.600	0.800	4.032	
	SW2 = 4.3 – 0.6 = 3.7m	2	3.700	0.600	0.800	3.552	
						18.000 m3	
	Total UCR in plinth and foundation.						**35.904 m3**

Note: Student may find quantity by centerline method. Final answer will be same by all methods.

1 M for center line calcula-tion

2 M for final correct answer

1 M for proper table work and calcula-tion

iv) Mosaic flooring — **4 M**

Item No.	Description or Particular of work	No	Length	Breadth	Depth	Quantity	Total Quantity
i)	**Mosaic flooring**						
	Room 1	1	4.500	7.000		31.500	
	Room 2	1	4.000	5.000		20.000	
	Door Sill for D1	3	0.300	1.000		0.900	
							52.400 m^2

Note: Students may take different dimensions of room as shown in section of figure but correct method is to take actual dimensions of room.

3 M for calculation

1 M for final correct answer

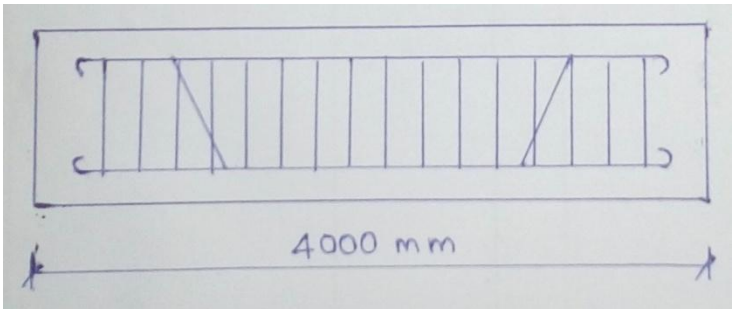
Q4.(B) Attempt any one of the following: — **6 M**

Calculate the quantities of reinforcement for the following and prepare a bar bending schedule.

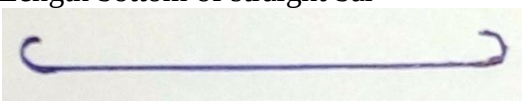
Member	Overall size	Details of Reinforcement
Beam	4000 mm-length (230 mm × 400 mm section)	(a) Bottom Reinforcement 16 mm ϕ - 5 Nos. – (3 straight and 2 bent up) (b) Top Reinforcement 12 mm ϕ – 3 Nos. (c) Stirrups – 6 mm ϕ @ 150 mm c/c

Assume clear cover on all sides = 25 mm.

Length of main bar



i) Length bottom of straight bar



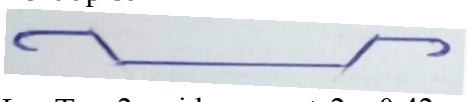
$L = T_L - 2 \times \text{side cover} + 2 \times 9\phi$

$= 4000 - 2 \times 25 + 2 \times 9 \times 16$

$= 4238$ mm.

3 M for calculation of length

i) Bent up bar

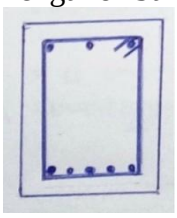


$L = T_L - 2 \times \text{side cover} + 2 \times 0.42 \times d + 2 \times 9\phi$
$= 4000 - 2 \times 25 + 2 \times 0.42 \times 350 + 2 \times 9 \times 16$
$= 4532$ mm.

ii) Length of anchor Bar

$L = T_L - 2 \times \text{side cover} + 2 \times 9\phi$
$= 4000 - 2 \times 25 + 2 \times 9 \times 12$
$= 4166$ mm.

iii) Length of Stirrups



A = 230 – 2 x 25
= 180
B = 400 – 2 x 25
= 350
L = 2 (A + B) + 24 d
= 2 (180 + 350) + 24 x 6
= 1204 mm.

iv) Number of stirrups = $\frac{TL - 2 \times \text{Clear cover}}{\text{Spacing}} + 1$

$= \frac{4000 - 2 \times 25}{150} + 1$

= 27.33 say 28 Nos

Bar Bending Schedule

Sr. No.	Description	Shape of Bar	No.	L (m)	Total length (m)	Dia. Of bar (mm)	Wt. kg/m ($d^2/162$)	Total wt. in kg
1	Bottom straight bar 16 mm ϕ		3	4.238	12.714	16	1.580	20.1
2	Bottom bent-up bar 16 mm ϕ		2	4.532	9.064	16	1.580	14.34
3	Top anchor bar 12 mm ϕ		3	4.166	12.498	12	0.889	11.10
4	Length of Stirrups 6 mm ϕ @ 150 c/c		28	1.204	33.712	6	0.222	7.484
								53.02Kg

3 M for BBS

b)	**Calculate the quantities of cement, sand and coarse aggregate for 40 m^3 cement concrete having proportion (1 : 2 : 4)**	**6 M**
	Wet volume of concrete = 40 m^3 Dry volume = 52% more of wet volume $= \frac{52}{100} \times 40 + 40$ $= 60.80\ m^3$	**1 M**
	Volume of cement = $\frac{\text{Dry volume}}{\text{Sum of proportion}}$ x Content of cement in proportion Volume of cement = $\frac{60.80}{1+2+4} \times 1$ Volume of cement = 8.685 m^3	**2 M**
	Number of cement bags = $\frac{\text{Volume of cement}}{\text{Volume of one cement bag}}$ Number of cement bags = $\frac{8.685}{0.035}$ = **248.14 say 250 bags**	**1 ½ M**
	Volume of Sand = $\frac{\text{Dry volume}}{\text{Sum of proportion}}$ x Content of sand in proportion Volume of Sand = $\frac{60.80}{1+2+4} \times 2$ **Volume of Sand = 17.37 m^3**	
	Volume of Coarse aggregate = $\frac{\text{Dry volume}}{\text{Sum of proportion}}$ x Content of coarse aggregate in proportion Volume of Coarse aggregate = $\frac{60.80}{1+2+4} \times 4$ **Volume of Coarse aggregate = 34.74 m^3**	**1 ½ M**

Q No. 5	Attempt any TWO of the following :								16 M
a)	Find quantity of excavation and concrete for circular community well.								08 M

SR. No.	Description	No.	L	B	H	Unit	Qty	Total Qty	
1	**Excavation**								
i)	a) Excavation upto 1.5m in soft rock	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
	b) Excavation from 1.5m to 3.0m in soft rock	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
	c) Excavation from 3.0m to 4.0m in soft rock	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.0	M^3	19.634		
						M^3		**78.538**	**1M**
ii)	a) Excavation from 4.0m to 4.5m in hard murum	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		0.5	M^3	9.81		
	b) Excavation from 4.5m to 6.0 m in hard murum	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
	c) Excavation from 6.0m to 7.5m in hard murum	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
	d) Excavation from 7.5m to 9.0m in hard murum	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
						M^3		**98.173**	**1M**
iii)	a) Excavation from 9.0m to 10.5m in hard rock	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
	b) Excavation from 10.5m to 12.0m in hard rock	--	$\frac{\pi}{4}d^2=\frac{\pi}{4}x\ 5^2$		1.5	M^3	29.452		
						M^3		**58.904**	**1M**
						M^3	**Total Quantity**	**235.615**	**1M**
2	Concrete a)P.C.C (0.2m thick)		$\frac{\pi}{4}x(5.4^2-5^2)$		1.5	M^3	4,90		**2M**
	b)P.C.C(0.2m thick)		$\frac{\pi}{4}x(7.4^2-5.4^2)$		0.2	M^3	4.021		**2M**
						M^3	**Total Quantity**	**8.921**	

5 (b)

Chainage	0	30	60	90
Ground Level	500	499.70	498.90	497.60
Formation level	497.5	497.3	497.10	496.80
Depth(F.L-G.L)	-2.5	-2.4	-1.8	-0.8

1M

Chainage	Depth	BD	SD^2	$A=BD+SD^2$	$A_m=A_1+A_2$	L	$Q=A_m \times L$	
							Cutting	Filling
0	-2.5	30	9.375	39.375				
30	-2.4	28.8	8.64	37.44	38.407	30	1152.21	--
60	-1.8	21.6	4.86	26.46	31.95	30	958.5	--
90	-0.8	9.6	0.96	10.56	18.51	30	555.3	--
				Total Quantity in m^3			2666.01	--

2M

2M

2M

1M

5 (c)

Rate Analysis for R.C.C. Work (1:2:4) for Slab including Steel Reinforcement

Assume Wet Volume of R.C.C = 10 m^3

a) Dry Volume = 52% more of Wet volume

$= \frac{52}{100} \times 10 + 10 = 15.2$ cu.m.

1M

b) Volume of Cement = $\frac{\text{Dry Volume}}{\text{Sum of Mix Proportion}}$ x Content of cement in proportion

Volume of Cement = $\frac{15.2}{1+2+4} \times 1 = 2.1714$ cu. m

No. of Cement Bags = $\frac{2.1714}{0.0347} = 62.576$ bags

= approximately = 63 bags

c) Volume of Sand = $\frac{\text{Dry Volume}}{\text{Sum of Mix Proportion}}$ x Content of Sand in proportion

Volume of Sand = $\frac{15.2}{1+2+4} \times 2 = 4.3428$ cu. m

d) Volume of Aggregates = $\frac{\text{Dry Volume}}{\text{Sum of Mix Proportion}}$ x Content of Aggregates in proportion

Volume of Aggregates = $\frac{15.2}{1+2+4} \times 3 = 8.6857$ cu. m

e) Assume 1% Steel Reinforcement

Volume of Steel = $\frac{1}{100}\ x\ 10 = 0.1m^3$

Weight of Steel = 0.1 x 7850 = 785 Kg

Binding Wire = 10 x 0.785 = 7.85Kg

Sr.No.	Particulars	Quantity	Rate Rs. P	Per	Amount Rs. P	
1	**Material**					
	Cement	63	350	Bag	22,050	
	Sand	4.3428	650	M^3	2822.82	
	Aggregates	8.6857	900	M^3	7817.13	
	Steel	785	40	kg	31400	
	Binding Wire	7.85	35	Kg	274.75	
					64,364.70	**2M**
2	**Labor**					
	Head Mason	1.5	400	Day	600	
	Mason	3	300	Day	900	
	Male Mazdoor	13	250	Day	3250	
	Female Mazdoor	10	200	Day	2000	
	For Reinforcement Blacksmith	15	200	Day	3000	
	Bhisti	2	400	Day	800	
	Contingencies T& P	Lump Sum	Lump Sum	Lump Sum	200	
					10,750	**2M**
3	**Centering & Shuttering**					
	Carpenter	10	400	Day	4000	
	Mazdoor	10	300	Day	3000	
	Nails	Lump Sum	Lump Sum	Lump Sum	300	**2M**
					7300	
				Total	**82414.70**	
4	Water Charges			1.5%	1236.22	
5	Profit & Overhead			10%	8241.47	
				Grand Total	**91892.39**	**1M**

Rate Per Cubic Meter = $\frac{91892.39}{10} = \mathbf{9189.239Rs}$.

(Note:- if student have calculated the rate of sand and aggregates in brass instead of m^3 marks should be given accordingly. Rates will be different at different places hence examiner should give proportionate marks. Marks should not be given according the GRAND TOTAL, marks should be given according to data entered by students i.e Material, Labour, Centering Shuttering etc.)

5 (d)

SR. No	Desription	No.	L	B	H	Unit	Qty	Total Qty
1	Excavation	-	2.4	6	--	--	--	--
2	BBM (0.3m) thick A=(2.4x6 - 1.8x5.4)=4.68m^2 (1.8+0.3+0.3)=2.4m (5.4+0.3+0.3)=6.0m	-	4.68		2	M^3	--	9.36
3	P.C.C	-	2.4	6	0.15	M^3	--	2.16
4	R.C.C Slab	-	2.4	6	0.12	M^3	--	1.728

2M
2M
2M
2M

OR

5 (d)

SR. No	Desription	No.	L	B	H	Unit	Qty	Total Qty
1	Excavation	-	2.26	5.86	2.15	--	--	28.47
2	BBM (0.23m) thick L = 1.8 x 2 + (5.4 + 0.23+ 0.23) x 2 = 15.32m	-	15.32	0.23	2	M^3	--	7.04
3	P.C.C	-	2.26	5.86	0.15	M^3	--	1.986
4	R.C.C Slab	-	2.26	5.86	0.12	M^3	--	1.589

2M
2M
2M
2M

NOTE:- 1) In this numerical depth of excavation is not mentioned hence if student have attempted this quantity full marks should be given.
2) Thickness of brick work is not given if students have assumed thickness of brickwork 0.23m thick or 0.3m thick or have attempted this question full marks should be given to students by examiner.
3)P.C.C is calculated considering thickness of BBM as 0.3m. if students have considered thickness as 0.23m thick proportionate marks should be given.
4)R.C.C slab is calculated considering thickness of BBM as 0.3m. if students have considered thickness as 0.23m thick proportionate marks should be given.

Q No.6 **Attempt any FOUR of the following :** **16 M**

a) **Explain how you will prepare approximate estimate of an auditorium. ,** **04 M**

- Auditorium is designed to accommodate large audience. **1M**
- As such they lead to have wide span and multiple stories high in order to accommodate seating and acoustical requirements. **1M**
- Raised stage floors, special lightening equipments are often required as well. **1M**
- Typical features of auditoriums required for approximate estimate are as follows:-

a) **Sloped Floors: -** Sloped floor, with leveled terrace for each row of seating help provide proper sightline from audience to stage. **1M**

b) **Fixed Seats:-** Fixed seats are provided along with some space between two rows.

c) Special Lightening System: - Lightening system should be flexible to accommodate various performance venues.

d) Fire & Life Safety:- Fire and life safety is calculated in approximate estimate as additional cost may incurred for these safety features.

b) **Standard Format of Measurement Sheet.** **04 M**

1	2	3	4	5	6	7	8
Item No.	Description of Item	Number	Length(m)	Breadth(m)	Depth(m)	Quantity (m)	Total

2M

Abstract Sheet

1	2	3	4	5	6
Sr.No.	Particulars	Quantity or Number	Rate Rs. P	Per	Amount Rs. P

2M

6 (c) **1M**

Description	Multiplying Factor
A.C. Corrugated Sheet	1.10
M.S. Grill	1.00
Paneled Door	1.3 for Each side
Fully Glazed Window	0.5 for Each side

1M
1M
1M

6 (d) **Service Units:** **1M**

1)Hospital:- Per Bed **1M**
2)Auditorium :- Per Seat **1M**
3)Godown:- Per bay **1M**
4)Road:- Per KM

6(e) **Factors Affecting Task Work:-** **1M each for any four points**

1. Out turn of skilled labour depends on the nature, size, height, situation, location, climatic condition, technique adopted, wages paid etc.
2. Availability of skilled labour.
3. A well-organized work increases the out turn of labour.
4. Job satisfaction and working condition may increase the out turn work.
5. If the work is allotted on piece work basis then the daily wages output of labour increases.

6 (f)	**Contingencies**: • The term Contingencies indicates incidental expenses of miscellaneous character which cannot be classified under any distinct sub head, yet pertain to the work as a whole. • In an estimate a certain amount in the form of contingencies of 3 to 5 percent of estimated cost is provided to allow for the expenses for miscellaneous petty items which do not fall under any sub head of items of work. • Miscellaneous incidental expenses which cannot be classified under any subhead or item are met from the amount provided under contingencies. • If there is any saving against this amount, the amount may be utilized with the sanction of the competent authority for other expenses. **Work charged 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 est. 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.	**2M** **2M**