SUMMER– 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: State the meaning of the term estimating and costing. It is the process of calculating probable quantities of various items and expected expenditure to be incurred for particular project or work.	04 Marks
Q.1	a)(ii) Ans	Enlist the types of estimate. Mention the situation when revised estimate is prepared. Types of estimate: 1. Approximate estimate. a. Plinth area method. b. Cubic content method. c. Service unit method. d. Approximate quantity method. e. Typical bay method. 2. Detail estimate. a. Original or new estimate. b. Revised estimate. c. Supplementary estimate. d. Annual repairs and maintenance estimate. Revised estimate is prepared in following situations. 1. When original sanction amount exceeds or likely to exceed by more than 5% from the rates in original estimate. 2. When the expenditure of work exceeds or likely to exceed by more than 10% of administrative approval. 3. When there is material deviation from original proposed. 4. When sanctioned estimate is more than requirement	01 M 01 M 02 Marks (1/2 per situation)
Q.1	a)(iii)	State mode of measurements for the following items of work. I) Barbed wire fencing 2) Skirting 3) Dado 4) Purlins	

	Ans	Modes of measurement: 1. Barbed wire fencing: Running meter. 2. Skirting: Running meter (depth 15 cm or mentioned) OR Square meter. 3. Dado: Square meter. 4. Purlins: Running meter OR Cubic meter.	04 Marks (01 for each)
Q.1	a)(iv)	Prepare approximate estimate of a building using following data. 1) Proposed area of the building 150 sq.m. 2) Similar types of building is recently constructed in nearby locality having built-up area 110 sq.m. and the total cost of construction is Rs.12 lakhs.	
	Ans	Built up area rate = 12,00,000 / 110 = 10,909.1 per Sq. M. Approximate cost of proposed building = 10,909.1 x 150 = Rs. 16,36,365/-	02 M 02 M
Q.1	b) (i) Ans	Attempt any ONE of the following: Draw the standard formats of measurement sheet, abstract sheet; and face sheet. State use of face sheet. Measurement sheet:	

Item No.	Description of item	No.	Length L	Breadth B	Height D/H	Quantity

01 M

Abstract sheet:

Item No.	Description of item	Quantity	Unit	Rate	Unit of rate	Amount

01 M

Face sheet:
Division: _____
Sanction estimate No.: _____
Fund head: _____
Major head: _____
Minor head: _____
Service head: _____
Departmental head: _____

01 M

Estimate framed in the office of Executive Engineer, P.W.D., the probable expenses that will occur in Name of Work: _____
Administrative approval under No. _____ Dated _____
Technical sanctioned under No. _____ Dated _____
Estimate prepared by: _____
And checked by: _____
Call of authority: _____

01 M

General abstract

Sr. No.	Particulars	Amount
1	Estimated cost (as per abstract)	Rs. _____
2	Water supply and Sanitary charges @ ____%	Rs. _____
3	Electrification charges @ ____%	Rs. _____
4	Contingencies @ 3 to 5%	Rs. _____
5	Work charged establishment @ 1 to 2%	Rs. _____
	Total estimated cost	Rs. _____

01 M

<table>
<tr><td></td><td></td><td>Use: It is used to mention details of project for which estimate is prepared and attached at cover page of detail estimate.</td><td>01 M</td></tr>
<tr><td>Q.1</td><td>b)
(ii)
Ans</td><td>State the rules for deductions as per IS 1200 for
1) Masonry work in superstructure 2) Plastering
1) Masonry work in superstructure:
No deduction shall be made for----
• Opening up to 0.1 Sq.m. in area.
• Ends of beams, lintels, post up to 0.05 Sq.m.
• Wall plates, bed plates, bearing of slab etc. when thickness does not exceed 10 cm.
2) Plastering:
i. No deductions for opening up to 0.5 Sq. m. each and no addition made for jambs, soffits and sills of those openings.
ii. For opening more than 0.5 Sq.m. but not exceeding 3 Sq.m.
• 50% of opening area shall be deducted from each face if breadth of sill is same on each face <u>OR</u>
• Full opening area shall be deducted from the face on which breadth of sill is less.
iii. For opening more than 3 Sq.m. full deduction shall be made from each face but separate additions shall be made for jambs, soffits and sills.</td><td>02 M
01 M
02 M
01 M</td></tr>
<tr><td>Q.2</td><td>a)
Ans</td><td>Attempt any TWO of the following:
Describe the procedure for preparing approximate estimate of a water supply project.
I) Basis of preparing approximate estimate of Water supply project may be population to be served by project.
In this case knowing cost of recently constructed similar water supply project, cost per capita can be found out, and then approximate cost of new project can be calculated.
II) Otherwise water supply project is divided in to following units and approximate cost of each unit is found out and then total approximate cost of project is calculated.
<table>
<tr><th>Sr. No.</th><th>Unit</th><th>Service unit</th></tr>
<tr><td>1</td><td>Intake or head work</td><td>Per MLD <u>OR</u> Per m^3 capacity</td></tr>
<tr><td>2</td><td>Pumping machinery</td><td>Per H.P. <u>OR</u> KW</td></tr>
<tr><td>3</td><td>Rising main</td><td>Per running mater</td></tr>
<tr><td>4</td><td>Treatment unit like aerator, flash mixer, clarifloculator, rapid sand filter, disinfection.</td><td>Per MLD <u>OR</u> Per m^3 capacity</td></tr>
<tr><td>5</td><td>Ground storage reservoir and ESR</td><td>Per liter capacity</td></tr>
<tr><td>6</td><td>Distribution system</td><td>Per running meter</td></tr>
<tr><td>7</td><td>Staff quarter</td><td>Per Sq. m.</td></tr>
<tr><td>8</td><td>Land acquisition</td><td>Per Acre</td></tr>
</table></td><td>02 M
02 M
04 M</td></tr>
<tr><td>Q.2</td><td>b)

Ans</td><td>Prepare approximate estimate of a bridge having 4 spans of 50 m each using following data.
(i) Cost of existing bridge Rs.l.5 cr. (ii) Existing bridge having 3.3 spans of 60 m each.
Length of existing bridge = No. of spans x length of each span
= 3.3 x 60
= 198 m.
Rate per meter length = Cost / Length
= 1,50,00,000 / 198
= 75757.58</td><td>02 M
02 M</td></tr>
</table>

Length of new bridge = 4 x 50 = 200 m — 02 M

Approximate cost of new bridge = 200 x 75757.58
= Rs. 15151516. — 02 M

Q.2 c) The formation level of road at starting point is 470.00 m. The road surface shall be falling gradient line of 1 to 60 formation width of road is 12 m. Side slope 1:2 in embankment and 1:1.5 in cutting. .
Assume there is no cross slope to the ground.

Chainage in M	0	30	60	90	120	150
R.L. of G.L. in m	465.00	467.20	468.10	468.20	469.70	469.00

Calculate the quantity of earthwork. For road using Mean Sectional Area Method.

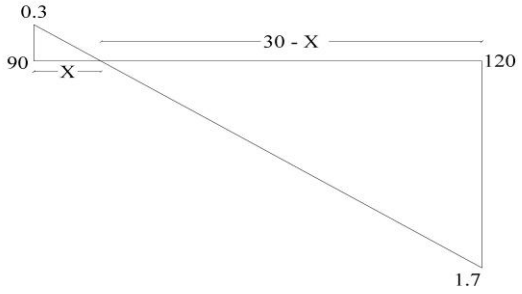
Ans

Fall in gradient 1:60

Fall in formation level for each 30 m = 30 / 60 = 0.5 m.

Chainage in M	0	30	60	90	120	150
R.L. of G.L. in m	465.00	467.20	468.10	468.20	469.70	469.00
Formation level	470.0	469.5	469.0	468.5	468.0	467.5
Height of embankment	5.0	2.3	0.9	0.3	--	--
Depth of cutting	--	--	--	--	1.7	1.5

02 M



X / 0.3 = (30 – X) / 1.7
1.7X = 9 – 0.3X
2X = 9
X = 4.5
No banking and no cutting at section = 90 + 4.5 = 94.5 m

01 M

Chainage	Depth 'd'	Area		Mean area		L	Volume	
		Banking S=2	Cutting S=1.5	Banking	Cutting		Banking	Cutting
0	5.0	110	--	--	--	--	--	--
30	2.3	38.18	--	74.09	--	30	2222.7	--
60	0.9	12.42	--	25.3	--	30	759	--
90	0.3	3.78	--	8.1	--	30	243	--
94.5	0	0	--	1.89	--	4.5	8.505	--
120	-1.7	--	24.735	--	-12.3675	25.5	--	315.37
150	-1.5	--	21.375	--	-23.055	30	--	691.65
						Total	3233.205	1007.02

04 M

Earth work in banking = 3233.205 Cu.m.
Earth work in cutting = 1007.02 Cu.m. — 01 M

Q.3 Attempt any FOUR of the following:

a) How will you prepare estimate for irrigation canal?

Ans Estimate for irrigation canal.

The unit to be adopted for finding out the approximate estimate of irrigation canal , is one

		of the following a) Area of land under command of canal b) Per Km length. In the first case, the area under the command of irrigation canal is worked out in hectares. Knowing the cost of similar project, suitable amount per hectare is decided. The approximate estimate is calculated by multiplying the area under the command to per hectare cost of canal. In second case cost per Km length is calculated from the similar units, constructed previously. The approximate cost of proposed canal is calculated by multiplying the length of proposed canal to cost per km length of canal. An amount of contingencies, normally 10% is added to the cost of project. For overheads, 10%cost of approximate estimate is included in the estimate. At last cost for land acquisition, normally 12% is added to get total approximate estimated cost of a project.	01 M 02 M 01 M
Q.3	b) Ans	Describe D.S.R. State its uses. D.S.R.: - A list of rates of various items is prepared to facilitate preparation of estimate by government bodies like Public Works Department. As the rates vary from place to place, Maharashtra Government publishes list of rates as per districts. These rates are in the form of printed booklet and called as District Schedule of Rates (DSR). This booklet is revised every year because of changes in cost of labor, material every year. It includes Completed rates, per unit cost of item of work and Labor rates. Per unit cost of item includes cost of material, cost of labor, transportation charges, storage of material, charges for tools machineries and plants etc. Labor rates include charges to be paid to head mason, mazdoor, coolie etc. depending on the category of labor. It also includes initial lead and lift and separate charges are applicable for more lead and lift. Similarly the rates are applicable to ground floor only and they are increased for each upper floor. Uses of DSR: a) The work carried out by the department is estimated according to DSR. b) Rates shown in DSR keep check on rates quoted by the contractor. c) If rates of contractor differ much with rates in DSR, tender may be rejected.	01 M 02 M 01 M
Q.3	c) Ans	Give the hire charges for following machinery/equipment. (i) Concrete mixer (ii) Dumper (iii) Vibrator (iv) JCB **Note:- Hire charges may vary from place to place.**	01 M for each

Machinery/Equipment	Hire charges
1) Concrete Mixer	Rs. 600 to Rs. 800 per day
2) Dumper	Rs. 1000 to Rs. 1200 per day
3) Vibrator	Rs. 400 to Rs. 500 per day
4) JCB	Rs. 800 to Rs. 1000 per hour

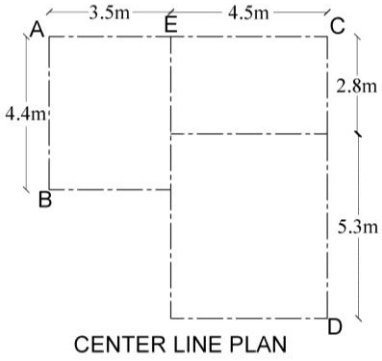
Q.3	d) Ans	State the desired accuracy in taking measurement of work as per IS 1200. To achieve the desired accuracy in measurements, following points must be observed. 1) Dimensions shall be measured to the nearest 0.01m except a) Thickness of slab measured nearest to 0.005m b) Wood work is to be measured 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	02 M 02 M
Q.3	e) Ans	Explain the long wall and short wall method for taking out quantities. In this method longer walls in building in one direction are consider as long wall and it is measured out to out. Walls in perpendicular direction of long walls, are consider as short walls and measured in to in for a particular layer of work. This is most practical method as it can be used under all circumstances. Following steps are involved in this method. 1) Foundation plan showing centre line with all dimensions. Centre to centre length is calculated by adding half width of each cross wall to inner dimensions of a room. 2) Group the walls as long walls and short walls. Measure the length of long wall for an item using equation, length of long wall = c/c length of long wall + width of item at that layer. 3) Measure the length of short wall for an item using equation, length of short wall = c/c length of short wall - width of item at that layer. 4) Multiply number of walls, length, breadth and depth to get the quantity of item. This method is simple, quick and accurate. Method is also known as PWD method. At every layer from foundation to superstructure, length of long wall decreases gradually and length of short wall increases.	02 M 02 M
Q.3	f) Ans	State purpose of supplementary estimate. Give one example. 1) During the execution of project, certain new items or additional works crop up to supplement the original project. Under such circumstances, it becomes necessary to prepare supplementary estimate. 2) Supplementary estimate is prepared for covering the estimate of sub-work of a project, which is considered necessary for full development of project. 3) Sometimes changes due to material deviation of a structural nature from the original approved design are necessary when the work is in progress. Then for all such items supplementary estimate is prepared. Example: If in a bed room of Bungalow of executive engineer, attached toilet is not provided in original project and then it is decided to construct attached toilet, then supplementary estimate is necessary.	03 M 01 M

Q.4 a) Work out quantities of the following any THREE items of work from Figure No.1.

(i)Excavation for foundation (ii) Brick work in super structure in c.m. (1 :6)

(iii) Internal plaster in c.m. (1 :4) (iv) R.C.C. slab (1 :2:4)

Ans C/C distance AB = 4.1 + 0.3 = 4.4 m.
C/C distance CD = 7.5 + 0.6 = 8.1 m
C/C distance AE = 3.2 + 0.3 = 3.5 m
C/C distance EC = 4.2 + 0.3 = 4.5 m



CENTER LINE PLAN

Measurement Sheet

S.N.	Description	No	L	B	D/H	Qty	Total Qty
1)	Excavation for foundation	1	5.4	1.0	1.15	6.21 m^3	
	AB = 4.4+1.0=5.4	2	9.1	1.0	1.15	20.93m^3	
	CD= 8.1+1.0=9.1	2	2.5	1.0	1.15	5.75 m^3	
	AE= 3.5-1.0=2.5	3	3.5	1.0	1.15	12.075m^3	
	EC =4.5-1.0=3.5						44.965m^3
	OR by center line method						
	Total center line length = 41.1 m						
	Effective center line length = 41.1 – 4 x 1.0/2 = 39.1 m.	1	39.1	1.0	1.15	44.965m^3	44.965m^3
2)	Brick work in superstructure in CM (1:6)	1	4.7	0.3	3.0	4.23 m^3	
	AB = 4.4+0.3=4.7	2	8.4	0.3	3.0	15.12 m^3	
	CD= 8.1+0.3=8.4	2	3.2	0.3	3.0	5.76 m^3	
	AE= 3.5-0.3=3.2	3	4.2	0.3	3.0	11.34 m^3	
	EC =4.5-0.3=4.2						
	Deductions						
	Door D	3	1.0	0.3	2.1	-1.89 m^3	
	Windows W1	5	1.2	0.3	1.2	-2.16 m^3	
	Windows W	2	1.8	0.3	1.2	-1.296m^3	31.104m^3
	OR by center line method						
	Total center line length = 41.1 m	1	40.5	0.3	3.0	36.45 m^3	
	Effective center line length = 41.1 – 4 x 0.3/2 = 40.5 m.						
	Deductions					-5.346m^3	31.104m^3
3)	Internal plaster in CM (1:4)						
	Ceiling						
	Bed room	1	3.2		4.1	13.12 m^2	
	Kitchen	1	4.2		2.5	10.5 m^2	
	Living	1	4.2		5.0	21.0 m^2	
	Internal faces of wall						

Any Three 04 M each

			Bed room	2	3.2		3.0	19.2 m^2		
				2	4.1		3.0	24.6 m^2		
			Kitchen	2	4.2		3.0	25.2 m^2		
				2	2.5		3.0	15.0 m^2		
			Living	2	4.2		3.0	25.2 m^2		
				2	5.0		3.0	30.0 m^2		
			Deductions							
			Doors	2.5	1.0		2.1	-5.25 m^2		
			Windows W1	2.5	1.2		1.2	-3.60 m^2		
			Windows W	1	1.8		1.2	-2.16 m^2	172.81m^2	
		4)	R.C.C. Slab (1:2:4)	1	8.4	4.8	0.15	6.048 m^3		
				1	4.7	3.5	0.15	2.468 m^3	8.516 m^3	
Q.4	b)	Attempt any ONE of the following:								
	(i)	Find out the quantities of cement, sand and aggregate for R.C.C. 1:2:4 work of 25 cu.m quantity.								
	Ans	Quantities of cement, sand and aggregate.								
		Wet volume of concrete given is 25 cu.m								
		Add 52% more for voids and wastage to get dry volume. ----------								01 M
		Dry volume = 25 + 25 (52/100) = 38 cu.m ----------								01 M
		Concrete is in proportion 1:2:4 , hence								
		Quantity of cement = [dry volume / (1+2+4)] x part of cement								
		= (38/7) x 1 = 5.43cu.m ----------								01 M
		Number of bags= 5.43 / 0.035 = 155.1 bags = 155 bags OR 156 bags. ----------								01 M
		Quantity of sand = (38 / 7) x 2 = 10.86 cu.m ----------								01 M
		Quantity of aggregate = (38 / 7) x 4 = 21.71 cu.m ----------								01 M
		Note: Someone may take volume of 1 bag of cement as 0.034 m^3.								

Q.4 b)(ii) A R.C.C. simply supported beam of size 295 mm x 645 mm is reinforced with 4 Nos. of 20 mm diameters main bars are placed in one row and two bent up. Two Anchor bars of 12 mm diameter are provided at top. 8 mm diameters stirrups are provided at 140 mm c/c. The overall beam length is 6 m. Calculate the total quantities of the steel required. Show bar bending schedules.

Ans Data given: Beam size 295mm x 645 mm
Length of beam = 6m
Main bars: 4 no of 20 mm diameter out of which two bent up.
Anchor bars at top: two anchor bars of 12 mm dia.
Stirrups : 8 mm dia. provided at 140 mm c/c

Assume cover to the reinforcement 25 mm from all sides.
Bars are bent up at 45^0
180^0 Hook is provided on both sides

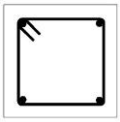
a) Calculate length of one straight bar with 180^0 hook on both sides.
L = 6000 - 2 x 25 + 2 x 9 x 20 = 6310 mm
= 6.31m ---------- 01 M

b) Length of bent up bars with 180^0 hook on both sides.
L= 6000 - 2 x 25 + 2 x 9 x 20 + 2 x 0.42 x (645 - 50) = 6809.80mm
= 6.81m ---------- 01 M

c) Length of anchor bar at top with 180^0 hook on both sides.
L = 6000 -2 x 25 + 2 x 9 x 12 = 6166 mm
= 6.17 m ---------- 01 M

d) length of 2 legged stirrup
L = 2 x (295 – 2x25) + 2 x (645 – 2x25) + 24 x 8 = 1872mm = 1.87 m
No of stirrups = [(6000 - 2 x 25)/ 140] + 1 = 43.5 =44 nos. ---------- 01 M

Bar bending schedule:

S.N	Particulars	Shape of bar	No of bars	Dia.of Bar(mm)	Total length (m)	Wt of Bar in kg/m	Total wt In kg
1)	Top anchor bars with hook on both sides,		2	12mm	12.34m	0.89	10.98 kg
2)	Two straight bars at bottom with hook on both sides		2	20mm	12.62m	2.47	31.17kg
3)	Two bent up bars at 450		2	20mm	13.62m	2.47	33.64kg.
4)	Two legged stirrups		44	8 mm	82.28m	0.39	32.09kg.
						Total	107.88kg.

02 M

Q.5 Attempt any TWO of the following:

a) Prepare rate analysis for plain cement concrete of grade M15 (1:2:4).

Ans Assume Wet volume of Concrete = 10 Cu. m.

(A) Calculation of materials :

Therefore, Dry volume of concrete = 52 % more of wet concrete — 01 M

= 10 + ((52/100) x 10) = 15.20 cu. m.

PCC Grade M15 having proportion 1:2:4

(1) Volume of cement = (dry volume/sum of proportion) x part of cement

= (15.20/(1+2+4)) x 1 = 2.1714 cu. m. — 01 M

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

= 2.1714 / 0.035 = 62.04 say 62.50 bags.

Note: Someone may take volume of 1 bag of cement as 0.034 m^3.

(2) Volume of sand = (dry volume/ sum of proportion) x part of sand. — 01 M

= (15.20/(1+2+4)) x 2 = 4.343 cu. m.

(3) Volume of coarse aggregate. = (dry volume/ sum of proportion) x part of agg. — 01 M

= (15.20/(1+2+4)) x 4 = 8.686 cu. m.

(B)Table for rate analysis for 10 Cu. m.

Particulars	Quantity	Rate per unit	Unit of mesurts.	Amount (Rs.)
(A) Material :				
Cement	62.50 bags	Rs. 330	bag	20625.00
Sand	4.343 cu. m.	Rs. 800	Cu. m.	3474.40
Coarse Aggregate	8.686 cu. m.	Rs. 800	Cu. m.	6948.80
(B) Labour :				
Head mason (Mistri)	1/2 no.	Rs. 500	day	250.00
Mason	2.5 no.	Rs. 400	day	1000.00
Male Mazdoor	12 no.	Rs. 300	day	3600.00
Female Mazdoor	18 no.	Rs. 250	day	4500.00
Bhisti (including curing)	6 no.	Rs. 250	day	1500.00
Forms etc. (as per req.)	Lump sum	1800 L.S.	--	1800.00
Sundries T and P etc.	Lump sum	300 L.S.	--	300.00
			Total of Material and Labour	43998.20
			Add 1.5 % water charges	659.97
			Add 10 % contractors profit	4399.82
			Grand Total (Rate per 10 Cu. m.)	49057.99
			Rate per Cu. m.	4905.79
			Say	Rs.4906.00

04 Marks for Table and values.

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

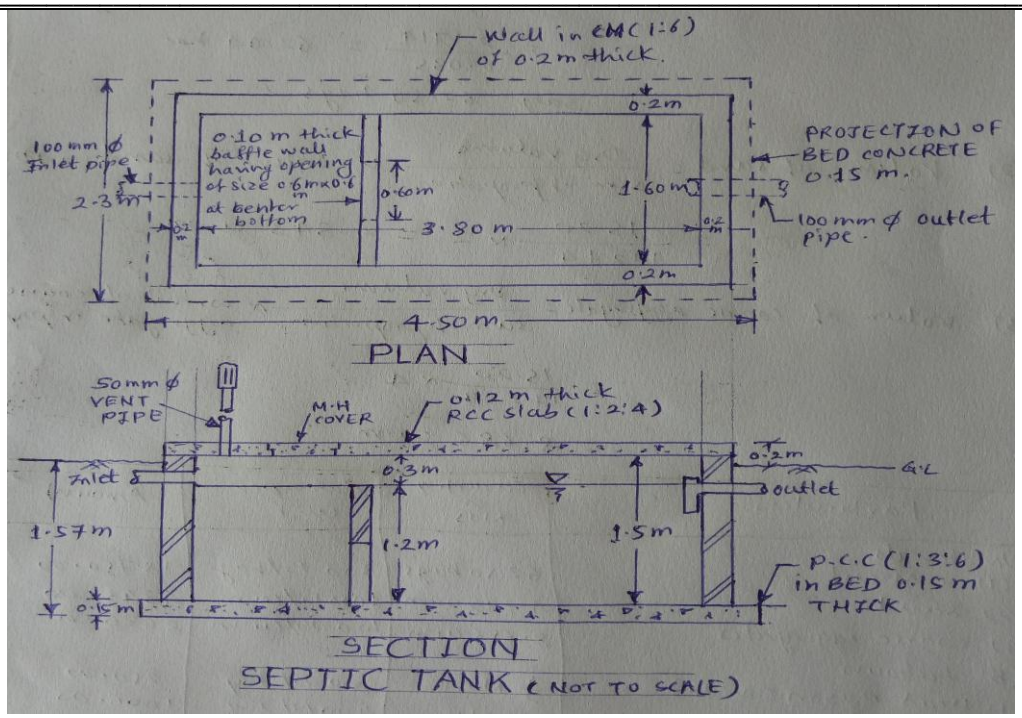
Q.5 b) Workout the quantity of the following hems. For septic tank having internal size 1.6 m x 3.8 m having height 1.5 m. The top of slab of septic tank is 20 cm. above G.L.

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

(iii) B.B. Masonry in C.M. (1:6) of 200 mm thick.

(iv) R.C.C. slab (1:2:4) on septic tank 12 cm thick.

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



02 Marks for Figure

Sr. No.	Item of work	No.	Length (m.)	Width (m.)	Height / Depth (m.)	Qty.	
1.	Excavation						
	(a) up to 1.5 m depth	1	4.50	2.30	1.5	15.53 cu.m.	01 M
	(b) from 1.5 m to 3.0 m depth	1	4.50	2.30	0.07	0.72 cu.m.	
	Total Earthwork in Excavation					16.25 cu.m.	
2.	P.C.C. (1:3:6) 15 cm thick	1	4.50	2.30	0.15	1.55 cu.m.	01 M
3.	B.B.Masonry in C.M. (1:6) of 200 mm thick						
	(a) Long walls	2	4.20	0.20	1.50	2.52 cu.m.	
	(b) Short walls	2	1.60	0.20	1.50	0.96 cu.m.	
	(c)baffle wall	1	1.60	0.10	1.20	0.19 cu.m.	02 M
	Deduction for opening in baffle wall	1	0.600	0.10	0.60	(-)0.04 cu.m.	
	Total Quantity of B.B. Masonry					3.63 cu.m.	
4.	12 mm thk. RCC slab with manhole cover	1	4.20	2.00	0.012	0.10 cu.m.	02 M

Q.5 c) Ans

Prepare the rate analysis for U.C.R. masonry in c.m. (1:4) in foundation.

Assume Volume of masonry = 10 Cu. m.

(A) Calculation of materials :

Therefore, Dry volume of cement mortar = 42% of volume of masonry = (42/100) x10 = 4.20 cu. m. — 01 M

(1) Volume of cement = (dry volume/sum of proportion) x part of cement

= (4.20/(1+4)) x 1 = 0.84 cu. m. — 01 M

Therefore no. of cement bags = volume of cement / vol. of cement bag
= 0.84 / 0.035 = 24 bags.

(2) Volume of sand = (dry volume/ sum of proportion) x part of sand.
= (4.20/(1+4)) x 4 = 3.36 cu. m. — 01 M

(3) Volume of Stone = 25 % more of volume of masonry.
= ((25/100) x 10) + 10 = 12.50 cu. m. — 01 M

(B)Table for rate analysis for 10 Cu. m.

Particulars	Quantity	Rate per unit	Unit of mesurts.	Amount (Rs.)
(A) Material :				
Cement	24 bags	Rs. 330	bag	7920.00
Sand	3.36 cu. m.	Rs. 800	Cu. m.	2688.00
Stone including through bond stone and wastage	12.50 cu. m.	Rs. 1100	Cu. m.	13750.00
(B) Labour :				
Head mason (Mistri)	1/2 no.	Rs. 500	day	250.00
Mason	12 no.	Rs. 400	day	4800.00
Male Mazdoor	10 no.	Rs. 300	day	3000.00
Female Mazdoor	10 no.	Rs. 250	day	2500.00
Bhisti	1.5 no.	Rs. 250	day	375.00
Scaffolding	Lump sum	400 L.S.	--	400.00
Sundries T and P etc.	Lump sum	300 L.S.	--	300.00
			Total of Material and Labour	35983.00
			Add 1.5 % water charges	539.75
			Add 10 % contractors profit	3598.30
			Grand Total (Rate per 10 Cu. m.)	40121.05
			Rate per Cu. m.	4012.11
			Say	Rs.4012.00

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

04 M for Table and values

Q.6 a) Attempt any FOUR of the following:

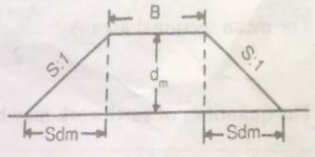
Ans Defme 'Task work'. Enlist any four factors affecting task work.

Task Work: The capacity of doing work by an artisan or skilled labour in the form of quantity of work per day is known as the Task-Work or Out-turn of the labour. — 02 M

- Factors affecting task work of the labour:

Task work of a skilled labour depends upon the following factors: — Any four (1/2 M each)

(1) Nature, Size, Height, situation, location, climatic condition, techniques adopted and wages paid etc.
(2) Availability of skilled labour.
(3) A well-organized work.
(4) Job satisfaction or working conditions.
(5) Allotment of piece of work.

Q.6	b) Ans	State the names of software that are used for preparation of detailed estimate of· building work. Following are the names of software that are used for preparation of detailed estimate of building work. 1. Sage Estimating 2. CoConstruct 3. Buildertrend 4. Clear Estimates 5. MEP Estimating 6. Corecon 7. Sigma 8. Esticom 9. Estimator 10. STACK 11. Build-Quant 12. Build-Master 13. Civil estimator 14. Turbo Bid 15. Intelli Bid 16. Pro Est 17. B2W (BID2Win) **(Note** : The names of software may vary with student knowledge. Therefore marks should be given with respect to that.)	Any eight (1/2 M each)
Q.6	c) Ans	What are the different methods used for calculation of earthwork quantities for a road and canal? Explain any one. The different methods used for calculation of earthwork quantities for road and canal are as follows: 1. Mid-sectional area method 2. Mean Sectional area method 3. Prismoidal formula method 4. Trapezoildal formula method **(1) Mid-sectional are method:** In this method, the mid-section area is calculated by dividing the trapezoidal cross-section of Road/Canal into rectangle and two triangles and then this mid-section area is multiplied by the length of the section to get quantity of earthwork as given below: Area of mid section = Area of rectangular portion + area of two triangular portion $= Bd_m + \frac{1}{2}sd_m^2 + \frac{1}{2}sd_m^2 = Bd_m + sd_m^2$ $\therefore$ Quantity of earthwork $= (Bd_m + sd_m^2) \times L$  Fig. 7-4 General, $Q = (Bd + sd^2) \times L$, where d stands for mean height or depth. The quantities of earthwork may be calculated in a tabular form as below :-	02 M 02 M (For any one method)

Stations or Chain-age	Depth or Height	Mean Depth or Height "d"	Area of central portion Bd	Area of sides Sd^2	Total Sectional Area $Bd+sd^2$	Length between stations L	Quantity $(Bd + sd^2) \times L$	
							Embank-ment	Cutting

(2) Mean Sectional area method : In this method, cross sectional area at two ends of section is calculated and then mean of these two is multiplied by length of section to get volume of earthwork.

Sectional area at one end $A_1 = Bd_1+sd_1^2$, sectional area at the other end $A_2=Bd_2+sd^2_2$, d_1 and d_2 are the heights or depth at the two ends.

The mean sectional area $A = \frac{A_1+A_2}{2}$, Quantity $Q = \frac{A_1+A_2}{2} \times$ Length.

The quantities of earthwork may be calculated in a tabular form as given below :—

Stations or Chainage	Height or Depth "d"	Area of central portion Bd	Area of sides Sd^2	Total Sectional Area $Bd+Sd^2$	Mean Sectional Area	Length between station L	Quantity $(Bd+sd^2) \times L$	
							Emba-nkment	Cutting

(3) Prismoidal Formula Method: In this method, the cross sectional area at the two ends of a portion of embankment is calculated and then mid sectional area is also calculated. The quantity or volume can be calculated by following formula:

Quantity or volume = (L/6) x (A_1 + A_2 + A_m)

Where A_1 and A_2 are the cross sectional areas at the two ends of a portion of embankment of road or canal of length L, A_m is the mid-sectional area.

Let d_1 and d_2 be the heights of banks at the two ends, and d_m be the mean height at the mid-section, B be the formation width and S:1 be the side slope. Then

$$\text{Quantity} = \frac{L}{6}(A_1+A_2+4A_m)$$
$$= \frac{L}{6}\left[(Bd_1+sd_1^2)+(Bd_2+sd_2^2)+4\left\{B\left(\frac{d_1+d_2}{2}\right)+s\left(\frac{d_1+d_2}{2}\right)^2\right\}\right]$$
$$= \frac{L}{6}\left[\left(Bd_1+Bd_2+4\frac{Bd_1}{2}+4\frac{Bd_2}{2}\right)+sd_1^2+sd_2^2+4s\frac{d_1^2+d_2^2+2d_1d_2}{4}\right]$$
$$= \frac{L}{6}\left[(3\,Bd_1+3\,Bd_2)+2sd_1^2+2sd_2^2+2sd_1d_2\right]$$
$$= \frac{3BL}{6}(d_1+d_2)+\frac{2Ls}{6}(d_1^2+d_2^2+d_1d_2)$$
$$= \frac{BL}{2}(d_1+d_2)+\frac{Ls}{3}(d_1^2+d_2^2+d_1d_2)$$
$$= \left\{B\left(\frac{d_1+d_2}{2}\right)+s\left(\frac{d_1^2+d_2^2+2d_1d_2}{3}\right)\right\} \times L$$
$$= [\text{Sec. Area of central portion} + \text{Sec. Area of side slope portions}] \times \text{Length.}$$

The same is also applicable for cutting.

(4) Trapezoidal Formula Method: When a series of cross-sectional areas calculated at equidistant points, the volume may be worked out by Trapezoidal formula.
Let A_0, A_1, A_2, A_3, A_4,…….A_n are the areas of cross-sections.
D= Distance between the section: V= volume of cutting or banking.

Volume by Trapezoidal Formula Method —

$$V = \frac{D}{2}\{A_0+2A_1+2A_2+2A_3+..2A_{n-1}+A_n\}$$
$$= D\left\{\frac{A_0+A_n}{2}+A_1+A_2+A_3+\text{— — —}+A_{n-1}\right\}$$

Q.6	d) Ans	Define' rate analysis and state the factors affecting rate analysis. 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.	01 M

		*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.	01 M any four 1/2 M each

Q.6 e) Calculate the quantities of following items of work for a circular community well as shown in Figure No.2.

(i) Excavation in Soft Murum. (ii) R.C.C. Ring Beam quantity of concrete.

Ans 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
(i)	**Excavation in soft murum**					
1	i) up to 1.5 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.5 m	31.86 cu. m.
2	ii) 1.5m to 3.0 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.5 m	31.86 cu. m.
3	iii) 3.0m to 4.5 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.5 m	31.86 cu. .
4	iv) 4.5m to 6.0 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.5 m	31.86 cu. m.
5	iv) 6.0m to 7.5 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.5 m	31.86 cu. m.
6	iv) 7.5m to 8.5 m depth	1	$((\pi/4) \times 5.20^2)$ sq. m.		1.0 m	21.24 cu. m.
	Total excavation of soft rock					**180.54 cu. m.**
(ii)	**R.C.C. Ring beam (RCC M20)**					
	The Ring Beam has size of 0.3 m x 0.3m. The inner diameter of well is 4.60 m and Outer diameter is 5.20 m.					
1	RCC quantity in Ring Beam	1	$(\pi/4) \times (5.20^2 - 4.60^2)$ sq. m.		0.3 m.	1.39 cu. m.
	Total Quantity of RCC in Ring Beam					**1.39 cu. m.**

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

02 M