PAPER 15 - STRATEGIC COST MANAGEMENT AND DECISION MAKING

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Full Marks: 100 **Time allowed: 3 hours**

Section – A

1. **Answer the following with justification and each question carries 2 marks. [10×2= 20]**

(i) If the first time you perform a job takes 60 minutes, how long will the eighth job take if you are on an 80% learning curve?

a. 48 minutes
b. 30.72 minutes
c. 31 minutes
d. None of the above

(ii) A company has 2,000 units of an obsolete item which are carried in inventory at the original purchase price of ₹30,000. If these items are reworked for ₹10,000, they can be sold for ₹18,000. Alternatively, they can be sold as scrap for ₹3,000 in the market. In a decision model used to analyze the reworking proposal, the opportunity cost should be taken as:

a. ₹8,000
b. ₹12,000
c. ₹3,000
d. ₹10,000

(iii) The single price of the selling product manufactured by a company is fixed at ₹1,500 per unit. In the coming year, 500 units of the product are likely to be sold. If the total value of investments of the company is ₹15 lakhs and it has a target ROI of 15%, the target cost would be:

a. ₹9.30
b. ₹9.50
c. ₹1050
d. None of these

(iv) If the direct labour cost is reduced by 20% with every doubling of output, what will be the cost of labour for the sixteenth unit produced as an approximate percentage of the cost of the first unit produced?

a. 51.2%
b. 40.96%
c. 62%
d. None of these

(v) A company determines its selling price by making up variable costs 60%. In addition, the company uses frequent selling price mark down to stimulate sales. If the mark down average 10%, what is the company's contribution margin ratio?

a. 30.6%

b. 44%

c. 86.4%

d. None of these

(vi) Back flush costing is most likely to be used when:

a. Management desires sequential tracking of costs

b. A Just-in-Time inventory philosophy has been adopted

c. The company carries significant amount of inventory

d. Actual production costs are debited to work-in-progress.

(vii) A company produces two joint products, P and V. In a year, further processing costs beyond split-off point spent were ₹8,000 and ₹12,000 for 800 units of P and 400 units of V respectively. P sells at ₹25 and V sells at ₹50 per unit. A sum of ₹9,000 of joint cost were allocated to product P based on the net realization method. What were the total joint cost in the year? a. ₹ 20,000

b. ₹ 10,000

c. ₹15,000

d. None of these

(viii) When allocation service department cost to production departments, the method that does not consider different cost behaviour patterns is the:

a. Step method

b. Reciprocal method

c. Single rate-method

d. Dual rate-method

(ix) The information relating to the direct material cost of a company is as under:

	₹
Standard price per unit	3.60
Actual quantity purchased in units	1,600
Standard quantity allowed for actual production in units	1.450
Material price variance on purchase (favourable)	240

What is the actual purchase price per unit?

a. ₹ 3.45
b. ₹ 3.75
c. ₹ 3.20
d. ₹ 3.25

(x) A company manufactures two products using common material handling facility. The total budgeted material handling cost is ₹60,000. The other details are:

	Product X	**Product Y**
Number of units produced	**30**	**30**
Material moves per product line	**5**	**15**
Direct labour hour per unit	**200**	**200**

Under activity based costing system the material handling cost to be allocated to product X (per unit) would be:

a. ₹1,000

b. ₹ 500

c. ₹ 1,500

d. ₹2,500

Answer : 1

(i) (b)

Three doublings from 1 to 2 to 4 to 8 implies .83. Therefore, we have 60× (.8)3 = 60 ×.512 = 30.72 minutes.

(ii) (c)

Original price is not relevant

Rework income	₹18,000
Deduct cost of rework	₹10,000
Net inflow	₹8,000

It is relevant The other alternative relevant cash flow is from sale as scrap = ₹3,000. Hence, the opportunity cost is ₹3,000.

(iii) (c)

Particulars	₹
Sales Revenue = 500 × ₹ 1,500	7,50,000
Less: ROI 15% on ₹ 15 Lakhs =	2,25,000
Target Cost	5,25,000

Target Cost per unit = Target cost / 500 = 5,25,000 / 500 = ₹ 1,050.

(iv) (b)

1st	100%
2nd	80% ×100
4th	80% × 2nd

8th	80% × 4th
16th	80% × 8th = 80%×80%×80%×80% = 40.96%

Say, 41% of the time required for the first unit.

(v) (a)

When V (Var. cost) = 100, SP = 160,

M. Cost/SP = 60/100 SP after 10% mark down of SP = 144,

Cost = 60-16=44

Contribution Margin Ratio = 44/144=0.3056=30.6%

(vi) (b)

Back flush costing is most likely to be used when Just-in-Time inventory philosophy has been adopted.

(vii)(c)

Products	P	V	Total
Units	800	400	
S.P. (₹)	25	50	
Sales (₹)	20,000	20,000	
Further costs (₹)	8,000	12,000	
NRV (₹)	12,000	8,000	20,000

Joint cost appropriated ₹9,000

Total Joint Cost = (9,000/12,000) x 20,000 = ₹15,000

(viii) (c)

The single rate method combines fixed and variable costs without regard to cost behaviour patterns. A and B do not exactly fit in with the given question as they can be used on a single or dual rate; and Ans D allows variable costs to be allocated on different basis from fixed costs.

(ix) (a)

Actual quantity bought x standard price = 1,600 x ₹3.60 = ₹5,760

Deduct favourable price variance ₹240

Actual quantity x actual price = ₹5,520 Or,

1,600 x actual price = ₹ 5,520

So, Actual price ₹ 5,520/1,600 = ₹ 3.45

(x) (b)

Total moves in material handling = 5+15=20

Percentage move for Product A = 5/20=25%

Material handling cost to be allocated to Product A = ₹60,000/25%=₹15,000

i.e., ₹ 15,000/30= ₹500 per unit.

Section – B

Answer any five questions from Question No. 2 to 8 Each question carries 16 marks.

[5 ×16 = 80]

2. (a) K & Co. manufactures and sells 15,000 units of a product. The Full Cost per unit is ₹200. The Company has fixed its price so as to earn a 20% Return on an Investment of ₹18,00,000. Required:

(i) Calculate the Selling Price per unit from the above. Also, calculate the Mark-up % on the Full Cost per unit.

(ii) If the Selling Price as calculated above represents a Mark-up % of 40% on Variable cost per unit, calculate the Variable cost per unit.

(iii) Calculate the Company's Income if it had increased the Selling Price to ₹230. At this price, the company would have sold 13,500 units. Should the Company have increased the Selling price to ₹460?

(iv) In response to competitive pressures, the Company must reduce the price to ₹210 next year, in order to achieve sales of 15,000 units. The Company also plans to reduce its investment to ₹16,50,000. If a 20% Return on Investment should be maintained, what is the Target Cost per unit for the next year? [8]

(b) The ORC Club of a large public sector undertaking has a cinema theatre for the exclusive use of themselves and their families. It is a bit difficult to get good motion pictures for show and so pictures are booked as and when available.

The theatre has been showing the picture 'Blood Bath' for the past two weeks. This picture, which is strictly for adults only has been a great hit and the manager of the theatre is convinced that the attendance will continue to be above normal for another two weeks, if the show of 'Blood Bath' is extended. However, another popular movie, eagerly looked forward to by both adults and children alike, 'Appu on the Airbus' is booked for next two weeks. Even if 'Blood Bath' is extended the theatre has to pay the regular rental on 'Appu on the Airbus' as well.

Normal attendance at theatre is 2,000 patrons per week, approximately one fourth of whom are children under the age of 12. Attendance of 'Blood Bath' has been 50% greater than the normal total. The manager believes that this would taper off during the second two weeks, 25% below that of the first two weeks, during the third week and $33^1/_3$% below that of the first two weeks, during the fourth week. Attendance for 'Appu on the Airbus' would be expected to be normal throughout its run regardless of the duration. All runs at the theatre are shown at a regular price of ₹2 for adults and ₹1.20 for children fewer than 12. The rental charge for 'Blood Bath' is ₹900 for one week or ₹1,500 for two weeks. For 'Appu on the Airbus' it is ₹750 for one week or ₹1,200 for two weeks. All other operating costs are fixed - ₹4,200 per

week, except for the cost of potato wafers and cakes, which average 60% of their selling price, sales of potato wafers and cakes regularly average ₹1.20 per patron, regardless of age.

The Manager can arrange to show 'Blood Bath' for one week and 'Appu on the Airbus' for the following week or he can extend the show of 'Blood Bath' for two weeks or else he can show 'Appu on the Airbus' for two weeks as originally booked.

Show by computation, the most profitable course of action he has to pursue. **[8]**

Answer: 2(a)

1. Target Sale Price per unit = Full Cost + Target Profit = ₹200 + $\frac{18,00,000}{15,000 units} \times 20\%$	₹224
So, Mark-up on Full Cost = ₹24 ÷ ₹200	12%
2. Above Sale Price ₹224 = VC + 40% thereon, i.e. 140% on VC. So, Var. Cost =₹ $\frac{224}{140\%} \times 100$	₹160
3. Present Contribution at 15,000 units = (₹224 – ₹160) x 15,000 units =	₹9,60,000
Revised Contribution at 13,500 units = (₹230 – ₹160) x 13,500 units =	₹9,45,000
Hence, Increase in Sale Price is not beneficial, due to reduction in contribution by	₹15,000
4. Target Profit for next year $\frac{16,50,000 \times 20\%}{15,000\ units}$ = ₹ = 22 So, Target Cost for next year = New Sale Price less Target Profit = ₹210 – ₹22	₹188
Since Revised Contribution is less than Target Contribution above, rent reduction is not advisable.	

Answer: 2(b)

Statement showing evaluation of alternatives

		Blood bath	Blood bath & Appu on the airbus	Appu on the airbus
		₹	₹	₹
No. of spectators				
Adults:				
Third week	3,000 x 75%	2,250.00	2,250.00	1,500.00
fourth week	3,000 x 2/3	2,000.00	1,500.00	1,500.00
		4,250.00	3,750.00	3,000.00
Children:				
Third week				500.00
fourth week			500.00	500.00
			500.00	1,000.00

Total spectators:	4,250.00	4,250.00	4,000.00
Revenue:			
By sale of tickets	8,500.00	8,100.00	7,200.00
(3,000 x 2 +1000 x 1.2)			
Add : contribution from snacks	2,040.00	2,040.00	1,920.00
	10,540.00	10,140.00	9,120.00
Less : Incremental cost	1,500.00	900.00	
	9,040.00	9,240.00	9,120.00

It is found that the net revenue is more at the option of running blood bath and Appu on the Air bus a week each, it must be chosen.

3. PH Ltd., has a productive capacity of 2,00,000 units of product BXE per annum. The company estimated its normal capacity utilisation at 90% for 2022-23. The variable costs are ₹22 per unit and the fixed factory overheads were budgeted at ₹7,20,000 per annum. The variable selling overheads amounted to ₹6 per unit and the fixed selling expenses were budgeted at ₹5,04,000. The operating data for 202223 are as under:

Production	**1,60,000 units**
Sales @ ₹40 per unit	**1,50,000 units**
Opening stock of finished goods	**10,000 units**

The cost analysis revealed an excess spending of variable factory overheads to the extent of ₹80,000. There are no variances in respect of other items of cost.

Required:

(i) Determine the budgeted break-even point for 2022-23

(ii) What increase in price would have been necessary to achieve the budgeted profit?

(iii) Present statements of profitability for 2022-23 using:

(a) Marginal costing basis.

(b) Absorption costing basis **[16]**

Answer: (3)

Fixed cost = Fixed overheads + selling expenses = ₹720000 + ₹504000 = ₹1224000

		Amount (₹)
I	Selling price	40.00
II	Variable cost	28.00
III	Contribution	12.00

Break even at budget = (₹1224000/12) = 102000 units

(i) Contribution at budget = [(200000x90%)x12] 2160000

particulars	Amount (₹)
Contribution per unit (2160000/150000)	14.40
Add : Variable cost	28.00
	42.40
Standard variable production cost	22.00
Add: Standard fixed cost (720000/200000 x 90%)	4.00
	26.00

(ii) Profit under Absorption Costing

		Units	Amount (₹)	Amount (₹)
Standard Variable cost	(160000x22)			3,520,000.00
Add : Variance				80,000.00
				3,600,000.00
Add :Fixed production cost absorbed	(160000x4)		680,000.00	
Add : Under recovery	(720000-680000)		40,000.00	720,000.00
		160,000.00		4,320,000.00
Add : Opening stock		10,000.00		260,000.00
				4,580,000.00
Less : Closing stock		20,000.00	(43.2x0.2/1.6)	540,000.00
				4,040,000.00
Add : selling & dis. Cost				
Variable	(150000x6)		900,000.00	
Fixed			504,000.00	1,404,000.00
Total cost				5,444,000.00
profit (b/f)				556,000.00
Sales	(150000x40)			6,000,000.00

Profit under marginal costing				
i) Sales				6,000,000.00
ii) Variable cost				
Production			3,600,000.00	
Add : opening	(10000x22)		220,000.00	
			3,820,000.00	
Less : closing	20000x36/16)		450,000.00	3,370,000.00
Selling & distribution				900,000.00
				4,270,000.00
iii) Contribution				1,730,000.00
iv) Fixed cost				1,224,000.00
v) Profit				506,000.00

4. (a) One kilogram of product 'Kit' requires two chemicals A and B. The following were the details of product 'Kit' for the month of June, 2023:

Standard mix:

Chemical 'A' 50%

Chemical 'B' 50%

Standard price per kilogram of Chemical 'A' ₹12 and Chemical 'B' ₹15 Actual input of Chemical 'B' 70 kilograms. Actual price per kilogram of Chemical 'A' ₹15 Standard normal loss 10% of total input.

Materials Cost variance total ₹650 adverse.

Materials Yield variance total ₹135 adverse.

You are required to calculate:

1. **Materials mix variance total**
2. **Materials usage Variance total**
3. **Materials price variance total**
4. **Actual loss of actual input**
5. **Actual input of chemical 'A'**
6. **Actual price per kilogram of Chemical 'B'** **[10]**

(b) What is Bench trending and how does it differ from Bench Marking? [6]

Answer: 4(a)

Let, actual output of chemical A be 'a' kgs

Actual price per Kg of chemical B be `b'

Standard input be 100Kgs

Actual output be 90Kgs

	Standard			Actual		
	Q	P	V	Q	P	V
A	50	12	600	a	15	15a
B	50	15	750	70	b	70b
	100		1350	70 + a		15a + 70b
(-) normal loss	10	--	--	a – 20	--	--
	90		1350	90		15a + 70b

	(1)	(2)	(3)	(4)
	SQSP	RSQSP	AQSP	AQAP
A		12 x (70+a/100) x 50	12 x a	
B		15 x (70+a/100)/50	15 x 70	
	1350	945 + 13.5a	1050 + 12a	15a + 70b

Given material cost variance = (1) – (4) = - 650

= 15a + 70b = ₹ 2000

Material yield variance = (1) – (2) = - 135

$\Rightarrow$ a = 40

$\Rightarrow$ b = 20

1) SQSP = r 1350
2) RSQSP = 945 + (13.5 x 40) = ₹ 1485
3) AQSP = 1050 + (12 x 40) = ₹1530
4) AQAP = (15 x 40) + (70 x 20) = ₹ 2000

(a) Material mix variance = ₹ 45(A)

(b) Material usage variance = ₹ 180(A)

(c) Material price variance = ₹ 470(A)

(d) Actual loss of actual input = ₹ 20

(e) Actual input of chemical A = 40Kgs

(f) Actual price per Kgs of chemical B = ₹ 20

Answer: 4(b)

Bench Trending: Continuous monitoring of specific process performance with a selected group of benchmarking is a systematic and continuous measurement process of comparing through measuring an organization business processes against business leaders (role models) anywhere in the world, to gain information that will help organization take action to improve its performance. The continuous process of enlisting the best practices in the world for the processes, goals and objectives leading to world class levels of achievement.

Benchmarking is the process of comparing the cost, time or quality of what one organization does against what another organization does. The result is often a business case for making changes in order to make improvements.

Benchmarking is a powerful management tool because it overcomes "paradigm blindness". Paradigm Blindness can be summed up as the mode of thinking, "the way we do it is the best because this is the way we've always done it". Bench Marking opens organizations to new methods, ideas and tools to improve their effectiveness. It helps crack through resistance to change by demonstrating other methods of solving problems than the one currently employed and demonstrating that they work, because they are being used by others.

I. Identify your problem areas.

II. Identify other industries that have similar processes.

III. Identify organizations that are leaders in these areas. IV. Survey companies for measures and practices

V. Visit the "best practice" companies to identify leading edge practices. VI. Implement new and improved business practices.

5. (a) A Company with two manufacturing division is organized on profit centre basis. Division 'A' is the only source for the supply of a component that is used in Division B in the manufacture of a product KPO. One such part is used each unit of the product KPO. As the demand for the product is not steady. Division B can obtain order for increased quantities only by spending more on sales promotion and by reducing the selling prices. The manager of Division B has accordingly prepared the following forecast of sales quantities and selling prices.

Sales units per day	Average Selling price per unit of KPO (₹)
1,000	5.25
2,000	3.98
3,000	3.30
4,000	2.78
5,000	2.40
6,000	2.01

The manufacturing cost of KPO in Division B is ₹3,750 first 1,000 units and ₹750 per 1,000 units in excess of 1,000 units.

Division A incurs a total cost of ₹1,500 per day for an output to 1,000 components and the total costs will increase by ₹900 per day for every additional 1,000 components manufactured. The Manager of Division A

states that the operating results of Division will be optimised if the transfer price of the component is set at ₹1.20 per unit and he has accordingly set the aforesaid transfer price for his supplies of the component to Division A.

You are required:

(i) Prepare a schedule showing the profitability at each level of output for Division A and Division B

(ii) Find the profitability of the company as a whole at the output level which

(A) Division A's net profit is maximum. (B) Division B's net profit is maximum.

(iii) If the company is not organised on profit centre basis, what level of output will be chosen to yield the maximum profit. [8]

(b) XYZ Ltd. makes three main products, using broadly the same production methods and equipment for each. A conventional product costing system is used at present, although and Activity Based Costing (ABC) system is being considered. Details of the three products, for typical period are:

	Labour Hours per unit	Machine Hours per unit	Material per unit	Volumes unit
Product X	½	1½	₹20	750
Product Y	1½	1	₹12	1,250
Product Z	1	3	₹25	7,000

Direct labour costs ₹6 per hour and production overheads are absorbed on a machine hour basis. The rate for the period is ₹28 per machine hour. You are required:

(i) to calculate the cost per unit for each product using conventional methods. Further analysis shows that the total of production overheads can be divided as follows

	%
Costs relating to set-ups	35
Costs relating machinery	20
Costs relating materials handling	15
Costs relating to inspection	30
Total production overhead	100%

The following activity volumes are associated with the product line for the period as a whole. Total activities for the period

	Number of Set- ups	Number of movements of materials	Number of Inspections

Product X	**75**	**1**	**150**
Product Y	**115**	**2**	**180**
Product Z	**480**	**8**	**670**
	670	**12**	**1,000**

You are required:

(i) To calculate the cost per unit for each product using ABC principles;

(ii) To comment on the reasons for any differences in the costs in your answers. [8]

Answer: 5(a)

Statement showing profit of division A:

Sale per day(units)	Sale value	Cost	Profit/(loss)
	₹	₹	₹
1000	1200	1500	(300)
2000	2400	2400	-
3000	3600	3300	300
4000	4800	4200	600
5000	6000	5100	900
6000	7200	6000	1200

Profit of division B:

No of units	Sales	Transfer price	Other manufacturing cost	Total cost	Profit/(loss)
	₹	₹	₹	₹	₹
1000	5250	1200	3750	4950	300
2000	7960	2400	4500	6900	1060
3000	9900	3600	5250	8850	1050
4000	11120	4800	6000	10800	320
5000	12000	6000	6750	12750	(750)
6000	12060	7200	7500	14700	(2640)

(i) Profitability of the company at the output level where division A's net profit is maximum:

	₹
Profit of division A at 6000units	1200
Profit of division B at 6000units	(2640)
Profit /(loss)	(1440)
Division B's net profit is maximum:	
Profit of division A at 2000 units	-
Profit of division B at 2000units	1060
	1060

(ii) When the company is not organized on profit centre basis Profit at different levels of output

Units	Division A	Division B	Total
	₹	₹	₹
1000	(300)	300	—
2000	-—	1060	1060
3000	300	1050	1350
4000	600	320	920
5000	900	(750)	150
6000	1200	(2640)	(1440)

Best output level is 3000 units.

Answer: 5(b)

(i) Computation of cost per unit using Conventional Methods:

Total overheads `

X = 750 x 1.5 x 28= 31,500

Y = 1250 x 1 x 28= 35,000

Z = 7000 x 3 x 28= 5,88,000

6,54,500

Computation of Cost

	X	Y	Z
	₹	₹	₹
Materials	20	12	25
Labour	3	9	6
Overheads	42	28	84
Factory Cost	65	49	115

(ii) Under ABC Costing

	Setup Cost	Machine Cost	Machine Handling Cost	Inspection Expenses	Total
Costs(₹)	2,29,075	1,30,900	98,175	1,96,350	6,54,500
Cost Driver	No. of setups	Machine hours	No. of Moment of Materials	No. of Inspections	
Cost driver rates(₹)	341.90 (229075/670)	5.6 (130900/23375)	818.125 (98,175/120)	196.35 (196350/1000)	

Cost per unit under ABC costing

	X		Y		Z	
	₹	₹	₹	₹	₹	₹
Materials		20.00		12.00		25.00
Labour		3.00		9.00		6.00

Overheads						
Setup Cost	34.19		31.45		23.44	
Machine cost	8.40		5.60		16.80	
Machine Handling Cost	13.09		13.74		10.17	
Inspection Cost	39.27	94.95	28.27	79.06	18.79	69.20
Total Cost		117.95		100.06		100.20

6. (a) The ABC Pvt Ltd., which has a satisfactory preventive maintenances system in its plant has installed a new Hot Air Generator based on electricity instead of fuel oil for drying its finished products. The Hot Air Generator required periodic shutdown maintenance. If the shutdown is scheduled yearly, the cost of maintenance will be as under:

Maintenance Cost	Probability
₹15,000	**0.3**
₹20,000	**0.4**
₹25,000	**0.3**

The costs are expected to be almost linear, i.e., if the shutdown is scheduled twice a year the maintenance cost will be double.

There is no previous experience regarding the time taken between breakdowns. Costs associated with breakdown will vary depending upon the periodicity of maintenance.

The probability distribution of breakdown cost is estimated as under:

Breakdown Costs per annum	Shutdown once a year	Shutdown twice a year
₹75,000	**0.2**	**0.5**
₹80,000	**0.5**	**0.3**
₹1,00,000	**0.3**	**0.2**

Simulate the total costs – maintenance and breakdown costs – and recommend whether shutdown overhauling should be resorted to once a year or twice a year? [8]

6. (b) A captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows:

		Batting Position				
		III	**IV**	**V**	**VI**	**VII**
Batsmen	**A**	**40**	**40**	**35**	**25**	**50**
	B	**42**	**30**	**16**	**25**	**27**
	C	**50**	**48**	**40**	**60**	**50**
	D	**20**	**19**	**20**	**18**	**25**
	E	**58**	**60**	**59**	**55**	**53**

Make the assignment so that the expected total average runs scored by these batsmen are maximum. [8]

Answer: 6(a)

Assigning random numbers to maintenance cost once a year basis:

Cost (₹)	Probability	Random Numbers (R.N.)
15,000	0.30	00-29
20,000	0.40	30-69
25,000	0.30	70-99

Assigning random numbers to breakdown costs when overhauling is once a year basis:

Cost (₹)	Probability	Random Numbers (R.N.)
75,000	0.20	00-19
80,000	0.50	20-69
1,00,000	0.30	70-99

The total costs will be as under:

Year	R.N	Maintenance Cost	R.N.	Breakdown Cost	Total
1	27	15,000	03	75,000	90,000
2	44	20,000	50	80,000	1,00,000
3	22	15,000	73	1,00,000	1,20,000
4	32	20,000	87	1,00,000	1,20,000
5	97	25,000	59	80,000	1,05,000
			Average Annual Cost		1,06,000

Assigning random numbers to maintenance costs, on twice a year basis:

Cost	Probability	Random Numbers (RN)
30,000	0.30	00-29
40,000	0.40	30-69
50,000	0.30	70-99

Assigning random numbers to breakdown costs

Cost	Probability	Random Numbers (RN)
75,000	0.50	00-49
80,000	0.30	50-69
1,00,000	0.20	80-99

The total costs will be as under:

Year	R.N	Maintenance Cost	R.N.	Breakdown Cost	Total
1	42	40,000	54	80,000	1,20,000
2	04	30,000	65	80,000	1,10,000
3	82	50,000	49	75,000	1,25,000
4	38	40,000	03	75,000	1,15,000
5	91	50,000	56	80,000	1,30,000
			Average Annual Cost		1,06,000

[Note R.Ns. are taken from table]

Recommendation: From the above working it may be seen that shutdown maintenance/overhauling once a year will be more economical. The average annual cost will only be ₹1.06 lakhs as against 1.20 lakhs when shutdown is twice a year.

Answer: 6(b)

	III	IV	V	VI	VII
A	40	40	35	25	50
B	42	30	16	25	27
C	50	48	40	60	50
D	20	19	20	18	25
E	58	60	59	55	53

Loss Matrix

	III	IV	V	VI	VII
A	20	20	25	35	10
B	18	30	44	35	33
C	10	12	20	0	10
D	40	41	40	42	35
E	2	0	1	5	7

Row Operation

M3

10	10	14	25	0
0	12	25	17	15
10	12	19	0	10
5	6	4	7	0
2	0	0	5	7

Column Operation

10	10	15	25	$\boxed{0}$
$\boxed{0}$	12	26	17	15
10	12	20	$\boxed{0}$	10
5	6	5	7	0
2	$\boxed{0}$	1	5	7

Improved Matrix

	III	IV	V	VI	VII
A	10	6	10	25	0
B	0	8	21	17	15
C	10	8	15	0	10
D	5	2	0	7	0
E	6	0	0	9	11

Maximum Average Runs

A → VIII - 50

B → III - 42

C → VI - 60

D → V - 20

7. (a) A Company manufactures 3 products which are processed through 3 different production stages. The time required to manufacture one unit of each of the three products and the daily capacity of the stages are given in the following table:

State	**Time/unit in minutes**			
	Product	**Product 2**	**Product 3**	**Stage capacity (minutes)**
1	**1**	**2**	**1**	**430**
2	**3**	**-**	**2**	**460**
3	**1**	**4**	**-**	**420**
Profit/unit	**₹3**	**₹2**	**₹5**	

(i) Set the data in a simplex table.

(ii) Find the table for optimum solution **[8]**

(b) The following table gives data on normal time & cost and crash time & cost for a project.

Activity	Normal		Crash	
	Time (days)	Cost (₹)	Time (days)	Cost (₹)
1 – 2	6	600	4	1,000
1 – 3	4	600	2	2,000
2 – 4	5	500	3	1,500
2 – 5	3	450	1	650
3 – 4	6	900	4	2,000
4 – 6	8	800	4	3,000
5 – 6	4	400	2	1,000
6 – 7	3	450	2	800

The direct cost per day is ₹100

(i) Draw the network and identify the critical path **[8]**

(ii) What are the normal project duration and associated cost?

Answer: 7(a)

Let x_1 be the no. of units of product 1

Let x_2 be the no. of units of product 2

Let x_3 be the no. of units of product 3

Objective function: Max $Z = 3x_1+2x_2 + 5x_3$

Subject to constraints:

$x_1+2x_2+ x_3 \leq 430$

$3x_1+2x_3 \leq 460$

$x_1+4x_2 \leq 420$ and

$x_1, x_2, x_3 \geq 0$

$x_1+2x_2+ x_3+S_1 = 430$

$3x_1+2x_3 +S_2 = 460$

$x_1+4x_2 + S_3 = 420$

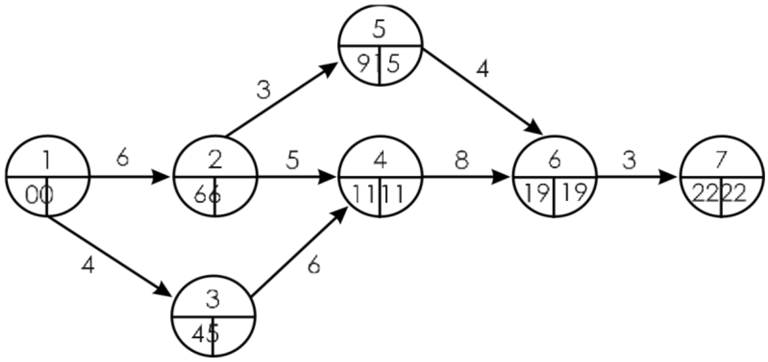
Max $Z = 3x_1+2x_2 + 5x_3+0.S_1+0.S_2+0.S_3$

$\therefore x_1 = 0, \quad x_2 = 100, \quad x_3 = 230,$

$z = 1350$

Answer: 7(b)

(i) The network for normal activity times indicates a project time of 22 weeks with the critical path 1-2-4-6-7.



(ii) Normal project duration is 22 weeks and the associated cost is as follows:

Total cost = Direct normal cost + Indirect cost for 22 weeks.

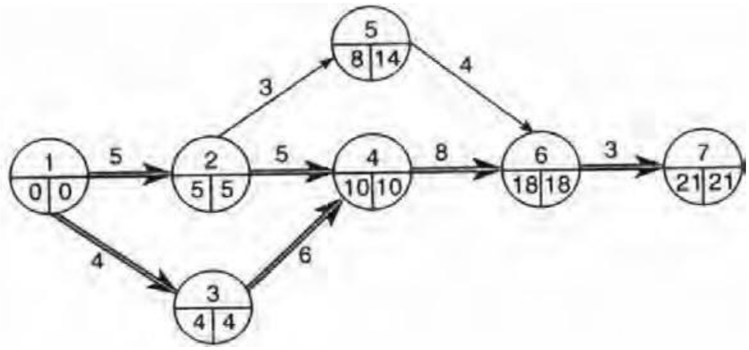
= 4,700 + 100 x 22 = ₹ 6,900.

(iii) For critical activities, crash cost - slope is given below:

Critical activity	Crash cost-slop
1-2	$\frac{1000 - 600}{6 - 4}$ = 200
2-4	$\frac{1500 - 500}{5 - 3}$ = 500
4-6	$\frac{3000 - 800}{8 - 4}$ = 550
6-7	$\frac{800 - 450}{3 - 2}$ = 350

Of the activities lying on the critical path, activity 1—2 has lowest cost slope Therefore, we shall first crash this activity by just one day.

Duration = 21 days, and cost = 4700 + 1 x 200 + 100 x 21 = ₹ 7000.



Other activities too have become critical. Now we have 2 critical paths:

1→2→3→6→7 and 1→3→4→6→7.

To reduce duration of the activity further, we shall have to reduce duration of both the paths. We have following alternatives:

Crash activity 6 — 7 by 1 day at a cost of ₹ 350.

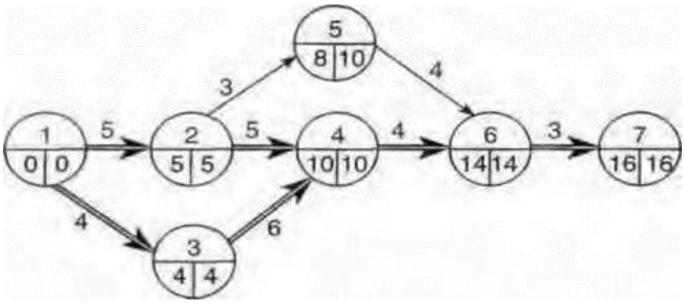
Crash activity 4 — 6 by 4 days at the cost of ₹ 550 per day.

Crash activities 1—2 and 1 — 3 by 1 day each at a cost of ₹ (200 + 700) = ₹ 900.

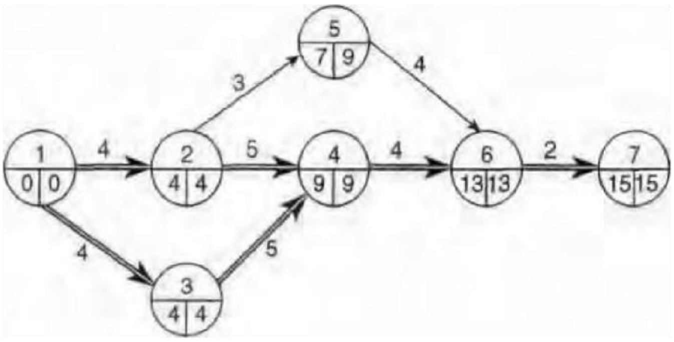
Crash activities 2 — 4 and 3 — 4 by 2 days each at a cost of ₹ (500 + 550) = ₹ 1050/day.

Thus, we shall first crash activities 6 — 7 by 1 day and then activity 4 — 6 by 4 days. On crashing activity 6 — 7 by 1 day, cost = 4900 + 350 x 1 + 100 x 20 = ₹ 7250, and duration = 20 days. Next we crash 4—6 by 4 days.

Cost = 5250 + 550 x 4 + 100 x 16 = ₹ 9050. Duration = 16 days.

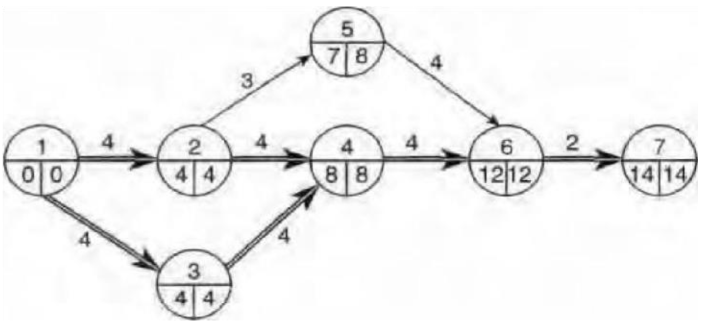


Next we crash activities 1—2 and 3—4 by 1 day each. Cost = 7450 + 200 x 1 + 550 x 1 + 100 x 15 = ₹ 9700.



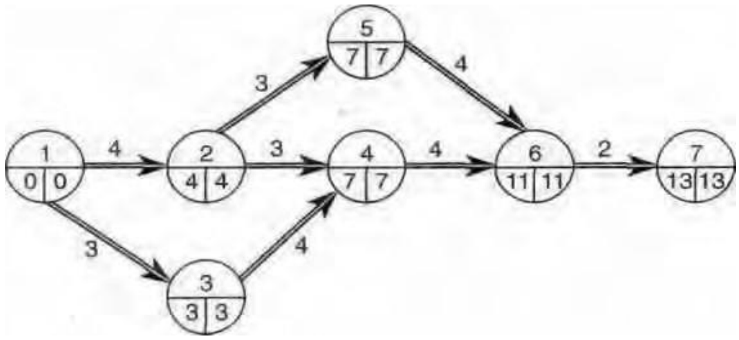
Next we crash activities 2 ⟶ 4 and 3 ⟶ 4 by 1 day each.

Cost = 8200 + 500 x 1 + 550 x 1 + 100 x 14 = ₹ 10,650. Duration = 14 days.



We crash activities 1—3 and 2—4 by 1 day each.

Cost = 9250 + 700 x 1 + 500 x 1 + 100 x 13 = ₹ 11,750 Duration = 13 days.



Now there are three critical paths:

1—2—5—6—7, 1—2—4—6—7, 1—3—4—6—7

Also, no further crashing is possible. Hence minimum duration of the project =13 days with cost ₹ 11,750.

8. Write Short note (any four) [4×4 =16]

(a) Business Process Re-engineering

(b) Cost reduction & control

(c) Socio Economic Costing

(d) Pareto Analysis

(e) Target Costing.

Answer: 8

(a) Business Process Re-engineering:

Business Process Re-engineering (BPR) refers to the fundamental rethinking and redesign of business processes to achieve improvement in critical measures of performance such as cost, quality, service, speed and customer satisfaction.

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.

Example of business process reengineering:

(i) Credit Card Approval

An applicant submits an application. The application is reviewed first to make sure that the form has been completed properly. If not, it is returned for completion.

(ii) Ford Motors

One of the best-known examples of organisations that used BPR in an effort to become more efficient is Ford Motors, a car manufacturer. Ford Motor Company is the world's second largest manufacturer of cars and trucks with products sold in more than 200 markets.

(b) Cost reduction & control:

Cost Control VS Cost Reduction: Both cost reduction and cost control are efficient tools of management but their concepts and procedure are widely different. The differences are summarised below:

Cost Control	Cost Reduction
(a) Cost Control represents efforts made towards achieving target or goal.	(a) Cost reduction represents the achievement in reduction of cost
(b) The process of cost control is to set up a target, ascertain the actual performance and compare it with the target, Investigate the variances, and take remedial measures.	(b) Cost reduction is not concern with maintenance of performance according to standard
(c) Cost control assumes the existence of standards or norms which are not challenged	(c) Cost reduction assumes the existence of concealed potential savings in standards or norms which are therefore subjected to a constant challenge with a view to improvement by bringing out savings
(d) Cost Control is a preventive function. Costs are optimized before they are incurred	(d) Cost reduction is a corrective function. It operates even when an efficient cost control system exists. There is room for reduction in the achieved costs under controlled conditions
(e) Cost control lacks dynamic approach	(e) Cost reduction is a continuous process of analysis by various methods of all the factors affecting costs, efforts and functions in an organization. The main stress is upon the why of a thing and the aim is to have continual economy in costs

(c) Socio Economic Costing:

Socioeconomics (also known as social economics) is the social science that studies how economic activity affects and is shaped by social processes. In general, it analyzes how societies progress, stagnate, or regress because of their local or regional economy, or the global economy.

In many cases, socioeconomics focus on the social impact of some sort of economic change. Such changes might include a closing factory, market manipulation, the signing of international trade treaties, new natural gas regulation, etc. Such social effects can be wide-ranging in size, anywhere from local effects on a small community to changes to an entire society. Examples of causes of socioeconomic impacts include new technologies such as cars or mobile phones, changes in laws, changes in the physical environment (such as increasing crowding within cities), and ecological changes (such as prolonged drought or declining fish stocks).

Companies are increasingly interested in measuring socio-economic impact as part of maintaining their license to operate, improving the business enabling environment, strengthening their value chains, and fuelling product and service innovation.

As a result, companies are increasingly interested in measuring their socioeconomic impact for a variety of reasons, ranging from reducing cost and risk to creating and capturing new opportunities. These reasons include:

1. Obtaining or maintaining license to operate
2. Improving the business enabling environment
3. Strengthening value chains
4. Fuelling product and service innovation

(d) Pareto Analysis:

Pareto Analysis is a rule that recommends focus on the most important aspects of the decision making in order to simplify the process of decision making. It is based on the 80: 20 rule that was a phenomenon first observed by Vilfredo Pareto, a nineteenth century Italian economist. He noticed that 80% of the wealth of Milan was owned by 20% of its citizens. This phenomenon, or some kind of approximation of it say, (70: 30 etc.) can be observed in many different business situations. The management can use it in a number of different circumstances to direct management attention to the key control mechanism or planning aspects. 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

The Pareto Analysis is generally applicable to the following business situations:

(i) Pricing of a product

(ii) Customer Profitability analysis

(iv) Application in Activity Based Costing

(v) Quality Control

(e) Target Costing: This technique has been developed in Japan. It aims at profit planning. It is a device to continuously control costs and manage profit over a product's life cycle. In short, it is a part of a comprehensive strategic profit management system. For a decision to enter a market prices of the competitors' products are given due consideration. Target Costing initiates cost management at the earliest stages of product development and applies it throughout the product life cycle by actively involving the entire value chain. In the product concept stage selling price and required profit are set after consideration of the medium term profit plans, which links the operational strategy to the long term strategic plans.

Target Cost = Planned Selling Price - Required Profit.

The main features or practices followed in Target Costing are

Step 1 - Identify the market requirements as regards design, utility and need for a new product or improvements of existing product.

Step 2 - Set Target Selling Price based on customer expectations and sales forecasts.

Step 3 - Set Target Production Volumes based on relationships between price and volume.

Step 4 - Establish Target Profit Margin for each product, based on the company's long term profit objectives, projected volumes, and course of action, etc.

Step 5 - Set Target Cost (or Allowable cost) per unit, for each product. Target cost = Target selling price less Target profit margin

Step 6 - Determine Current Cost of producing the new product, based on available resources and conditions.

Step 7 - Set cost reduction Target in order to reduce the Current Cost to the Target Cost.

Step 8 - Analyze the Cost Reduction Target into various components and identify cost reduction opportunities using Value Engineering (VE) and Value Analysis (VA) and Activity Based Costing (ABC)

Step 9 - Achieve cost reduction and Target profit by Effective Implementation of Cost Reduction decisions

Step 10 - Focus on further possibilities of cost reduction ie Continuous Improvement program.