WINTER– 18 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.

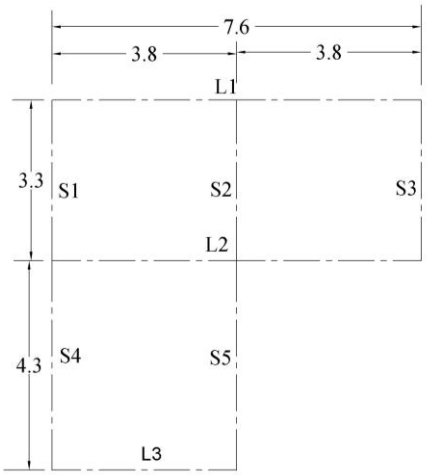
Q. No.	Sub Q. N.	Answers	Marking Scheme
Q.1	a) (i) Ans	***Attempt any THREE of the following:*** **(12)** ***State the purpose of estimating and costing.*** **Purpose of estimating**: 1) Before starting the construction project it is necessary to know the probable cost so that financial arrangements 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. In brief, estimating is important for various sanctions, scheduling, tendering etc. **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.	(any four) 1/2 mark For each 1/2 mark For each

Q.1	a)(ii) Ans	***Describe in brief revised and supplementary estimate.*** **Revised estimate**: Revised estimate is a type of detailed estimate. It is prepared under following circumstances.1) when original sanctioned detailed estimate exceeds by 5% or more, either rates being found insufficient or due to some other reason. 2) When expenditure on work exceed the limit of administrative sanction by more than 10%.3) When there is deviation in rates of material.4) When there is major alteration in original work. The revised estimate should be accompanied by a comparative statement showing variation in each item, quantity, rate under original estimate and revised estimate side by side. Similarly reason for the variation should be mentioned. **Supplementary estimate**: It is type of detailed estimate. It is prepared when additional work is required to supplement original work. It is also required when further development is necessary during the progress of work. This is the fresh estimate of the additional work. The abstract should show the amount of original estimate and the total amount including the supplementary amount for which sanction is required.	02 M 02 M
Q.1	a)(iii) Ans	***Prepare an estimate for two span bridge of 40 m each, the cost of existing bridge is Rs. 50,000/- per meter.*** Data Given: span = 40m , no of span = 2, Cost of existing bridge = 50000 per meter. Total length of proposed bridge = 2 x 40 = 80 m. Rate of construction per meter = 50000 /m Approximate cost of new bridge = 50000 x 80 =4000000/- Hence approximate estimate of bridge is Rs. 4000000/-	01 M 01 M 01 M 01 M
Q.1	a)(iv) Ans	***Draw standard format of measurement book and abstract sheet*** Measurement sheet Item No. | Description of item | No | Length L(m) | Breadth B(m) | Height H(m) | Quantity | Total Qty. Abstract sheet Item No. | Description of item | Quantity | Unit | Rate | Unit of rate | Amount	02 M 02 M
Q.1	b) (i) Ans	***Attempt any ONE of the following:*** ***State standard mode of measurement for following items.*** ***1. DPC 2. Wood work for door frame. 3. Skirting*** ***4. Ornamental cornice 5. Honeycombed brickwork 6. Form work*** **Mode of Measurements.** **DPC** : DPC is measured in sq.m **Wood work for door frame**: woodwork for door frame is measured in cu.m. **Skirting** :Skirting shall be measured in running meter stating its height.	**(6)** 01 M for each

		Ornamental cornice: It is measured in cu.m. **Honeycombed brickwork**: Honeycombed brickwork is measured sq.m, stating its thickness and pattern of honey combing. Holes or openings in honeycombing shall not be deducted. **Formwork**: Formwork is measured in sq.m	
Q.1	b) (ii) Ans	***Describe in brief rules of deduction for opening as per IS 1200 for brickwork and plastering.*** **Deduction in masonry 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) **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 3 sq.m , deduction is made for both faces and addition for jambs, soffits and sills are taken into account.	03 M 03 M
Q.2	a) Ans	***Attempt any TWO of the following:*** ***Describe in brief procedure for preparing approximate estimate of irrigation project and highway project.*** **Approximate estimate of Irrigation project**. Approximate estimate of Irrigation project is determined by considering approximate estimate of storage reservoir, dam, or canals. For storage reservoir and the dam , estimate is prepared on the basis of per million cubic meter of storage capacity or sq.m of catchment area. This method involves , selection of site with the help of topo- sheets and finding the catchment area. Finding rainfall data from rain gauge station near catchment area, Finding capacity of reservoir by contours, and deciding construction cost per million cubic meter. For canals ,approximate estimate is prepared on the basis of per km, or per cubic meter capacity of canal or per hectare of command area. For example; 1) Approximate cost of 10 km long irrigation canal is Rs. 5 lakhs at the rate of Rs. 50,000/- per km. 2) For an irrigation project of command area 2000 hectares , approximate estimate is Rs 40 lakhs at rate of Rs 2000/- per hectare. **Approximate estimate of highways.** For preparation of approximate estimate of highways , service unit method is adopted.	**(16)** 01 M 02 M 01 M

		Service unit adopted for new proposed highway is per km or per mile. The cost of road per km depends upon nature of road(National/ state highway or village road),width of road, thickness of metaling pavement surface, temporary and permanent acquisition of land , topography and cross drainage works. By knowing the cost of construction per km length of a similar type of road(rate),approximate estimate of proposed road can be prepared. For example: State highway of 10 km is constructed in Rs 20,00000/- . Hence approximate cost per km length is Rs.200000/-.	01 M 01 M 01 M 01 M
Q.2	b)	***Prepare approximate estimate for high school building from following data.*** ***i. Proposed plinth area = 2500 sqm. ii. Plinth area rate = 4000/sqm.*** ***iii. Water supply charges = 3% of cost of building.*** ***iv. Electric installation charges = 10% of cost of building.*** ***v. Contingencies = 3% of overall cost of building.***	
	Ans	**Approximate estimate of school building**. Cost of building = plinth area x rate = 2500 x 4000 = Rs.100,00000/- Water supply charges = 3% of cost of building = 3 /100 x 100,00000 = Rs.300000/- Electrical installation charges = 10% of cost of building. = 10/100 x 10000000 = Rs.1000000/- Overall cost = 10000000 +300000 + 1000000 = Rs 11,300,000/- Contingencies = 3% of overall cost = 3/100 x 11300000 = Rs 3 39000/- Approximate Estimate = 11,300,000 + 339000 = Rs.11,639,000/-	01 M 01 M 01 M 02 M 01 M 02 M
Q.2	c)i)	***Describe in brief center line method for taking out quantities.***	
	Ans	**Centre line method** : Centre line method is used for calculating quantities of rectangular , circular and polygonal buildings. This method is simple and quick. Calculations in this method are less and easy. Centre line method involves the following steps. a)prepare centre line plan at foundation from given drawing and write centre line lengths of each wall. b) Find the total length of centre lines having the same type of footing . c) Calculate the number of junctions of cross walls. It may be noted that ,corners of buildings are not taken as junctions. If two walls meet at one point , then take n=2 at that point. Calculation of length of an item = Total centre line length - n x (1/2 width of item) Where n= number of junctions of cross walls with main walls . d) For buildings having different type of walls , each set of walls should be taken separately. e) Multiply number, length, breadth, depth to get the quantity of item.	01 M 03 M
Q.2	c)ii)	***State the approximate percentage of steel required for following R.C.C. members.*** ***1. Footing 2. Column 3. Beam 4. Slab***	
	Ans	**Approximate percentage of steel required for** 1) Footing : 0.5% to 0.8 % of quantity of concrete in cu.m 2) Column : 1% to 5% of quantity of concrete in cu.m	01 M for

		3) Beam : 1% to 2% of quantity of concrete in cu.m density of mild steel 4) Slab : 0.7% to1% of quantity of concrete in cu.m (But steel is not expressed in cu.m, hence quantity in quintals is calculated by considering density of mild steel as 7850Kg/m^3. 1$m^3$of steel = 7850kg.)	each
Q.3	a) Ans	***Attempt any FOUR of the following:*** ***Describe in brief DSR.*** 1) It is printed booklet (or in the form of soft copy) in which rate of various items are given. DSR means District Schedule of rates. 2) In DSR, labour rates and material rates are also mentioned. 3) DSR served as guide for preparation of estimate of any work. 4) DSR is revised every year because of changes in cost of materials and labour charges every year.	**(16)** 01 M for each
Q.3	b) Ans	***State data required for detailed estimate.*** 1) Drawing: - Detailed drawing showing plan, elevation and section with all dimensions. 2) Specifications: - Detailed specification which decides rates of various items. 3) Rates: - Market rates of various items, materials and labours. For this DSR may be preferred. 4) Location of work: - It is needed to use appropriate rates of items. 5) Modes of measurement: - Modes of measurements for various items shall be decided.	Any four 01 M foe each
Q.3	c) Ans	***Define: i. Provisional sum ii. Provisional quantities*** **i) Provisional sum**: - It is amount provided in the estimate for specialized items such as installation of lift, air conditioner, firefighting equipment, acoustic work etc., details of which are not known at the time of preparing estimate. **ii) Provisional quantities**: - When the quantities of particular items are uncertain due to unavailability of data, provisional quantities of those items are called provisional items and corresponding quantities are called provisional quantities.	02 M 02 M
Q.3	d) Ans	***Enlist any four software used for estimation in civil engineering.*** 1) Tally system 2) Sage 3) Maxwell system 4) Premier construction software 5) e-Take off 6) Construction partner 7) Auto Quantity Takeoff – QTO 8) Estimator – CESDb etc.	Any four 01 M for each
Q.3	e) Ans	***Define: i. Lead and Lift ii. Task work*** i. Lead: - It is horizontal distance between point of earthwork excavation and point of earthwork disposal. It is generally measured in terms of 50 m distance. ii. Lift: - It is average vertical distance between point of excavation and point of disposal. Standard lift is 1.5 m. iii. Task work: - It is capacity of doing the work by average labour in terms of work per day (08 hours0	01 M 01 M 02 M
Q.4	a) Ans	***Work out quantities of the following any THREE items of work from Figure No.1.*** ***(i)Earth work in Excavation (ii) P.C.C. (1:4:8)*** ***(iii) U. C. R. Masonry in foundation (iv) Mosaic flooring***	**(12)**



Any three items

Sr. No.	Description	No.	L	B	D/H	Quantity	
	Calculation of earthwork & PCC considering 1000 mm PCC width						
1.	Earth work in excavation						
	$L_1 = L_2 = 7.6 + 1.0 = 8.6$	2	8.6	1.0	0.7	12.04	
	$D = 0.2 + 0.4 + 0.1 = 0.7$						02 M
	$L_3 = 3.8 + 1.0 = 4.8$	1	4.8	1.0	0.7	3.36	
	$S_1 = S_2 = S_3 = 3.3 – 1.0 = 2.3$	3	2.3	1.0	0.7	4.83	02 M
	$S_4 = S_5 = 4.3 – 1.0 = 3.3$	2	3.3	1.0	0.7	4.62	
						24.85 m^3	
2.	P. C. C. (1 : 4 : 8)	2	8.6	1.0	0.2	3.44	02 M
		1	4.8	1.0	0.2	0.96	
		3	2.3	1.0	0.2	1.38	02 M
		2	3.3	1.0	0.2	1.32	
						7.1 m^3	
	Calculation of earthwork & PCC considering 100 mm PCC width						
1.	Earth work in excavation						
	$L_1 = L_2 = 7.6 + 0.1 = 7.7$	2	7.7	0.1	0.7	1.08	
	$D = 0.2 + 0.4 + 0.1 = 0.7$						02 M
	$L_3 = 3.8 + 0.1 = 3.9$	1	3.9	0.1	0.7	0.27	
	$S_1 = S_2 = S_3 = 3.3 – 0.1 = 3.2$	3	3.2	0.1	0.7	0.67	02 M
	$S_4 = S_5 = 4.3 –0.1 = 4.2$	2	4.2	0.1	0.7	0.59	
						2.61 m^3	
2.	P. C. C. (1 : 4 : 8)	2	7.7	0.1	0.2	0.31	
		1	3.9	0.1	0.2	0.08	
		3	3.2	0.1	0.2	0.19	02 m
		2	4.2	0.1	0.2	0.17	
						0.75 m^3	02 m
3	U. C. R. Step I						

		$L_1 = L_2 = 7.6 + 0.6 = 8.2$	2	8.2	0.6	0.4	3.936	
		$L_3 = 3.8 + 0.6 = 4.4$	1	4.4	0.6	0.4	1.056	
		$S_1 = S_2 = S_3 = 3.3 – 0.6 = 2.7$	3	2.7	0.6	0.4	1.944	
		$S_4 = S_5 = 4.3 – 0.6 = 3.7$	2	3.7	0.6	0.4	1.776	
		Step II						
		$L_1 = L_2 = 7.6 + 0.5 = 8.1$	2	8.1	0.5	0.6	4.86	
		$L_3 = 3.8 + 0.5 = 4.3$	1	4.3	0.5	0.6	1.29	02 m
		$S_1 = S_2 = S_3 = 3.3 – 0.5 = 2.8$	3	2.8	0.5	0.6	2.52	
		$S_4 = S_5 = 4.3 – 0.5 = 3.8$	2	3.8	0.5	0.6	2.28	
							19.66 m^3	02 m
	4.	Mosaic tiles						
		Living room	1	3.5	4.0	--	14.0	01 M
		Bed room	1	3.5	3.0	--	10.5	01 M
		Kitchen	1	3.5	3.0	--	10.5	01 M
		Door sill (assume width = 1 m)	3	1.0	0.3	--	0.9	01 M
							35.9 m^2	

Note: "If Students attempted to solve the problem by assuming appropriate (Foundation= 1000 mm) value. Consider and Give appropriate marks."

Q.4 b) **(06)**

Attempt any ONE of the following:

(i) ***Find out the quantity of steel and prepare BBS from following data.***

1. Size of room = 6m x 4m 2. Thickness of slab = 120 mm

3. Main bars bent up alternatively along longer span = 12 mm dia. @ 140 mm c/c.

4. Distribution bars along longer span = 6 mm dia. @ 125 mm c/c.

Ans Assume size of room = 6 m x 4 m as overall size.

Thickness of slab = 120 mm

Assume cover = 15 mm

So effective depth = 120 – 2 x 15 = 90 mm

1) Length of main bar (12 mm dia @ 140 mm c/c)

Effective length = Lx – 2 x cover + 2 x 9 x dia + 0.42d

= 4000 – 2 x 15 + 2 x 9 x 12 + 0.42 x 90 — 01 M

= 4000 – 30 + 216 + 37.8

= 4223.8 mm = 4.224 m.

Main Bar

No. of main bars = [(Ly – 2 x cover)/spacing)] + 1

= [(6000 – 2 x 15)/140)] + 1 — 01 M

= 43.64 m Say 44 m.

Length of distribution bar (6 mm dia @ 125 mm c/c)

Length = Ly – 2 x cover + 2 x 9 x dia.

= 6000 – 2 x 15 + 2 x 9 x 6 — 01 M

= 6000 – 30 + 108 = 6078 mm = 6.078 m.

No. of bars = [(4000 – 2 x 15) / 125] + 1 = 32.76 Say 33. — 01 M

04 bars may be given at top on either sides

Hence No. of bars = 33 + 4 x 2 = 41.

Sr. No.	Description	Shape	No.	L	Weight Kg/m	Total weight Kg.
1.	Main bars 12 mm dia.		44	4.224	0.887	164.85
2.	Distribution bars 6 mm dia.		33 OR 41	6.078	0.22	44.13 OR 54.82

Note: - Answer may be different if-
1. Given room size 6 m x 4 m assumed as internal dimensions. — 02 M

Q.4 b)(ii) ***Find out total quantity of material required for 25 m^3 concrete. The proportion of concrete is 1:2:4***

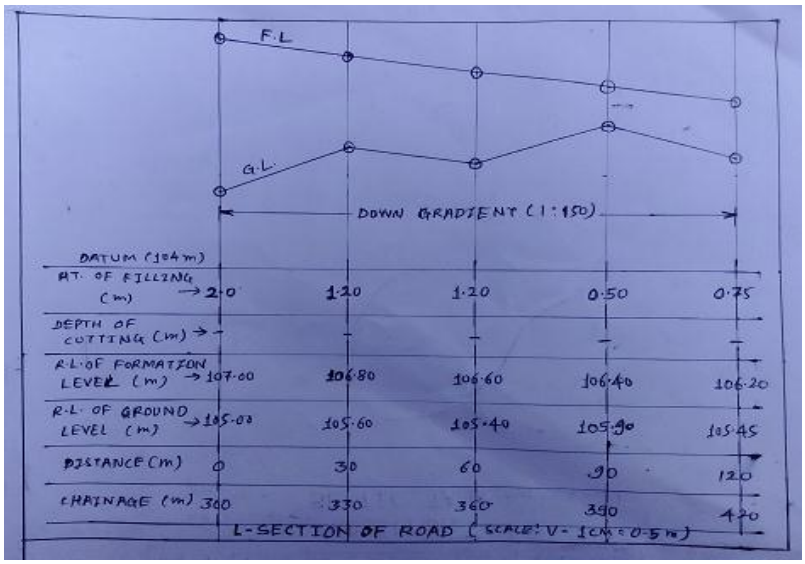
Ans
Wet volume = 25 m^3
Dry volume of concrete 52% more. — 02 M
Dry volume = 25 + 0.52 x 25 = 38 m^3
Cement required = [38 / (1 + 2 + 4)] x 1 = 5.4285 m^3 — 02 M
= 5.4285 / 0.035 = 155 bags.
Fine aggregate = 5.4285 x 2 = 10.86 m^3 — 01 M
Coarse aggregate = 5.4285 x 4 = 21.72 m^3 — 01 M

Q.5 ***Attempt any TWO of the following:*** — **(16)**

a) ***Calculate quantity of earth work from following data:***
i. Formation level of starting chainage = 107 ii. Formation width of road = 10 m.
iii. Down gradient of road = 1 in 150 iv. Side slope = 2 H : 1 V

Chainage m	*300*	*330*	*360*	*390*	*420*
Ground level m	*105*	*105.6*	*105.4*	*105.9*	*105.45*

Ans
Given data :
Formation width of Road = b = 10 m.
Formation level of starting change = 107
Gradient 1V : 150 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 gradient of road is 1 : 150
so for 150 m = 1 m
for 120 m = x
by cross multiplying, we get
150 x = 120 * 1
x = 120/150 = 0.8 m
Therefore formation level of First chainage = 107
so, formation level of last chainage (i.e.420) = 107 m – 0.8 m = 106.20 m — 02 M
Therefore for fall each chainage = Total fall / no. of remaining chainage
= 0.8/4 = 0.2 m



02 M for figure

(1) Mid-sectional area method:

Earthwork Calculation

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

Chain age (m)	Height (m)	Mean Ht. (h) (m)	Central Area (bh) (m^2)	Area of side parts sh^2 (m^2)	Total Area ($bh+sh^2$) (m^2)	Length in meter (L)	Quantity of earthwork ($bh+sh^2$) x L (m^3)	
							Filling	Cutting
300	2.00	--	--	--	--	--	--	--
330	1.20	1.60	16.00	5.12	21.12	30	633.60	--
360	1.20	1.20	12.00	2.88	14.88	30	446.40	--
390	0.50	0.85	8.50	1.45	9.95	30	298.50	--
420	0.75	0.625	6.25	0.78	7.03	30	210.90	--
						total	1589.40	--

02 M for table and 02 M for correct values.

OR

(2) Mean-Sectional area method:

Earthwork Calculation

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

Chain age (m)	Height (h) (m)	Area (b+sh)h (m^2)	Mean area A (m^2)	Length in meter (L)	Quantity of earthwork (A x L) (m^3)	
					Filling	Cutting
300	2.00	28.00	--	--	--	--
330	1.20	14.88	21.44	30	643.20	--
360	1.20	14.88	14.88	30	446.40	--
390	0.50	5.50	10.19	30	305.70	--
420	0.75	8.62	7.06	30	211.80	--
				total	1607.10	--

02 M for table and 02 M for correct values.

*(**Note :** Calculation of Quantity of earthwork can be done by any one method from above*

two method)

Q.5 b) Ans

Prepare rate analysis for 12 mm thick cement plaster in C.M. (1:4) in super structure.

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.

= 1.20 cu. m.

Add 30 % mortar to fill up joint = ((30/100)x1.2) + 1.2 = 1.56 cu.m.

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

= (0.25 x 1.56) + 1.56 — 01 M

= 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 M

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

= 0.39 / 0.035 = 11.14 say 12 bag. — 01 M

(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 M

Table for rate analysis for 100 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. 530	Cu. m.	826.80
Scaffolding	--	--	Lump.	350.00
		Material cost		**5376.80**
(B) Labour :				
Mason	10 nos.	Rs. 400	day	4000.00
Male coolie	5 nos.	Rs. 300	day	1500.00
Female coolie	5 nos.	Rs. 250	day	1250.00
Bhistie	2.5 no.	Rs. 200	day	500.00
		Labour cost		**7250.00**
			Add material cost	5376.80
			Total	**12626.80**
			Add 10 % contractors profit	1262.68
			Rate per 100 sq. m.	13889.48
			Rate per Sq. m.	138.89
			Say	**Rs.139.00**

04 M for Table and values.

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

Q.5 c) Ans

Prepare the rate analysis for brickwork in superstructure (1:6) proportion.

(1) Calculation of materials: Assume volume of brick masonry = **10 cu.m.**

(A) Dry volume of mortar considering frog filling and wastage etc. = 35 % of volume of brick masonry.

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

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

= (3.5/(1+6)) x 1 = 0.5 cu. m.

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

= 0.5 / 0.035 = 14.29 say 14.50 bags. — 01 M

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

= (3.5/(1+6)) x 6 = 3.0 cu. m. — 01 M

(4) Number of bricks required:

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

Volume of brick = 0.2 m x 0.1 m x 0.1 m = 0.002 cu. m.

No. of bricks = Volume of masonry / Volume of one brick

= 10 / 0.002 = 5000 Nos.

Total no. of bricks by adding 5 % of wastage = ((5/100) x Nos. of brick) + Nos. of brick

= ((5 / 100) x 5000) + 5000 = 5250 Nos.

Table for rate analysis for 10 cu. m. — 01 M

Particulars	Quantity	Rate per unit	Unit of mesurts.	Amount (Rs.)
(A) Material :				
Cement	14.50 bag	Rs. 350.00	bag	5075.00
Sand	3.0 cu. m.	Rs. 530.00	Cu. m.	1590.00
Bricks	5250 Nos.	Rs. 5.00	No.	26250.00
Scaffolding	--	--	Lump.	375.00
		Material cost		**33290.00**
(B) Labour :				
Mason	8 nos.	Rs. 400	day	3200.00
Male coolie	5 nos.	Rs. 300	day	1500.00
Female coolie	3 nos.	Rs. 250	day	750.00
Bhistie	3 nos.	Rs. 200	day	600.00
		Labour cost		**6050.00**
			Add material cost	33290.00
			Total	**39340.00**
			Add 1.5 % water charges	590.10
			Add 10 % contractors profit	3934.00
			Rate per 10 cu. m.	43864.10
			Rate per cu. m.	4386.41
			Say	**4387.00**

04 M for Table and values.

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

Q.6 — ***Attempt any TWO of the following:*** — **(16)**

a) ***Define rate analysis and state factors affecting rate analysis. Explain in brief importance of rate analysis.***

Ans — 01 M

(A) Rate analysis :

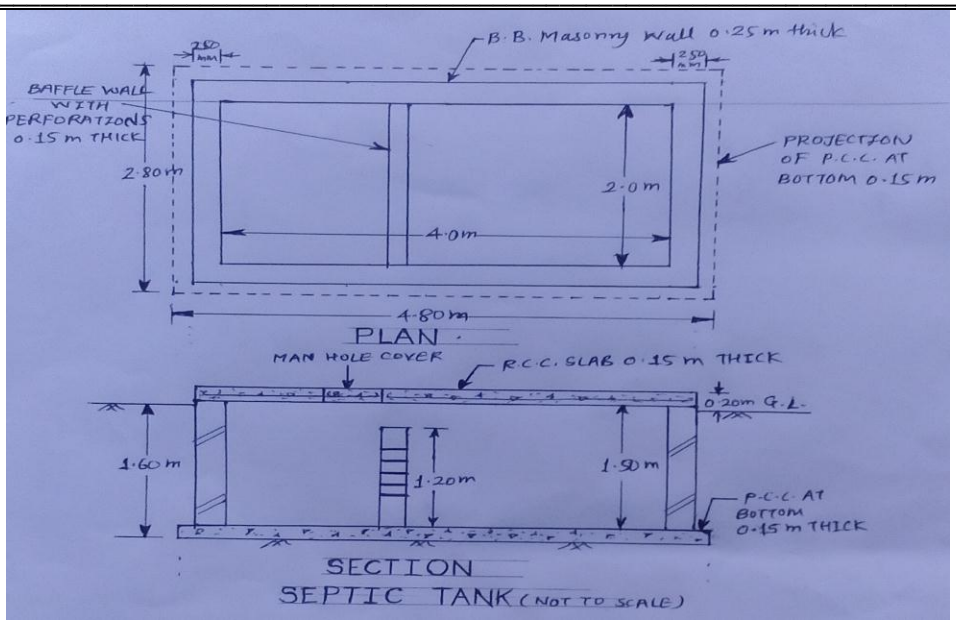
The determination of rate per unit of a particular item of work, from the cost of quantities of materials, the cost of labourers and other miscellaneous petty expenses require for its completion is known as the rate analysis.

(B) 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. *(ii) Labour :-* The labour force will be necessary to arrange the materials in a proper way so that the item can be completed. **(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. *(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, th0e 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. **(C) 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 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. To revise the schedule of rates due to increase in the cost of material and labour or due to change in technique.	01 M 04 M (any four : 01 M for each) 02 M (1/2 M for each)
Q.6	b)	***Work out the quantity of following items for septic tank (size 2 m x 4 m) and height 1.45 m. The top of slab of septic tank is 20 cm above GL.*** ***i. Earth work in excavation ii. P.C.C. (15 cm thick) at bottom.*** ***iii. B.B. Masonry (250 mm thick) iv. R.C.C. slab at top (15 cm thick)***	
	Ans	Assume baffle wall of 0.15 m thick and 15 cm offset is provided for P.C.C. on all sides of Septic Tank. First of all , draw the plan and sectional elevation of Septic tank from the given data	



02 M for figure

Calculations for Quantity :

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

Sr. No.	Item of work	Nos.	Length	width	depth / thk.	Quantity
			OR Area			
(i)	**Earthwork in excavation**					
1	i) up to 1.5 m depth	1	4.80 m	2.80 m	1.5 m	20.16 cu. m.
2	ii) 1.5m to 3.0 m depth	1	4.80 m	2.80 m	0.1 m	1.34 cu. m.
	TOTAL EARTHWORK IN EXCAVATION					**21.50 cu. m.**
(ii)	**P.C.C. at bottom (15 cm thick)**					
	PCC at BED	1	4.80 m	2.80 m	0.15 m	2.02 cu. m.
	Total quantity of PCC at bottom					**2.02 cu. m.**
(iii)	**B.B. Masonry (250 mm thick)**					
1	Long wall = 4+0.25+0.25 = 4.5 m. length	2	4.50 m	0.25 m	1.5 m	3.38 cu. m.
2	Short wall = 2.0 m length	2	2.00 m	0.25 m	1.5 m	1.50 cu. m.
3	Baffle wall = 2.0 m length	1	2.00 m	0.15 m	1.2 m	0.45 cu. m.
	Total quantity of B.B. masonry					**5.33 cu. m.**
(iv)	**R.C.C. Slab at top (15 cm thick)**					
1	RCC slab	1	4.50 m	2.50 m	0.15 m	**1.69 cu. m.**
1	Quantity of steel in RCC Slab	1	Qty. of Conc. X Rate of steel per cu. m of conc. = 1.69 cu. m. x 60 Kg/cu.m.			**101.40 Kg**.

01 M

01 M

02 M

*(**Note :** As i) size of tank is not getting clear ii) baffle wall (size, thickness) is not given. In the problem itself. The student can assume the data as per their own understanding hence*

02 M

assessment can be done by considering changes in assumptions made for above points for each students)

Q.6 c)

Ans

Find quantity of earthwork in excavation and cement 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)	**Earth work in Excavation**					
1	i) Excavation of soft rock up to 1.5 m depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.5 m	23.86 cu. m.
	ii) Excavation of soft rock 1.5 m to 3.0 m depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.0 m	15.90 cu. m.
				Total excavation of soft rock		**39.76 cu. m.**
2	i) Excavation of Hard murum 1.5 m to 3.0 m depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		0.5 m.	7.95 cu. .
	ii) Excavation of Hard murum 3.0 m to 4.5m. depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.5 m.	23.86 cu. m.
	iii) Excavation of Hard murum 4.5 m to 6.0m. depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.5 m.	23.86 cu. m.
	iv) Excavation of Hard murum 6.0 m to 7.5m. depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		0.5 m.	7.95 cu. m.
				Total excavation of Hard Murum		**63.62 cu. m.**
3	i) Excavation of Hard rock 6.0 m to 7.5 m depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.0 m.	15.90 cu. m.
	ii) Excavation of Hard rock 7.5 m to 8.5 m depth	1	$((\pi/4) \times 4.5^2)$ sq. m.		1.0 m	15.90 cu. m.
				Total excavation of Hard rock		**31.80 cu. m.**
B)	**Cement Concrete**					
	The concrete platform is having thickness of 0.15 m and itforms a ring like structure.					
4	ii) Concrete in Horizontal Platform	1	$(\pi/4) \times (6.5^2 - 4.5^2)$ sq. m.		0.15 m.	2.59 cu. m.
				Total quantity of Cement Concrete		**2.59 cu. m.**

02 (01 M for lift wise cal. And 01 M for its total)

02 M (01 M for lift wise cal. And 01 M for its total)

02 (01 M for lift wise cal. And 01 Mark for its total)

02 M