Paper 15- Strategic Cost Management- Decision Making

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Full Marks: 100 **Time Allowed: 3 Hours**

This paper contains two sections **A** and **B**. **Section A** is compulsory and contains question No.1 for 20 marks. **Section B** contains question Nos. 2 to 8, each carrying 16 marks. Answer any five questions from **Section B**.

Section – A [20 Marks]

1. Choose the most appropriate answer to the following questions giving justification [10x2=20]

(i) 120 units of semi-conductors are required to be sold to earn a profit of ₹1,00,000 in a monopoly market. The fixed cost for the period is ₹80,000. The contribution in the monopoly market is as high as 3/4th of its variable cost. Determine the target selling price per unit.

(a) ₹4500
(b) ₹3250
(c) ₹4000
(d) ₹3500

(ii) Abhishek Ltd. operates Throughput Accounting System. The details of product A per unit are as under:

Particulars	Details
Selling Price	₹150
Material Cost	₹60
Conversion Cost	₹40
Time to Bottleneck Resources	10 minutes

The return per hour for product A is

(a) ₹540
(b) ₹300
(c) ₹240
(d) ₹180

(iii) Sara Ltd. is to market a new product. It can produce up to 3,00,000 units of this product. The following are the estimated cost data:

Particulars	Fixed Cost	Variable Cost
For Production up to 1,50,000 units	₹16,00,000	60%
Exceeding 1,50,000 units	₹24,00,000	50%

Sale price is expected to be ₹25 per unit.

How many units must the company sell to break even?

(a) 1,00,000 units
(b) 1,11,000 units
(c) 1,27,000 units
(d) 75,000 units

(iv) Sarathi Ltd. makes components and sells internally to its subsidiary and also to external market. The external market price is ₹48 per component, which gives a contribution of 40% of sales. For external sales, variable costs include ₹3 per unit for distribution costs. This is, however not incurred in internal sales. There are no capacity constraints. To maximize company profit, the transfer price to subsidiary should be:

(a) ₹19.20

(b) ₹25.80

(c) ₹28.80

(d) None of these

(v) A manufacturing company uses two types of materials- A and B, for manufacture of a standard product. The following information is given:

	Standard Mix			Actual mix	
Materials A	240 Kg	@ ₹5 = ₹1200		224 Kg	@ ₹5 = ₹1120
Materials B	160 Kg	@ ₹10 = ₹1600		176 Kg	@ ₹10 = ₹1760
	400 Kg	₹2800		400 Kg	₹2880
30% loss	120 Kg		25% loss	100 Kg	
	280 Kg	₹2800		300 Kg	₹2880

Direct Materials Mix Variance is:

(a) ₹ 80 (fav.)

(b) ₹ 80 (unfav.)

(c) ₹ 160 (fav.)

(d) ₹ 160 (unfav.)

(vi) Which of the following is/are scope of Uniform Costing:

(a) In a single enterprise having a number of branches or units, each of which may be a separate manufacturing unit

(b) In a number of concerns in the same industry bound together through a trade association or otherwise

(c) In industries which are diverse in nature

(d) Both (a) and (b)

(vii) Which of the following is not a Limitation of Inter-Firm Comparison:

(a) Information about the organisation is made available freely with the fear of disclosure of confidential data to outside market or public

(b) Non-availability of a suitable base for comparison

(c) Absence of a proper system of Cost Accounting so that the costing figures supplied may not be relied upon for comparison purposes

(d) The top management may not be convinced of the utility of inter-firm comparison

(viii) Rudra Ltd. manufactures a product whose time for the first unit is 10000 hours. It experiences a learning curve of 80%, What will be the total time taken in hours for unit 5 to 8?

(a) 40960 hours
(b) 32000 hours
(c) 15360 hours
(d) 20000 hours

(ix) Which of the following is a valid constraint for a linear programming problem?
(a) $6x^2 + 8x + 2 = 0$
(b) $10x_1 + 4x_2 \leq 20$
(c) $8x_x + 6x_2 > 14$
(d) $(24_{x1} + 8_{x2})/6_{x2} \leq 16_{x1}$

(x) Which of the following is/are the method/s of solving an assignment problem:
(a) Complete Enumeration Method
(b) Transportation Method
(c) Both (a) and (b)
(d) Simplified Method

Answer:

1. (i) (d) ₹3,500

Contribution = ₹(1,00,000 + 80,000) = ₹1,80,000
Contribution/Unit = ₹(180000 ÷ 120) = ₹1500
Variable cost/unit = 1500 ÷ ¾ = ₹2000
Selling price = ₹1,500 + ₹2,000 = ₹3,500

(ii) (a) ₹540

(Selling Price – Material Cost) ÷ Time on bottleneck resources
= [(₹150 – ₹60) ÷ 10 minutes] × 60 = ₹540

(iii) (b) 2,22,000 units

At a production of 1,50,000 units or less the fixed costs amount to ₹16 lakhs. Contribution is ₹10 per unit (₹25 – 60% of ₹25).
Production will however, be more than this level. Total fixed cost is then ₹24 lakhs. Contribution for first 1,50,000 units = ₹15,00,000.
Hence, to meet ₹24 lakh fixed cost, further ₹9,00,000 of contribution is required. Contribution beyond 1,50,000 units is ₹12.5 (₹25 – 50% of ₹25).
Additional units to be sold = (₹9,00,000 ÷ ₹12.50) + 1,50,000 = (72,000 + 1,50,000) units = 2,22,000 units

(iv) (b) ₹25.80

= ₹48 × 60% – ₹3 = ₹25.80

(v) (b) ₹80 (unfav.)

Revised Standard Quantity:

A	B
$\frac{240}{400} \times 400$	$\frac{160}{400} \times 400$
240 Kg	160 Kg

Direct Materials Mix Variance:

SP (RSQ – AQ)

A	₹5 (240 – 224)	= ₹80 (fav.)
B	₹10 (160 – 176)	= ₹160 (unfav.)
		= ₹80 (unfav.)

(vi) (d) Both (a) and (b)

Uniform Costing methods may be advantageously applied:

(a) In a single enterprise having a number of branches or units, each of which may be a separate manufacturing unit.

(b) In a number of concerns in the same industry bound together through a trade association or otherwise, and

(c) In industries which are similar in nature such as gas and electricity, various types of transport, and cotton, jute and woollen textiles.

(vii) (a) Information about the organisation is made available freely with the fear of disclosure of confidential data to outside market or public

The practical difficulties that are likely to arise in the implementation of a scheme of inter-firm comparison are:

(a) The top management may not be convinced of the utility of inter-firm comparison.

(b) Reluctance to disclose data which a concern considers to be confidential.

(c) A sense of complacence on the part of the management who may be satisfied with the present level of profits.

(d) Absence of a proper system of Cost Accounting so that the costing figures supplied may not be relied upon for comparison purposes.

(e) Non-availability of a suitable base for comparison.

(viii) (c) 15360 hours

As per the data:

At 80% Learning Curve, the total time for 8 units will be $8 \times (0.8)^3 \times 10000$

40960 hours and for 4 units it is $4 \times (0.8)^2 \times 10000$ i.e. 25600 hours. Hence the time taken for units 5 to 8 will be 15360 hours i.e. (40960 – 25600).

(ix) (b) $10x_1 + 4x_2 \leq 20$

Other options do not conform to linearity or fundamental of constraints.

(x) (c) Both (a) and (b)

There are four methods of solving an assignment problem and they are:

(1) Complete Enumeration Method

(2) Simplex Method

(3) Transportation Method and

(4) Hungarian Method

Section – B

Answer any five questions.

[16×5= 80]

2. (a) Sweet Ltd. has sales of 4,00,000 units at a price of ₹100.00 per unit and profit of ₹140.00 Lakhs in the current year. Due to stiff competition, next year the Company has to reduce its price of product @ 3% to achieve same target volume of sales. The cost structure and profit for the current year is given as below:

Particulars	(₹ Lakhs)
Direct Material	100.00
Direct Wages	80.00
Variable Factory Overheads	30.00
Fixed Overheads including Sales & Admin Expenses	50.00
Total Cost	260.00

To achieve the Target Cost to maintain the same profit, the Company is evaluating the proposal to reduce Labour Cost and Fixed Factory Overheads. A Vendor supplying the Machine suitable for the Company's operations has offered an advanced technology Semi-Automatic Machine of ₹20 Lakhs as replacement of Old Machine worth ₹6 Lakhs. The Vendor is agreeable to take back the Old Machine at ₹2 Lakhs only. The Company's policy is to charge depreciation at 15% on WDV. The Maintenance Charge of the Existing Machine is ₹2 Lakh per annum whereas there will be warranty of services free of cost for the New Machine first two years. There are 7 Supervisors whose Salary is ₹3 Lakhs per annum. The New Machine having Conveyor Belt is expected to help in cost cutting measures in the following ways -

(1) **Improve Productivity of workers by 10%**

(2) **Cut-down Material Wastage by 5%**

(3) **Elimination of services of Supervisors because of automatic facilities of the machine**

(4) **Saving in Packaging Cost by ₹2 Lakhs.**

Assuming Cost of Capital to be 15%, calculate how many Supervisors should be removed from the production activities to achieve the Target Cost. [6]

2. (b) The accountant of XYZ Ltd. has prepared the following estimate on the basis of which he has advised that a contract should not be accepted at the price offered. The estimate (₹) was as follows:

Material X in stock at original cost	1,50,000
Material Y on order at contract price	1,80,000
Material Z to be ordered at current price	3,00,000
Skilled Labour	5,40,000
Unskilled Labour	3,00,000
Supervisory Cost	1,00,000
General Overheads	1,80,000
Total Cost	17,50,000
Price offered	14,00,000
Net Loss (Price offered – Total Cost)	3,50,000

The following details are available about the cost components listed above.

a. Material X is an obsolete material. It can be used on another product W, the material for which is available at ₹1,35,000 (Material X requires some adaptation to be used which costs ₹15,000). It may take some time before W's order is confirmed. Until then storage will cost ₹12,000.

b. Material Y is ordered for some other product which is no longer required. It now has a residual value of ₹1,55,000.

c. Skilled labour can work on other contracts which are presently operated by semi-skilled labour at a cost of ₹4,00,000

d. Unskilled labour are specifically employed for this contract.

e. Supervisory staff will remain whether or not the contract is accepted. Only two them can replace other positions where the salary is ₹50,000.

f. Overheads are charged at 33⅓% of skilled labour. Only ₹1,25,000 would be avoidable.

You are required to answer the following questions using relevant cost approach:

(i) Relevant costs of material X, Y and Z

(ii) Relevant cost of labour-skilled and unskilled

(iii) Relevant cost of Supervisory cost and General overheads

(iv) If the contract is accepted, what would be the resulting financial impact on XYZ's profit. [10]

Answer:

(a) A. Targeted Cost Reduction

Targeted price Reduction = 3% of 400 lakhs = ₹12 lakhs

∴ Targeted Cost Reduction = ₹12 lakhs

B. Net Savings on account of New Machine

1. Savings on account of the New Machine
   a. Reduction in wages due to Improving Productivity of workers by 10%
      = {80 lakhs – [(80 lakhs ÷ 110) × 100] = (80.00 – 72.72) = ₹7.28 lakhs
   b. Cut-down Material Wastage by 5% = 5% of 100 lakhs = ₹5.00 lakhs
   c. Saving in Packaging Cost = ₹2.00 lakhs
   d. Saving in Maintenance Cost = ₹2.00 lakhs
   e. Total Savings = 7.28 + 5.00 +2.00 + 2.00 = ₹16.28 lakhs
2. Additional Costs on account of the New Machine
   a. Loss in Disposal of Old Machine = (₹6 lakhs – ₹2 lakhs) = ₹4.00 lakhs
   b. Difference in Depreciation = (₹20 lakhs - ₹6 lakhs) x 15% = ₹2.10 lakhs
   c. Cost of Capital Investment = (₹20 lakhs × 15%) = ₹3.00 lakhs
   d. Total Additional Costs = (4.00 + 2.10 + 3.00) = ₹9.10 lakhs
3. Net Savings = (16.28 – 9.10) = ₹7.18 lakhs

C. Supervisors to be Removed

Shortfall = (A – B) = (12.00 – 7.18) = ₹4.82 lakhs

∴ Number of Supervisors to be removed

= (4.82 lakhs ÷ 3 lakhs per supervisors) = 1.61

i.e. say 2 Supervisors.

(b) (i) Relevant costs of material X, Y and Z

Material X (Obsolete)

Material X in stock at original cost = ₹1,50,000

Reuse Value = ₹1,35,000

Adaptation Cost = ₹15,000

Storage Cost = ₹12,000

Relevant Cost of Material X = ₹(1,35,000 – 15,000 – 12,000) = ₹1,08,000

Material Y (No longer required)

Material Y on order at contract price = ₹1,50,000

Residual Value = ₹1,55,000

Relevant Cost of Material Y = ₹1,55,000

Material Z (To be ordered)

Material Z to be ordered at current price = ₹3,00,000

Relevant Cost of Material Z = ₹3,00,000

Material X is an obsolete material but can be used as substitute of some other material available at ₹1,35,000 after incurring an adaptation cost of ₹15,000 and Storage cost of ₹12,000. While using Material 'X' for current work, these costs can be saved, so relevant cost = ₹(1,35,000 – 15,000 – 12,000) = ₹1,08,000

(ii) Relevant cost of labour-skilled and unskilled

Skilled Labour (Can replace unskilled labour)

Cost of skilled labour = ₹5,40,000

Replacement Cost (in place of unskilled labour) = ₹4,00,000

Relevant Cost of Skilled Labour = ₹4,00,000 [Lower of the Above]

Unskilled Labour (Specifically Employed)

Cost of unskilled labour = ₹3,00,000

Relevant Cost of Unskilled Labour = ₹3,00,000

(iii) Relevant cost of Supervisory cost and General overheads

Supervisory cost = ₹1,00,000

Replacement Value for others = ₹50,000

Relevant Supervisory Cost = ₹50,000

Avoidable General Overheads = ₹1,25,000

Relevant Costs of General Overheads = ₹1,25,000

(iv) Computation of Financial Impact

Serial	Element	Amount (₹)
A	Price Offered	14,00,000
B	Relevant Costs	
	1. Material X	1,08,000
	2. Material Y	1,55,000
	3. Material Z	3,00,000
	4. Skilled Labour	4,00,000
	5. Unskilled Labour	3,00,000

	6. Supervisory Cost	50,000
	7. General Overheads	1,25,000
	8. Total (1 to 7)	14,38,000
C	Financial Impact (A – B)	(38,000)

Observation: The loss is much less than what the accountant has worked out. However, if the contract is accepted, XYZ's profit will be reduced by ₹38,000.

3. An agro-based farm is planning its production for next year. The following is relating to the current year:

Product/Crop	M	N	O	P
Area Occupied (Acres)	**125**	**100**	**150**	**125**
Yield per acre (ton)	**50**	**40**	**45**	**60**
Selling Price per ton (₹)	**100**	**125**	**150**	**135**
Variable Cost per acre (₹)				
Seeds	**150**	**125**	**225**	**200**
Pesticides	**75**	**100**	**150**	**125**
Fertilizers	**62.50**	**37.50**	**50**	**62.50**
Cultivation	**62.50**	**37.50**	**50**	**62.50**
Direct Wages	**2000**	**2250**	**2500**	**2850**

Fixed overhead per annum ₹13,44,000. The land that is being used for the production of O and P can be used for either crop. But not for M and N; the land that is being used for the production of M and N can be used for either crop, but not for O and P. In order to provide adequate market service, the company must produce each year at least 1,000 tons of each of M and N and 900 tons each of O and P.

Required:

(i) Determine the profit for the production mix fulfilling market commitment.

(ii) Assuming the land could be cultivated to produce any of the four products and there was no market commitment, calculate the profit amount of most profitable crop and break-even point of most profitable crop in terms of acres and sales value. [16]

Answer:

3. (i) Determination of Profit for Production Mix fulfilling the market commitment:

a. Statement of Recommended Product Mix

Sl. No.	Product	M	N	O	P
1	Yield per acre (ton)	50	40	45	60
2	Selling Price per ton (₹)	100	125	150	135
3	Sales Revenue per acre (₹)	5000	5000	6750	8100
4	Variable Cost per acre (₹):				
	a. Seeds	150	125	225	200
	b. Pesticides	75	100	150	125
	c. Fertilizers	62.50	37.50	50	62.50
	d. Cultivation	62.50	37.50	50	62.50

	e. Direct Wages	2000	2250	2500	2850
	f. Sub Total (a. to e.)	2350	2550	2975	3300
5	Contribution per acre (₹)	2650	2450	3775	4800
6	Rank	III	IV	II	I
7	Minimum Sales per annum (tons) (Minimum Market Commitment)	1000	1000	900	900
8	Minimum Area (acres) [7 ÷ 1]	(1000 ÷ 50) = 20	(1000 ÷ 40) = 25	(900 ÷ 45) = 20	(900 ÷ 60) = 15
9	Occupied Area (acres)**	125	100	150	125
10	Recommended Mix as per Rank in 6 (acres)	{(125+100) – 25} = 200	25 (Minimum)	20 (Minimum)	{(150+125) – 20} = 255

**Area of M&N can be interchanged and area of O&P can be interchanged.

b. Statement of Profit

Serial	Particulars	Workings	Rupees
1	Contribution for the recommended product Mix		
	M	(200 × 2650) = 5,30,000	5,30,000
	N	(25 × 2450) = 61,250	61,250
	O	(20 × 3775) = 75,500	75,500
	P	(255 × 4800) = 12,24,000	12,24,000
	Sub Total		18,90,750
2	Fixed Cost		13,44,000
3	Profit (1–2)		5,46,750

(ii) Most profitable crop

Product P gives highest contribution of ₹4,800 per acre and hence is the most profitable crop.

Statement of Profit if complete land is used for P:

Contribution = (500 × 4800) = ₹24,00,000

Fixed cost = ₹13,44,000

Profit = ₹10,56,000

Break-even point in acres for P = 13,44,000 ÷ 4,800 = 280 acres

Break-even point in sales value = 280 × 135 × 60 = ₹22,68,000.

4. (a) The following is a flexible budget of FB Co. Ltd. for a production department:

Particulars	Level of Activity		
Direct Labour Hours	**4000**	**5000**	**6000**
Number of Units	**8000**	**10000**	**12000**
Fixed Overhead (₹)	**5000**	**5000**	**5000**
Variable Overhead (₹)	**800**	**1000**	**1200**
Total Overheads (₹)	**5800**	**6000**	**6200**

Normal Level of activity was 5000 direct labour hours.

Actual Results were:

Direct Labour hours – 4800
Variable Overhead – ₹900
Output in Units – 10400
Fixed Overhead – ₹5100
Compute Fixed overhead cost variance, Fixed overhead volume variance, Fixed overhead expenditure variance, Variable overhead cost variance, Variable overhead efficiency variance, Variable overhead expenditure variance and Efficiency, Capacity and Activity ratios. [10]

4. (b) State any six limitations of standard costing. [6]

Answer:

4. (a) Step 1: Initial Workings

Normal level of activity has been expressed in terms of direct labour hours. Accordingly:

Standard Labour Hours per unit of Output = (10,000 ÷ 5,000) = 2 hours per unit
Standard Labour Hours for Actual Output = (10,400 ÷ 2) = 5,200 hours

Standard Rate of Recovery for FOH = (5,000 ÷ 5,000) = ₹1 per labour hour
Standard Rate of Recovery for VOH = (1,000 ÷ 5,000) = ₹0.20 per labour hour

Step 2: FOH Variances

Description	Formula	Workings	Variance
FOH Cost Variance	SRSH – AOH	(1 × 5200) – 5100 = 100 (F)	₹100 (F)
FOH Volume Variance	SR (SH – BH)	1 × (5200 – 5000) = 200 (F)	₹200 (F)
FOH Expenditure Variance	SRBH – AOH	(1 × 5000) – 5100) = 100 (A)	₹100 (A)

Step 3: VOH Variances

Description	Formula	Workings	Variance
VOH Cost Variance	SRSH – AOH	(0.2 × 5200) – 900 = 140 (F)	₹140 (F)
VOH Efficiency Variance	SR (SH – AH)	0.2 × (5200 – 4800) = 80 (F)	₹80 (F)
VOH Expenditure Variance	SRAH – AOH	(0.2 × 4800) – 900 = 60 (F)	₹60 (F)

Step 4: Ratios

Description	Formula	Workings	Ratio
Efficiency Ratio	SH ÷ AH	5200 ÷ 4800	108.33%
Capacity Ratio	AH ÷ BH	4800 ÷ 5000	96 %
Activity Ratio	SH ÷ BH	5200 ÷ 5000	104%

Answer:

4. (b) Limitations of standard costing:

1. Establishment of standard costs is difficult in practice.
2. In course of time, sometimes even in a short period the standards become rigid.
3. Inaccurate, unreliable and out of date standards do more harm than benefit.
4. Sometimes, standards create adverse psychological effects. If the standard is set at high level, its non-achievement would result in frustration and build-up of resistance.

5. Due to the play of random factors, variances cannot sometimes be properly explained, and it is difficult to distinguish between controllable and non-controllable expenses.
6. Standard costing may not sometimes be suitable for some small concerns. Where production cannot be carefully scheduled, frequent changes in production conditions result in variances. Detailed analysis of all of which would be meaningless, superfluous and costly.

5. (a) A company is organized on decentralized lines, with each manufacturing division operating as a separate profit centre. Each division has full authority to decide on sale of the division's output to outsiders and to other divisions.

Division C has always purchased its requirements of a component from Division A but when informed that Division A was increasing its selling price to ₹150, the manager of Division C decided to look at outside suppliers. Division C can buy the components from an outside supplier for ₹135. But Division A refuses to lower its price in view of its need to maintain its return on the investment. The top management has the following information:

C's annual purchase of the component: 1,000 units

A's variable costs per unit: ₹120

A's fixed cost per unit: ₹20

Required:

(i) Will the company as a whole benefit, if Division C buys the component at ₹135 from an outside supplier?

(ii) If Division A did not produce the material for Division C, it could use the facilities for other activities resulting in a cash operating savings of ₹18,000. Should Division C then purchase from outside sources?

(iii) Suppose there is no alternative use of Division A's facilities and the market price per unit for the component drops by ₹20. Should Division C now buy from outside? [3+4+3]

5. (b) Describe the Pre-requisites of Benchmarking. [6]

Answer:

5. (a) (i) Division C buying the component at ₹135 from an outside supplier

Purchase cost (from outside supplier) (1,000 units × ₹135 p.u.)	1,35,000
Less: Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000
Net loss	15,000

Observation: The company as a whole will incur a loss of ₹15,000 if Division C buys the component from an outside supplier at ₹135 p.u.

(ii) Division C buying the component at ₹135 from an outside supplier and Division A saving ₹18,000

Purchase cost (from outside supplier) (1,000 units × ₹135 p.u.)		1,35,000
Less: a. Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000	

b. Operating savings by using facilities for other activities	18,000	
c. Total Savings		1,38,000
Net Gain		3,000

Observation: The company as a whole will benefit by ₹3,000 if Division C buys the component from an outside supplier at ₹135 p.u. and Division A's facilities are used for other activities.

(iii) There is no alternative use of Division A's facilities and the market price per unit for the component drops by ₹20

Purchase cost (from outside supplier) (1,000 units × ₹115 p.u.)	1,15,000
Less: Saving in variable cost of Division A by reducing division's output (1,000 units × ₹120 p.u.)	1,20,000
Net Gain	5,000

Observation: The company as a whole will benefit by ₹5,000 if Division C buys the component from an outside supplier at ₹115 p.u.

Answer:

5. (b) The following are the Pre-requisites of Benchmarking:

1. Commitment: Senior Managers should support benchmarking fully and must be omitted to continuous improvements.

2. Clarity of Objectives: The objectives should be clearly defined at the preliminary stage. Benchmarking teams have a clear picture of their Firm's performance before approaching others for comparisons.

3. Appropriate Scope: The scope of the work should be appropriate in the light of the objectives, resources, time available and the experience level of those involved.

4. Resources: Sufficient resources must be available to complete projects within the required time scale.

5. Skills: Benchmarking teams should have appropriate skills and competencies.

6. Communication: Stakeholders, and also staff and their representatives, are to be kept informed of the reasons for benchmarking.

6. (a) Mr. Partha, a businessman, is considering taking over a certain new business. Based on past information and his own knowledge of the business, he works out the probability distributions of the daily costs and sales revenue, as given here:

Cost (in ₹)	Probability	Sales (in ₹)	Probability
85000	**0.10**	**95000**	**0.10**
90000	**0.10**	**100000**	**0.10**
95000	**0.40**	**105000**	**0.20**
100000	**0.20**	**110000**	**0.40**
105000	**0.20**	**115000**	**0.15**
		120000	**0.05**

Use the following sequences of random numbers to be used for estimating costs and revenues. Obtain the probability distribution of the daily net revenue.

Sequence 1: 81, 83, 27, 81, 35, 91, 72, 90 62, 28, 26, 25, 91, 62, 82, 02, 12, 38, 10, 18.

Sequence 2: 38, 71, 37, 28, 70, 82, 18, 71, 91, 58, 48, 38, 71, 93, 02, 91, 73, 17, 09, 04.

[10]

6. (b) A computer centre has got three expert programmers. The centre needs three expert programmers. The centre needs three application programmes to be

developed. The Head of the computer centre, after studying carefully the programmes to be developed, estimated the computer time in minutes required by the experts to the application programmes as follows:

		Programmes		
		A	B	C
Programmers	1	1200	1000	800
	2	800	900	1100
	3	1100	1400	1200

Assign the programmers to the programmes in such a way that the total computer time is least. **[6]**

Answer:

6. (a) Step 1: Random numbers 00 – 99 are allocated in proportion to the probabilities associated with each event as given below:

Cost	Prob.	Cum. Prob.	Random Number Interval	Revenue	Prob.	Cum. Prob.	Random Number Interval
85000	0.10	0.10	00 – 09	95000	0.10	0.10	00 – 09
90000	0.10	0.20	10 – 19	100000	0.10	0.20	10 – 19
95000	0.40	0.60	20 – 59	105000	0.20	0.40	20 – 39
100000	0.20	0.80	60 – 79	110000	0.40	0.80	40 – 79
105000	0.20	1.00	80 – 99	115000	0.15	0.95	80 – 94
				120000	0.05	1.00	95 – 99

Step 2: Simulate cost and revenue data using given random numbers we get:

Random Number	Cost (in '000 ₹)	Random Number	Revenue (in '000 ₹)	Net revenue (in '000 ₹)
81	105	38	105	0
83	105	71	110	5
27	95	37	105	10
81	105	28	105	0
35	95	70	110	15
91	105	82	115	10
72	100	18	100	0
90	105	71	110	5
62	100	91	115	15
28	95	58	110	15
26	95	48	110	15
25	95	38	105	10
91	105	71	110	5
62	100	93	115	15
82	105	02	95	–10
02	85	91	115	30
12	90	73	110	20
38	95	17	100	5
10	90	09	95	5

18	90	04	95	5

Step 3: Frequency distribution of net revenue and probabilities by expressing frequencies in relative form are as under:

Net revenue (in ₹)	Frequency	Probability
–10000	1	0.05
–5000	0	0.00
0	3	0.15
5000	6	0.30
10000	3	0.15
15000	5	0.25
20000	1	0.05
25000	0	0.00
30000	1	0.05
Total	**20**	**1**

Answer:

6. (b) Using the Hungarian Assignment Method, we subtract the smallest element of each row to get the following table:

Programmers	Programmes		
	A	B	C
1	400	200	0
2	0	100	300
3	0	300	100

Now from all the elements of a column, subtract the minimum element of that column. Repeat this operation with all the columns to get the following table:

Programmers	Programmes		
	A	B	C
1	~~400~~	~~100~~	~~0~~
2	~~0~~	~~0~~	~~300~~
3	~~0~~	~~200~~	~~100~~

The minimum number of lines to cover all the zeros is 3, which is equal to the order of the matrix (3). Hence the above table will give the optimum assignment. The assignments are as follows:

Programmers	Programmes		
	A	B	C
1	400	100	[0]
2	~~0~~	[0]	300
3	[0]	200	100

Each row and each column has one and only one assignment, an optimal assignment has been made.

Thus the optimal solution is:

Assign 1 to C, 2 to B and 3 to A.

Total minimum computer time will be 800 + 900 + 1100, i.e., 2800 minutes.

7. (a) A project schedule consists of the following activities with the time estimates noted against each activity:

Activity	Time	Activity	Time
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

(i) Construct a PERT network and compute T_E T_L and for each event, (ii) Find the critical path, (iii) Obtain the total and free floats of each activity. [8]

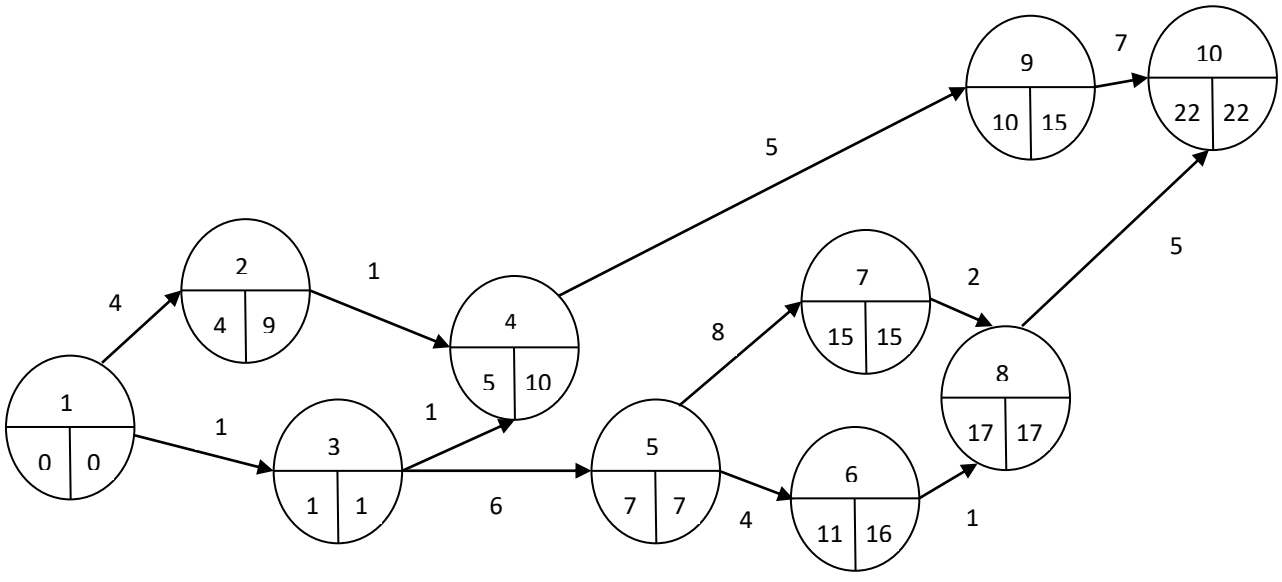
7. (b) Mr. Ashis, a dealer of cement has two warehouses M and N with stocks of 30000 and 20000 bags of cement respectively. Three customers A, B and C have placed order on the dealer for 15000, 20000 and 15000 bags respectively. Costs of transportation per 1000 bags of cement from different warehouses to different customers are given below:

	Transportation Cost (₹ '00) per 1000 bags		
To	A	B	C
From			
M	40	20	20
N	20	60	40

The dealer wants to find how to fulfill the orders so that the transportation cost is minimum. Formulate the problem. [8]

Answer:

7. (a) (i) Based on the above details relating activities, precedence and expected time (t_e), a network diagram with T_E and T_L for each event can be drawn as follows:



(ii) Critical path is:

1-3-5-7-8-10

Project duration is 22 units of time.

(iii) **Statement showing the Total Float and Free Float**

Activity	Working	Total Float $T_L - T_E - t_e$	Working $E_F - T_E - t_e$	Free Float
1-2	9 – 0 – 4	5	4 – 0 – 4	0
1-3	1 – 0 – 1	0	1 – 0 – 1	0
2-4	10 – 4 – 1	5	5 – 4 – 1	0
3-4	10 – 1 – 1	8	5 – 1 – 1	3
3-5	7 – 1 – 6	0	7 – 6 – 1	0
4-9	15 – 5 – 5	5	10 – 5 – 5	0
5-6	16 – 7 – 4	5	11 – 7 – 4	0
5-7	15 – 7 – 8	0	15 – 7 – 8	0
6-8	17 – 11– 1	5	17 – 11 – 1	5
7-8	17 – 15 – 2	0	17 – 15 – 2	0
8-10	22 – 17 – 5	0	22 – 17 – 5	0
9-10	22 – 10 – 7	5	22 – 10 – 7	5

Answer:

7. (b) As transportation costs are given per 1000 bags, we assume 1 unit = 1000 bags

Let Warehouse M supplies x_1 units to A and x_2 units to B. As the stock of M is 30000 bags or 30 units, so C gets $(30 - x_1 - x_2)$ units from M.

Total requirement of A is 15000 bags or 15 units. Of this x_1 is supplied from M. Thus remaining $(15 - x_1)$ units is to be supplied from N.

Similarly, B gets $(20 - x_2)$ units from N and C gets $[15 - (30 - x_1 - x_2)] = x_1 + x_2 - 15$ units from N.

Using the supplied values of Transportation Cost per unit we express Total Transportation Cost as –

$Z=4000x_1 + 2000x_2 + 2000(30 - x_1 - x_2) + 2000(15 - x_1) + 6000(20 - x_2) + 4000(x_1 + x_2 - 15)$

Or, $Z = 4000x_1 - 2000x_2 + 150000$

As the problem deals with units of cement bags, each of the units mentioned above should be non-negative.

Hence the constraints are –

$x_1 \geq 0, x_2 \geq 0,$

$30 - x_1 - x_2 \geq 0$ Or, $x_1 + x_2 \leq 30,$

$15 - x_1 \geq 0$ Or, $x_1 \leq 15,$

$20 - x_2 \geq 0$ Or, $x_2 \leq 20$

$x_1 + x_2 - 15 \geq 0$ Or, $x_1 + x_2 \geq 15$

Thus the mathematical formulation of the given LPP is –

Minimize $Z = 4000x_1 - 2000x_2 + 150000$ Subject to the constraints

$x_1 + x_2 \leq 30$

$x_1 + x_2 \geq 15$

$x_1 \leq 15$

$x_2 \leq 20$

$x_1 \geq 0, x_2 \geq 0$

8. Write short notes on any four of the following: 4×4=16

(a) Explain the limitations of Backflush accounting.

(b) State the Characteristics of Re-engineering Process and Seven Principles of BPR.

(c) Differentiate between Lean Accounting and Traditional Standard Costing.

(d) Explain the 4P's of TQM.

(e) Describe the usefulness of Pareto Analysis.

Answer:

8. (a) Backflushing is a theoretically elegant solution to the complexities of assigning costs to products and relieving inventory, but it is difficult to implement. Backflush accounting is subject to the following problems:

- **Requires an accurate production count-** The number of finished goods produced is the multiplier in the backflush equation, so an incorrect count will relieve an incorrect amount of components and raw materials from stock.
- **Requires an accurate bill of materials-** The bill of materials contains a complete itemization of the components and raw materials used to construct a product. If the items in the bill are inaccurate, the backflush equation will relieve an incorrect amount of components and raw materials from stock.
- **Requires excellent scrap reporting-** There will inevitably be unusual amounts of scrap or rework in a production process that are not anticipated in a bill of materials. If you do not separately delete these items from inventory, they will remain in the inventory records, since the backflush equation does not account for them.
- **Requires a fast production cycle time-** Backflushing does not remove items from inventory until after a product has been completed, so the inventory records will remain incomplete until such time as the backflushing occurs. Thus, a very rapid production cycle time is the best way to keep this interval as short as possible. Under a backflushing system, there is no recorded amount of work-in-process inventory.

Backflushing is not suitable for long production processes, since it takes too long for the inventory records to be reduced after the eventual completion of products. It is also not suitable for the production of customized products, since this would require the creation of a unique bill of materials for each item produced.

Answer:

8. (b) Characteristics of Re-engineering Process:

(i) Several jobs are combined into one

(ii) Often workers make decisions

(iii) The steps in the process are performed in a logical order

(iv) Work is performed, where it makes most sense

(v) Quality is built in.

(vi) Manager provides a single point of contact

(vii) Centralized and decentralized operations are combined.

Seven Principles of BPR:

(a) Processes should be designed to achieve a desired outcome rather than focusing on existing tasks.

(b) Personnel who use the output from a process should perform the process

(c) Information processing should be included in the work, which produces the information

(d) Geographically dispersed resources should be treated, as if they are centralized

(e) Parallel activities should be linked rather than integrated

(f) Doers should be allowed to be self-managing

(g) Information should be captured once at source.

Answer:

8. (c) The following are the contrasting features of Lean Accounting and Traditional Standard Costing:

Lean Accounting	Traditional Standard Costing
Quick, simple, and timely	Complex and wasteful processes
Clear and easy to understand	Difficult for people to understand
Provides information for effective decisions	Leads to bad decisions
Supports value stream measurements and box scores	Supports measurements that undermine Lean endeavours
Supports a value stream (total process) approach	Supports a departmental view of production
Enables value stream financial control and improvement	Narrows the focus of financial control and improvement
Enables inventory valuation	Enables inventory valuation
Enables value based pricing	Enables Cost + Pricing

Answer:

8. (d) It is possible that the organisation is led to Total Quality Paralysis, instead of improvement, by improper implementation of TQM. To avoid such disruption and paralysis the following principles (called the four P's) of TQM should be followed:

The 4P's	
People	To avoid misdirection, TQM teams should consist of team spirited individuals who have a flair for accepting and meeting challenges. Individuals who are not ideally suited to the participatory process of TQM, should not be involved at all, e.g. lack of enthusiasm, non-attendance at TQM meetings, failure to complete delegated work, remaining a "Mute Spectator" at TQM meetings, etc.
Process	It is essential to approach problem-solving practically and to regard the formal process as a system designed to prevent participants from jumping to conclusions. As such, it will provide a means to facilitate the generation of alternatives while ensuring that important discussion stages are not omitted.
Problem	Problems need to be approached in a systematic manner, with teams tackling solvable problems with a direct economic impact, allowing for immediate feedback together with recognition of the contribution made by individual participants.
Preparation	Additional training on creative thinking and statistical processes are

	needed in order to give participants a greater appreciation of the diversity of the process. This training must quickly be extended beyond the immediate accounting circle to include employees at supervisory levels and also who are involved at the data input stage.

Answer:

8. (e) Usefulness of Pareto Analysis: It provides the mechanism to control and direct effort by fact, not by emotions. It helps to clearly establish top priorities and to identify both profitable and unprofitable targets. Pareto analysis is useful to:

(i) Prioritize problems, goals, and objectives to Identify root causes.

(ii) Select and define key quality improvement programs.

(iii) Select key customer relations and service programs.

(iv) Select key employee relations improvement programs.

(v) Select and define key performance improvement programs.

(vi) Maximize research and product development time.

(vii) Verify operating procedures and manufacturing processes.

(viii) Product or services sales and distribution.

(ix) Allocate physical, financial and human resources.