WINTER– 17 EXAMINATION

Subject Name: Estimating and Costing **Model Answer** Subject Code: 17501

Important Instructions to examiners:

1. The answers should be examined by key words 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 errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4. While assessing figures, examiner may give credit for principal components indicated in the figure. The figures 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 some cases, the assumed constant 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 judgement on part of examiner of relevant answer based on candidate's understanding.
7. For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
Que1	a)i	**Estimating:** It is defined as the procedure of working out the probable cost of work **Costing :** It is the process of determining actual cost of work before the execution of work. **Purpose of estimating**: 1) Before starting the construction project it is necessary to know the probable cost so that financial arrangements can be made. It is the main purpose of estimating. 2)Various technical and administrative departments need estimate for approval and sanctioning the project. 3) Before starting construction project, contractor and concerning authority must know the tools, plants, machineries and equipments. Estimate helps to know the requirements of tools, plants equipments and labor required. 4) With the help of estimating, construction schedule and program accordingly can be prepared. 5) Companies and Government departments invite tenders of the project. Estimating helps in preparing probable cost of project on basis of which contractor fills the tender. 6)To determine the value of construction, or value of property, estimate is prepared. 7)To determine completion period of the project, Estimate is prepared. **Purpose of Costing.** 1) To study feasibility of project. 2) Owner is able to plan finance before starting construction. 3) Various items required for construction is well known in advance which helps the planning. 4) Alterations are possible if costing goes beyond capacity.	1 mark $1^1/_2$ (1/2 mark for any 3 purposes Of estimating) $1^1/_2$ (1/2 mark for any 3 purposes Of costing.)

Que1	a)ii	Types of Approximate Estimate: 1)Service unit method. 2) Plinth area method. 3) Approximate quantities method.4) Cube rate estimate (cubic content method). 5) Typical bay method. **Approximate quantities method**: In this method total length of walls is calculated in running meter. This total length is multiplied by the rate per running meter of wall gives fairly accurate cost. For this method, structure is divided in two parts.1) foundation including plinth 2) superstructure. The running meter cost for foundation and superstructure is calculated first and then running meter rate should be multiplied by total length of wall. To find out running meter rate for foundation, the approximate quantities of items such as excavation, foundation, brickwork up to plinth and DPC are calculated per running meter then multiply by rates. Similarly for superstructure rate per running meter is determined from approximate quantities of brickwork, woodwork, roof, floor finishing etc. For this method plan or line plan of the structure should be available.	2 marks 2marks
Que1	a)iii	Data: No of bays =3 Each span =40m Cost of existing bridge is Rs40,000/- per meter. Total length of bridge= 3 x 40 = 120 m. Cost of bridge per meter = 40000 Approximate cost of new bridge = 120 x 40000 = 4800000/- Approximate estimate of bridge is Rs.4800000/-.	2 marks 2marks
Que1	a)iv	**Desired Accuracy in taking measurements:** To achieve the desired accuracy in measurements, following points must be observed. 1) Dimensions shall be measured to the nearest 0.01m except a) Thickness of slab measured nearest to 0.005m b) Wood work is to be measured nearest to 0.002m c) Reinforcement , to the nearest 0.005m d) Thickness of roadwork less than 200mm, is measured nearest to 0.005m. The tolerances in measurements are a) For volumes ----- 0.01 cu.m b) For areas ----------0.01 sq.m c) For lengths ---------- 0.01 rmt d) For weights ----------0.001 ton or 1kg. **Fraction less than one half is neglected.** **Fraction equal to one half or more than one half is considered as one.**	2marks 2marks

Que1	b)i	Standard mode of measurement for 1) Dado: It is measured in sq.m. stating the type of finish. 2) D.P.C.: D.P.C. is measured in sq.m. Measurement shall be taken stating the thickness. The item shall include ,formwork, levelling,curing etc. Horizontal and vertical DPC shall be measured separately. 3) Half brickwork: It is measured in sq.m.Brick on edge shall also be paid in sq.m. wire netting if provided shall be included in item. 4) Barbed wire fencing: It is measured in running meter. Gauge of wire shall be described. Each line of wire shall be measured. Fencing posts shall be measured separately. 5) Collapsible gate: It is measured in sq.m. Measurement shall be taken as fixed stating size of gate opening, pickets, pivoted flat bars and size of meshes formed by them when fully extended. The top and bottom runners, locking lugs, handles shall be included in item. 6) Wash basin: It is measured in numbers., stating the size. Fitting of necessary accessories and method of fitting shall be fully described.	(1mark For each correct Answer.)
Que1	b)ii	Rules for deduction for opening as per IS1200 a) FOR brick work as per IS1200 1) No deduction is made for opening up to 0.1sq.m (1sq.ft) 2) No deduction for ends of beam, posts, rafter, purlins up to 0.05sq.m of section. 3) No deduction bed plate , wall plate, bearings of chajjas etc up to 100mm depth. 4) Bearings of floor and roof slabs, concrete blocks for hold fasts are not deducted from Brick Masonry 5) For other Rectangular openings , deduction will be equal to Volume of B.M. less volume of opening. (LX BX H – l x b x h) 6) For semicircular arch opening Deduction = ((l x h)+ ¼ x l x r) x thickness of wall) b) Deduction rules for Plastering. 1) No deduction or addition is made for ends of beam, joists, post, rafters and steps. 2) No deduction is made for small openings up to o.5 sq.m and no addition is made for jambs, soffits and sills of these openings. 3) For openings exceeding 0.5sq.m but less than 3sq.m deduction is made for one face only and no addition for jambs, soffits and sills is considered. 4) For openings above 3sq.m , deduction is made for both faces and addition for jambs, soffits and sills are taken into account.	3 marks 3marks

Que2	a)	Procedure of Approximate estimate for water supply project. Procedure involves statement of objects, collection of physical data, hydrologic and demographic data, Municipal and industrial data etc. to draw up the approximate estimate. For such projects , the unit to be adopted to arrive at the approximate cost may be one of the following i) Area served by the project ii) Population served by the project. i) **Area served by the project**: In this case , the total area covered by the project is worked out in hectares or in sq.km. Then to prepare approximate estimate, the project area in hectares or sq.km is multiplied by the existing rate of similar project per hectares or sq.km. ii) **Population served by the project**: In this case ,the total population to be served by the project is worked out. Then to prepare approximate estimate total projected population is multiplied by the existing cost per capita for similar type of project. ➢ To serve any other loads for industries or institutions, their individual load is worked out and converted to equivalent area or population. ➢ The per capita cost is widely variable according to density of population, location of different zones, demand of water per capita and existing facilities in case of water supply project.	2 marks 2marks 2marks 2marks
Que2	b)	Approximate estimate for public building: i) cost of building = plinth area x rate = 2200 x 3500 = Rs.7700000/- ii)cost of electric installation charges= 8% of cost of building = 8/100 (7700000) = Rs616000/- iii)cost of water supply = 3% of cost of building = 3/100 x (7700000) = Rs.231000/- Overall cost of building = (7700000 +616000 +231000) = Rs **8547000/-** iv) cost of contingencies= 2% of overall cost of building = 2/100 x(8547000) = Rs 170940/- v) Engineer supervision charges = 4% of overall cost of building = 4/100 x(8547000) =Rs.341880 /- Total cost = (**8547000 +**170940 +341880) = Rs. 9059820/- **Hence approximate estimate of given public building is Rs 9059820/-**	1 marks 3 marks 3 marks 1 mark

Que2	c)i	**Long wall short wall method For taking out the quantities**. This method is also known as out to out and in to in method. Step1: First prepare foundation plan showing center lines. Step2: Determine center to center lengths of wall from plan. Step3: consider long wall which is measured outer to outer and short wall which is measured inner to inner. Step4: Calculate length of long wall at particular layer by using equation , Length of long wall = c/c length of wall + width of wall at particular layer. Step 5 Calculate the length of short wall at particular layer by using the equation, Length of short wall= c/c length of wall - width of wall at particular layer. Step6: The lengths of long walls and short walls are multiplied separately by the width and height of corresponding layer and added to get the quantity. The length of long wall decreases from earthwork to brickwork of superstructure and length of short wall increases. This method is simple and most accurate. There are less chances of mistake in calculation. This is adopted in PWD hence called as PWD method.	2marks 2 marks
Que2	c) ii	**Prismoidal Method for finding out earthwork quantities.** Prismoidal Method for finding out earthwork quantities is based on calculating the volume of prismoids formed between successive cross sections. A prismoid is defined as a solid having ends of plane figures and of not necessarily the same number of sides ,lying in parallel planes and having longitudinal faces as trapezoids. From mensuration volume of prism having end faces in parallel planes will be equal to $V= L/6(A_1 + A_2+ 4A_m)$ Where A_1 and A_2 are the areas at the ends and A_m is the area of mid section parallel to ends. L is the length between ends. This prismoidItem No. Description of Itemal formula is applicable to calculate the quantity of earthwork for a single strip having three cross sections A_1, A_m and A_2. Prismoidal formula for calculating the quantity of earthwork having more than cross sections at a regular intervals will be V= L/3(First area + Last area + 4 sum of even areas + 2sum of odd areas This can be used only for odd number of cross sections. For even number of cross sections, the volume of end strip is calculated by trapezoidal formula and it is added to the volume of odd number of cross sections obtained by prismoidal formula to get total volume.	1 mark 1.5 1.5

<table>
<tr><td>Que3</td><td>a</td><td>Format of Measurement sheet
<table><tr><td>Item No.</td><td>Description of Item</td><td>No.</td><td>Length</td><td>Breadth</td><td>Height or Depth</td><td>Quantity</td><td>Total Quantity</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>Format 0f Abstract sheet
<table><tr><td>Item No.</td><td>Description of Item</td><td>Quantity</td><td>Unit</td><td>Rate</td><td>Unit of rate (per)</td><td>Amount Rs.</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td>02

02</td></tr>
<tr><td>Que3</td><td>b</td><td>Centage charges:- It is also called departmental charges. When an engineering department executes the work of another department of government or local bodies, a percentage amount 10% to 15% of estimated cost is charged for recovery of cost of establishment, planning, designing, supervision, audit charges etc. This charges are called centage charges.

Local administration fixes up the percentage in consultation with Accountant General.

The total expenditure for the work should be shown separately as-

For work expenditure = Rs.

For centage charges = Rs.</td><td>02

02</td></tr>
<tr><td>Que3</td><td>c</td><td>Prime cost:- Prime cost is the net cost or purchase cost of article at shop and refers to supply of article only and not to carrying out work.

Provisional sum:- It is an amount arbitrarily provided by an experienced estimator in total estimated cost of project to carry out some special type of work whose details are not known at the time of preparing estimate. e.g. Installation of lift.</td><td>02

02</td></tr>
<tr><td>Que3</td><td>d</td><td>Any Four

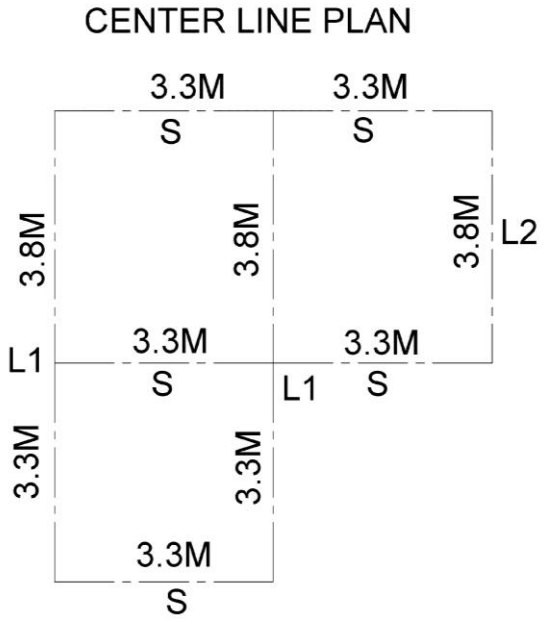
1. Build-Quant
2. Build-Master
3. Civil estimator
4. Turbo Bid
5. Intelli Bid
6. Pro Est
7. B2W (BID2Win)
8. STACK estimating</td><td>Any Four

01 for each</td></tr>
<tr><td>Que3</td><td>e</td><td>Factors affecting task work (Any Eight)
1. Physical health of worker.
2. Experience of worker.
3. Environmental factors like temperature, humidity etc.</td><td>Any Eight

½ for each</td></tr>
</table>

4. Motivation of management.
5. Ways of worker.
6. Team spirit.
7. Quality of material provided.
8. Tools and plants provided.
9. Specification of items.
10. Co-ordination, supervision and controlling by management.

Que4 a



Any Three Items

Item No.	Description of item	No.	Length	Breadth	Height or Depth	Quantity	Total Quantity	
1	Earthwork in excavation L_1= 3.8+3.3+0.8=7.9 D= 0.15+0.4+0.2=0.75 L_2= 3.8+0.8=4.6 S = 3.3-0.8=2.5	2	7.9	0.8	0.75	9.48		01
		1	4.6	0.8	0.75	2.76		01
		5	2.5	0.8	0.75	7.5		01
							19.74 m^3	01
	OR by center line method Total center line length = 34.5 m Effective center line length = 34.5 – 4 x 0.8/2 = 32.9 m.	1	32.9	0.8	0.75	19.74	19.74 m^3	OR 04
2	U.C.R. masonry in foundation. Step 1 L_1= 3.8+3.3+0.6=7.7	2	7.7	0.6	0.4	3.696		

			L_2= 3.8+0.6=4.4 S=3.3 – 0.6=2.7	1 5	4.4 2.7	0.6 0.6	0.4 0.4	1.056 3.24		02
			Step 2 L_1= 3.8+3.3+0.4=7.5 L_2= 3.8+0.4=4.2 S=3.3 – 0.4=2.9	2 1 5	7.5 4.2 2.9	0.4 0.4 0.4	0.6 0.6 0.6	3.6 1.008 3.48	16.08m^3	02
			OR by center line method Step 1 Effective centerline length= 34.5-4x0.6/2 = 33.3 Step 2 Effective centerline length= 34.5-4x0.4/2 = 33.7	1 1	33.3 33.7	0.6 0.4	0.4 0.6	7.992 8.088	16.08m^3	**OR** 02 02
		3	D.P.C. L_1= 3.8+3.3+0.4=7.5 L_2= 3.8+0.4=4.2 S=3.3 – 0.4=2.9	2 1 5	7.5 4.2 2.9	0.4 0.4 0.4	-- -- --	6.0 1.68 5.8	13.48m^2	02 02
			OR by center line method Effective centerline length= 34.5-4x0.4/2 = 33.7	1	33.7	0.4	--	13.48	13.48m^2	**OR** 04
		4	Internal Plaster 3 m long walls 3.5 m long walls	8 4	3.0 3.5	3.0 3.0	-- --	72.0 42.0	114.0m^2	02 02
Que4	b)i	Quantity of steel Assuming cover 25 mm a) 10 mm dia. bars at top: Length of each bar= 4200 – 2x25 + 2x9x10(Hook) = 4330 mm =4.33m. Weight of 10 mm dia. Bar 0.62 kg per m. Quantity of 10 mm dia. Bars = 2 x 4.33 x 0.62 = 5.37 kg. b) 16 mm dia. Bars at bottom: Length of each straight bar= 4200 – 2x25 + 2x9x16(Hook) = 4438 mm = 4.438 m. Length of each bent up bar= 4200 – 2x25 + 2x9x16(Hook)+ 2x0.42x(0.45 – 2x0.025) = 4774 mm = 4.774 m. Weight of 16 mm dia. Bar 1.58 kg per m. Quantity of 16 mm dia. Bars if no bent up = 4 x 4.438x1.58 = 28.05 kg. OR Quantity of 16 mm dia. Bars if 1 bars is bent up Straight bars = 3x4.438x1.58 = 21.04 kg.								02 02

		Bent up bars = 1x4.774x1.58 = 7.54 kg. Total = 28.58 kg. OR Quantity of 16 mm dia. Bars if 2 bars are bent up Straight bars = 2x4.438x1.58 = 14.025 kg. Bent up bars = 2x4.774x1.58 = 15.085 kg. Total = 29.11 kg. c) Stirrups 6 mm dia. b = 230 – 2x25 = 180 mm d = 450 – 2x25 = 400 mm Length of each stirrup = 2x180 + 2x400 + 24x6 = 1304 mm = 1.304 m. No. of stirrups = [(4200 – 2x25)/150] + 1 = 28 Weight of 6 mm dia. Bar 0.22 kg per m. Quantity of stirrups = 28 x 1.304 x 0.22 = 6.37 kg.	02
	b)ii	a)Quantity of Bricks: Assume finished size of brick 0.2x0.1x0.1 m (Actual size is 0.19x0.098x0.09 m) No. of bricks = 40 / (0.2x0.1x0.1) = 20,000 Volume of bricks = 20,000 x 0.19 x 0.09 x 0.09 = 30.78m^3 b) Mortar required = 40 – 30.78 = 9.22 m^3 for frog filling and wastage assume 10% Wet mortar required = 9.22 + 0.1x9.22 = 10.14 m^3 ---------- Increase for dry mortar 30% Dry mortar required = 10.14x0.3x10.14 = 13.18 m^3 ---------- Note: This quantity may vary as per assumption. c) Quantity of cement = [13.18/(1+6)]x1 = 1.88 m^3 No. of bags = 1.88/0.035 = 53.8 bags. ---------- d) Quantity of sand = [13.18/(1+6)]x6 = 11.3 m^3 ----------	02 01 01 01 01
Q. 5		**Attempt any <u>TWO</u> of the following.**	(16 M)
	a)	Calculate the quantity of earth work by mean area method from given data: (i) Formation level of starting chainage = 51.30 (ii) Formation width of road = 10 m (iii) Downward gradient of 1 in 200. (iv) Side slope 2 : 1 for cutting and banking	

Chainage (m)	120	160	200	240	280
Ground level (m)	50.85	50.65	50.75	51.25	51.45

	Ans.	Given data : Formation width of Road = b = 10 m. Formation level of starting change = 51.30 Gradient 1V : 200 H Side slope 2 : 1 for cutting as well as banking i.e. s = 2 First of all, the longitudinal section of the proposed road is to be drawn from the given data: Down ward gradient is 1 : 200 so for 200 m = 1 m for 160 m = x by cross multiplying, we get 200 x = 160 * 1	(8 M)

x = 160/200 = 0.8 m

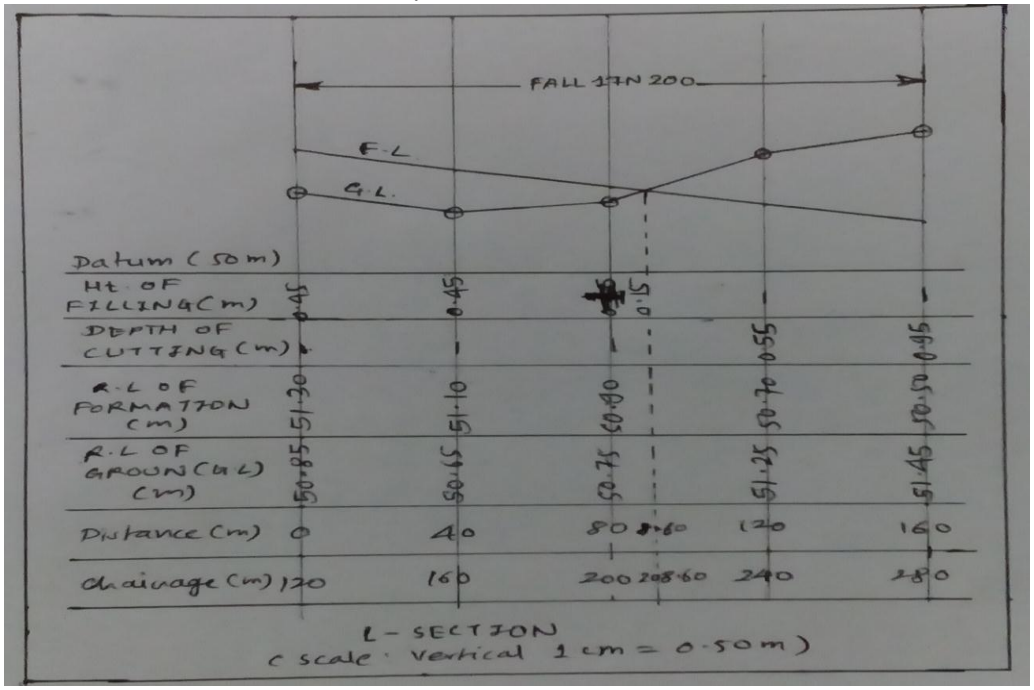
Therefore formation level of First chainage =51.30

so, formation level of last chainage (i.e.280) = 51.30 m – 0.8 m = 50.50 m

Therefore for fall each chainage = Total fall / no. of remaining chainage

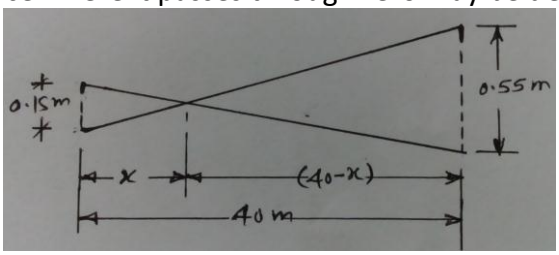
= 0.8/4 = 0.2 m

02



2 Marks

Now from the L-section, the road passes from banking to cutting in between chainage 200 and 240. The distance where it passes through zero may be deterimed as follows:



The two triangles on either side of zero point are symmetrical

(x / 0.15) = ((40 – x) / 0.55)

0.55 x = 0.15 (40 – x)

0.55 x + 0.15 x = 6

0.7 x = 6

x = 6 / 0.7

x = 8.60 m

Earthwork Calculation

b = 10 m, s = 2 for cutting as well as filling

Station	Height (h) (m)	Area (b+sh)h	Mean area (Sq. m.)	Length in metre	Volume (cu. m.)	
					Filling	Cutting
1	0.45	4.91	--	--	--	--
2	0.45	4.91	4.91	40.00	196.40	--
3	0.15	1.55	3.23	40.00	129.20	--
4	0.00	0.00	0.78	8.60	6.71	--

02 marks for table & 02 marks for correct values

5	0.55	6.11	3.06	31.40	--	96.08
6	0.95	11.31	8.71	40.00	--	348.40
				total	332.31	444.48

(b) Ans.

Prepare rate analysis for 12 mm thick cement plaster in cm (1 : 4) in superstructure.

Given, Thickness of plaster = 12 mm = 12/1000 = 0.012 m.

Cement = 1 part and sand = 4 part.

Assume area of plaster = 100 sq. m.

(1) Calculation of materials :

Wet volume of mortar = area x thickness of plaster

= 100 sq. m. x 0.012 m.

= 1.2 cu. m. 01

Add 30 % of mortar for joint filling

= 1.3 x 1.2 = 1.56 m^3

(2) Dry volume of mortar = 25 % more by total wet volume 01

= (0.25 x 1.56) + 1.56

= 1.95 cu. m.

(3) Volume of cement = (dry volume of mortar/sum of cm ratio) x part of cem.

= (1.95/(1+4)) x 1 = 0.39 cu. m. 01

Therefore no. of cement bags = volume of cement / vol. of cem. Per bag

= 0.39 / 0.035 = 11.14 say 12 bag.

(4) Volume of sand = (dry volume of mortar/sum of cm ratio) x part of sand.

= (1.95/(1+4)) x 4 = 1.56 cu. m. 01

Table for rate analysis for 10 sq. m.

Particulars	Quantity	Rate per unit	Unit of mesurts.	Amount (Rs.)
(A) Material :				
Cement	12 bag	Rs. 350	bag	4200.00
Sand	1.56 cu. m.	Rs. 900	Cu. m.	1404.00
Scaffolding	--	--	Lump.	1000.00
		Material cost		**6604.00**
(B) Labour :				
Head mason	0.5	Rs. 500	day	250.00
Mason	10 no.	Rs. 400	day	4000.00
Male coolie	8 no.	Rs. 300	day	2400.00
Female coolie	4 no.	Rs. 300	day	1200.00
Bhistie	1 no.	Rs. 300	day	30.00
T & P	L. S.			500.00
		Total Labour cost		**8650.00**
			Total cost	15254.00
			Add water charges 1.5%	228.81
			Overall cost	15482.81
			Add 10 % contractors profit	1548.28
			Rate per 100 sq. m.	17031.09
			Rate per Sq. m.	170.31
			Say	**Rs.170.00**

04

*(**Note :** Assumption can be made by understanding of student. Rate may vary from place to place.)*

(C) Ans. Prepare Rate analysis for U.C.R. masonry in cm (1 : 6) in superstructure. — 01

Calculation for materials :

Assume, volume of masonry = 10 cu. m.

Therefore, — 01

Dry volume of cement mortar = 42 % of volume of masonry

= (42/100) x 10 = 4.20 cu. m.

(1) Volume of stone = 10 cu. m. — 01

Loose volume of stone = wet vol. of stone masonry + 10 % more for loose vol.

= 10 + ((10/100) x 10) = 11.00 cu. m.

(2) Quantity of cement = (Dry vol. of CM/sum of ratio) x part of cement

= (4.2/(1+6)) x 1 = 0.60 cu. m. — 01

No. of cement bags = (vol. of cement / vol. of cement per bag)

= 0.60 / 0.034 = 17.65 say 18 bags.

(3) volume of sand = (Dry vol. of CM/Sum of ratio) x part of sand

= (4.2 / (1+6)) x 6 = 3.60 cu. m.

Table for rate analysis for 10 sq. m.

Particulars	Quantity	Rate per unit	Unit of mesurts.	Amount (Rs.)
(A) Material :				
Rubble	11 cu. m.	Rs. 412.00	Cu. m.	4532.00
cement	18 bags	Rs. 330.00	bag	5940.00
Sand	3.60 cu. m.	Rs. 352.00	Cu. m.	1267.20
		Material cost		**11739.20**
(B) Labour :				
Mason	6 Nos.	Rs. 300	day	1200.00
Male coolie	6 Nos.	Rs. 200	day	1200.00
Female coolie	6 Nos.	Rs. 170	day	1020.00
Bhistie	2 Nos.	Rs. 150	day	300.00
Scaffolding	--	--	Lumpsum	375.00
		Labour cost		**4095.00**
			Add material cost	11739.20
			Total	15834.20
			Add 10 % contractors profit	1583.42
			Rate per 10 sq. m.	17417.62
			Rate per Sq. m.	1741.76
			Say	**1742.00**

— 04

*(**Note :** Assumption can be made by understanding of student. Rate may vary from place to place.)*

6 **Attempt any <u>TWO</u> of the following :**

(a) (i) Ans. State importance of rate analysis.

The rate analysis is important:

(1) To determine the actual cost per unit of the items.

(2) To work out the economical use of materials and processes in completing the — 01 for each

		particulars item. (3) To calculate the cost of extra items which are not provided in the contract bond, but are to be executed as per the directions of the department. (4) To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.	point
	(ii) Ans.	State factors affecting rate analysis. *Factors affecting the rate analysis :- The factors which affect the rate analysis of an item can be broadly divided into following : *(1) Major Factors and (2) Minor Factors* (1) Major factors : The are mainly two factors on which the rate of an item depends**,--------(i) Materials and (ii) Labour.** *(i) Materials :-* The quantities of various materials required for the construction of an item can be easily worked out by knowing the specification of that item. The prices of various materials will depend on the market conditions. Thus, the quantities of the various materials required are fixed. But their prices are variable from place to place and from time to time as they depend on the prevailing market conditions. Hence before starting the rate analysis of an item. It is essential to collect the prices of such materials from the market of that instant.	01
		With the help of the quantities of various materials and prices of the materials, the cost of materials for a particular item can be calculated. *(ii) Labour :-* The labour force will be necessary to arrange the materials in a proper way so that the item can be completed. In any case, it is quite clear that the labour force required will depend on the efficiency of the laborers and hence, this force will be variable from place to place. Also the price or wage of labour is a variable factor and will vary from place to place, person to person and time to time. By knowing the amount of labour force and the wage of laborer, the cost of labour of a particular item is calculated.	01
		(2) Minor Factors :- (i) *Special equipment:* - If the execution of an item requires the use of some special equipment ort plant, the cost of using such special equipment on the rental basis should be included in the rate analysis of that item. (ii) *Place of work :-* The site of work will also have some effect on the rate of an item under certain conditions. If it is too far, more amount will have to be spent on carting. This will increase the cost of transportation of the materials and consequently, the rates of the items are to be modified. (iii*) Nature of work :-* If the work consists if large quantities of the items, the rates may be less and vice versa. *(iv) Conditions of contract* :- If the condition of contract are very stiff, the rates of various items will be high and vice versa.	½ mark for each any four points

(v) *Profit of the contractor* :- The usual percentage of the profit of the contractor is TEN. But if it is more or less, the rate of the item will be correspondingly affected.

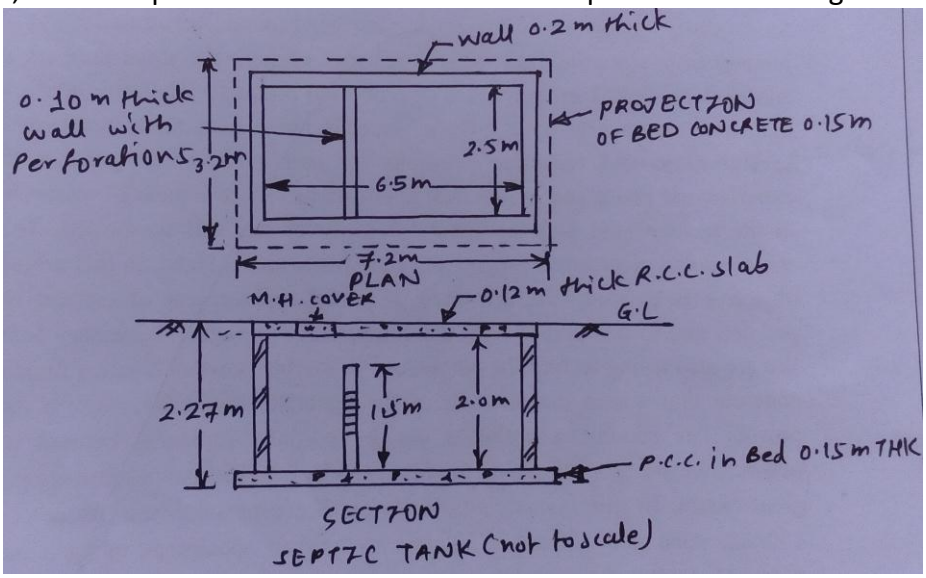
(vi) *Specifications* :- If the specifications of work provide for rigid type tolerances and superior quality turn out, the rates will be on the higher side.

(vii) Site conditions :- If the site conditions are such that difficulties will be experienced during execution of work, such as foundations involving water troubles, the rates will be on the higher side. On the other hand, if site conditions are ideally suited for the construction activities, the contractor may quote slightly lower rates.

(viii) Miscellaneous :- The other remaining miscellaneous factors affecting rates of items include time of completion of the project, climatic conditions, reputation of the contracting firm, discipline of the organization, etc.

(b) Calculate quantities of following items for Septic Tank of size 2.5 m x 6.5 m and height 2 m.
(i) Excavation (ii) Brick masonry
(iii) P.C.C. in bed (15 cm thick) (iv) Slab on top (12 cm thick)
Assume wall thickness as 0.2 m. 15 cm offset is provided for P.C.C. on all sides of Septic Tank.

Ans. First of all , draw the plan and sectional elevation of Septic tank from the given data



02 marks for fig.

(1) Excavation :-
Quantity for Excavation = No. x Length x breadth x depth
= 1 x 7.2 m x 3.2 m x 2.27 m = 52.30 cu. m.

(2) Brick work :-
(a) Qty. of Brick work for L/W = Nos. x L x B x H
= 2 x 6.9 m x 0.2 m x 2.0 m. = 5.52 cu. m.
(b) Qty. of Brick work for S/W = Nos. x L x B x H
= 2 x 2.5 m x 0.2 m x 2.0 m. = 2.00 cu. m.
(c) Qty. of Brick work for Baffle Wall = Nos. x L x B x H
= 1 x 2.5 m x 0.1 m x 1.5 m. = 0.375 cu. m.

01

Therefore, Total Qty. of Brick work = Sum of Qty. of Long wall, Short wall and Baffle wall
= 5.52 + 2.00 + 0.375 = 7.895 cu. m.

(3) P.C.C. in BED :-

Qty. of PCC in BED = Nos. x L x B x H — 02

= 1 x 7.2 m x 3.2 x 0.15 m = 3.456 cu. m.

(4) Slab on Top :-

(a) Qty. of Concrete in Slab = Nos. x L x B x H — 01

= 1 x 6.9 m x 2.9 m x 0.12 m = 2.40 cu. m.

(b) Qty. of Steel in RCC slab = Qty. of concrete x Qty. of steel per cu.m. of conc.

= 2.40 cu. m. x 60 kg/cu.m. = 144 Kg. — 01

*(**Note :** As i) Ground level is not mentioned. ii)) size of tank is not getting clear iii) baffle wall (size, thickness & no.) is not given in the problem itself. The student can assume the data as per their own understanding hence assessment can be done by considering changes in assumptions made for above three points for each students)These calculations and values in tabular form can also be accepted.)* — 01

(c) Ans

Find Quantity of excavation and concrete for circular community well. Refer figure no. 2

From the Figure no. 2

Qty. of Excavation and concrete is calculated in Table below:

Sr. No.	Item of work	Nos.	Length / OR Area	width	depth / thk.	Quantity
(A)	**Excavation**					
1	i) Excavation of soft murum up to 1.5 m depth	1	$((\pi/4) \times 4^2)$ sq. m.		1.5 m	18.85 cu. m.
	ii) Excavation of soft murum up to 3.0 m lift	1	$((\pi/4) \times 4^2)$ sq. m.		0.5 m	6.28 cu. m.
	Total excavation of soft murum					**25.13 cu. m.**
2	i) Excavation of soft rock up to 3.0 m lift	1	$((\pi/4) \times 4^2)$ sq. m.		1.0 m.	12.57 cu. m.
	ii) Excavation of soft rock up o 4.5 m. lift	1	$((\pi/4) \times 4^2)$ sq. m.		1.5 m.	18.85 cu. m.
	ii) Excavation of soft rock up to 6.0 m. lift	1	$((\pi/4) \times 4^2)$ sq. m.		1.0 m.	12.57 cu. m.
	Total excavation of soft rock					**43.99 cu. m.**
3	i) Excavation of Hard rock up to 6.0 m lift	1	$((\pi/4) \times 4^2)$ sq. m.		0.5 m.	6.28 cu. m.
	ii) Excavation of Hard rock up to 7.5 m. lift	1	$((\pi/4) \times 4^2)$ sq. m.		1.5 m.	18.85 cu. m.
	ii) Excavation of Hard rock up to 8.5 m. lift	1	$((\pi/4) \times 4^2)$ sq. m.		1.0 m.	12.57 cu. m.

02 (1 Mark for lift wise cal. And 1 Mark for its total)

02 (1 Mark for lift wise cal. And 1 Mark for its total)

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				Total excavation of soft rock				**37.70 cu. m.**		02 marks
			(B)	**Concrete**						
				The concrete parapet wall has 0.20 m thickness and concrete platform is also having thickness of 0.20 m and it forms a ring like structure.						
			4	i) Concrete in Vertical Portion	1	$(\pi/4) \times (4.4^2 - 4.0^2)$ sq. m.	1.5 m.	3.96 cu. m.		
				ii) Concrete in orizontal Portion	1	$(\pi/4) \times (6.4^2 - 4.4^2)$ sq. m.	0.2 m.	3.39 cu. m.		
				Total excavation of soft rock				**7.35 cu. m.**		