FINAL EXAMINATION

GROUP - III

(SYLLABUS 2016)

SUGGESTED ANSWERS TO QUESTIONS

JUNE - 2017

Paper-15 : STRATEGIC COST MANAGEMENT – DECISION MAKING

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

The figures in the margin on the right side indicate full marks.
Answer Question No. 1 in Section A, which is compulsory, carrying 20 marks.
Further, answer any 5(five) Questions from Section B, each carrying 16 marks.

Section – A (20 Marks)

1. **Choose the most appropriate answer to the following questions giving justification. Each question carries 2 (two) marks.** **2x10=20**

(i) **Stock Control data for Material P are:**
Annual usage: 3600 units; Cost per unit: ₹100/-; Cost of placing an order: ₹40; Stockholding Cost: 20% of the overall stock volume; Lead time: One month
The EOQ based on the above data is:
(a) 210 units
(b) 175 units
(c) 90 units
(d) 120 units

(ii) **Which of the following would take place if a company is able to reduce its variable cost?**

Contribution Margin	Break-Even Point
(a) Increase	Increase
(b) Decrease	Decrease
(c) Increase	Decrease
(d) Decrease	Increase

(iii) **The following details relate to Product P-1 of a manufacturing company:**

Level of activity (units)	1000	2000
Cost per unit (₹):		
Direct materials	4.00	4.00
Direct labour	3.00	3.00
Production Overheads	3.50	2.50
Selling Overheads	1.00	0.50
	11.50	10.00

The total fixed cost and variable cost per unit are:

	Total Fixed Cost (₹)	Variable Cost per unit (₹)
(a)	2,000	7.00
(b)	2,000	8.50
(c)	3,000	7.00
(d)	3,000	8.50

(iv) **A company makes a single product which it sells at ₹10 per unit. Fixed costs are ₹ 48,000 per month and the product has a contribution to sales ratio of 40%. In a period when actual sales were ₹1,40,000, the company's margin of safety in units was:**
(a) 2000
(b) 3000

(c) 3500
(d) 4000

(v) The following tasks are associated with ABC system:
I. Allocation of costs to products
II. Identification of cost pools
III. Identification of cost drivers
IV. Calculation of pool rates
The proper order of the preceding tasks is:
(a) III, II, IV, I
(b) I, II, III, IV
(c) III, IV, II, I
(d) IV, III, II, I

(vi) A company has the capacity of production of 80000 units and presently it sells 20000 units at ₹ 100 each. The demand is sensitive to selling price and it has been observed that every reduction of ₹ 10 in selling price the demand is doubled. What should be the target cost at full capacity it profit margin on sales is taken at 25%?
(a) ₹ 58 lakhs
(b) ₹ 52 lakhs
(c) ₹ 48 lakhs
(d) ₹ 50 lakhs

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

Standard price per unit	₹ 7.20
Actual quantity purchased in units	1600
Standard quantity allowed for actual production in units	1450
Material price variance on purchase (Favourable)	₹ 480

What is the actual purchase price per unit?
(a) ₹7.50
(b) ₹6.40
(c) ₹6.50
(d) ₹6.90

(viii) Backflush 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

(ix) The preparation and use of standard cost, their comparison with actual costs and the measurement and analysis of variances to originating causes is defined as:
(a) Marginal Costing
(b) Standard Costing
(c) Throughput Costing
(d) Kaizen Costing

(x) The following are cost data for two alternative ways of processing the clerical work for legal cases brought before the district court:

	Semi-automatic	Fully automatic
Monthly fixed costs (₹):		
Occupancy	15,000	15,000
Maintenance contract	5,000	10,000
Equipment lease	25,000	1,00,000
Unit variable cost (per report) (₹)		
Supplies	80	20
Labour	60	20

The cost indifference point will be:
(a) 800 cases
(b) 850 cases
(c) 750 cases
(d) 700 cases

Answer:

1. (i) (d)

Explanation: 120 units as per the following computation:
EOQ = $\sqrt{2AB/C}$, where
A = Annual Requirement of the material = 3,600 units.
B = Buying or Ordering Cost /Order = ₹ 40.
C = Carrying or Stockholding Cost per unit per annum = ₹ 100 × 20%
EOQ = $\sqrt{2 \times 3{,}600 \times 40/20}$ =120 units (d).

(ii) (c)

Explanation: Contribution margin = Sales Less Variable Cost
So, reduction in variable cost will increase contribution.
BEP = FC/Contribution Margin
Hence, increase in contribution will reduce BEP.

(iii) (d)

Explanation: Variable Cost per unit = 4.00 + 3.00 = ₹ 7.00
Total FC (included in Production Overheads and Selling Overheads) is as follows:

Units	1,000	2,000
Total OH	4.50 × 1,000 = 4,500	3.00 × 2,000 = 6,000

Difference in Overhead = ₹ 1,500
Difference in Volume = 1,000
∴ Variable per unit = ₹1.50
Add this to Variable cost per unit of ₹ 7.00.
The Total variable cost = ₹ 1.50 + ₹ 7.00 = ₹ 8.50
Fixed Cost = ₹4,500 - (1,000 × 1.50) = ₹ 4,500 - ₹ 1,500 = ₹ 3,000.

(iv) (a)

Explanation: BEP = $\frac{FC}{C/S\ Ratio} = \frac{₹48{,}000}{0.4}$ = ₹ 1,20,000 or 12,000 units.
When sells are ₹ 1,40,000, the volume is ₹ 1,40,000 ÷ 10 = ₹ 14,000 units
∴ Margin of Safety is 14,000 – 12,000 = 2,000 units.

(v) (a)

Explanation: Because cost is allocated based on the cost pool rates. So, whole process starts with identification of cost drivers followed by identification of cost pools, determination of rates and then allocation.

(vi) (c)

Explanation:

Maximum Capacity	80,000 Units
Present Sale	20,000 Units @ ₹ 100/-per Unit
Selling Price/Unit	Demand
100	20,000
90	40,000
80	80,000
Target Price	₹ 80
Target Cost/Unit	80 - 25% of Sales = 80 - 20 = ₹ 60/- per unit
Total Target Cost	80,000 Units × ₹60/- per unit = ₹ 48 lakhs.

(vii) (d)

Explanation:
Material Price Variance (MPV) = Standard cost of Actual Quantity - Actual Cost
480 = 7.20 × 1,600 - Actual Cost
or, Actual Cost = 11,520 - 480 = 11,040
Actual Price / Unit = 11,040 ÷ 1,600 = ₹ 6.90.

(viii) (b)
Explanation: A Just-in-Time inventory philosophy has been adopted. The reason for this is that JIT assumes zero inventory for raw materials, work-in-progress and finished goods and the system of backflush accounting records the transaction only at the termination of the production and sales cycle.

(ix) (b)
Explanation: Because standard costing only involves the process described.

(x) (a)
Explanation: Cost Indifference Point is calculated as follows:

$$\frac{\text{Difference in monthly FC}}{\text{Difference in unit VC}}$$

$$= \frac{₹1{,}25{,}000 - ₹45{,}000}{₹140 - ₹40} = \frac{₹80{,}000}{₹100} = 800 \text{ Cases.}$$

Section – B

Answer any five questions.
Each Question carries 16 Marks.

16×5=80

2. (a) What is Value Chain? How does it help modern cost management? 2+4=6

(b) (i) What are the problems of Traditional Costing arising out of volume-based cost allocation to products?
(ii) How can Activity-Based Costing help refining such costing system? 1+3=4

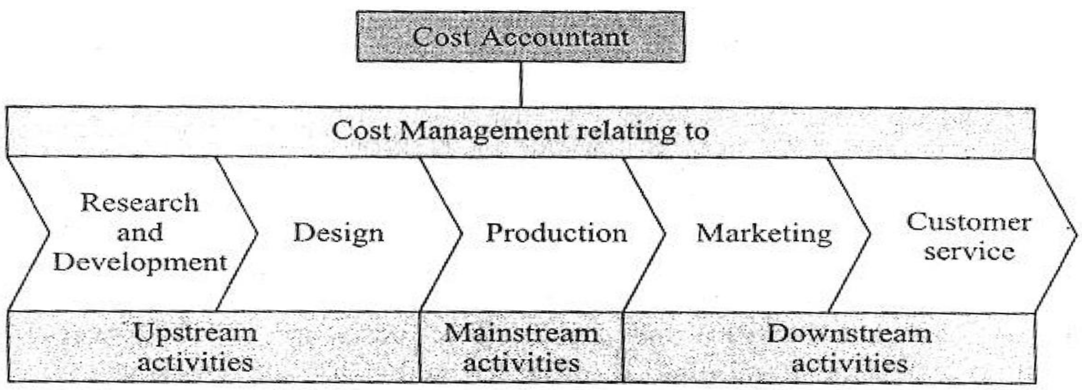
(c) (i) What are relevant costs and relevant revenues?
(ii) In making repetitive decisions using relevant costs and benefits, should a decision maker be aware of several pitfalls? If so, mention a few and briefly explain them. 2+4=6

Answer:

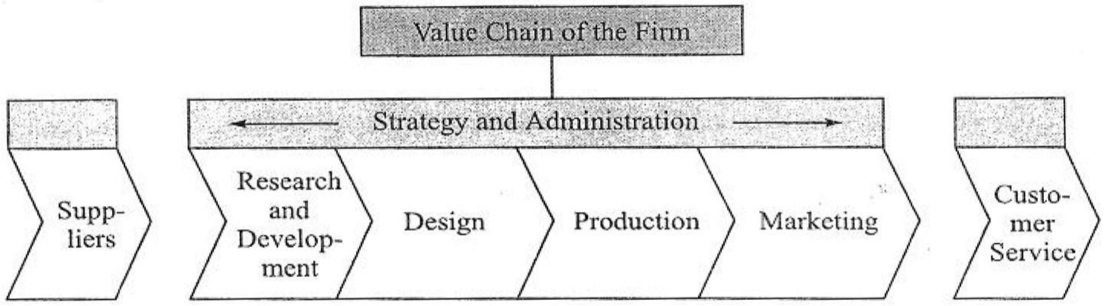
2. (a) A value chain is the sequence of business functions in which utility (usefulness) is added to the products or services of the firm. Through proper analysis and management of each segment of the value chain, customer value is enhanced. Non-value creating activities are eliminated.

In value chain analysis, each of the business functions is treated as an essential and valued contributor and is constantly analyzed to enhance value relative to the cost incurred. Like business functions, in value chain approach also, it is important that the efforts of all functions are integrated and co-ordinated to increase the value of the products or services to the customers.

The following diagram shows the important functions or activities of a firm and the role of the cost accountant in cost management.



Michael Porter introduced the value chain concept in cost management is 1985. It was developed further by Ahw subsequently. When the supplier and customers are included, the firm is viewed as an extended value chain as shown below:



The value chain approach is an integral part of strategic cost management, which is an approach to Management Accounting that explicitly highlights strategic issues and concerns. It sets cost analysis as a broader context in which cost information is used to develop superior strategies.

Modern cost accountant has an important role to play in analyzing cost information relating to each of the segments of the value chain and supplying the same to other functional managers for improved decisions.

(b) (i) Under traditional costing, overhead which occupies and important share of the total cost structure of the firm is generally allocated based on volume-based allocation rates viz. rates per labour hour, rate per machine hour, % of labour cost, etc. It does not take into consideration disproportionate consumption service department services. As a result, the product cost gets distorted i.e., some products are over costed while others are under costed. The basic assumption in cost allocation is; the higher the volume, the greater the share of indirect costs to the product or service. This simplistic assumption dies not hold good in reality.

(ii) The Activity-Based Costing (ABC) is a system that focuses on activities as the fundamental cost objects and uses the cost of these activities for computing the costs of products. The Activity-Based Costing refines the problems of Traditional Costing System by the following means:

1) In the traditional system, cost analysis is done by product. In ABC, the managers focus attention on activities rather than products because activities in various departments may be combined and costs of similar activities ascertained, e.g., quality control, handling of materials, repairs to machines etc., If detailed costs are kept by activities, the total company costs for each activity can be obtained, analysed, planned and controlled.
2) Unlike the Traditional Costing Systems, managers under ABC, manage activities and not products. Changes in activities lead to changes in costs. Therefore, if the activities are managed well, costs will fall and the resulting products will be more competitive.
3) Allocating Overhead Cost to production based on a single cost driver (allocation base, such as unit basis, percentage of material, percentage of prime cost, labour hour rate, machine hour rate etc.) can result in an unrealistic product cost because the traditional system fails to capture cause-and-effect relationships. To manage activities better and to make wiser economic decisions, managers need to identify the relationships of causes (activities) and effects (costs) in a more detailed and accurate manner.
4) ABC highlights problem areas that deserve management's attention and more detailed analysis. Many actions are possible, on pricing, on process technology, on product design, on operational movements and on product

mix. Traditional Costing can lead to under costing for over costing of products or services. Over or Under Costing of products distorts cost information. A poor quality of cost information causes management to make poor decisions for pricing, product emphasis, make or buy etc.

ABC differs from the traditional system only in respect of allocations of overheads or indirect costs. Direct Costs are identified with, or assigned to, the cost object, in the same manner as is done in case of traditional costing system. Overhead costs are linked to the cost objects based on activities.

(c) (i) Relevant costs are costs appropriate to aiding the making of specific management decisions (CIMA). They are estimated future costs that differ among alternatives. Similarly, relevant revenues and expected future revenues that differ among alternatives. The two key aspects of relevance are:

(1) The costs and revenues must occurs in future, and

(2) They must differ among alternatives.

(ii) In such decision making, the decision maker must be aware of some pitfalls. Examples are:

(1) Sunk cost – be ignored as not relevant.

(2) Fixed Costs – if they change for the decision at hand, the changed portion only becomes relevant.

(3) Opportunity costs – They need not be overlooked (e.g., to outsource an activity when there is no idle capacity). An opportunity cost is the cost of an opportunity foregone by not using a limited resource in its next best alternative use.

3. (a) Accelerate Co. Ltd., manufactures and sells four types of products under the brand names of A, B, C and D. The sales mix in value comprises 33 1/3%, 41 2/3%, 16 2/3% and 8 1/3% of products A, B, C and D, respectively. The total budgeted sales (100%) are ₹ 60,000 p.m. Operating Costs are — Variable costs: Product A 60% of selling price, Product B 68% of selling price, Product C 80% of selling price, Product D 40% of selling price; Fixed costs: ₹ 14,700 p.m.

Required:

Calculate the break-even-point for the products on overall basis. 8

(b) A2Z p.l.c supports the concept of tero technology or life cycle costing for new investment decisions covering its engineering activities. The financial side of this philosophy is now well established and its principles extended to all other areas of decision making. The company is to replace a number of its machines and the Production Manager is torn between the Exe Machine, a more expensive machine with a life of 12 years, and the Wye machine with an estimated life of 6 years. If the Wye machine is chosen, it is likely that it would be replaced at the end of 6 years by another Wye machine. The pattern of maintenance and running costs differs between the two types of machine and relevant data are shown below:

	Exe	**Wye**
Purchase price	**₹ 19,000**	**₹13,000**
Trade-in value/breakup/scrap	**₹ 3,000**	**₹ 3,000**
Annual repair costs	**₹ 2,000**	**₹ 2,600**
Overhaul costs	**(at year 8) ₹ 4,000**	**(at year 4) ₹ 2,000**
Estimated financing costs	**10% p.a.**	**10% p.a.**

averaged over machine life

Required: Recommend with supporting figures, which machine to purchase, stating any assumptions made? 8

Answer:

3. (a) Computation of overall breakeven point

			A	B	C	D	Total
a	Sales	(₹)	20,000	25,000	10,000	5,000	60,000
b	Variable cost	(₹)	12,000	17,000	8,000	2,000	39,000
c	Contribution	(₹)	8,000	8,000	2,000	3,000	21,000
d	Fixed cost	(₹)					14,700
e	Profit	(₹)					6,300
f	P/V ratio	(%)	40%	32%	20%	60%	35%
g	Break even sales	(₹)	14700/35% =				42,000

(b) Profitability of Alternate Machines

		Exe Machine		WYE Machine
Initial cost(₹)		19,000		13,000.00
Less: Scrap at the end of the life(₹)	(3,000x0.32)	960.00	(3,000x0.56)	1,680.00
		18,040.00		11,320.00
Present value of total annual cost(₹)	(2,000x6.81)	13,620.00	(2,600x4.36)	11,336.00
Overhaul Cost	(4,000x0.47)	1,880.00	(2,000x0.68)	1,360.00
		33,540.00		24,016
Capital recovery factor	(1/6.81)	0.15	(1/4.36)	0.23
Equivalent annual cost (₹)		5,031.00		5,523.68

Conclusion:

As the equivalent annual cost is less for Exe Machine, it is better to purchase the same.

4. (a) SRM Ltd. has developed a new product 'Kent' which is about to be launched into the market and anticipates to sell 80,000 of these units at a sale price of ₹ 300 over the product's life cycle of four years. Data pertaining to product 'Kent' are as follows:

Costs of Design and Development of Moulding Dies and Other tools	**₹ 10,25,000**
Manufacturing costs	**₹ 125 per unit**
Selling costs	**₹ 12,500 per year + ₹ 100 per unit**
Administration costs	**₹ 50,000 per year**
Warranty expenses	**5 replacement parts per 25 units at ₹ 10 per part, 1 visit per 500 units (cost ₹ 500 per visit)**

Required:

(i) Compute the product Kent's Life Cycle Cost.

(ii) Suppose SRM Ltd. can increase sales volume by 25% through 15% decrease in selling price, should SRM Ltd. choose the lower price? 8

(b) BCG Manufacturers sell their product at ₹ 1,000 per unit. Their competitors are likely to reduce the price by 15%. BCG Manufacturers want to respond aggressively by cutting price by 20% and expect that the present volume of 150000 units per annum will increase to 200000 units. BCGM want to earn a 10% target profit on sales. Based on a detailed value engineering, the comparative position is given below:

Particulars	**Existing (₹)**	**Target (₹)**
Direct Material Cost per unit	**400**	**385**
Direct Labour Cost per unit	**55**	**50**
Direct machinery costs per unit	**70**	**60**
Direct Manufacturing expenses per unit	**525**	**425**
Manufacturing Overheads		
No. of orders (₹ 80 per order)	**22,500**	**21,250**
Testing hours (₹ 2 per hour)	**45,00,000**	**30,00,000**
Units reworked (₹ 100 per unit)	**12,000**	**13,000**

Manufacturing overheads are allocated using relevant cost drivers. Other operating costs per unit for the expected volume are estimated as follows:

Research and Design	**₹ 50**
Marketing and Customer Service	**₹ 130**
	₹ 180

Required:

(i) Calculate target costs per unit and target costs for the proposed volume showing break up of different elements.

(ii) Prepare target product profitability statement. 4+4=8

Answer:

4. (a)

Statement showing 'Kent's Life Cycle Cost (80,000 Units)

Particulars	Amount (₹)
Costs of Design and Development of Moulds, Dies and other tools	10,25,000
Manufacturing Costs (₹125 × 80,000 units)	1,00,00,000
Selling Costs (₹100 × 80,000 units + ₹ 12,500 × 4)	80,50,000
Administration Costs (₹ 50,000 × 4)	2,00,000
Warranty : (80,000 units / 25 units × 5 parts × ₹ 10) (80,000 units / 500 units × 1 visit × ₹ 500)	 1,60,000 80,000
Total cost	1,95,15,000

Statement showing 'Kent's Life Cycle Cost (1,00,000 Units)

Particulars	Amount (₹)
Costs of Design and Development of Moulds, Dies and other tools	10,25,000
Manufacturing Costs (₹125 × 1,00,000 units)	1,25,00,000
Selling Costs (₹100 × 1,00,000 units + ₹ 12,500 × 4)	1,00,50,000
Administration Costs (₹ 50,000 × 4)	2,00,000
Warranty: (1,00,000 units / 25 units × 5 parts × ₹10) (1,00,000 units / 500 units × 1 visit × ₹ 500)	 2,00,000 1,00,000
Total cost	2,40,75,000

Statement showing "Kent's Life Time Profit"

Particulars	Amount (₹) 80,000 units	Amount (₹) 100,000 units
Sales	(80,000 × ₹ 300) 2,40,00,000	(1,00,000 × ₹ 255) 2,55,00,000
Less : Total Cost	1,95,15,000	2,40,75,000
Profit	44,85,000	14,25,000

Decision: Reducing the, price by 15% will decrease profit by ₹ 30,60,000. Therefore, SRM Ltd. should not cut the price.

(b) Part 1:

Target Selling Price: ₹ 1000 less 20%	₹ 800
Less: Target Profit Margin (10% of ₹ 800)	₹ 80
Target Cost per unit	₹ 720

The breakup of the target cost per unit of ₹ 720 per unit is as follows:

Direct Materials		385
Direct Labour		50
Direct Machinery costs		60
Direct Manufacturing Costs		495
Add: Manufacturing Overheads:		
Ordering and receiving (21250 × ₹ 80)/200000	8.50	

Testing and Inspection (30,00,000 × ₹,2)/200000	30.00	
Rework (13,000 × ₹ 100)/200000	6.50	45
Other Operating Costs:		
Research and Design	50	
Marketing and Customer Service	130	180
Full Product Costs		720

Part 2:

Target Product Profitability

Particulars	Per Unit (₹)	Total for 200000 units (₹)
1. Sales	800	16,00,00,000
2. Cost of Goods Sold:		
Direct Materials	385	7,70,00,000
Direct Labour	50	1,00,00,000
Direct Manufacturing Costs	60	1,20,00,000
	495	9,90,00,000
Manufacturing Overheads	45	90,00,000
	540	10,80,00,000
3. Gross Margin (1-2)	260	5,20, 00,000
4. Operating Costs:		
Research and Design	50	1,00,00,000
Marketing and Customer Service	130	2,60,00,000
	180	3,60,00,000
5. Operating Profit (3 - 4)	80	1,60,00,000

5. (a) A manufacturing company currently operating at 80% capacity has received an export order from Middle East, which will utilise 40% of the capacity of the factory. The order has to be either taken in full and executed at 10% below the current domestic prices or rejected totally.

The current sales and cost data are given below:

Sales	**₹ 16.00 lakhs**
Direct Material	**₹ 5.80 lakhs**
Direct Labour	**₹ 2.40 lakhs**
Variable Overheads	**₹ 0.60 lakhs**
Fixed Overheads	**₹ 5.20 lakhs**

The following alternatives are available to the management:

(I) Continue with domestic sales and reject the export order.

(II) Accept the export order and allow the domestic market to starve to the extent of excess of demand.

(III) Increase capacity so as to accept the export order and maintain the domestic demand by:

- **(i) Purchasing additional plant and increasing 10% capacity and thereby increasing fixed overheads by ₹ 65,000, and**
- **(ii) Working overtime at one and half time the normal rate to meet balance of the required capacity.**

Required:

Evaluate each of the above alternatives and suggest the best one. **6**

(b) The following particulars are extracted from the records of Ajanta Works Limited:

Particulars	**Product A**	**Product B**
Selling price per unit	**₹ 1,000.00**	**₹ 1,200.00**
Consumption of Material	**Kg. 20.00**	**Kg. 30.00**
Material cost	**₹ 100.00**	**₹ 150.00**

Direct wages	**₹150.00**	**₹ 100.00**
Direct expenses	**₹ 50.00**	**₹ 60.00**
Machine Hours used	**3**	**2**
Overhead Expenses:		
Fixed	**₹ 50.00**	**₹ 100.00**
Variable	**₹ 150.00**	**₹ 200.00**

Note: Direct wages per hour is ₹ 50.00

Required:

(i) Comment on the profitability of each product (both use the same raw material) when:

(I) Total sales potential in units is limited

(II) Total sales potential in value is limited

(III) Raw Material is in short supply, and

(IV) Production Capacity (in terms of Machine Hours) is the limiting factor.

(ii) Assuming raw material as the key factor, availability of which is 10000 Kg., and maximum sales potential of each product being 3500 units, find out the product mix which will yield the maximum profit. 4+6=10

Answer:

5. (a)

	Present Sales 80%	40% - Foreign 60% - Domestic	40% - Foreign 80% - Domestic
1. Sales	16.00	(7.20+12.00)= 19.20	(7.20 + 16.00) = 23.20
2. Variable Cost			
Direct Material	5.80	7.25	8.70
Direct Labour	2.40	3.00	3.60
Variable Overheads	0.60	0.75	0.90
Overtime Premium	--	---	0.15
	8.80	11.00	13.35
3. Contribution	7.20	8.20	9.85
4. Fixed Cost	5.20	5.20	(5.20 + 0.65) = 5.85
5. Profit	2.00	3.00	4.00

As per the above calculations, it is evident that the profit is maximum in Alternative III i.e., accepting the foreign order fully and monitoring the present domestic sales. It is the best alternative to be pursued by the management.

(b) Marginal Cost Statement of Ajanta Works Limited

Particulars	Cost Per Unit (₹)	
	A	B
Selling Price	1000	1200
Direct Materials	100	150
Direct Wages	150	100
Direct Expenses	50	60
Variable Overheads	150	200
Marginal Cost	450	510
Contribution Margin	550	690
P/V Ratio	55%	57.50%
Contribution per Kg of material	27.5	23.0
Contribution per Machine Hour	183	345

(i) The comments based on the above statement are as follows:

I. When total sales potential in units is a limiting factor, Product B is more profitable, as it is making a larger contribution margin per unit as compared to A.

II. When total sales potential in value is a limiting factor, Product B is still more profitable, as its P/V ratio is more than that of A.

III. When Raw Material is in short supply, A is more profitable as its contribution in per kg, of material is more than that of Product B.

IV. When production capacity is limited, B is more profitable as it makes larger contribution per machine hour than A.

(**Note**: Best position is reached when contribution per unit of key factor is maximum.)

(ii) Contribution per kg. of materials of A is more than that of B. So, 10,000 kg. ÷ 20 kg. = 500 units of A will only be produced and sold.

6. (a) Nikee Ltd. manufactures and sells one variety of sports-shirt in India. Noted football clubs and supporters of these clubs are the main customers. Nikee's products show some rectifiable defects. These problems can generally be detected and repaired during internal inspection at a cost of ₹ 15 per unit.

During 2016, 50000 shirts were produced and sold. After inspection defect was detected in respect of 5% of output. Inspection cost is ₹25 per shirt. After sales, customers reported defects in respect of 6% of output. These shirts were received back from customers at a transportation cost of ₹8 per unit. Because of negative publicity due to defects, there would be loss of sales in 2017 to the extent of 5% of external failures.

Required:

(i) Analyse costs of quality showing separately (with workings) the:
- **(I) Inspection or appraisal cost**
- **(II) Internal failure cost**
- **(III) External failure cost**
- **(IV) Opportunity cost due to external failure, and**
- **(V) Total costs of quality**

(ii) If the selling price per shirt is ₹250 and variable cost is 60% of sales, fixed cost ₹5,50,000 p.a., prepare a statement showing profitability of the product during 2016. **6+2=8**

(b) You are given the following estimates for next year's budgeted sales and costs of single product produced by Bee Ltd.:

Selling Price	***12**	
Sales demand:	**Units**	**Probability**
	3200	**0.50**
	4000	**0.30**
	5000	**0.20**
	₹	**Probability**
Variable cost per unit	**5.00**	**0.3**
	6.00	**0.5**
	7.00	**0.2**
Fixed cost for the period:	**₹ 20,000**	

Required:

(i) **Expected value of sales for the period.**

(ii) **Expected variable cost and contribution for the period.**

(iii) **Expected profit or loss for the budget period.** **2+4+2=8**

Answer:

6. (a)

Statement of Costs of Quality

		₹
(a)	Inspection or Appraisal Cost (₹ 25 × 50,000 shirts)	12,50,000
(b)	Internal failure (re-work) cost (5% × 50,000 × ₹ 15)	37,500

(c)	External failure cost (i.e., transportation + re-work cost) [6% × 50,000 × (₹ 8 + 15)]	39,000
(d)	Opportunity cost (i.e., loss of contribution) [10% × (5% × 50,000) × (₹ 250 × 40%)]	25,000
	Total Quality Cost	13,51,500

Profitability statement

	₹
Sales (50,000 × ₹ 250)	1,25,00,000
Less: Variable Cost (60%)	75,00,000
Contribution	50,00,000
Less: Quality Cost (as above)	13,51,500
Contribution, net of quality costs	36,48,500
Less: Fixed Cost	10,00,000
Net Profit	26,48,500

(b)

(1)	Expected Value of Sales:		
	Expected Sales × Profitability		
	3,200 × 0.5 = 1,600		
	4,000 × 0.3 = 1,200		
	5,000 × 0.2 = 1,000	3,800 @ ₹ 12	45,600
(2)	Expected Variable Cost:		
	Unit Variable costs × Profitability		
	₹ 0.5 × 0.3 = 1.5		
	₹ 0.6 × 0.5 = 3.0		
	₹ 0.7 × 0.2 = 1.4	5.9 × 3,800	22,420
	Expected Contribution		23,180
(3)	Expected Profit:		
	Expected Contribution		23,180
	(-) Fixed Cost		20,000
	Expected Profit	₹	3,180

7. (a) XYZ Auto-manufacturing company has to prepare a design of its latest model of motorcycle. The various activities to be performed to prepare a design are as follows:

Activity	Description of activity	Preceding activity
A	Prepare drawing	-
B	Carry out cost analysis	A
C	Carry out financial analysis	A
D	Manufacture tools	C
E	Prepare bill of material	B,C
F	Receive material	D,E
G	Order sub-accessories	E
H	Receive sub-accessories	G
I	Manufacture components	F
J	Final assembly	I,H
K	Testing and shipment	J

Prepare an appropriate network diagram. **8**

(b) In a processing industry two products A and B are made involving two operations. The production of B also results in a by-product C. The product A can be sold at a profit of ₹ 3 per unit and B at a profit of ₹ 8 per unit. The by-product C has a profit of ₹ 2 per unit. Forecast shows that upto 5 units of C can be sold. The company gets 3 units of C for each

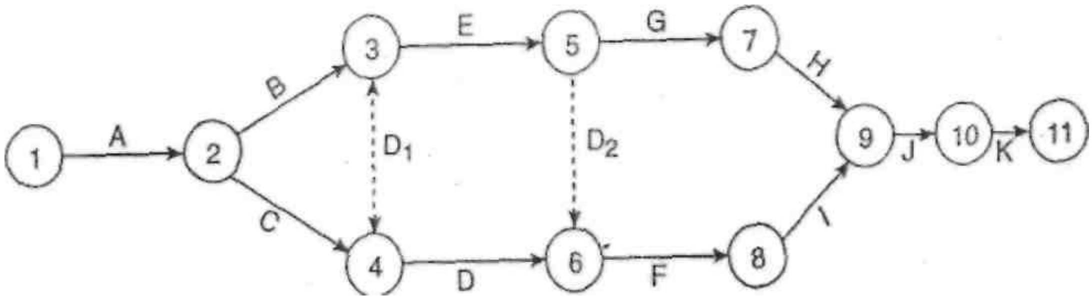
unit of B produced. The manufacturing times are 3 hours per unit for A on each of the operation one and two and 4 hours and 5 hours per unit for B on operation one and two, respectively. Because the product C results from producing B, no time is used in producing C. The available times are 18 hours and 21 hours of operation one and two respectively. The company desires to know how much of A and B should be produced keeping C in mind to make the highest profit.

Required:

Formulate LP model for this problem. **8**

Answer:

7. (a) The network diagram will be as follows:



(b) Let X_1, X_2, X_3 be the number of units produced of products A, B and C respectively. Objective function:

Then the profit gained by the industry is given by

$Z = 3x_1 + 8x_2 + 2x_3$

Here it is assumed that all the units of products A and B are sold.

Condition-1:

In first operation, A takes 3 hrs of manufacturer's time and B takes 4 hrs of manufacturer's time. Therefore, total number of hours required in first operation becomes - $3x_1 + 4x_2$

In second operation, per unit of A takes 3 hrs of manufacturer's time and per unit B takes 5 hrs of manufacturer's time. Therefore, the total number of hours used in second operation becomes - $3x_1 + 5x_2$

Since there are 18 hours available in first operation and 21 hours in second operation, the restrictions become

$3x_1+4x_2 \leq 18$

$3x_1+5x_2 \leq 21$

Condition-2:

Since the maximum number of units of C that can be sold is 5, therefore,

$X_3 \leq 5$

Condition-3:

Further, the company gels three units of by product C for every unit of product B produced, therefore,

$X_3 = 3X_2$

Now, the allocation problem of the industry can be finally put in the following linear programming problem:

Maximise

$Z = 3x_1 + 8x_2 + 2x_3$

Subject to the Constraints
$3x_1 + 4x_2 \leq 18$
$3x_1 + 5x_2 \leq 21$
$x_3 \leq 5$
$x_3 = 3x_2$
$x_1, x_2, x_3 \geq 0$

8. Write short notes on any four of the following: 4x4= 16
(a) Variants of Backflush Accounting
(b) Transfer Pricing
(c) Principles of Total Quality Management (TQM)
(d) Learning Curve Theory
(e) Simulation Technique

Answer:

8. (a) There are a number of variants of the Backflush system, each differing as to the 'trigger points' at which costs are recognized within the cost accounts and thus associated with products. Variant-1-This has two trigger points (TP): TP 1 - purchase of raw materials/components. A 'raw and in process (RIP)' account will be debited with the actual cost of materials purchased, and creditors credited. TP 2 - completion of good units. The finished goods (FG) account will be debited with the standard cost of unit produced and the RIP and CC account will be credited with the standard cost. Variant-2- This has only one trigger points - the completion of good units. The FG account is debited with the standard cost of units produced, with corresponding credits to the CC account and the creditors account.

(b) **Transfer Pricing:**
A transfer price is the price of one segment(sub unit, department, division etc.,) of an organization charges for a product or services supplied to another segment of the same organization. Transfer prices are used when individual entities of a larger multi-entity firm are treated and measured as separately run entities.

The benefits of Transfer Pricing Policy are as under:
(i) Divisional performance evaluation is made easier.
(ii) It will develop healthy inter-divisional competitive spirit.
(iii) Management by exception is possible.
(iv) It helps in co-ordination of divisional objectives in achieving organizational goals.
(v) It provides useful information to the top management in making policy decisions like expansion, sub-contracting, closing down of a division, make or buy decisions, etc,
(vi) Transfer Price will act as a check on supplier's prices.
(vii) It fosters economic entity and free enterprise system.
(viii) It optimizes the allocation of company's financial resources based on the relative performance of various profit centres, which in turn, are influenced by transfer pricing policies.

(c) Principles of Total Quality Management (TQM):
The philosophy of TQM rest on the following principles, which are enlisted below:
(i) Clear exposition of the benefits of a project.
(ii) Total Employee Involvement (TEI).
(iii) Process measurement.
(iv) Involvement of all customers and contributors.
(v) Elimination of irrelevant data.
(vi) Understanding the needs of the whole process.
(vii) Use of errors to prompt continuous improvement.
(viii) Use of statistics to tell people how well they are doing.

(d) **Learning Curve Theory:**

Learning Curve Theory is concerned with the idea that when a new job, process or activity commences for the first time, it is likely that the workforce involved will not achieve maximum efficiency immediately. Repetition of the task is likely to make the people more confident and knowledeable and will eventually result in a more efficient and rapid operation. Eventually the learning process will stop after continually repeating the job. As a consequence the time to complete a task will initially decline and then stabilize once efficient working is achieved. The cumulative average time per unit is assumed to decrease by a constant percentage every time that output doubles. Cumulative average time refers to the average time per unit for all units produced so far, from and including the first one made.

Learning is the process by which an individual acquires skill, knowledge and ability. When a new product or process is started, the performance of a worker is not at its best and a learning phenomenon takes place. As the experience is gained, the performance of a worker improves, time taken per unit of activity reduces and his productivity goes up. This improvement in productivity of a worker is due to learning effect. Cost predictions especially those relating to direct labour cost must allow for the effect of learning process. This technique is a mathematical technique. It can be very much used to accurately and graphically predict cost.

Learning Curve is essentially a measure of the experience gained in production of an article by an individual or organization. As more units are produced, people involved in production become more efficient than before. Each subsequent unit takes fewer man-hours to produce. The amount of improvement will differ with each type of article produced. This improvement or experience gain is reflected in a decrease in man-hours or cost.

The learning curve ratio can be calculated with the help of the following formula:
Learning Curve ratio = Average cost of first 2 units/Average labour cost of first unit.

(e) **Simulation:**

Simulation is a modelling and analysis tool that is widely used for the purpose of designing, planning and control of manufacturing systems. Simulation in general is to pretend that one deals with a real thing while really working with an imitation. In Operations Research, the imitation is a computer model of the simulated reality. The task of executing simulations provides insight and a deep understanding of physical processes that are being modelled.

Simulation is generally referred to as computer simulation, which simulates the operation of a manufacturing system. A computer simulation or a computer model is a computer program, which attempts to simulate an abstract model of a particular system.

A simple example of a simulation involves the tossing of a ball mto the air. The ball can be said to "simulate" a missile, for instance. That is, by experimenting with throwing balls starting at different initial heights and initial velocity vectors, it can be said that we are simulating the trajectory of a missile.

Monte Carlo method of simulation is the most popular method of simulation. In Linear Programming, Simulation is called as the 'technique of last resort'. It means, when all other methods fails, we resort to Simulation as the last resort.