Paper 15 – Strategic Cost Management and Decision Making

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

Section A

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

(i) A company has forecast sales and cost of sales for the coming year as ₹ 25 lakhs and ₹ 18 lakhs respectively.
The inventory turnover has been taken as 9 times per year. In case the inventory turnover increases to 12 times and the short term interest rate on working capital is taken as 10%, what will be saving in cost?
(a) ₹ 10,000 (b) ₹ 20,000 (c) ₹ 15,000 (d) ₹ 5,000

(ii) Which of the following would decrease unit contribution margin the most?
(a) 15% decrease in selling price (b) 15% increase in variable costs
(c) 15% decrease in variable costs (d) 15% decrease in fixed costs

(iii) When allocating service department costs to production departments, the method that does not consider different cost behavior patterns is the
(a) Step method (b) Reciprocal method
(c) Single-rate method (d) Dual-rate method.

(iv) 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

(v) A company is to market a new product. It can produce up to 1,50,000 units of this product. The following are the estimated cost data:

	Fixed Cost	Variable Cost
For production up to 75,000 units	₹ 8,00,000	60%
Exceeding 75,000 units	₹ 12,00,000	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

(vi) The following details relate to two competing companies, Alps and Himalayas, for identical projects:
I. The net present value (NPV) of Alps is ₹ 20,000 and its internal rate of return (IRR) is 18%.
II. For the same life period, Himalayas' estimated cash flows are:

Year	₹ '000
0	(450)
1	300
2	200
3	100

And its cost of capital is 15%.

Which one of the following combinations is correct concerning the NPV and the IRR of the two projects?

Projects	
Alps	Himalayas

A) Higher NPV	**Higher IRR**
B) Higher NPV	**Lower IRR**
C) Lower NPV	**Higher IRR**
D) Lower NPV	**Lower IRR**

(vii) Nulook Ltd. Uses a JIT system and back flush accounting. It does not use a raw material stock control account During May, 8000 units were produced and sold. The standard cost per unit is ₹100; this includes materials of ₹45. During May, ₹4,80,000 of conversion costs were incurred.
The debit balance on cost of goods sold account for May was
(a) ₹ 8,00,000 (b) ₹ 8,40,000 (c) ₹ 8,80,000 (d) ₹ 9,20,000

(viii) A company has estimated the selling prices and the variable costs of one of its products as under:

Probability	Selling price (per unit)	Probability	Variable cost (per unit)
0.25	60	0.25	30
0.45	75	0.40	45
0.30	90	0.35	60

The company will be able to produce and sell 4,000 units in a month irrespective of the selling price. The selling price and variable cost per unit are independent of each other. The specific fixed cost relating to this product is ₹ 20,000. The probability that the monthly net profit of the product will be ≥ ₹ 1,20,000 is
(a) 0.2525 (b) 0.4512 (c) 0.3825 (d) 0.3075

(ix) In calculating the life cycle costs of a product, which of the following items would be included?
A. Planning and concept design costs
B. Preliminary and detailed design costs
C. Testing costs
D. Production costs
E. Distribution costs
(a) All of the above (b) D and E (c) B, D and E (d) D

(x) 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.

Answer:

(i) (d)

$$\text{Saving Cost} = \frac{18,00,000}{9} \times \frac{10}{100} - \frac{18,00,000}{12} \times \frac{10}{100}$$

(ii) (a)
A given percentage change in unit sale price must have greater effect on contribution margin than any other factor affected by the same percentage change.

(iii) (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.

(iv) (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

(v) (b)

At a production of 75,000 units or less the fixed costs amount to ₹8 lakh Contribution is ₹10 per unit (₹25 - 60% of ₹ 25). Production will however, be more than this level. Total fixed cost is then ₹ 12 lakh.

Contribution for first 75,000 units = ₹7,50,000

Hence, to meet ₹12 lakh fixed cost, further ₹4,50,000 contribution is required.

Contribution beyond 75,000 units is ₹ 12.5 (₹ 25 - 50% of ₹25).

Additional units to be sold = ₹4,50,000 / ₹12.50 = 36,000) units = 1,11,000 units.

(vi) (c)

Working for Himalayas

Year	CF Rs	DF at 15%	PV Rs	DF at 20%	PV Rs
0	(450)	1.000	(450)	1.000	(450)
1	300	0.870	261	0.833	250
2	200	0.756	151	0.694	139
3	100	0.658	66	0.57	58
		NPV	28		(3)

Hence IRR = 20% (approx.)

Projects

Alpas	Himalayas
Lower NPV	Higher IRR

(vii) (b)

	₹
Cost of goods sold	8,00,000
(Less) Material cost	(3,60,000)
Conversion cost allocated	4,40,000
Conversion cost incurred	4,80,000
Excess charged to cost of goods sold account	40,000

Total dedit on cost of goods sold account = Rs. 8,00,000 + Rs. 40,000 = Rs. 8,40,000

(viii) (d)

The sales demand is 4,000 units per month. The monthly contribution must absorb the fixed costs of ₹20,000 and leave at least a surplus of ₹1,20,000 profit. So, the contribution per unit must be ₹1,40,000/4,000 units = ₹ 35 in the minimum.

The following selling price and variable cost pairs will produce a contribution of more than ₹35.

Selling Price	Variable Cost	Contribution	Joint Probability of SP & VC
₹	₹	₹	
75	30	45	0.45 x 0.25 = 0.1125
90	30	60	0.30 x 0.25 = 0.0750
90	45	45	0.30 x 0.40 = 0.1200
			0.3075

(ix) (a)
All the costs mentioned in the question are parts of the total life cycle costs.

(x) (b)

Section B

Answer any five questions from Question No. 2 to 8
Each question carries 16 marks. [5 × 16 = 80]

2. (a) Desktop Co. manufactures and sells 7,500 units of a product. The full Cost per unit is ₹ 100. The Company has fixed Its price so as to earn a 20% return on an Investment of ₹ 9,00,000.
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 ₹ 115. At this price, the Company would have sold 6,750 units. Should the company have increased the Selling price to ₹ 230? [2+2+2=6]

(b) A local Government authority owns and operates a leisure centre with numerous sporting facilities, residential accommodation, a cafeteria and a sports shop. The summer season lasts for 20 weeks including a peak period of 6 weeks corresponding to the school holidays. The following budgets have been prepared for the next summer season:
Accommodation:
60 single rooms let on a daily basis.
35 double rooms let on a daily basis at 160% of the single room rate.
Room rate:
Fixed costs ₹ 29,900.
Variable costs ₹ 4 per single room per day and ₹ 6.40 per double room per day
Sports centre:
Residential guests each pay ₹ 2 per day and casual visitors ₹ 3 per day for the use of facilities. Fixed costs ₹ 15,500.
Sports Shop:
Estimated contribution ₹ 1 per person per day.
Fixed costs ₹ 8,250.
Cafeteria:
Estimated contribution ₹ 1.50 per person per day.
Fixed costs ₹ 12,750.
During the summer season the centre is open 7 day a week and the

Following activity levels are anticipated.

Double rooms fully booked for the whole season.

Single rooms fully booked for the peak period but at only 80% of

Capacity during the rest of the season.

30 casual visitors per day on average.

You are required to:

i) Calculate the charges for single and double rooms assuming that the authority wishes to make a ₹ 10,000 profit on accommodation.

ii) Calculate the anticipated total profit for the leisure centre as a whole for the season.

[5+5=10]

Answer:

(a) (i) **Computation of selling price and mark – up % on the full Cost per unit**

Target Sale Price per unit = Full Cost + Target Profit = ₹100 +	₹124
So, mark – up price is	24%

(ii) **Computation of variable Cost per unit:**

Above sale Price ₹124 = VC + 40% thereon, i.e. 140% on Vc. so, Var. cost $\frac{₹124}{140\%} = ₹89$

(iii) **Calculate the company's income if selling price are increased**

Present contribution at 7,500 units = (₹124 – ₹ 89) × 7,500 units = ₹ 2,62,500
Revised contribution at 6,750 units = (₹115 – ₹89) × 6,750 units = ₹ 1,75,500
₹87,000

Hence, Increase in Sale Price is not beneficial due to reduction in Contribution by ₹87,000

2 (b) (i) Computation of usage of room days

		₹
single room		
(60 × 7 × 6)	2,520.00	
(60 × 7×14×80%)	4,704.00	
		7,224.00
Double room (35×7×20)		4,900.00
i) total sale value of accommodation		
Variable cost		
Single room (7224×4)	28,896.00	
Double room (4900×4)	31,360.00	60,256.00
Fixed cost		29,900.00
Required profit		10,000.00
		100,156.00

Let 'S' be the room rent of single room and 1.6'S' is the rent of double room Therefore
7224S + 4900(1.6S) = 100516
7224s + 7840s = 100516 = s = 6.65
Double room rent =(6.65 × 1.6) = 10.64

(ii) Statement showing computation of total profit to leisure centre

			₹
a. Accommodation			10,000.00
b. Sports centre:			
Total	[(7224 × 2) + (4900 × 2 × 2) + (30 × 7 × 20 × 3)]	46,648.00	

		15,550.00	31,148.00
Less: Fixed			
c. Sports centre:			
Contribution	[(7224 × 1) + (4900 × 2 × 1) + (30 × 7 × 20 × 1)]	21,224.00 8,250.00	12,974.00
Less: Fixed			
d. Cafeteria			
Contribution	[(7224 ×1.5) + (4900 ×2 ×1.5)+(30 ×7 ×20 × 1.5)]	31,836.00 12,750.00	19,086.00
Less: Fixed			
			73,208.00

3. A firm has two machines, namely, machine 'P' and machine 'Q'. Machine 'P' can be used for the production of either product 'A' or product 'B' or both. Machine 'Q' can be used for the production of either product 'X' or product 'Y' or both. In order to maintain customer relations a minimum quantity of 1500 units each of 'A' and 'B' and 1200 units each of 'X' and 'Y' should be produced by the firm.
The production and cost data for 2016 are as under:
Machine hours available P - 4500 hours
Q - 5100 hours

	PRODUCTS			
	A	**B**	**X**	**Y**
Machine used	**P**	**P**	**Q**	**Q**
Machine hours required per unit of out put	**1.0**	**1.25**	**1.25**	**0.8**
Selling price per unit	**₹ 200**	**₹ 250**	**₹ 300**	**₹ 256**
Direct material per unit	**80**	**100**	**100**	**80**
Direct labour per machine hour	**90**	**80**	**100**	**125**
Variable overhead per machine hour	**12**	**12**	**20**	**20**

Fixed overheads are ₹4 lacs per annum. An additional expenditure involving a fixed overhead of ₹25,000 per annum will convert the machine P and Q into a versatile centre such that any four of the products can be manufactured on these two machines. The rate of output on these machines and direct wage rate will, however, remain the same.
Required:

i) Set an optimal product mix subject to minimum market commitments both before and after the conversion of the machines into a versatile centre.
ii) Evaluate the profitability under the two sets or product mixes.
iii) Advise the management whether the conversion of machine should be undertaken or not. [7+7+2=16]

Answer:

Statement showing computation of Contribution per machine hour & determination of priority for profitability:

		A	B	X	Y
		₹	₹	₹	₹
I	Selling Price	200	250	300	256
II	Variable Cost				
	Direct material	80	100	100	80
	Direct Labour	90	100	125	100
	Variable Overhead	12	15	25	16
		182	215	250	196

III	Contribution	18	35	50	60
IV	Contribution per hour	18	28	40	75
V	Priority	IV	III	II	I

Statement showing optimum product mix under the given condition & computation of profit before conversion of machines into Versatile:

		A	B	X	Y	Total
	Minimum units to be produced	1500	1500	1200	1200	
	Units in remaining hours	--	900	--	3300	
I	No. of units	1500	2400	1200	4500	
II	Contribution per unit	18	35	50	60	
III	Total contribution	27000	84000	60000	270000	441000
IV	Fixed Cost					400000
V	Profit					41000

Working Notes

		P		Q
Available Hours		4,500	1500	5,100
A	1,500 × 1		1,200 × 1.25	
B	1,500 × 1.25	3,375	1,200 × 0.8	2,460
		1,125		2,640
No. of Units = 1125/1.25		900	2,640/0.8	3,300

Statement showing optimum mix under the given condition & computation of profit at that mix after conversion of machines into Versatile:

			A	B	X	Y	Total
	minimum units to be produced		1500	1500	1200	1200	
	Units in remaining hours		--	--	--	4706.25	
I	No. of units		1500	1500	1200	5906.25	
II	Contribution per unit	₹	18	35	50	60	
III	Total contribution	₹	27000	52500	60000	354375	493875
IV	Fixed Cost	₹					425000
V	Profit	₹					68875

Working Notes:

Total No. of hours = 9,600
Hours utilized (3,375 + 2,460) = 5,835
3,765
Units of Y = 3,765/0.8 = 4,706 Units

As the profit is increased by ₹27,875 it is advised to convent the machines into versatile centers.

4. (a) Despite the increase in the sales price of its sole product to the extent of 20%, a company finds that it has incurred a loss during the year 2012-13 to the extent of ₹4 lakhs as against a profit of ₹5 lakhs made in 2011-12. This adverse situation is attributed mainly to the increase in prices of materials and overheads, the increase over the previous year being on the average, 15% and 10% respectively.
The following figures are extracted from the books of the company:

	31-3-2012	31-3-2013
Sales	**1,20,00,000**	**1,29,60,000**

Cost of Sales:		
Material	**80,00,000**	**91,10,000**
Variable overhead	**20,00,000**	**24,00,000**
Fixed overhead	**15,00,000**	**18,50,000**

Required: Analyze the variances over the year in order to bring out the reasons for the fall in profit. [12]

(b) What is inter-firm comparison? [4]

Answer:

(a)

Statement of figures extracted from the books of the company

Year		2011-12	2012-13 (based on 2011-12 prices)	Difference
(a)		(b)	(c)	(b) - (c)
Sales	(W.N. 1)	120	*108.00	12
Cost of sales:				
Material	(W.N. 2)	80	79.22	
Variable overhead	(W.N. 3)	20	21.82	
Fixed overhead	(W.N. 4)	15	16.82	

*Decrease in sales = ₹ 120 - ₹ 108 = ₹ 12 lakhs or 10% of 2011-12 sales figure at 2012-13 rate

Contribution to sales ratio during 2011-12 = $\frac{\text{Sales - variable costs}}{\text{Sales}}$

$= \frac{₹120 - ₹100}{₹120}$ or (1/6) of per rupee sale

Loss of contribution during 2012-13 on the sale of 12 lakhs = ₹12 lakhs × 1/6 = ₹2 lakhs

Computation of Variances

Sales Price Variance

= Actual sales - Standard sales

= ₹ 129.60 - ₹ 108 = ₹ 21.60 lakhs (F)

Material Price Variance

= Standard cost of actual quantity - Actual cost

= ₹ 79.22 - ₹ 91.10 = ₹ 11.88 lakhs (A)

Variable Overhead Expenditure Variance

= Budgeted variable overhead for actual hours - Actual variable overhead

= (₹ 21.82 - ₹ 24) = ₹ 2.18 lakhs (A)

Variable Overhead Efficiency Variance

= Std. variable overhead for standard hours - Std. variable overhead for actual hours

= ₹ 18 - ₹ 21.62 = ₹ 3.62 lakhs (A)

* Variable overhead in 2011-12 was ₹ 20 lakhs. Since there was a decrease in sales in 2012-13 to the extent of 10% of 2011-12 sales figure (based on 2011-12 prices). Therefore, the standard variable overhead for standard hours at this reduced sales in 2012-13 would be equal to (₹ 20 lakhs *minus* 10% of 20 lakhs) i.e. (₹ 20 lakhs - ₹ 2 lakhs) = ₹ 18 lakhs.

Fixed Overhead Expenditure Variance

= Budgeted fixed overhead - Actual fxed overhead

= ₹ 16.82 - ₹ 18.50 = ₹ 1.68 lakhs (A)

Fixed Overhead Volume Variance

= Std. fixed overhead for actual output - Std. fixed overhead for budgeted output

= (16.82-15) = ₹ 1.82 lakhs (A)

Reconciliation Statement

Particulars		(₹)
Profit during 2011 -12		5,00,000
Add: Net increase in profit due to the sales of 2011-12 [after taking into account increase in sales price but decrease in contribution margin due to decrease in quantum (vol. of sales)] (Refer to working note 5)		19,60,000 24,60,000
Less: Usage/Efficiency variance		
Material	7,22,000	
Variable overhead	3,82,000	
Fixed overhead volume variance	1,82,000	12,86,000
Less: Price variances		
Material price variance	11,88,000	
Variable overhead expenditure variance	2,18,000	
Fixed overhead expenditure variance	1,68,000	15,74,000
Loss during 2012-13 (Difference figure)		4,00,000

Conclusion:

The reasons for the decrease in the total profit figure of the year 2012-13 (inspire of the increase in sales price) are due to adverse - (i) Usage/efficiency variances to the extent of? 12,86,000 and (ii) Price variances to the extent of ₹15,74,000.

(1) Sales during 2010-11 at 2009-10 price level	$= \frac{129.60}{120} \times 100$	= ₹108 lakhs
(2) Material cost of 2010-11 at 2009-10 price level	$= \frac{91.10}{115} \times 100$	= ₹79.22 lakhs
(3) Variable overhead of 2010-11 at 2009-10 price level	$= \frac{24}{110} \times 100$	= ₹21,82 lakhs
(4) Fixed overhead of 2010-11 at 2009-10 price level	$= \frac{18.50}{110} \times 100$	= ₹16.82 lakhs
(5) Net increase in profit due to rise of 20% of S.P. and reduction in contribution due to reduction in sales	= 129.6 – 108-2	= ₹19.6 lakhs

4 (b)

Inter-firm comparison as the name denotes means the techniques of evaluating the performances, efficiencies, deficiencies, costs and profits of similar nature of firms engaged in the same industry or business. It consists of exchange of information, voluntarily of course, concerning production, sales cost with various types of break-up, prices, profits, etc., among the firms who are interested of willing to make the device a success. The basic purposes of such comparison are to fnd out the work points in an organisation and to improve the efficiency by taking appropriate measures to wipe out the weakness gradually over a period of time.

5. (a) A Company with two manufacturing divisions is organised 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 KLIM. One such part is used each unit of the product KLIM. As the demand for the product is not steady. Division B can obtain orders 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 KLIM (₹)
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 KLIM 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 his 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. [3+(1+1)+3= 8]

(b) The budgeted overheads and cost driver volumes of XYZ are as follows.

Cost Pool	Budgeted Overheads (₹)	Cost Driver	Budgeted Volume
Material procurement	**5,80,000**	**No. of orders**	**1,100**
Material handling	**2,50,000**	**No. of movements**	**680**
Set-up	**4,15,000**	**No. of set ups**	**520**
Maintenance	**9,70,000**	**Maintenance hours**	**8,400**
Quality control	**1,76,000**	**No. of inspection**	**900**
Machinery	**7,20,000**	**No. of machine hours**	**24,000**

The company has produced a batch of 2,600 components of AX-15, its material cost was ₹1,30,000 and labor cost ₹2,45,000. The usage activities of the said batch are as follows.

Material orders – 26, maintenance hours – 690, material movements – 18, inspection – 28, set ups – 25, machine hours – 1,800

Calculate – cost driver rates that are used for tracing appropriate amount of overheads to the said batch and ascertain the cost of batch of components using activity Based Costing. [8]

Answer:

(a)

(i) 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)

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

	₹
Profit of division A at 6000units	1,200
Profit of division B at 6000units	(2,640)
Profit /(loss)	(1,440)
Division B's net profit is maximum:	
Profit of division A at 2000 units	-
Profit of division B at 2000units	1060
	1,060

(iii) 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 3,000 units

5 (b)

Computation of Cost Driver rates

	Particulars		**Amount (₹)**
1.	Material procurement	580000/1100	527
2.	Material handing	250000/680	368
3.	Set-up	415000/520	798
4.	Maintenance	970000/8400	115
5.	Quality control		196
6.	Machinery	720000/24000	30

Computation of batch cost of 2,600 units of AX- 15

		₹
Material cost		1,30,000

Labour cost		2,45,000
Prime cost		3,75,000
Add: overheads		
Material orders 26 x 527	13,702	
Material handling 18 x 368	6,624	
Set-up 25 × 798	19,950	
Maintenance 690 × 115	79,350	
Quality Control 28 × 196	5,488	
Machinery 1800 × 30	54,000	1,79,114
Total Cost		**5,54,114**

6. (a) A firm received an order to make and supply eight units of standard product which involves intricate labor operations. The first unit was made in 10 hours. It is understood that this type of operations is subject to 80% learning rate. The workers are getting a wages rate of ₹ 12 per hour.

(i) What is the total time and labour cost required to execute the above order?

(ii) If a repeat order of 24 units is also received from the same customer, what is the labour cost necessary for the second order? [3+3=6]

(b) A Company has 4 factories F_1,F_2,F_3 and F_4, manufacturing the same product. Production and raw material costs differ from factory to factory and are given in the table below in the first two rows. The transportation costs from the factories to the sales depots S_1, S_2 and S_3 are also given. The last two columns in the table below give the sales price and total requirements at each depot and the production capacity of each factory is given in the last row.

	F_1	F_2	F_3	F_4	Sales Price/Unit (₹)	Requirement
Production Cost/Unit (₹)	**15**	**18**	**14**	**13**		
Raw Materials Cost/Unit (₹)	**10**	**9**	**12**	**9**		
Transportation Cost/Unit (₹)						
S_1	**3**	**9**	**5**	**4**	**34**	**80**
S_2	**1**	**7**	**4**	**5**	**32**	**120**
S_3	**5**	**8**	**3**	**6**	**31**	**150**
Production capacity	**10**	**150**	**50**	**100**		

Determine the optimal solution and the associated profit by using the Vogel's Approximation Method (VAM). [10]

Answer:

(a)

80% Learning Curve results are given below:

Production (Units)	Cumulative Average Time (hours)	Total Time (hours)
1	10	10
2	8	16
4	6.4	25.6
8	5.12	40.96
16	4.096	65.54
32	3.2768	104.86

Labour time required for first eight units = 40.96 hours

Labour cost required for 8 units = 40.96 hours × ₹ 12/hr = ₹ 491.52

Labour time for 32 units = 104.86 hours

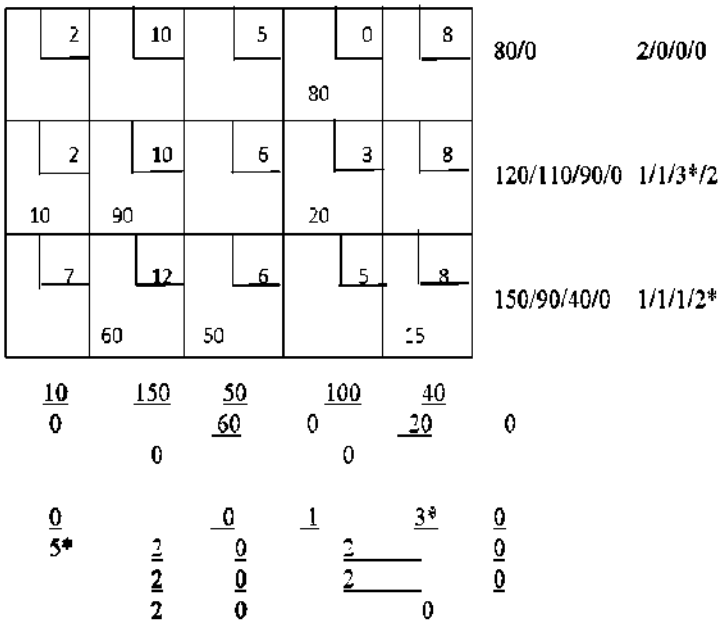
Labour time for first eight units = 40.96 hours

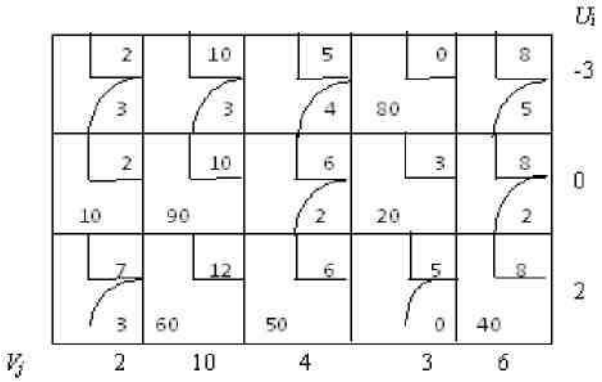
Labour time required for 2nd order for 24 units = 36.90 hours

Labour cost for 24 units = 63.90 hours × ₹ 12/hr = ₹ 766.80

6 (b)

Loss Matrix





As Δ_{ij} is ≥ 0, the solution is optimum

			Qty		Maximum Profit
S_1	F_4	→	80 × 8 =		640
S_2	F_1		10 × 6 =		60
	F_2		90 × (-2) =	(-)	180
F_4			20 × 5 =		100
F_3	F_2		60 × -4 =	(-)	240
	F_3		50 × 2 =		100
	Dumy		60 × 0 =		0
			350		**₹ 480**

7. (a) 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 indirect cost per day is ₹ 100

(i) Draw the network and identify the critical path.

(ii) What are the normal project duration and associated cost? [8]

(b) A Factory 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:

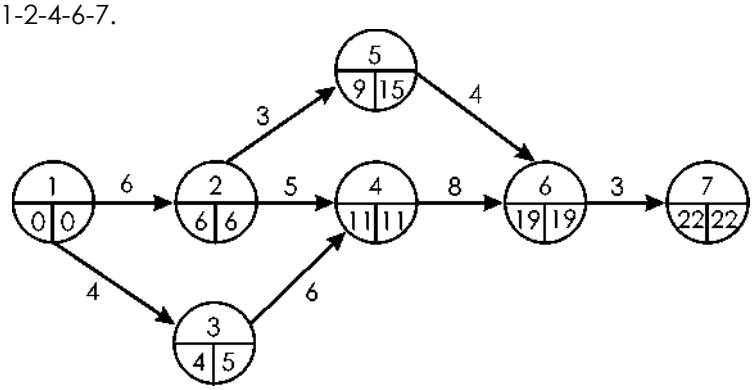
State	Time/unit in minutes			
	Product	Product 2	Product 3	Stage capacity (minutes)
1	1	2	1	430
2	3	-	2	460
3	1	4	-	420
Profit/unit	₹ 3	₹ 2	₹ 5	

Formulate LPP. [8]

Answer:

(a)

(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.

7 (b)

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

$x_1 = 0$

$x_2 = 100$

$x_3 = 230$

z = 1350

8. Write short notes on any four out of the following 5 questions. [4 ×4=16]

(a) Throughput Accounting
(b) Lean Accounting
(c) Cost Control Vs. Cost Reduction
(d) Total Quality Management (TQM)
(e) Benefits of ERP.

Answer:

(a) Throughput accounting:

Throughput accounting is a management accounting technique used as a performance measure in the theory of constraints. It is the business intelligence used for maximizing profits. It focuses importance on generating more throughputs. It seeks to increase the velocity or speed of production of products and services keeping in view of constraints. It is based on the concept that a company must determine its overriding goal and then it should create a system that clearly defines the main capacity constraint that allows it to maximize that goal. The changes that this concept causes are startling.

Throughput accounting is a system of performance measurement and costing which traces costs to throughput time. It is claimed that it complements JIT principles and forces attention to the true determinants of profitability. Throughput accounting is defined as follows:

Throughput Concepts:

a few new terms are used in throughput accounting. they are explained as below:

Throughput:

Throughput is the excess of sales value over the totally variable cost. that is nothing but contribution margin left after a product's price is reduced by the amount of its totally variable cost.

Totally Variable Cost:

This cost is incurred only if a product is produced. in many cases only direct materials are considered as totally variable cost. Direct labour is not totally variable, unless piece rate wages are paid.

Capacity Constraints:

it is a resource within a company, that limits its total output. For example, it can be a machine that can produce only a specified amount of a key component in a given time period, thereby keeping overall sales from expanding beyond the maximum capacity of that machine. there may be more than one capacity constraint in a company, but rarely more than one for a specified product or product line.

Throughput (or Cycle) Time:

Throughput (or cycle) time is the average time required to convert raw materials into finished goods ready to be shipped to customer. it includes the time required for activities such as material handling, production processing, inspecting and packaging.

Throughput Time Ratio:

it is the ratio of time spent adding customer value to products and services divided by total cycle time. it is also known as the 'ratio of work content to lead time'.

Total factory Cost:

With the exception of material costs, in the short run, most factory costs (including direct labour) are fixed. These fixed costs can be grouped together and called total factory costs (TFC).

(b) Lean Accounting:

What we now call lean manufacturing was developed by Toyota and other Japanese companies. Toyota executives claim that the famed Toyota Production System was inspired by what they learned during visits to the Ford Motor Company in the 1920s and developed by Toyota leaders such as Taiichi Ohno and consultant Shigeo Shingo after World War II. As pioneer American and European companies embraced lean manufacturing methods in the late 1980s, they discovered that lean thinking must be applied to every aspect of the company including the financial and management accounting processes.

Lean Accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking. Most companies embarking on lean manufacturing soon find that their accounting processes and management methods are at odds with the lean changes they are making. The reason for this is that traditional accounting and management methods were designed to support traditional manufacturing; they are based upon mass production thinking. Lean manufacturing breaks the rules of mass production, and so the traditional accounting and management methods are (at best) unsuitable and usually actively hostile to the lean changes the company is making

(c) 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 summarized 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	(b) cost reduction is not concern with maintenance of performance according to standard

take remedial measures.	
(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

(d) Total Quality management:

Total Quality management is a philosophy of continuously improving the quality of all the products and processes in response to continuous feedback for meeting the customers' requirements. It aims to do things right the first time, rather than need to fix problems after they emerge (A company should avoid defects rather than correct them). Its basic objective is customer satisfaction.

The elements of TQM are:

Total	Quality involves everyone and all activities in the company (Mobilizing the whole organization to achieve quality continuously and economically)
Quality	Understanding and meeting the customers' requirements. (Satisfying the customers first time every time)
Management	Quality can and must be managed (Avoid defects rather than correct them)

TQM is a vision based, customer focused, prevention oriented, continuously improvement strategy based on scientific approach adopted by cost conscious people committed to satisfy the customers first time every time. It aims at Managing an organization so that it excels in areas important to the customer.

The underlying principles of TQM:

The philosophy of TQM rest on the following principles which are enlisted below:

- Clear exposition of the benefits of a project.
- Total Employee involvement (TEI).
- Process measurement.
- Involvement of all customers and contributors.
- Elimination of irrelevant data.
- Understanding the needs of the whole process.
- Use of graphical and pictorial techniques to achieve understanding.
- Establishment of performance specifications and targets.
- Use of errors to prompt continuous improvement.

- Use of statistics to tell people how well they are doing

(e) Benefits of Enterprise Resource Planning:

The benefits accruing to any business enterprise by implementing an ERP package are unlimited.

- **Product Costing:** determination of cost of products correctly, is quite critical for every industry. ERP supports advance costing methods, including standard costing, actual costing and activity –based costing. Additionally, all costing methods and information can be fully integrated with finance. This provides the company with essential financial information for monitoring controlling costs.
- **Inventory Management:** ERP can be used in multi-national, multi – company, and multi—site manufacturing and distribution environments. This system simplifies complicated logistics by allowing one to plan and manage companies in different countries as a single unit and its advanced functionality allows one to process product and financial information flows in several different ways.
- **Distribution & delivery** : Delivery and distribution in ERP lets one to define logistics processes, flexibly and efficiently to deliver the right product from the right warehouse to the right customer at the right time –every time. to the customer, the most important element of quality is one-time delivery. it doesn't matter how well a product is made if arrives late. Processing distribution or acquisition orders involves several closely related activities.
- **E – Commerce:** Internet enables ERP offers Internet, Intranet and extranet solutions for business, business to consumer, employee self-service and more.
- **Automatic Control:** it ensure automatic quality control procedure.
- **After Sales Service:** it ensures better after sales service.
- **Improvement in Production Planning:** it improved production planning.
- **Quick response:** It enables quick response to change in business operations & market conditions.
- **Cumulative Edge's:** it helps to achieve competitive advantages by improving business process.