MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)

(ISO/IEC -270001 – 2005 certified)

Important Instructions to examiners:

1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language error such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and communication skill).

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.

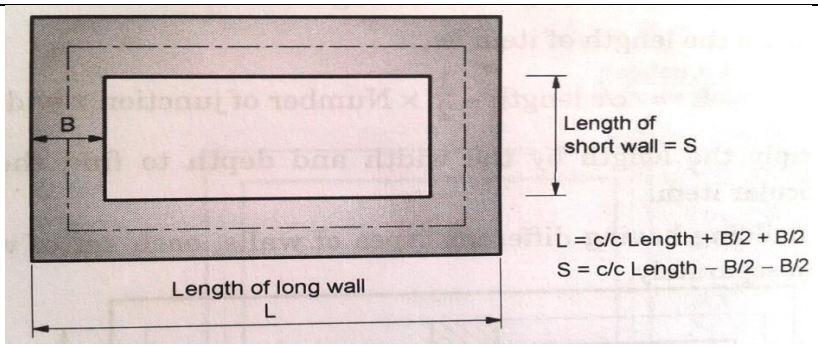
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding

Question and Model Answers	Mark
Q.1 (a) Attempt any THREE of the following:	**12 M**
(i) State the purpose of estimating & costing.	**4 M**
Purposes of estimating:- • To know the approximate cost of proposed work. • To obtain administrative approval and technical sanction. • To know the requirement of tools, plants and equipment. • To fix up the completion period. • To draw up a construction schedule and programme. • To invite tender for execution of work. • To keep control over expenditure during construction. **Purpose of Costing:-** • To arrange the finance for proposed work. • To know the probable cost of project before the execution. • For valuation of existing property • To know the cost of various items, well in advance, to be constructed	**2M (for any 2)** **2M (for any 2)**
(ii) Differentiate between Revised and Supplementary estimate	**4 M**

Revised estimate	Supplementary estimate
Prepared when there is change of rate or quantity of materials or Major addition/alterations are introduced in original work	Prepared when additional work is required to supplement the original work during the progress of work
When the original sanctioned estimate is likely to exceed by more than 5% or When the expenditure on a work exceeds or likely to exceeds the amount of administrative sanctioned by more than 10%	The fresh detailed estimate of additional work is prepared in addition to the original estimate
Abstract sheet of original estimate need to be changed due to change in the rates or quantity of the item	The abstract sheet should show the amount of original estimate & the total amount including the supplementary amount, for which sanction is required.

2M each (for any 2)

(iii)State the units of measurement for following item of work:	**4 M**
I)Skirting -Rmt (for less than 30 cm height) or Sq.m (for more than 30 cm height) Ii)expansion joint - Rmt Iii)dadoes - Sq.m Iv)brick wall (100mm thick) -Sq.m	**1M each**

(iv) Explain longwall and shortwall method for calculating items of work	**4 M**
 "Long wall and short wall" is also called as "PWD method" 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. **(Note:- Student should draw a diagram showing long wall and short wall or at least write sample Calculation of long wall and short wall.)**	**1M for neat labeled fig.** **3M for Discr iption**
(v) State any four advantages of using software programmes for estimating & costing	**4 M**
1. Achieve great accuracy using software 2. Calculates quantities from drawings (soft copy of plan, elevation & section) 3. It is easy to prepare bills of quantities. 4. It helps for project planning (i.e. preparing Bar charts, Gantt chart etc) 5. Software's also be used to prepare rate analysis of item 6. Cost break up for material, labour and machine can be done using software	**1M each (for any 4)**
Q.1 (b) Attempt any One of the following	**6 M**
(i) Draw the format for measurement sheet and abstract sheet and face sheet	**6 M**
1) Measurement sheet	**2 M**

Item No	Particulars of Items	No	Length (L)	Breadth (B)	Depth(D) Height (H)	Quantity	Total Quantity
1	2	3	4	5	6	7	8

2) Abstract sheet

Item No	Particulars of Items	Quantity	Unit	Rate	Per (Unit)	Amount
1	2	3	4	5	6	7

2 M

3) Face sheet

FACE SHEET

Name of Work_____

Sr No	Particulars	Amount
1	Estimated Cost	
2	Water supply & Sanitary Charges @ ---------%	
3	Electrification Charges @ ---------%	
4	Contingencies @ ---------%	
5	Work Charged Establishment @ ---------%	
	Total Amount (In words_____)	

2M

(ii) The cost of construction of Govt Polytechnic Nanded Building is 2 crores for a capacity of 500 students and area of construction about 2000m^3 Prepare approximate estimate of a newly proposed of Gov Poly Building for 1200 students with the area 5000M^3 **6M**

a) By using Plinth Area Method

Rate of construction per Sqm = $\frac{\text{Rs. 200,00,000}}{2000\text{m}^2}$

= Rs.10,000/- per Sqm **3M**

b)Approximate cost of

Proposed polytechnic = Rate per Sqm x Proposed area of Construction

= 10,0000 x 5000

= 500,00,000 (5Crores) **3M**

OR

b) By using Service Unit Method

Rate of construction per Student = $\frac{\text{Rs 200,00,000}}{500\text{ Nos}}$ **3M**

= Rs. 40000 /- Per Student

Cost of construction for proposed

Polytechnic = Rs. 40000 x 1200 Nos

=Rs. 480,00,000 **3M**

(Four Crores Eighty Lakhes)

(**Note – 1 Unit of Area is given in question as M^3 but it should be Considered as M^2**

2 Examiner should give Full Marks for correct answer by any one method above)

Q.2 Attempt any Four of the following	**16**
a. State the rule for deduction in plastering as per IS-1200.	**4 M**
i) No deduction is made for ends of beams, posts, rafters, purlins etc. ii) No deduction is made for opening up to 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 up to 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.	**1M each**
b. Explain the terms:- (i) Contingencies (ii) Provisional sum	**4 M**
(i) **Contingencies:** - It is the incidental expenses of a miscellaneous character which cannot be reasonably predicted during preparation of estimate and to meet such unforeseen expenses an additional amount of 3% to 5% of the estimated cost of the works is provided in the total estimate. (ii) **Provisional sum: -** 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 call provisional sum. Some special works are as follows:- Shifting of water lines, Installation of air conditioner and its fittings etc.	**2M** **2M**
c. Give the market rates of the following materials.	**4M**
(i) C.C. teakwood Rs. 3000-3500 per cuft (ii) Cement bags Rs. 270-310 per bag (iii) Course aggregate (20mm) Rs. 900-1500 per m^3 (iv) Reinforcement (Steel) Rs. 39000-42000 per tone **(Note:-Market rate may vary from place to place. Examiner should give proportionate marks)**	**1M each**
d. State factors affecting rate analysis	**4M**
A. Major Factors :- 1) Material 2) Labour **B. Minor Factors: -** 3) Special Equipment 4) Place of work 5) Magnitude of work 6) Conditions of Contract 7) Profit of the contractor 8) Specification 9) Miscellaneous	**4M**
e. Enlist any eight software's available for civil engineering estimates.	**4M**
List of software's:- 1. QE-Pro 2. 2002 CD Estimator. 3. Chief Estimator	**½ M Each**

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.	**(Any 8)**
f. State different methods of approximate estimate. Explain any one.	**4M**
1. Plinth area method 2. Cubical content method 3. Service unit method 4. Approximate quantity method 5. Typical bay method	**2M**
1. **Plinth area method: -** This is prepared on the basis of Plinth Area of building. The rates are calculated from the cost of similar building having similar specification, height & construction, in the locality. Plinth area estimate is calculated by finding the plinth area of the proposed building & multiplying by the plinth area rate. The plinth area should be calculated for the covered area by taking external dimension of the building at the floor level. Approximate cost = Plinth area x Plinth area rate **OR** 2. **Cubical content method:-** This method is generally used for multi-storied buildings. It is more accurate that the other two methods viz., plinth area method and unit base method. The cost of a structure is calculated approximately as the total cubical contents (Volume of buildings) multiplied by Local Cubic Rate. The volume of building is obtained by Length x breadth x depth or height. The length and breadth are measured out to out of walls excluding the plinth off set. The cost of string course, cornice, corbelling etc., is neglected. The cost of building = volume of building x Rate per unit volume. **OR** 3. **Service unit method:-** In service unit method no. of service unit is decided for calculating approximate estimate, such as per kilometer for a highway, per meter of a span for a bridge, per classroom for school building, per bed for hospital, per liter for water tanks, per seat for cinema hall etc. These units are considering first then approximate cost is calculated by multiplying the cost per service unit by the no. of service unit in the structure. Approximate estimate = No. of service unit x Cost per service unit **OR** 4. **Approximate quantity method:-**In this method, various quantities are worked out with the help of many short-cuts. For instance, the wall foundations are measured in linear measurements i.e., in running meters. The approximate quantities of items such as excavation, foundation concrete, brickwork up to plinth level and damp-proof course are computed per running length and with the help of rates of these items, a fairly accurate rate per running meter. This rate when multiplied by the total running measurement gives the approximate cost of the building up to plinth level. Similarly, the superstructure is measured in running measurements and a suitable rate per running meter is built-up including brickwork, inside and outside finishing, woodwork, etc. **OR** **5. 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	**2M for any one method**

Q.3 Attempt the following: **18 M**

(a) Workout the quantities of following any three items and enter the same in standard format for measurement sheet with descreption of itemRefer Fig 1(any four) **12 M**

(i) Earthwork in excavation

(ii) PCC in foundation

(iii) UCR masonry in foundation and plinth

(iv) Brick masonry

(v) Internal Plastering

(vi) Flooring

By Long wall Short wall Method :-

Assume horizontal wall as long wall & vertical walls as short wall

L = 0.3/2 + 4 +0.3 +3.7 +0.3/2 = 8.3M (3Nos)

S_1 = 0.3/2 + 4 + 0.3/2 = 4.3M (3Nos)

S_2= 0.3/2 +4.5 +0.3/2 =4.8M (2Nos)

Sr. No.	Description of item of work	No.	Length L (m)	Breadth B (m)	Depth D (m)	Quantity	Total Quantity
1	**Earthwork in excavation**						
	Long wall	3	9.50	1.20	1.40	47.88	
	L_1= 8.30+1.20 = 9.50m						
	Short wall						
	S_1= 4.30 - 1.20 = 3.10m	3	3.10	1.20	1.40	15.624	
	S_2= 4.80 - 1.20 = 3.60m	2	3.60	1.20	1.40	12.096	
							75.60 cu.m
2	**P.C.C. (0.15m thick)**						
	Long wall						
	L_1= 8.30+1.20 = 9.50m	3	9.50	1.20	0.15	5.13	
	Short wall						
	S_1= 4.30 - 1.20 = 3.10m	3	3.10	1.20	0.15	1.674	
	S_2= 4.80 - 1.20 = 3.60m	2	3.60	1.20	0.15	1.296	
							8.10 cu.m
3	**UCR masonry in foundation and plinth**						
	Step-I						
	Long wall						

4 M

4 M

	L_1= 8.30+0.90 = 9.20m	3	9.20	0.90	0.50	12.42		**4 M**
	Short wall							
	S_1= 4.30 - 0.90 = 3.40m	3	3.40	0.90	0.50	4.59		
	S_2= 4.80 - 0.90 = 3.90m	2	3.90	0.90	0.50	3.51		
	Step-II							
	Long wall							
	L_1= 8.30+0.70 = 9.00m	3	9.00	0.70	0.60	11.34		
	Short wall							
	S_1= 4.30 - 0.70 = 3.60m	3	3.60	0.70	0.60	4.536		
	S_2= 4.80 - 0.70 = 4.10m	2	4.10	0.70	0.60	3.444		
	Step-III							
	Long wall							
	L_1= 8.30+0.50 = 8.80m	3	8.80	0.50	0.75	9.90		
	Short wall							
	S_1= 4.30 - 0.50 = 3.80m	3	3.80	0.50	0.75	4.275		
	S_2= 4.80 - 0.50 = 4.30m	2	4.30	0.50	0.75	3.225		
							57.24 cu.m	
4	**Brick masonry**							
	Long wall							
	L_1= 8.30+0.30 = 8.60m	3	8.60	0.30	3.30	25.542		
	Short wall							
	S_1= 4.30 - 0.30 = 4.00m	3	4.00	0.30	3.30	11.88		
	S_2= 4.80 - 0.30 = 4.50m	2	4.50	0.30	3.30	8.91		**4 M**
	Deduction:-							
	D-	4	1.20	0.30	2.10	(-) 3.024		
	W-	7	1.20	0.30	1.50	(-) 3.78		
	Lintel over D-	4	1.50	0.30	0.15	(-) 0.27		
	Lintel over W-	7	1.50	0.30	0.15	(-) 0.473		
							38.785 cu.m	
5	**Internal Plastering**							
	Ceiling:-							
	Bed room	1	4.00	4.00	-----	16.00		**1 M**
	Kitchen	1	3.70	4.00	-----	14.80		

	Living	1	8.00	4.50	-----	36.00	**66.80 Sqm**	
	Walls:-							
	Bed room	4	4.00	-----	3.20	51.20		
	Kitchen	2	3.70	-----	3.20	23.68		
		2	4.00	-----	3.20	25.60		
	Living	2	8.00	-----	3.20	51.20		**3M**
		2	4.50	-----	3.20	28.80		
	Deduction							
	D- 0.50x	7	1.20	-----	2.10	(-) 8.82		
	W- 0.50x	7	1.20	-----	1.50	(-) 6.30		
							165.36 sqm	
6	**Flooring**							
	Bed room	1	4.00	4.00	-----	16.00		**4 M**
	Kitchen	1	3.70	4.00	-----	14.80		
	Living	1	8.00	4.50	-----	36.00		
	Near Door Sill	4	1.20	0.30	-----	1.44		
							68.24 sqm	

(Note:-1 In question paper solve any four is written but consider it as solve any three only & give full marks if student calculate quantity of any three items accurately (3 x 4 = 12 M)

2) Student may calculate the quantity of Earthwork, P.C.C., U.C.R. Masonry & Brickwork either by Long wall-Short wall method or by Centerline method. Final answer will be same by both the methods.

3) if Student calculates the correct quantity of Earthwork, P.C.C. by assuming offset of P.C.C. then give full marks

b) Attempt any ONE of the following: **6 M**

(i) Calculate the quantities of earthwork in cutting and in banking for a portion of road with following data:-

1)formation width of road is 12m
2)formation level of starting chainage is 51.50m
3)the road surface shall be given falling gradient of 1 in 200
4)side slopes are 1v:2H BANKING and 1V:1.5H in cutting

Chainage in 'm'	**0**	**30**	**60**	**90**	**120**	**150**	**130**
G.L. in 'm'	**50.80**	**50.60**	**50.70**	**51.20**	**51.40**	**51.30**	**51.00**

Here last chainage is printed as 130 but it should be taken as 180 as per Chainage interval of 30m

F.L. at chainage '0' = 51.50 m

F.L. at chainage '30' = 51.50 -1/200 x 30 = 51.35 m

F.L. at chainage '60' = 51.35 -1/200 x 30 = 51.20 m

F.L. at chainage '90' = 51.20 -1/200 x 30 = 51.05 m

F.L. at chainage '120' = 51.05 -1/200 x 30 = 50.90 m **1/2M**

F.L. at chainage '150' = 50.90 -1/200 x 30 = 50.75 m

F.L. at chainage '180' = 50.75 -1/200 x 30 = 50.60 m

Chainage at Zero Depth:- x/0.50 = (30-x)/0.15

x = 23.07 m

Chainage at Zero Depth = 60+23.07 = 87.07 m **1/2M**

A. By Mean Sectional Area Method

CH	GL	FL	d	B x d	S x d^2	Area	Am	L	Qty (Bank)	Qty (Cutting)
0	50.80	51.50	0.70	8.4	0.98	9.38	--------	------	--------	-------
30	50.60	51.35	0.75	9.00	1.125	10.125	9.753	30	292.590	
60	50.70	51.20	0.50	6.00	0.50	6.50	8.313	30	249.390	
83.07	--------	-------	0	0	0	0	3.25	23.07	74.978	
90	51.20	51.05	-0.15	1.80	0.034	1.834	0.917	6.93		6.355
120	51.40	50.90	-0.50	6.00	0.375	6.375	4.105	30		123.150
150	51.30	50.75	-0.55	6.60	0.454	7.054	6.715	30		201.450
180	51.00	50.60	-0.40	4.80	0.24	5.04	6.047	30		181.410
							Total	**cum**	**616.958**	**512.365**

5M

B. By Mid Sectional Area Method

or

CH	GL	FL	d	d_m	Bxd_m	Sxd_m^2	Area	L	Qty (Bank)	Qty (Cutting)
0	50.80	51.50	0.70	----	----	-----	-----	-----	-----	-----
30	50.60	51.35	0.75	0.725	8.70	1.051	9.751	30	292.530	
60	50.70	51.20	0.50	0.625	7.50	0.781	8.281	30	248.430	
83.07	--------	-------	0	0.25	3.00	0.125	3.125	23.07	72.094	
90	51.20	51.05	-0.15	0.075	0.90	0.008	0.908	6.93		6.292
120	51.40	50.90	-0.50	0.325	3.90	0.158	4.058	30		121.740
150	51.30	50.75	-0.55	0.525	6.30	0.413	6.713	30		201.390
180	51.00	50.60	-0.40	0.475	5.70	0.338	6.038	30		181.140
								Total Volume (Cum)	**613.054**	**510.562**

5M

(ii) Workout the quantities of m.s.reinforcement for the following and tabulate in a bar bending schedule format prepare **6M**

Member	Overall size	Details of Reinforcement
Beam	**4m Long (230x230)mm section**	**a)Main bar 12mm and 4Nos 2 Straight and 2 bent up 45^0 b)Anchor bar 10mm and 2 Nos c)Stirrups-6mm and at 150mm c/c**

Ans- Assume overall cover 25mm

Length of Main Straight Bar= (4000-50)+18 x (12) = 4166mm = 4.166m **1/2M**

Length of Bentup bar = (4000-50) + 18 x (12)+ 2 x 0.42 x (230-50) = 4317 mm = 4.317m **1M**

Length of Anchor bar = (4000-50)+18 x (10) = 4130mm = 4.130m **1/2M**

a=230-50=180mm, b=180mm

Length of Stirrups= 2(a+b) +24(dia) = 2 x (180+180) + 24 x (6) = 864mm = 0.864 m

No of stirrups=(4000-50)/150 + 1 = 28 Nos **1M**

Bar Bending Schedule:-

Sr No	Description	Shape of bar	Dia (ϕ)	No.	L	Total Length	Wt Kg/m	Total Wt (kg)
1	Bottom Main straight bar		12	2	4.166	8.332	0.889	7.407
2	Bentup bar		12	2	4.317	8.634	0.889	7.676
3	Top anchor bar		10	2	4.130	8.260	0.617	5.096
4	Stirrups		6	28	0.864	24.192	0.222	5.371
								25.550 kg

3M

Q.4 Attempt any TWO of the following: **16M**

a) R.C.C. slab of overall size 5500mm x 3000 mm & thickness 175 mm is provided with 12 mm main bars bent-up alternately and placed at distance 150 mm c/c. The distribution steel of 8 mm diameter is provided at distance 200 mm c/c. Find out the quantity of steel, prepare bar bending schedule. Take cover 15 mm **8M**

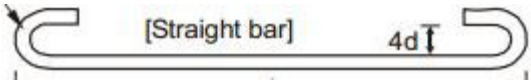
L =5500mm , B = 3000mm, d = 175mm, cover 15mm

a) Main Bar(12 mm dia @ 150 c/c)

1) Length = 3000-(2 X 15) + (18 X 12) + (0.42 X 145)
= 3246 mm = 3.246 m

2) No. Of Main bars = (5500 – 2 X 15)/150 + 1
= 38 Nos **2M**

b) Distribution Bar (8 mm dia @ 200 c/c)



1) Length = 5500- (2 x15) + (18 x 8)
= 5614 mm = 5.614 m

2) No. of Distribution Bar at Bottom = (3000 – 2 x 15)/200 + 1 **2M**

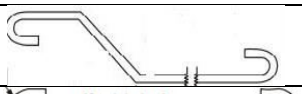
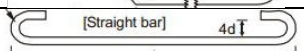
= 16 Nos

No. of Distribution Bar at Top = 2+2 = 4 Nos

Total Distribution Bar = 16 + 4 =20 Nos

1M

Bar Bending Schedule:-

Sr No.	Description	Shape of bar	No	Dia	L	Total Length	Wt Kg/m	Total Wt
1	Main Bar		38	12	3.246	123.348	0.889	109.656
2	Distribution bar		20	8	5.614	112.280	0.395	44.358
							Total Wt	**154.014 Kg**

3M

b) 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 in Fig No.2 **8M**

Sr. No.	**Description**	**No.**	**L**	**B**	**H**	**Qty**	**Total Qty**
1	**Excavation**						
a	Excavation in soil from 0 to 1.5 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
b	Excavation in soil from 1.5to3.0 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
c	Excavation in hard murum from 3.0 to 4.50 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
d	Excavation in hard murum from 4.5 to 6.0 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
e	Excavation in soft rock from 6.0 to7.5 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
f	Excavation in soft rock from 7.5 to 9.0 m depth	1	$\pi/4$ X 9.6^2		1.50	108.573	**108.573 Cum**
g	Excavation in hard rock from 9.0to10.5 m depth	1	$\pi/4$ X 8.4^2		1.50	83.127	**83.127 Cum**
h	Excavation in hard rock from 10.5 to 12.0 m depth	1	$\pi/4$ X 8.4^2		1.50	83.127	**83.127 Cum**
i	Excavation in hard rock from 12.0 to 12.5 m depth	1	$\pi/4$ X 8.4^2		0.50	27.709	**27.709 Cum**
2	**UCR Masonry**	1	$\pi/4$ (9.60^2 - 8.40^2)		2.70	45.804	
		1	$\pi/4$ (9.40^2 - 8.40^2)		7.00	97.861	**143.665 Cum**

2M **2M** **2M** **2M** **2M**

Note- If the student solve the problem taking the depths as 60 m and 27 m as printed in question paper, give full credit accordingly.

c) Prepare rate analysis for B.B. masonry in C.M.(1:6) proportion

Rate Analysis for Brick Work in Super Structure in C.M (1:6) in Super Structure

Assume Volume of Brick Masonry = 10 cu.m

1) Calculation of materials

a) Dry Volume = 30% of volume of masonry = $\frac{30}{100}$ x 10 = 3.00 cu.m. **1/2 M**

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

Volume of Cement = $\frac{3.0}{1+6}$ x 1 = 0.4285 cu.m

No. of Cement Bags = $\frac{0.4285}{0.035}$ = 12.24 bags = approximately = 13 bags **1/2 M**

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

Volume of Sand = $\frac{3.0}{1+6}$ x 6 = 2.571 cu.m **1/2 M**

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 throughout = 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. **1 M**

Sr. No	Particular	Quantity	Rate	Per	Amount
A	**Material**				
1	Cement	13	300	Bag	3900
2	Sand	2.571	1950	Cum	5013.45
3	Bricks	5000	7	Nos	35000
				Total (A)	**43913.45**
B	**Labour**				
1	Head Mason	0.5	600	Day	300
2	Mason	8	500	Day	4000
3	Male Mazdoor	8	350	Day	2800
4	Feamale Mazdoor	10	250	Day	2500
5	Bhisti	2	350	Day	700
6	Scaffolding, Sundries T.&P.	L.S.	L.S.	L.S.	700
				Total (B)	**11500**
	Total Cost of Material & Labour (C) = Total (A+B)				**54913.45**
	Add Water Charges @ 1.5% of Total Cost of Material & Labour =				823.70

2 M **2 M** **1/2 M**

	Overall Cost= Total Cost + Water Charges =	**55737.15**	**1/2 M**
	Add Contractors Profit @ 10% of Overall Cost (E) =	5573.71	
	Grand Total= Overall Cost + Contractors Profit =	**61310.86**	
	Rate per cu.m = Grant total / Assumed Volume of U.C.R. Masonry =	**6132.0 per cum**	**1/2 M**

{Note:- 1) Examiner should keep in mind that rates of materials and labours differs from place to place and time to time, proportionate marks should be given for following the correct procedure of preparing rate analysis.

Q.5 Attempt any TWO of the following: **16 M**

a) Prepare rate analysis for 12 mm thick cement plastering in cement mortar (1:4) **08 M**

Assume Quantity (Area) of plaster = 100 m^2

Wet Volume = Area x Thickness **1/2 M**

= 100 x 0.012

= 1.20 m^3

Add 30% to fill-up the joints

= 1.20x 1.30 **1/2 M**

= 1.56 m^3

Material Calculation

Dry Volume = 25% more of wet volume

= 25/100 x (1.56) = 1.95 m^3 **1/2 M**

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

Volume of Cement = $\frac{1.95}{1+4}$ x 1 = 0.390 cu.m **1/2 M**

No. of Cement Bags = $\frac{0.390}{0.035}$ = 11.143bags = approximately = 12 bags

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

Volume of Sand = $\frac{1.95}{1+4}$ x 4 =1.560 cu.m **1/2 M**

Sr. No	Particular	Quantity	Rate	Per	Amount
A	**Material**				
1	Cement	12	300	Bag	3600
2	Sand	1.56	1950	Cum	3042
				Total (A)	**6642.00**
B	**Labour**				
1	Head Mason	0.5	600	Day	300
2	Mason	10	500	Day	5000

2 M

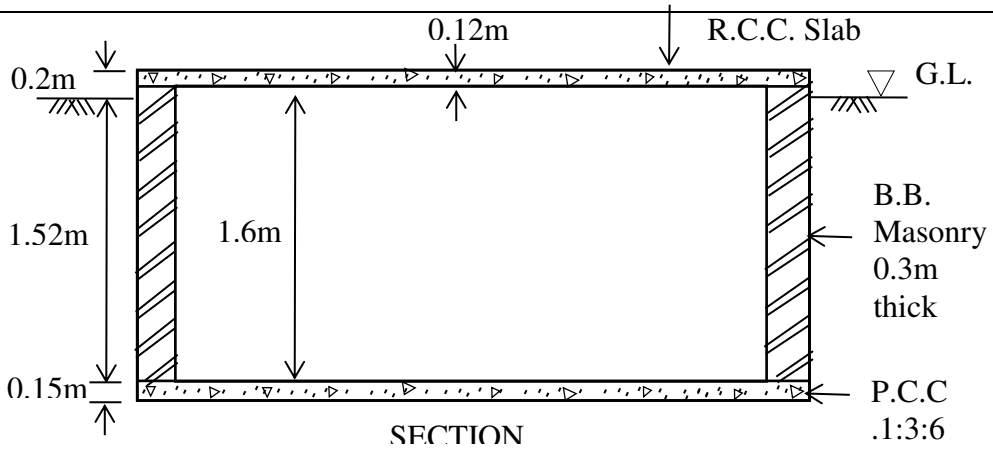
3	Male Mazdoor	8	350	Day	2800	**2 M**
4	Feamale Mazdoor	4	250	Day	1000	
5	Bhisti	1	350	Day	350	
6	Scaffolding Sundries T.&P.	L.S.	L.S.	L.S.	700	
				Total (B)	**10150**	
				Total Cost of Material & Labour (C) = Total (A+B)	**16792**	**1/2 M**
				Add Water Charges @ 1.5% of Total Cost of Material & Labour =	251.88	
				Overall Cost= Total Cost + Water Charges =	**17043.88**	**1/2 M**
				Add Contractors Profit @ 10% of Overall Cost (E) =	1704	
				Grand Total= Overall Cost + Contractors Profit =	**18748.268**	
				Rate per Sqm = Grant total / Assumed Volume of U.C.R. Masonry =	**188.00 per Sqm**	**1/2 M**

{Note:- 1) Examiner should keep in mind that rates of materials and labours differs from place to place and time to time, proportionate marks should be given for following the correct procedure of preparing rate analysis.

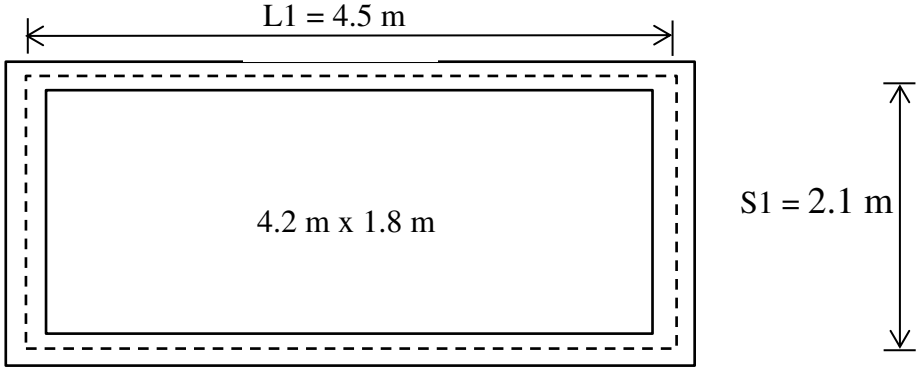
b) Work out the quantity of following items for septic tank having internal size 1.8 m x 4.2 m & height 1.6 m top of slab of septic tank is 20 cm above G.L. Assume suitable data; **8 M**

(i) Earthwork in excavation **(ii) P.C.C. (1:3:6) - 15 cm thick**

(iii) B.B. masonry in C.M. (1:6) 300 mm thick **(iv) R.C.C. slab (1:2:4) on septic tank 12 mm thick**



SECTION



PLAN

Assume wall spanning in horizontal direction as long wall & wall spanning in vertical direction as short wall in plan

Length of long wall;

$L_1 = (0.3/2) + 4.2 + (0.3/2)$

$L_1 = 4.50$ m……2 nos.

Length of short wall;

$S_1 = (0.3/2) + 1.8 + (0.3/2)$

$S_1 = 2.10$ m……2 nos

Assuming projection for P.C.C. as 0.15 m all over

Sr. No.	Description of item of work	No.	Length L (m)	Breadth B (m)	Depth D (m)	Quantity	Total Quantity	
1	Excavation L=4.20+2x0.30 = 4.80m B=1.80 +2x0.30= 2.40m	1	4.80	2.40	1.67	20.44	19.24	
							19.24 cu.m	**2M**
2	P.C.C. (0.15 m thick)	1	4.80	2.40	0.15	1.73		
							1.73 cu.m	**2M**
3	Brickwork 0.30m thick							
	Long wall L_1= 4.50+0.30 = 4.80m	2	4.80	0.30	1.60	4.61		
	Short wall S_1= 2.10 - 0.30 = 1.80m	2	1.80	0.30	1.60	1.73		
							6.34 cu.m	**2M**
	{Note: - The examiner should give full marks if Student calculates the quantity of brickwork either by Long wall-Short wall (out to out – in to in) method or by Centerline method, the final answer should be same.}							
4	R.C.C. Slab (1:2:4) L=4.20+2x0.30 = 4.80m B=1.80 +2x0.30= 2.40m	1	4.80	2.40	0.12	1.38		
							1.38 cu.m	**2M**

c) **(i) State significance of checklist while preparing detail estimate**.	**4M**
While preparing an estimate items are usually classified and grouped sub-head wise, it is convenient to make up the items in the same order as far as possible, as they would be executed or constructed. If the principle of following the order of construction from foundation to upward direction is followed there is little chance of omission of items. The sequence of taking out the quantities of items is same as the sequence of their execution is. For example sequence of items to be executed for a building is Site clearance, Earth work in excavation, P.C.C. below foundation, R.C.C. for footing, column, beam & slab, Plinth filling, P.C.C. below flooring likewise.	**2M** **2M**
c) (ii) Define **1) Day Work** **2) Lead & Lift** **3) Work Change establishment** **4) Task work**	
1) **Day Work: -** The term Day work is used to denote a procedure of costing or valuing an item of work on the basis of actual labours and material required. Certain types of work cannot be paid by measurement viz. special types of architectural works, dismantling partition wall, 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 are denoted by Day Work. 2) **a) Lead: -** Lead shall be Horizontal straight practicable distance through which the excavated earth can be carried or transported to place of soil heap. The measurement shall be taken separately for every 30 m (100 ft.) lead. **b) Lift**: - Lift shall be measured from bottom of excavation to the ground level and measured separately for every 1.5 m lift. 3) **Work Charged Establishment: -** During the construction of a project/work some supervisory staff such as supervisors, watchman, store clerk etc. are appointed on temporary basis. The wages to be paid to this staff is charged directly to the estimate of the work. To meet this expenditure a provision is made in the estimate of every work, which is known as work charged establishment. It is about 2 to 2.5 % of the estimated cost of the work. **(NOTE: - Work Change Establishment is written instead of Work Charged Establishment, If student attempts this sub-question examiner should give full marks.)** **4) Task work:-**The capacity of doing work by a skilled labour in the form of work per day is known as task work	**1M** **1/2M** **1/2M** **1M** **1M**

Q.6 Attempt any Four of the following:	**16M**
a) How will you consider electrification work, plumbing work in estimation	**4M**
While preparation of detailed estimate specifications of electrification work & plumbing services are not known. Therefore some provisions are made for the electrification work & plumbing services in the detailed estimate. Generally For Electrification work of building generally-8 to 10 % of estimated cost is provided For water supply & sanitary installation i.e. plumbing services of building generally-8 to 10 % of estimated cost is provided	**4M**
b) Define rate analysis, state purpose of rate analysis	**4M**
Rate Analysis: It is a method of determination of rate of an item of work from cost of material, cost of labour, hire charges Tools and plants and other miscellaneous expenses. **Purpose of Rate Analysis:** 1. To know the cost of various item of work for preparation of detailed estimate 2. To find the actual cost of an item per unit 3. To know the rate of an extra item of work 4. To prepare revised and supplementary estimate 5. To know the economical use of material in construction 6. To check the reliability of rates quoted by contractor in tender	**2M** **2M (any four)**
c) Write down the approximate percentage of steel required for various R.C.C. members	**4M**
Percentage of steel for various RCC work in terms of volume of concrete in cum 1. Lintel and slab : 0.7 to 1 % of volume of concrete in cum 2. Beam : 1 to 2 % of volume of concrete in cum 3. Column : 1 to 5 % of volume of concrete in cum 4. Foundation and Footing : 0.5 to 0.8 % volume of concrete in cum	**1M each**
d) Explain prismoidal formula method for finding earth work for road	**4M**
Prismoidal Formula: - Computation of volume of earthwork by prismoidal formula V = D/3 (first area + Last area + 4 x Sum of Odd area + 2 x Sum of even area) = D/3 ($A_0 + A_n + 4 \times (A_1 + A_3 + \ldots A_{n-1}) + 2 X (A_2 + A_4 + \ldots A_{n-2})$ Where L = Length of chainage, A_0= first area A_n= last area In this case of Prismoidal formula it is necessary to have odd number of sectional areas. If there are even numbers of sections, the end strip should be calculated separately & the remaining strip should be calculated by using following formula:- Q = L/6 ($A_1 + A_2 + 4A_m$)	**3M** **1M**

e) Define: (i) **Centage charges** (ii) **Prime cost** (iii)**Load factor** (iv)**Task work**	**4M**
(i) Centage charges: - These are the charges or cost of establishment, planning and design of project. It also included supervision charges. Generally 10 to 15 % of estimated cost is provided as centage charges. **(ii) Prime cost: -** Prime cost is the actual cost of articles at shop and refers to supply of articles only and not to carrying out work. During preparation of an estimate, it is not always possible to specify exact types of articles required, for ex: water supply fittings, sanitary fittings, door 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. **(iii)Load factor: -** It is the load carrying capacity of a particular vehicle in transportation of material. It depends on type of vehicle and road **(iv)Task work:-** The capacity of doing work by a skilled labour in the form of work per day is known as task work	**1M** **1M** **1M** **1M**