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 questionNo.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) A company has over-absorbed fixed production overheads for the period by ₹6,000. The fixed production overhead absorption rate was ₹8 per unit and is based on the normal level of activity of 5,000 units. Actual production was 4,500 units. What was the actual fixed production overheads incurred for the period?
   (a) ₹30,000
   (b) ₹34,000
   (c) ₹40,000
   (d) ₹42,000

(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) A company determines its selling price by marking up variable costs 60%. In addition, the company uses frequent selling price mark downs to stimulate sales. If the mark downs average 10%, what is the company's contribution margin ratio?
   (a) 27.5%
   (b) 30.6%
   (c) 37.5%
   (d) 41.75%

(iv) If the capacity usage ratio of a production department is 90% and activity ratio is 99%, then the efficiency ratio of the department is ____%.
   (a) 120
   (b) 110
   (c) 90
   (d) 80

(v) A chemical is manufactured by combining two standard items of input A (standard price ₹60/kg) and B (₹45/kg) in the ratio of 60%:40%. 10% of input is lost during processing. If during a month 1,200kg of the chemical is produced incurring a total cost of ₹69,600, the total material cost variance will be _____.
(a) ₹2,400 (A)
(b) ₹2,400 (F)
(c) ₹3,000 (A)
(d) ₹2,000 (F)

(vi) 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) ₹3,000
(c)₹10,000
(d) ₹30,000

(vii) A company absorbs overheads on machine hours. In a period, actual machine hours were 17,285, actual overheads were ₹4,96,500 and there was under-absorption of ₹12,520. What was the budgeted overheadabsorption rate per machine hour (to the nearest ₹)?
(a) 29
(b) 28
(c) 27
(d) 26

(viii)Z plc provides a single service to its customers. An analysis of its budget for the year ending 31st Dec shows that in period 4, when the budgeted activity was 5,220 service units with a sales value of ₹42 each, the margin of safety was 19.575%. The budgeted contribution to sales ratio of the service is 40%. Budgeted fixed costs in period 4 were nearest to:
(a) ₹1,700
(b) ₹71,000
(c) ₹88,000
(d) ₹1,76,000

(ix) ABC is defined as cost attribution to _____ on the basis of benefit received from indirect activities.
(a) Cost units
(b) Cost objects
(c) Cost centres
(d) Production units

(x) **A company operates through accounting system. The details of product X per unit are as under: selling price ₹50; Material cost ₹20; Conversion cost ₹15.**

Time on bottleneck resources 10 minutes.

The return per hour for product X is:

(a) ₹210

(b) ₹180

(c) ₹300

(d) ₹90

Answer:

1. **(i)** (a) ₹30,000

Absorbed overheads (4,500 units x ₹8)	= ₹36,000
Over absorbed overheads	= (₹6,000)
Actual overheads incurred	= ₹30,000

(ii) (a)15% decrease in selling price

Unit contribution margin (UCM) equals unit selling price minus unit variable costs. It can be decreased by either lowering the price or raising the variable costs. As long as UCM is positive, a given percentage change in selling price must have a greater effect than an equal but opposite percentage change in variable cost.

(iii) (b) 30.6%

When,

Variable cost =100 (assumed at 60%)

Selling price = 100 + 60 = 160

Contribution = 160 – 100 =60

Selling price (after 10% markdown of selling price) = 160 x 90/100 = 144

Contribution (after 10% markdown of selling price) = 60 – 16 = 44

Contribution margin ratio = $\dfrac{44}{144}$ x100 = 30.555% or 30.6%

(iv) (b) 110

Efficiency ratio = $\dfrac{\text{Activity ratio}}{\text{Capacity ratio}} = \dfrac{99\%}{90\%} = 110\%$

(v) (b)₹2,400 (F)

Material	Quantity	Rate	Amount
	Kgs.	(₹)	(₹)
A	60	60	3,600
B	40	45	1,800
	100		5,400
Less:	10		
	90		

Standard cost of output = ₹5,400/90 kgs   = ₹60/kg

Material cost variance   = (1,200 kg x ₹60) –₹69,600 = ₹2,400(F)

(vi) (b)₹3,000

Net inflow = Rework income – Cost of rework
= ₹18,000 –₹10,000 = ₹8,000

The original price of ₹30,000 is not relevant and only ₹8,000 is relevant for decision making. The other alternative relevant cash flow is from sale of scrap i.e., ₹3,000. Hence, the opportunity cost is ₹3,000.

(vii) (b) 28

Actual overheads incurred ₹4,96,500
Under-absorbed overhead ₹12,520
Actual overheads absorbed ₹4,83,980

$$\frac{Actual\ overheads\ absorbed}{Actual\ machine\ hours} = Amount\ absorbed\ per\ machine\ hour$$

$$\frac{4,83,980}{17,285} = 28\ per\ machine\ hour$$

(viii) (b) ₹71000

Break-even point (units) = 5,220 – (19.575% x 5,220)
= 4,198 units

Fixed costs   = Contribution at the break-even point
= 4,198 x ₹42 x 40%
= ₹70,526

(ix) (a) Cost units

ABC is defined as cost attribution to cost units on the basis of benefit received from indirect activities. It required to trace the significant activities in the organization and attempts to absorb the costs of such activities into product cost on the basis of benefit received by such unit.

(x) (b) ₹180

Return per hour for Product X = $\dfrac{Selling\ Price - Material\ Cost}{Time\ on\ bottleneck\ resource}$

$$=\frac{₹50-₹20}{10\ minutes}x\ 60= ₹180\ per\ hour$$

Section – B

Answer any five questions.

[16×5= 80]

2. **(a)** Jyoti Ltd. has developed a new product 'TRIO' which is to be launched soon. The company anticipated to sell 1,25,000 of these units at a sale price of ₹400 per unit over the Product Life Cycle of three years. The other data pertaining to Product TRIO are as under:

Calculate:

1. **Life Cycle Cost of the Product 'TRIO'.**
2. **Revised Life Cycle Cost if Jyoti Ltd. increases sales by 12% through 5% reduction in sale price along with increase in Fixed Manufacturing Cost by ₹1,20,000 per year.**
3. **Should the company go for reduction in sale price?** [10]

(b) A machine manufactures 10,000 units of a part of a total cost of ₹21 of which ₹18 is variable. This part is readily available in the market at ₹19 per unit. If the part is purchased from the market then the machine can either be utilized to manufacture a component in same quantity contributing ₹2 per component or it can be hired out at ₹21,000. Recommend which of the alternatives is profitable. [6]

Answer:

2. **(a)**   Income Statement

Particulars	As per Budget	At Reduced Prices
(a) Quantity sold	1,25,000 units (Given)	1,25,000 + 12% = 1,40,000 units
(b)Sales Price per unit	₹400 (Given)	₹400 – 5% = ₹380
(c)Sales revenue (axb)	5,00,00,000	5,32,00,000
Costs:R&D (Given)	32,50,000	32,50,000
Manufacturing – variable	1,25,000 units x ₹175 = 2,18,75,000	1,40,000 units x ₹175 = 2,45,00,000
Manufacturing – Fixed	₹12,75,000 x 3 = 38,25,000	(₹12,75,000 + ₹1,20,000) x 3 = 41,85,000
Marketing – Variable (a) Commission	1,25,000 units x ₹400 x 4% = 20,00,000	1,40,000 units x ₹380 x 4% = 21,28,000
(b)Others (Note)	1,25,000 units x ₹74 = 92,50,000	1,40,000 units x ₹74 = 1,03,60,000
Marketing – Fixed	₹6,72,000 x 3 = 20,16,000	₹6,72,000 x 3 = 20,16,000
Administration	₹6,60,000 x 3 = 19,80,000	₹6,60,000 x 3 = 19,80,000

Warranty	$\dfrac{1,25,000\ units}{50\ units}$ x 4 parts x ₹30 = 3,00,000	$\dfrac{1,40,000\ units}{50\ units}$ x 4 parts x ₹30 = 3,36,000
(d)Total Costs	4,44,96,000	4,87,55,000
(e) Profit (c-d)	55,04,000	44,45,000

Note: Marketing Cost per unit (given) is ₹90, of which Commission as per Budget is ₹400 x 4% = ₹16. Hence, other Variable marketing cost = 90 – 16 = ₹74 p.u., which will remain constant at reduced prices also.

Observation: price reduction decreases profit by 55,04,000 – 44,45,000 = ₹10,59,000, and is hence not desirable.

(b)

Particulars	Option 1	Option 2	Option 3
Description	Make	Buy & earn contribution on another component	Buy & hire out spare capacity
Relevant Costs	Variable Cost = 10,000 x 18 = ₹1,80,000	10,000 x 19 = ₹1,90,000	10,000 x 19 = ₹1,90,000
Relevant Benefits	Nil	10,000 x 2 = ₹20,000	Given Hire Revenue = ₹21,000
Net Costs	₹1,80,000	₹1,70,000	₹1,69,000

Decision: Purchasing this component and hiring out spare capacity is the best option, due to least costs.

Note: Fixed Costs of own production (i.e. ₹21 –₹18 = ₹3p.u.) is an apportionment, and hence irrelevant for decision making purposes.

3. **(a) A Gloves manufacturer has a net profit of ₹25 per pair on a selling price of ₹143. He is producing 6,000 pairs per annum which is 60% of the potential capacity. The cost per unit is as under:**

Direct Materials	35
Direct Wages	12.5
Works Overheads (50% fixed)	62.5
Administrative Overheads (75% fixed)	6

During the current year, the manufacturer also estimates demand of 6,000 pairs but anticipates that the fixed charges to go up by 10% while the rate of Direct Labour and Direct Materials will increase by 8% and 6% respectively. But he has no option of increasing the selling price. Under this situation he obtains an offer to utilize further 20% of capacity. What minimum price will you recommend to ensure an overall profit of₹1,67,300? **[8]**

(b) Your company has a production capacity of 2,00,000 units per year. Normal capacity utilisation is reckoned as 90%. Standard variable production costs are ₹11 per unit. The fixed costs are ₹3,60,000 per year. Variable selling costs are ₹3 per unit and fixed selling costs are ₹2,70,000 per year. The unit selling price is ₹20. In the year just ended on 31st March,2020 the production was 1,60,000 units and sales

were 1,50,000 units. The closing inventory on 31.03.2020 was 20,000 units. The actual variable production costs for the year were ₹35,000 higher than the standard.
(i) Calculate the profit for the year: (a) by the Absorption Costing Method, and (b) by the Marginal Costing Method.
(ii) Explain the difference in the profits. [8]

Answer:

3. (a)

1. Present Cost Analysis

Particulars	Cost per pair (₹)	Variable Cost per pair (₹)	Fixed cost per pair (₹)
Direct materials	35	100% = 35	-
Direct wages	12.5	100% = 12.5	-
Works OH	62.5	50% = 31.25	50% = 31.25
AOH	6	25% = 1.5	75% = 4.5
SOH (bal.fig)	2	100% = 2 (assumed fully variable)	-
Total cost (bal.fig)	118		35.75
Add: Profit (Given)	25		
Sale price (Given)	143		

Present Total Fixed Cost = 6,000 pairs x ₹35.75 per pair = ₹2,14,500
(Note: 2 alternative assumptions exist.

2. Proposed Costs

Particulars	₹ per pair
Variable Costs:	
Direct materials	35 + 6% = 37.10
Direct wages	12.50 + 8% = 13.50
Works OH	31.25
Admin OH	1.50
SOH	2
Total Variable Cost per pair	85.35

Revised Contribution per pair = selling price – variable cost = 143 – 85.35 = ₹57.65
Total Fixed Cost = ₹2,14,500 + 10% = ₹2,35,950

3. Selling price of the offer for required profit of ₹167300

Computation	Result
(a) Reqd Contribution = Fixed Cost+Reqd Profit = ₹2,35,950+₹1,67,300	₹4,03,250
(b) Contribution from Existing Customers = 6,000 pairs x ₹57.65	₹3,54,900
(c) Contribution required from New Order = (a-b)	₹57,350
(d) New Order Quantity = $\dfrac{6,000}{60\%}$ x 20%	2,000 pairs
(e) Contribution per pair from New Order = $\dfrac{57,350}{2,000}$	₹28.675
(f) Required Minimum Sale Price = VC+Contribution =₹28.675+ ₹85.35	₹114.025

Note: Possible Alternative Approaches:

1.Present Fixed Cost can also be taken at 100% Capacity=

$$\frac{6,000}{60\%} x ₹35.75 = ₹3,57,500$$

2. SOH can be assumed as fully fixed.

(b) Statement of cost of production and profit for the year ended 31ˢᵗ March, 2020

(Under Absorption Costing Method)   ₹

Sales (a)	(1,50,000 units x ₹20)		30,00,000
Cost of production:			
Std. Variable production cost	(1,60,000 units x ₹11)	17,60,000	
Add: increase in actual cost		35,000	17,95,000
Fixed cost			3,60,000
			21,55,000
Add: opening stock	(10,000 units x ₹13)		1,30,000
			22,85,000
Less: closing stock	$\frac{₹21,55,000}{1,60,000\ units} x\ 20,000\ units$		2,69,375
Cost of output (b)			20,15,625
Gross profit (a-b)			9,84,375
Less: selling expenses			
Variable		4,50,000	
Fixed		2,70,000	7,20,000
Net profit			2,64,375

Note: opening stock is valued at variable cost per unit (₹11) + Fixed cost per unit at normal capacity (₹2)

Statement of contribution and profit for the year ended 31ˢᵗ March, 2020

(Under Marginal Costing Method)   ₹

Sales (a)	(1,50,000 units x ₹20)		30,00,000
Variable cost			
Variable production cost	(1,60,000 units x ₹11)	17,60,000	
Add: increase in actual		35,000	17,95,000
Variable cost of opening stock			1,10,000
			19,05,000
Less: closing stock	$\frac{₹17,95,000}{1,60,000\ units} x\ 20,000\ units$		2,24,375
			16,80,625
Add: Variable selling cost	(1,50,000 units x ₹3)		4,50,000
(b)			21,30,625
Contribution (a-b)			8,69,375
Less: Fixed costs			
Production cost		3,60,000	
Fixed		2,70,000	6,30,000
Net profit			2,39,375

Analysis – The difference in profit under Absorption Costing and Marginal Costing statements is ₹25,000 (₹2,64,375 –₹2,39,375). This is mainly due to inclusions of fixed cost in valuation of closing stock under Absorption Costing and its exclusion in Marginal Costing method.

4. (a) Akash makes and sells a single product. The company operates a standard marginal costing system and a just-in-time purchasing and production system. No inventory of raw materials or finished goods is held.
Details of the budget and actual data for the previous period are given below:
Budget data

Standard production costs per unit:

Direct material	8 kg @ ₹10.80 per kg	₹86.40
Direct labour	1.25 hours @ ₹18 per hour	₹22.5
Variable overheads	1.25 hours @ ₹6 per direct labour hour	₹7.50
Standard selling price	₹180 per unit	
Budgeted fixed production overheads	₹1,70,000	
Budgeted production and sales	10,000 units	

Actual data

Direct material	74,000 kg @ ₹11.20 per kg
Direct labour	10,800 hours @ ₹19 per hour
Variable overheads	₹70,000
Actual selling price	₹184 per unit
Actual fixed production overheads	₹1,68,000
Actual production and sales	9,000 units

Prepare a statement using marginal costing principles that reconciles the budgeted profit and the actual profit. Your statement should show the variances in as much detail as possible. **[10]**

(b) "Standard costing system is not compatible with Activity based costing system". Do you agree with this statement? Explain your answer. **[6]**

Answer:

4. (a)   `   ₹

Budgeted profit (W1)		4,66,000
Sales volume contribution variance (9,000 units – 10,000 units) X ₹63.60	63,600 (A)	
Selling price variance9,000 units x (₹184 -₹180)	36,000 (F)	27,600 (A)
Cost variances:		
Direct material price variance74,000 kg x (₹10.80 –₹11.20)	29,600 (A)	

Direct material usage variance ((9,000 x 8kg) – 74,000kg) x ₹10.80	21,600 (A)	
Direct labour rate variance 10,800 x (₹18 –₹19)	10,800 (A)	
Direct labour efficiency variance((9,000x1.25)–10,800)x₹18	8,100 (F)	
Variable overhead expenditure variance (10,800 hours x ₹6) –₹70,000	5,200 (A)	
Variable overhead efficiency variance ((9,000 x 1.25) – 10,800) x ₹6	2,700 (F)	
Fixed overhead expenditure variance(₹1,70,000-₹1,68,000)	2,000 (F)	54,400 (A)
Actual profit (W2)		3,84,000

Workings:

1. Budgeted profit = Budgeted contribution – Fixed overheads

= (₹63.60 x 10,000) –₹1,70,000 = ₹4,66,000

{180 – 86.40 – 22.50 – 7.50}

2. Actual profit for the period

Sales (9,000 units x ₹184)		16,56,000
Direct materials (74,000kg x ₹11.20)	8,28,800	
Direct labour (10,800 hours x ₹19)	2,05,200	
Variable production overheads	70,000	(11,04,000)
Contribution		5,52,000
Fixed production overheads		(1,68,000)
Actual profit		3,84,000

(b) The Traditional Standard Costing system is not compatible with Activity Based Costing system due to the following reasons:

- Product costing based on manufacturing costs alone today represents an unacceptably low proportion of total cost.
- Non-manufacturing product costs such as product selling and distribution expenses are ignored for product costing purposes.
- ABC system addresses the treatment of all overhead related costs linking with cost drivers and cost pools.
- Greater variety, diversity and complexity of products are not taken in to consideration in traditional systems.
- The cost of technology is treated as product cost and consequently expensed on a straight line basis, irrespective of use.
- Customer related costs are not related to product cost object. Customer profitability has become as crucial as product profitability.

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? **[8]**

(b) Nestle has decided to increase the size of the store. It wants the information about the probability of the individual product lines: Kit Kat, Nescafe and Munch. It provides the following data for the year for each product line-

Particulars	Kit Kat	Nescafe	Munch
Revenues (₹)	79,350	2,10,060	1,20,990
Cost of goods sold (₹)	60,000	1,50,000	90,000
Cost of bottles returned (₹)	1,200	0	0
Number of purchase orders	36	84	36
Number of deliveries received	30	219	66
Hours of shelf stocking time	54	540	270
Items sold	12,600	1,10,400	30,600

Nestle also provides the following information for the year:

S.No.	Activity	Description of Activity	Total Costs	Cost Allocation Basis
1	Bottle Returns	Returning of Empty Bottles to the store	1,200	Direct tracing to product line
2	Ordering	Placing of orders of purchases	15,600	156 orders
3	Delivery	Physical delivery & the receipts of merchandise	25,200	315 deliveries
4	Shelf Stocking	Stocking of merchandise on store and ongoing re-stocking	17,280	864 hours of time
5	Customer Support	Assistance provided to customers including bagging and check-out	30,720	1,53,600 items sold

Required:

1. Nestle currently allocates Store Support Costs (all Costs other than Cost Of Goods Sold) to the product lines on the basis of the Cost Of Goods Sold for each

product line. Calculate the Operating Income and Operating Income as the percentage of revenue of each product line.

2. **If Nestle allocates Store Support Costs (all Costs other than the Cost Of Goods Sold) to the product lines on the basis of ABC System, calculate the Operating Income and Operating Income as the percentage of revenue of each product line.**

3. **Compare both the systems.** [8]

Answer:

5. (a) (i)

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

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

(ii)

	₹
Purchase cost (from outside supplier) (1,000 units x ₹135p.u.)	1,35,000
Less: Saving in variable cost of Division A for the units purchased by Division C from outside (1,000 units x ₹120 p.u.)	1,20,000
Opportunity cost of facilities used in Division A	18,000
	1,38,000
Net Profit	3,000

It is suggested that Division C should purchase the component from outside sources as this decision will benefit the company by ₹3,000.

(iii)

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

It is suggested that Division C should purchase the component from outside sources as this decision will benefit the company by ₹5,000.

(b)   1. Allocation based on Cost of Goods sold

- Total support costs = ₹1,200 + ₹15,600 + ₹25,200 +₹17,280 + ₹30,720 = ₹90,000
- Total cost of goods sold = ₹60,000 + ₹1,50,000 + ₹90,000 = ₹3,00,000
- Hence, ratio of support costs to COGS = ₹90,000/₹3,00,000 = 30%
- The product profit statement is as under:

Particulars	Kit Kat (₹)	Nescafe (₹)	Munch (₹)	Total (₹)
Revenues	79,350	2,10,060	1,20,990	4,10,400
Less: Cost of Goods	60,000	1,50,000	90,000	3,00,000

Sold				
Gross Margin	19,350	60,060	30,990	1,10,400
Less: Support Costs at 30%	18,000	45,000	27,000	90,000
Operating Income	1,350	15,060	3,990	20,400
Operating Income as % of Sales	1.70%	7.17%	3.30%	4.97%

Note: Cost of Bottles returned is presumed to have been already adjusted against COGS given above.

2. Allocation based on Activity Based Costing

(a) Computation of Activity Based Cost Driver Rates

Activity	Total Costs	Cost Allocation Base	ABC Rate
Bottle Returns	1,200	Direct tracing to product line	Directly allocated
Ordering	15,600	156 orders	₹100 per purchase order
Delivery	25,200	315 deliveries	₹80 per delivery
Shelf Stocking	17,280	864 hours of time	₹20 per hour
Customer Support	30,720	1,53,600 items sold	₹0.20 per item sold

(b) Product Profit Statement under ABC System is as under-

Particulars	Kit Kat(₹)	Nescafe (₹)	Munch (₹)	Total (₹)
Revenues	79,350	2,10,060	1,20,990	4,10,400
Less: Cost of Goods Sold	60,000	1,50,000	90,000	3,00,000
Gross Margin	19,350	60,060	30,990	1,10,400
Less: Activity Based Cost				
Bottle Returns	1,200	Nil	Nil	1,200
Ordering	3,600	8,400	3,600	15,600
Delivery	2,400	17,520	5,280	25,200
Shelf Stocking	1,080	10,800	5,400	17,280
Customer Support	2,520	22,080	6,120	30,720
Total Support Costs	10,800	58,800	20,400	90,000
Operating Income	8,550	1,260	10,590	20,400
Operating Income as % of Sales	10.78%	0.60%	8.75%	4.97%

Note: Cost of Bottles returned is presumed to have been already adjusted.

3. Comments:

a) Under COGS - based OH Allocation, OH are taken at 30% of COGS, without recognizing the extent of resources consumed for each product line. Hence, ABC based OH Allocation provides a better analysis of costs.

b) Under ABC System, "Nescafe" has a higher share of OH, on account of higher resource consumption. Hence, it shows a lower operating income % than under the earlier COGS – based Allocation System. The company should

identify possibilities of price increase in "Nescafe" to recover resource – based costs.

c)   "Kit Kat" has a higher operating income % and is most profitable. Hence, thecompany should explore avenues for increasing sales of "Kit Kat".

6.   **(a)A company manufactures 30 items per day. The sale of these items depends upon demand which has the following distribution:**

Sales (units)	27	28	29	30	31	32
Probability	0.10	0.15	0.20	0.35	0.15	0.05

The production cost and sales price of each unit are ₹40 and ₹50 respectively. Any unsold product is to be disposed of at a loss of ₹15 per unit. There is a penalty of ₹5 per unit if the demand is not met.

Using the following random numbers estimate total profit/loss for the company of the next 10 days: 10,99,65,99,95,01,79,11,16,20.

If the company decides to produce 29 items per day, what is the advantage or disadvantage to the company? **[8]**

(b)An organization producing 4 different products, viz., A,B, C and D having 4 operators viz., P, Q, R and S, who are capable of producing any of the four products, works effectively 7 hours a day. The time (in minutes) required for each operator for producing each of the products are given in the cells of the following matrix along with profit: **(₹ per unit)**

Operators	Products			
	A	B	C	D
P	6	10	14	12
Q	7	5	3	4
R	6	7	10	10
S	20	10	15	15
Profit (₹/unit)	3	2	4	1

Find out the assignments of operators to products which will maximize the profit. [8]

Answer:

6.   **(a)** First of all, random number 00-99 are allocated in proportion to the probabilities associated with the sale of the items as given below:

Sales	Probability	Cum. Probability	Random numbers assigned
27	0.10	0.10	00-09
28	0.15	0.25	10-24
29	0.20	0.45	25-44
30	0.35	0.80	45-79
31	0.15	0.95	80-94
32	0.05	1.00	95-99

Now demand for next 10 days can be simulated using the given number in order to estimate the total profit/loss for the company. It is given that production cost of each item is ₹40 and sale price is ₹50. Therefore, the profit per unit of sold item is

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₹10. There is a loss of ₹15 per unit associated with each unsold unit and a penalty of ₹5 per unit, if the demand is not met. Accordingly, profit and loss for next 10 days is calculated as under:

Day	Random number	Estimated sale	Profit/loss per day when production = 30 items per day	Profit/loss per day when production = 29 items per day
1	10	28	28 x ₹10 – 2 x 15 = 250	28 x ₹10 – 1 x 15 = 265
2	99	32	30 x ₹10 – 2 x 5 = 290	29 x ₹10 – 3x 5 = 275
3	65	30	30 x ₹10 = 300	29 x ₹10 – 1x 5 = 285
4	99	32	30 x ₹10 – 2 x 5 = 290	29 x ₹10 – 3x 5 = 275
5	95	32	30 x ₹10 – 2 x 5 = 290	29 x ₹10 – 3x 5 = 275
6	01	27	27 x ₹10 – 3 x 15 = 225	27 x ₹10 – 2 x 15 = 240
7	79	30	30 x ₹10 = 300	29 x ₹10 – 1x 5 = 285
8	11	28	28 x ₹10 – 2 x 15 = 250	28 x ₹10 – 1 x 15 = 265
9	16	28	28 x ₹10 – 2 x 15 = 250	28 x ₹10 – 1 x 15 = 265
10	20	28	28 x ₹10 – 2 x 15 = 250	28 x ₹10 – 1 x 15 = 265
		Total profit	₹2,695	₹2,695

The total profit for 10 days will be ₹2,695, if the company manufactures 30 items per day. In case the company decides to produce 29 items per day then the profit of the company for next 10 days will be ₹2,695. From this, it is evident that there is no additional profit or loss, if the production is reduced to 29 itemsper day since the total profit remains unchanged.

(b) It is given that the factory works effectively 7 hours (420 minutes) a day. Time required by each operator for producing each of the product is also given. Based on this information, following production and profit matrices are prepared:

Production Matrix (units)				
Operators	Products			
	A	B	C	D
P	420/6 =70	420/10 = 42	420/14 = 30	420/12 = 35
Q	420/7 = 60	420/5 = 84	420/3 = 140	420/4 = 105
R	420/6 = 70	420/7 = 60	420/10 = 42	420/10 = 42
S	420/20 = 21	420/10 = 42	420/15 = 28	420/15 = 28

Profit Matrix (in ₹)				
Operators	Products			
	A	B	C	D
P	70x3 =210	42x2 = 84	30x4 = 120	35x1 = 35
Q	60x3 = 180	84x2 = 168	140x4 = 560	105x1 = 105
R	70x3 = 210	60x2 = 120	42x4 = 168	42x1 = 42
S	21x3 = 63	42x2 = 84	28x4 = 112	28xx1 = 28

In order to apply assignment algorithm for minimizing losses, let us convert this profit matrix to a loss matrix by subtracting all elements of the given matrix from its highest element which is equal to 560. The matrix so obtained is given below:

Operators	Products			
	A	B	C	D
P	350	476	440	525
Q	380	392	0	455
R	350	440	392	518
S	497	476	448	532

Now we apply the assignment algorithm to the above loss matrix, subtracting the minimum element of each row from all elements of that row, we get the following matrix:

Operators	Products			
	A	B	C	D
P	0	126	90	175
Q	380	392	0	455
R	0	90	42	168
S	49	28	0	84

Now subtract the minimum element of each column from all elements of that column to get the following matrix:

Operators	Products			
	A	B	C	D
P	0	98	90	91
Q	380	364	0	371
R	0	62	42	84
S	49	0	0	0

Draw the minimum number of lines to cover all zeros. The number of lines to cover all zeros is 3, which is one less than the order of matrix (i.e., 4). Thus, the above matrix will not give optimal solution. Subtract the minimum uncovered element (i.e., 62) from all the uncovered elements and add it to the elements lying on the intersection of two lines, we get the following matrix:

Operators	Products			
	A	B	C	D
P	0	36	90	29
Q	380	302	0	309
R	0	0	42	22
S	111	0	62	0

The minimum number of lines which cover all zeros is 4, which is the order of the matrix. Hence, the above matrix will give the optimal solution. Specific assignments in this case are given below:

Operators	Products			
	A	B	C	D

P	0	36	90	29
Q	380	302	0	309
R	⊗	0	42	22
S	111	⊗	62	0

Statement showing the assignment of operators to products and maximum profit:

Operators	Products	Profit (₹)
P	A	210
Q	C	560
R	B	120
S	D	28
Total		918

7. **(a) A project schedule has the following characteristics:**

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,

(ii) Compute Earliest Time and Latest Time for each event,

(iii) Find the critical path,

(iv) Also obtain the Total and Free Floats of each activity. [8]

(b) Laxmi Chemical Company operates a small plant for the manufacture of two joint chemical products X and Y. the production of these chemicals require two raw materials, A and B, which cost ₹5 and ₹8 per litre respectively. The maximum available supply per week is 2,700 litres of A and 2,000 litres of B.

The plant can operate using either of two processes, which have different operating costs and raw materials requirements for the production of X and Y, as follows:

Process	Raw materials consumed		Output		Operating cost
	(litres per processing hours)		(litres per hour)		(₹ per hour)
	A	B	X	Y	
1	20	10	15	20	500
2	30	20	20	10	230

The plant can run for 120 hours per week in total, but for safety reasons, process 2 cannot be operated for more than 80 hours per week.

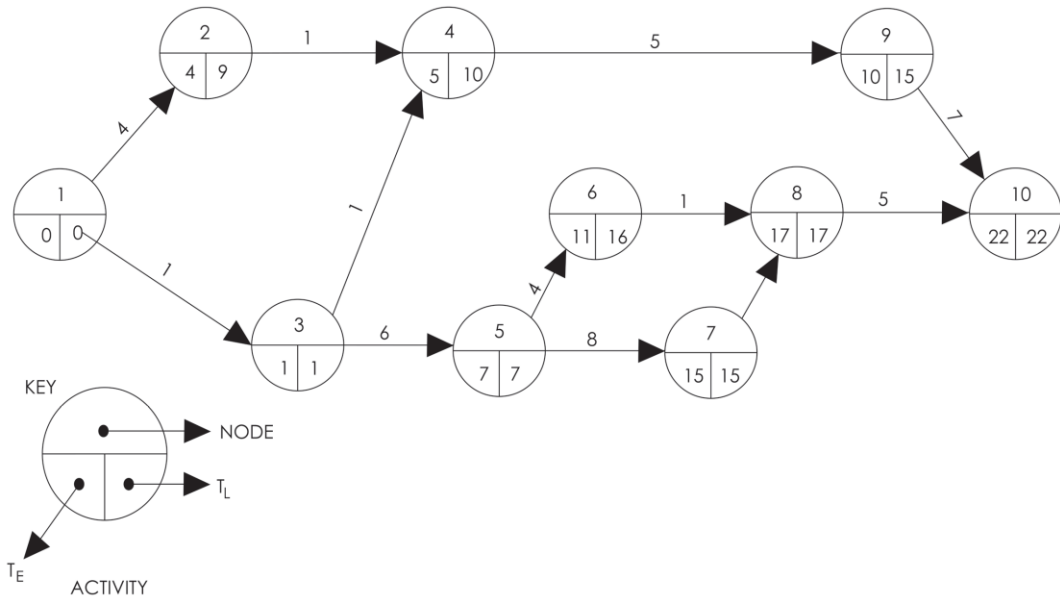**The selling prices of output are:**

X ₹18 per litre

Y ₹24 per litre

Required: Formulate a Linear Programming model. [8]

Answer:

7. (a) (i) Based on the above details relating activities, precedence and expected time (te), a network diagram 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	Duration	Earliest Time		Latest Time		Slack Time at		Total Float	Free Float
		EST	EFT (2+3)	LST (6-2)	LFT	Starting event	Ending event	LST – EST or LFT - EFT	(9-10)
1	2	3	4	5	6	7	8	9	10
1-2	4	0	4	5	9	0	5	5	0
1-3	1	0	1	0	1	0	0	0	0
2-4	1	4	5	9	10	5	5	5	0
3-4	1	1	2	9	10	1	5	8	3
3-5	6	1	7	1	7	1	0	0	0
4-9	5	5	10	10	15	5	5	5	0
5-6	4	7	11	12	16	0	5	5	0
5-7	8	7	15	7	15	0	0	0	0
6-8	1	11	12	16	17	5	0	5	5
7-8	2	15	17	15	17	0	0	0	0
8-10	5	17	22	17	22	0	0	0	0
9-10	7	10	17	15	22	5	0	5	5

(b) 1. Identifying the decision variables

(i) There are two decision variables in this problem, i.e., quantity of X and the quantity of Y to make each week. Therefore, one may start by letting these be x and y respectively. For this purpose objective function will have to be expressed in terms of X and Y. it is not possible because cost of X and Y is not given directly.

(ii) The operating costs are given in terms of processing hours:

	Process I		Process II	
	₹per hour	₹ per hour	₹ per hour	₹ per hour
Costs:				
Material A		100		150
Material B		80		160
Operating cost		500		230
Total costs		680		540
Revenue:				
A	15 x 18 = 270		20 x 18 = 360	
B	20 x 24 = 480	750	10 x 24 = 240	600
Contribution		70		60

Therefore, decision variables should be processing hours in each process rather than litre of X and Y.

Therefore,
Let P_1 = hours in Process 1
Let P_2 = hours in Process 2

2. Objective function
Maximise contribution = $70 P_1 + 60 P_2$
Subject to:

$$20 P_1 + 30 P_2 \leq 2,700$$
$$10 P_1 + 20 P_2 \leq 2,000$$
$$P_2 \leq 80$$
$$P_1 + P_2 \leq 120$$
$$P_1 \geq 0$$
$$P_2 \geq 0$$

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

   (a) **Advantages of Target Costing**
   (b) **Enterprise Resource Planning**
   (c) **Difference between Bench Trending and Bench Marking**
   (d) **Limitations of Activity Based Costing**
   (e) **Difference between PERT & CPM**

Answer:

8. **(a)** Advantages of Target Costing are:

   1. Innovation – It reinforces top-to-bottom commitment to process and product innovation, and is aimed at identifying issues to be resolved.

2. Competitive Advantage – It enables a firm to achieve competitive advantage over other firms in the industry. The firm which achieves cost reduction targets realistically stands to gain in the long run.

3. Market driven management – It helps to create a Company's competitive future with market-driven management for designing and manufacturing products that meet the price required for market success.

4. Real Cost Reduction – It uses management control systems to support and reinforce manufacturing strategies, and to identify market opportunities that can be converted into real savings to achieve the best value rather than simply the lower cost.

(b) Enterprise Resource Planning – ERP attempts to integrate all departments and functions across a company into a single computer system that can serve all those different department particular needs. In fact ERP combines all computerized departments together with the help of a single integrate software program that runs off as single database so that various departments can more easily share information and commission with each other. ERP perform core activities and increases customer service, thereby augmenting the corporate image. It bridges the information gap across organizations, provides complete integration of system not only across departments but also across companies under the same management. ERP is the solution for better project management. ERP not only addresses the current requirement of the company but also provide the opportunity of continually improving and refining business processes.

(c) Bench Trending: Continuous monitoring of specific process performance with a selected group. It is a systematic and continuous measurement process of comparing through measuring an organization business processes against business leaders 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.

Bench Marking: It 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. It is a continuous process of enlisting the best practices in the world for the process, goals and objectives leading to world-class levels of achievements. It is a powerful management tool because it overcomes "paradigm blindness".

(d) Limitations of Activity Based Costing are as follows:
- More time consuming to collect data.
- Cost of buying, implementing and maintain activity based system.
- In some cases, the establishment of cause and effect relationship between cost driver and costs is not a simple affair.

- ABC does not conform to generally accepted accounting principles in some areas.

(e)

PERT	CPM
It is an Event oriented system.	It is an Activity oriented system.
It is a technique for planning, scheduling & controlling of projects whose activities are subject to uncertainty in the performance time.	It is a technique for planning, scheduling & controlling of projects whose activities are not subjected to any uncertainty and the performance times are fixed.
It is a probabilistic model.	It is a deterministic model.
Basically does not differentiate critical and non-critical activities.	Differentiates clearly the critical activities from the other activities.