Q.6 Attempt any two:

i. Write the formula for calculating volume of a frustum of cone and a square pyramid. **5**

ii. Write down formulas to calculate area of irregular figures by trapezoidal rule and mid-ordinate methods. **5**

iii. Write formula for calculating volume and surface area for rectangular solid and pentagonal prism. **5**

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

OE00007 Mechanical Estimation & Costing

Programme: B.Tech. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. What is the main factor to be considered while preparing a detailed estimate? **1**

(a) Quantity of the materials
(b) Availability of materials
(c) Transportation of materials
(d) All of these

ii. The most reliable estimate is- **1**

(a) Detailed estimate (b) Preliminary estimate
(c) Plinth area estimate (d) Cube rate estimate

iii. Elements of Cost of a product are- **1**

(a) Material only (b) Labour only
(c) Expenses only (d) Material, Labour and expenses

iv. Which of the following is a fixed cost? **1**

(a) Salary (b) Direct material
(c) Direct labour (d) Direct Expenses

v. Lathe machine performed the metal removal operation from the surface at parallel to the axis of rotation of the workpiece is called- **1**

(a) Turning (b) Facing (c) Knurling (d) Taper turning

vi. In sheet metal operation two edges are joined by- **1**

(a) Grooving (b) Seaming (c) Heming (d) Bending

vii. Depreciation of plant and machinery is a part of- **1**

(a) Factory overhead (b) Selling overhead
(c) Distribution overhead (d)Administration overhead

viii. Depreciation is an example of- **1**
(a) Fixed cost (b) Variable cost
(c) Semi variable cost (d) None of these

ix. The internal measurement of a cuboidal room 15m x 6m x 4m. The room has to be painted along with the ceiling. If cost of painting is Rs 17 per m^2, Find the total cost to be paid. **1**
(a) Rs. 4916 (b) Rs. 3916 (c) Rs. 6916 (d) Rs. 5916

x. If the surface area of a cuboid is 108 cm^2, find the height of the cuboid. The length and breadth the cuboid is 6 cm and 3 cm respectively. **1**
(a) 8 cm (b) 4 cm (c) 2cm (d) 6 cm

Q.2 Attempt any two:

i. Explain briefly about the constituents of estimate. **5**

ii. Briefly explain about qualities and functions of an estimators. **5**

iii. Differentiate between estimation and costing. **5**

Q.3 i. Explain the elements of cost. **4**

ii. A factory owner employed 60 workers during the month of April 2022, whose details of expenditures are given below: **6**
(a) Material Cost = Rs. 20,000
(b) Rate of wages for each worker = Rs. 200/hr.
(c) Duration of work = 8 hours/day
(d) No. of holidays in the month = 5 days.
(e) Total overhead expenses = Rs. 950000
If workers paid overtime of 200 hours at the rate of Rs. 400 /hr. Calculate:
(a) Total Cost (b) Man hour rate of overheads.

OR iii. The variable overhead chares for a product are Rs. 2 and the fixed overhead charges per month are Rs. 45100. It is found that 65000 products are manufactured per month under normal conditions. **6**
(a) Find he normal overhead cost per product
(b) If the production drops 90%, determine the overhead charges that are unrecovered.
(c) If the production is increased to 130% by what amount these charges will be over-recovered?

Q.4 Attempt any two:

i. A product is shown in figure is to be turned from 35 mm dia to 95 mm long mild steel bar stock. Calculate the machining time required, if depth of cut in not to exceed 5 mm. and cutting speed for turning, facing and drilling is 20m./min. **5**

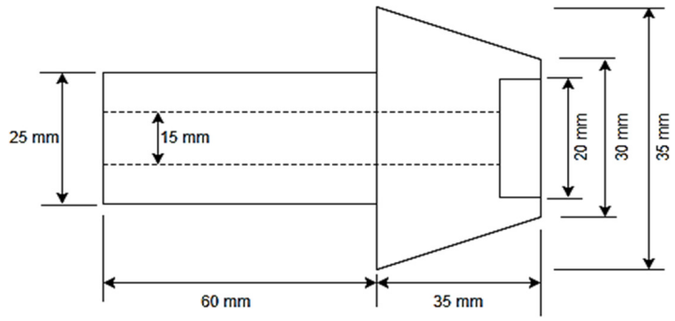


Figure 1

ii. A steel pipe 10 m long and 0.6 m diameter is to be fabricated from M.S. plate of 1.0 cm thickness. Estimate cost if **5**
(a) M.S. plates of size 2m x 1m are available at the rate of Rs.70
(b) Cost of rolling 10% of material cost
(c) Cost of riveting 20% of material cost
(d) Overhead charges 10% of material cost

iii. Calculate: **5**
(a) Cost of cutting 'V' groove with gas,
(b) Welding cost for welding two 1 m long M.S. piece of 8 mm thickness.
If cost of O_2 is Rs. 0.60 per m^3; cost of C_2H_2 is Rs. 5.0 per m^3; cost of filler rod is Rs. 2 per kg; labour charges are Rs. 0.8 per hr; and 60^o 'V' Groove is prepared for welding.

Q.5 i. Explain the term 'direct and indirect expenses'. State and explain various indirect expenses. **4**

ii. Explain briefly the term 'depreciation'. Enlist and explain any five methods to calculate depreciation. **6**

OR iii. Find the depreciation annuity by the annuity charging method after 3 years, when the cost of machine is Rs. 8000 and scrap value Rs. 4000. Rate of interest is 5%. **6**

Total No. of Questions: 6

Scheme of Marking

Enrollment No.....

Faculty of Engineering

End SemExamination Dec-2022

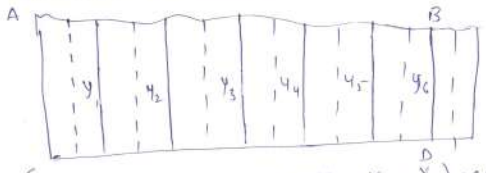
OE00007 Mechanical Estimation & Costing

Programme: B.Tech. Branch/Specialisation: All

Duration: 3Hrs. **Maximum Marks: 60**

		Correct Answers of MCQ (1Marks each)	
Q.1	**i.**	**(d) All of these**	**1**
	ii.	**(a) Detailed Estimate**	**1**
	iii.	**(d) Materials,Labour and Expenses**	**1**
	iv.	**(a) Salary**	**1**
	v.	**(a) Turning**	**1**
	vi.	**(b) Seaming**	**1**
	vii.	**(a) Factory Overhead**	**1**
	viii.	**(a) Fixed Cost**	**1**
	ix.	**(a) Rs. 5916**	**1**
	x.	**(b) 4 cm**	**1**
Q.2		**Attempt any two:**	
	i.	Explain Briefly any five Constituents of estimates. (*1 marks each)	**5**
	ii.	Explain any Five Qualities & Functions of Estimators. (* 0.5 Marks each)	**5**
OR	iii.	Five differences between Estimation & Costing. (*1 Marks Each)	**5**
Q.3	i.	Explain Briefly the elements of Cost. (*1 Marks each)	**4**
	ii.	A factory owner employed 60 workers .....**(Numerical)** (a) Total Cost Calculation (* 3 Marks) (b) Man hour rate of overheads.(* 3Marks) **Solution is attahed with the Scheme.**	**6**
OR	iii.	The Variable overheads chares for a product are.....**(Numerical)**	**6**
		(a) Normal overhead cost per product (* 2 Marks) (b) Detrmination of Overhead Charges (* 2 Marks) (c) Amount of Charges will be recovered (*2 Marks) **Solution is attahed with the Scheme.**	
Q.4		**Attempt any two:**	
	i.	A product is shown in figure..... **(Numerical)** Students who have attempted this question has awarded by full marks. Step-I Machining time for drilling(*1 marks) Step-II Machining time for Turning(*1 marks) Step-III Machining time for Facing(*1 marks) Step-IV Machining time for Boring (*1 marks) Step-V Total Machining time for each operations(*1 marks) **Solution is attahed with the Scheme.**	**5**
	ii.	A steel pipe 10 m long and 0.6 m diameter..... **(Numerical)** (a) Calcution of Material cost (* 1 marks) (b) Cost of Rolling (* 1 marks) (c) Cost of Rivetting (* 1 marks) (d) Overhead Charges (* 1 marks) (e) Total Cost (* 1 marks) **Solution is attahed with the Scheme.**	**5**
OR	iii.	Calculate:..... **(Numerical)** (a) Groove Cutting cost calculations (* 2.5 Marks) (b) Welding Cost Calculations (*2.5 Marks) **Solution is attahed with the Scheme.**	**5**
Q.5	i.	Explaination of Direct & Indirect Expenses(*1 Marks Each) Explaination of various Indirect Expenses(*2Marks)	**4**
	ii.	Explaination of Depriciation(*1 Marks) Explaination about any five methods of depriciation(*1 Marks each)	**6**
OR	iii.	Find the depriciation..... **(Numerical)** Formula (*1 Marks) Calculation(*4 Marks) **Solution is attahed with the Scheme.**	**6**
Q.6		**Attempt any two:**	
	i.	Formula for calculating the volume of a frustum of cone & a Square pyramid (*2.5 Marks each)	**5**
	ii.	Formula for calculating the area of a irregular figure by trapezoidal rule and mid-ordinate methods. (*2.5 Marks each)	**5**
	iii.	Formula for calculating the volume & Surface area for Rectangular solid & Pentagonal prism.(*2.5 Marks each)	**5**

The mid ordinate method

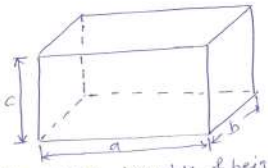


$$\text{Area} = \frac{(Y_1 + Y_2 + Y_3 + Y_4 + Y_5 + Y_6) \times CD}{6}$$

Average of Length of mid ordinate × Length of base line

Q.6 (iii)

1) Rectangular solid



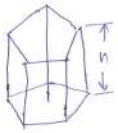
Let a, b & c are the Length, breadth & height of the solid

then Volume = abc

Length of diagonal = $\sqrt{a^2+b^2+c^2}$

Surface area = $2(ab+bc+ca)$

2) Pentagonal Prism



Let h = height of prism

& a = breadth of one side

∴ Volume of Prism = Area of the base × Height

Surface area = No. of surface × ah + Area of ends

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$1650 \times 2 = 8800 - C_2$

$C_2 = 8800 - 3300$

$\therefore$ RS. $= 5500$

$\therefore$ The reduced value of asset after two year will be Rs. 5500.

Q.6

(i) Formula for volume of a frustum of cone

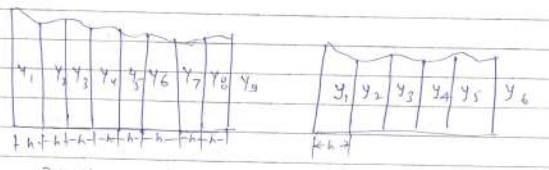
volume of Square pyramid $= \frac{h}{3} \times (a_1 + a_2 + \sqrt{a_1 a_2})$

where a_1 & a_2 are the areas of the two ends, but for frustum of cone

$a_1 = \pi R_1^2 \quad a_2 = \pi R_2^2$

$\therefore$ volume $= \frac{\pi h}{3} (R_1^2 + R_2^2 - R_1 R_2)$

(ii) Area of irregular figure



By Simpsons rule

By trapezoidal rule

the

Area $= \frac{h}{3}[(y_1 + y_2) + 2(y_3 + y_5 + y_7) + 4(y_2 + y_4 + y_6)]$

Area $= h\left[\frac{1}{2}(y_1 + y_6) + y_2 + y_3 + y_4 + y_5\right]$

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Q.5 (iii) Solution

$R = 5\%$ $C = Rs.\ 8000$ $S = Rs.\ 4000$ $N = 3$ years

Hence by substituting the given value in the formula

$$D = \frac{[C(1+R)^N - S][1-(1+R)]}{[1-(1+R)^N]}$$

$$D = \frac{[8000(1+0.05)^3 - 4000][1-(1+0.05)]}{[1-(1+0.05)^3]}$$

$$D = \frac{[8000(1.05)^3 - 4000][1-1.05]}{[1-(1.05)^3]}$$

$$D = \frac{(8000 \times 1.16 - 4000)(-0.05)}{1-1.16}$$

$$D = \frac{5280 \times 0.05}{0.16} = Rs.\ 1650$$

Hence depriciation annuity = Rs. 1650

Now, suppose we have to calculate the reduced value of asset after two years, It can be done in this way:

$$D = \frac{[D(1+R)^N - S][1-(1+R)]}{[1-(1+R)^N]}$$

Hence NOW S will become C_2, where C_2 is the reduced value of asset after two years & therefore $N = 2$ years

Hence by Substitution

$$1650 = \frac{[8000(1+0.05)^2 - C_2][1-(1+0.05)]}{[1-(1+0.05)^2]}$$

$$1650 = \frac{(8000 \times 1.1 - C_2) \times (-0.05)}{-0.1}$$

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(b) Welding cost:- For 8 mm thick plate. (Rightward welding)

Filler rod dia = 4mm

O_2 consumption = 0.5 cu.m/hr

C_2H_2 consumption = 0.3 cu.m/hr

Welding time/m length = 25 min

Length of filler rod used/m of welding = 3.6 m

As length of fusion to be welded is 1 m

∴ Time required for welding = $25 \times 1 = 25$ min

(i) O_2 consumed = $0.5 \times \frac{25}{60} = 0.209$ cu.m

∴ cost of O_2 @ Rs. 0.60/m^3 = 0.209×0.60

= 0.1254 Rs

(ii) C_2H_2 consumed = $0.3 \times \frac{25}{60} = 0.125$ cu.m

∴ cost of C_2H_2 @ Rs 5.0/m^3 = 0.125×5

= Rs. 0.625

(iii) Length of filler rod used for 1 m welding = 3.6 m

∴ Wt. of filler rod = $\frac{\pi}{4} \times (0.4)^2 \times 360 \times 7.8$ gm

= 316.8 gm = 0.3168 kg

∴ cost of filler rod @ Rs 2/kg = 2×0.3168

⇒ 0.6336 Rs

(iv) Labour charges of welding @ 0.8/hr for 25 min

= $\frac{25}{60} \times 0.8$ = Rs 3.33

∴ Total cost of welding = $0.209 + 0.625 + 0.6336 + 3.33$

⇒ Rs 4.80093 — Ans.

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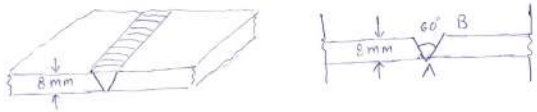
Q.4(iii) Solution



(a) Groove cutting :-

Length of cut AB = $\frac{8}{\sin 60^\circ}$ = 10 mm (say)

Cutting speed = 20 m/hr

O_2 consumption = 2 cu. m/hr

C_2H_2 consumption = 0.2 cu m/hr.

Therefore time required to cut one piece of 1 m length

= $\frac{1}{20}$ hr ⇒ 3 min

∴ Time required to cut both pieces each of 1 m

= 2 × 3 ⇒ 6 min

(i) Amount of O_2 required ⇒ 6 × $\frac{2}{60}$ cu. m ⇒ 0.2 cu.m

∴ cost of oxygen @ Rs 0.60/m^3

⇒ 0.2 × 0.60 = Rs. 0.12

(ii) Amount of C_2H_2 required = 6 × $\frac{0.2}{60}$ = 0.02 cu.m.

∴ cost of C_2H_2 @ Rs 5/m^3 = 0.02 × 5 ⇒ Rs 0.1

(iii) Labour (cost) of cutting @ Rs. 0.8/hr

⇒ 0.8 × $\frac{6}{60}$ ⇒ 0.08 (Rs)

∴ Total cutting cost

⇒ 0.02 + 0.1 + 0.08

⇒ Rs 0.2 ⟶ Ans.

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Solution of Q.4(ii)

(a) Material cost

Circumference of pipe = πd = $3.14 \times 0.6 \Rightarrow 1.884$ m

Sheet size is 2m X 1m

From this sheet we can prepare a ring of 1 m height & 0.6 m diameter taking 5.8 cm $\left(\Rightarrow \frac{2-1.884}{2} \text{ m}\right)$ an overlap using Lap Joint.

As we are required to prepare a pipe which should be of uniform diameter, therefore different rings cannot be joined by Lap Joint, therefore butt joint with single cover plate is adopted.

As we have decided that the length of one ring can be 1m, hence 10 such rings will have a full length pipe & one additional plate will be required to fabricate cover plates.

∴ Total number of plates of size 2m X 1m required

$\Rightarrow 10 + 1 \Rightarrow 11$

∴ Total material cost of plates $\Rightarrow 11 \times 270 \Rightarrow$ Rs 2970 → Ans.

(b) Cost of Rolling It is 10% of material cost

∴ Rolling cost = $\frac{2970 \times 10}{100}$ = Rs 297 → Ans

(c) Cost of Riveting It is 20% of material cost

∴ Cost of riveting = $2970 \times 0.20 \Rightarrow$ Rs 594 → Ans

(d) Overhead Charges These are 10% of material cost

$= 2970 \times 0.10 \Rightarrow$ Rs 297 → Ans

∴ Total cost $\Rightarrow 2970 + 297 + 594 + 297$

$\Rightarrow ₹ 4158$

∴ Cost of fabrication of Pipe will be Rs ₹4158 → Ans.

Teacher's Signature :

∴ Total time for turning $T_2 = t_1 + t_2 \Rightarrow 0.064 + 0.220$

$T_2 = 0.284$ min $\rightarrow$ Ans.

Step-III Facing

(i) Facing time required for facing on 30 mm dia side, assuming feed as 1 mm/revolution is

$$t_1 = \frac{\left(\frac{30-15}{2}\right)}{1 \times \frac{100 \times 20}{\pi \times 3.0}} = 0.04 \text{ min}$$

(ii) Facing time required for facing on 25 mm dia side

$$t_2 = \frac{\left(\frac{25-15}{2}\right)}{1 \times \frac{100 \times 20}{\pi \times 2.5}} = 0.02 \text{ min}$$

∴ Total facing time $T_3 = t_1 + t_2 \Rightarrow 0.04 + 0.02$

$T_3 = 0.06$ min $\longrightarrow$ Ans

Step-IV Boring

Time required for enlarging the hole from 15 to 20 mm for a length of 15 mm

$$T_4 = \frac{15}{1 \times \frac{100 \times 20}{\pi \times 1.5}} = 0.035 \text{ min} \longrightarrow \text{Ans}$$

Step-V Total time required

$T = T_1 + T_2 + T_3 + T_4$

$T = 0.220 + 0.284 + 0.060 + 0.035$

$T = 0.599$ min $\longrightarrow$ Ans

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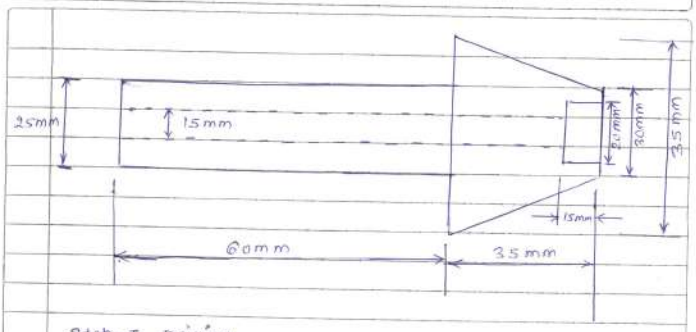
Expt.No. Solution of Q.4 (i) Page No. 3



Step-I Drilling

Drilling the hole of 15mm dia for a length 95mm will require

Time T_1 = Depth of hole / (Feed/rev. × r.p.m.) = $\frac{95}{1 \times \frac{100 \times 20}{\pi \times 1.5}}$ ⇒ 0.22 min → ANS

Here assuming the feed as 1mm/rev.

Step-II Turning

(i) Time required for taper turning from 35 mm to 30 mm for a length of 35mm, assuming feed as 3 mm/rev.

$t_1 \Rightarrow \frac{35}{3 \times \frac{100 \times 20}{\pi \times 3.5}}$ ⇒ 0.064 min

(ii) Time required for turning to reduce the dia from 35 mm to 25 mm in 2 cuts for a length of 60mm & assuming that each cut requires same time,

$t_2 \Rightarrow \frac{60}{3 \times \frac{100 \times 20}{\pi \times 3.5}} \times 2$ ⇒ 0.22 min

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Solution of Q.3(iii) 2

Variable overhead charges = Rs. 2/article

Fixed overhead charges = Rs. 45100/month

Article Produced under normal conditions = Rs. 65000/month

(a) Normal overhead cost/article

Total overheads Per Product ⇒ Variable overheads + Fixed overheads

⇒ Rs. 2 + Rs. 45100/65000

⇒ Rs. 2 + 0.69

⇒ Rs. 2.69 ⟶ Ans.

(b) Production drops to 90%

NOW monthly Production ⇒ 65000 × 0.90 = 58,500 units

∴ Fixed overheads for 58,500 units, at earlier rate of Rs. 0.69/unit ⇒ 58500 × 0.69 ⇒ 40,365

Fixed overheads under normal conditions = Rs. 45,100

∴ overheads to be unrecovered

⇒ Rs. 45100 − 40365 ⇒ Rs. 4,735 ⟶ Ans.

(c) Production increases to 130%

NOW, Monthly Production ⇒ 65000 × 1.30

⇒ 84,500 units

∴ Fixed overheads for 84500 units

⇒ 84500 × 0.69

⇒ Rs. 58,305

∴ Fixed overheads under normal conditions ⇒ Rs. 45,100

∴ overheads to be over recovered

⇒ 58305 − 45,100

⇒ Rs. 13,205 ⟶ Ans.

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Solution of Q.3 (ii)

(a) Material cost = Rs. 20,000

Number of workers = 60

Number of working days = 30 - 5 = 25 days

Duration of work/day = 8 hours

∴ Total man-hours for the month

⇒ 60 × 25 × 8 ⇒ 12000 hours

Wage rate/hour = Rs. 200/hr.

∴ Labour cost ⇒ 12000 × 200

⇒ Rs 2400000

∴ overtime allowances = No. of overtime hours × Hourly rate

= 200 × 400

= Rs. 80,000

∴ Total Labour cost = Rs. 2400000 + 80,000

= Rs. 2480000

Total overhead expenses = Rs. 950000

∴ Total cost = Material cost + Labour cost + overheads

= Rs. 20000 + 2480000 + 950000

∴ Total cost = Rs. 3450000 ⟶ Ans.

(b) Total man-hours ⇒ 12000 + overtime

⇒ 12000 + 200

⇒ 12,200 hours

∴ Man-hour rate of overheads ⇒ $\frac{\text{Total overheads}}{\text{Total man-hours}}$

⇒ $\frac{950000}{12,200}$

⇒ Rs. 77.86 ⟶ Ans.

Teacher's Signature :