Paper 15- Strategic Cost Management-DecisionMaking

Paper-15: Strategic Cost Management- Decision Making

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) Ink Ltd. makes leather purses. It has drawn up the following budget for its next financial period:
Selling price per unit ₹11.60; Variable production cost per unit ₹3.40; Sales commission 5% of selling price; Fixed production costs ₹4,30,500; Fixed selling and administration costs ₹1,98,150; Sales 90,000 units. The margin of safety represents:
(a) 5.6% of budgeted sales
(b) 8.3% of budgeted sales
(c) 11.6% of budgeted sales
(d) 14.8% of budgeted sales

(ii) A company uses a predetermined overhead recovery rate based on machine hours. Budgeted factory overhead for a year amounted to ₹7,20,000, but actual factory overhead incurred was ₹7,38,000. During the year, the company absorbed ₹7,14,000 of factory overhead on 1,19,000 actual machine hours. What was the company's budgeted level of machine hours for the year?
(a) 116098
(b) 119000
(c) 120000
(d) 123000

(iii) A company uses standard absorption costing to value inventory. Its fixed overhead absorption rate is ₹12 per labour hour and each unit of production should take four labour hours. In a recent period when there was no opening inventory of finished goods, 20000 units were produced using 100000 labour hours. 18000 units were sold. The actual profit was ₹464000.What profit would have been earned under a standard marginal costing system?
(a) ₹368000
(b) ₹440000
(c) ₹344000
(d) ₹560000

(iv) X plc intends to use relevant costs as the basis of the selling price for a special order: the printing of a brochure which requires a particular type of paper that is not regularly used by X plc although a limited amount is in X plc's inventory which was left over from a previous job. The cost when X plc bought this paper last year was ₹15 per ream and there are 100 reams in inventory. The brochure requires 250 reams. The current market price is ₹26 per ream and resale value is ₹10 per ream.

The relevant cost of the paper to be used in printing the brochure is:
(a) ₹2500
(b) ₹4900
(c) ₹5400
(d) ₹6500

(v) Alpha uses decision tree analysis to evaluate potential projects. The company has been looking at the launch of a new product which it believes has a 70% probability of success. The company is however considering undertaking an advertising campaign costing ₹50,000, which would increase the probability of success to 95%. If successful, the product would generate income of ₹200000 otherwise ₹70000 would be received. What is the maximum that the company would be prepared to pay for the advertising?
(a) ₹32500
(b) ₹29000
(c) ₹17500
(d)₹50000

(vi) A company uses standard absorption costing. The following information was recorded by the company for October:

	Budget	Actual
Output and sales (units)	8700	8200
Selling price per unit	₹26	₹31
Variable cost per unit	₹10	₹10
Total fixed overheads	₹34800	₹37000

The sales price variance for October was:
(a) ₹38500 adverse
(b) ₹38500 favourable
(c)₹41000 adverse
(d) ₹41000 favourable

(vii)Based on the data given, what is the amount of the overhead under/over absorbed?

Budgeted overheads	₹493200
Budgeted machine hours	10960
Actual machine hours	10493
Actual overhead	₹514157

(a) ₹20957 under-absorbed
(b) ₹20957 over-absorbed
(c) ₹41972 over-absorbed
(d) ₹41972under-absorbed

(viii)Bunny uses a JIT system and backflush 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; includes materials of ₹45. During May, ₹480000 of conversion costs were incurred. The debit balance on the cost of goods sold account for May was:
(a) ₹800000
(b) ₹840000
(c) ₹880000
(d) ₹920000

(ix) A company manufactures two products using common handling facility. The total budgeted material handling cost is ₹60000. The other details are:

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

Under ABC System, the material handling costs to be allocated to Product X (per unit) would be:
(a) ₹1000
(b) ₹500
(c) ₹1500
(d) ₹2500

(x) The selling price of Product P is set at ₹1500 for each unit and sales for the coming year are expected to be 500 units. If the company requires a return of 15% in the coming year on its investment of ₹1500000 in product P, the target cost for each unit for the coming year is:
(a) ₹930
(b) ₹990
(c) ₹1050
(d) ₹1110

Answer:

1. **(i)** (b) 8.3% of budgeted sales
Unit contribution = ₹(11.60 – 3.40 – 0.58) = ₹7.62
BEP = (430500 + 198150)/7.62 = 82500
Margin of safety = (90000 – 82500)/90000 = 8.3%

(ii) (c) 120000

Overhead absorbed = Actual hours x Pre-determined overhead rate
Or, 714000 = 119000 x Pre-determined overhead rate
Or, Pre-determined overhead rate = 714000/119000 = ₹6
Budgeted overhead = Budgeted machine hours x budgeted overhead rate
Or, Budgeted machine hours = 720000/6 = 120000 hours

(iii) (a) ₹368000

Standard absorption costing will include ₹96000 of the period's overhead (2000 units x 4 labour hours x ₹12 per hour) in the closing inventory valuation. Under standard marginal costing, ₹96000 would be charged against the period's profit resulting in profit being reduced by ₹96000 to ₹368000.

(iv) (b) ₹4900

The original purchase price is a sunk cost and therefore not a relevant cost. The relevant cost of the materials in stock is ₹1000 (100 reams @ ₹10 net realizable value). An additional 150 reams must be purchased for ₹3900 (150 x ₹26) resulting in a relevant cost of ₹4900.

(v) (a)₹32500

Expected income with advertising = (200000 x 0.95) + (70000 x 0.05) = ₹193500
Expected income without advertising = (200000 x 0.7) + (70000 x 0.3) = ₹161000
The maximum amount the company should pay for advertising is the increase in expected value of ₹32500 (193500 – 161000).

(vi) (d)₹41000 favourable

Sales price variance =(actual margin – budgeted margin) x actual sales volume
(₹17 –₹12) x 8200 = ₹41000 favourable
Note that fixed overhead rate per unit is (₹34800/8700) = ₹4
Actual margin = 31-10-4 = ₹17
Budgeted margin = 26-10-4 = ₹12

(vii) (d)₹41972 under-absorbed

Overhead absorption rate = 493200/10960 = ₹45
Overhead absorbed = 10493 x 45 = ₹472185
Overhead incurred = ₹514157
Under absorbed = ₹41972

(viii) (b) ₹840000

		₹
Cost of goods sold	800000	
Less: Material cost		360000
Conversion cost allocated		440000
Conversion cost incurred		480000
Excess charged to Cost of goods sold A/c		40000

Total debit on Cost of goods sold A/c = ₹800000 + ₹40000 = ₹840000

(ix) (b)₹500

Total moves in material handling = 5 + 15 = 20

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

Material handling cost to be allocated to Product A = 60000 x 25/100 = ₹15000

Or, = ₹15000/30 units = ₹500 p.u.

(x) (c)₹1050

		₹
Sales revenue	(500 units x ₹1500)	750000
Less: Return on investment	(₹1500000 x 15/100)	225000
Total cost allowed		525000
Target cost per unit	(₹525000/500 units)	₹1050

Section – B

Answer any fivequestions.

[16×5= 80]

2. (a) Amar Ltd. produces 4 products P, Q, R and S by using three different machines X, Y and Z. Each machine capacity is limited to 6000 hours per month. The details given below are for July-

Particulars	P	Q	R	S
Selling Price p.u. (₹)	10,000	8,000	6,000	4,000
Variable Cost p.u. (₹)	7,000	5,600	4,000	2,800
Machine Hours required p.u.				
Machine X	20	12	4	2
Machine Y	20	18	6	3
Machine Z	20	6	2	1
Expected Demand (units)	200	200	200	200

1. **Find out the Bottleneck Activity.**
2. **Allocate the Machine Hours on the basis of the Bottleneck.**
3. **Ascertain the profit expected in the month if the monthly Fixed Cost amounts to ₹9,50,000.**
4. **Calculate the unused spare hours of each machine. [8]**

(b) A lodging home is being run in a small hill station with 50 single rooms. The home offers concessional rates during six off-season months in a year. During this period, half of the full room rent is charged. The management's profit margin is targeted at 20% of the room rent. The following are the cost estimates and other details for the year ending 31st march, 2019 (assume a month to be of 30 days):

(a) Occupancy during the season is 80%, while in the off-season is 40% only;

(b) Expenses:	**₹**
(i) Staff salary (excluding room attendants)	**2,75,000**
(ii) Repairs to buildings	**1,30,500**
(iii) Laundry and linen	**40,000**
(iv) Interior and tapestry	**87,500**
(v) Sundry expenses	**95,400**

(c) Room attendants are paid ₹5 per room-day on the basis of occupancy of the rooms in a month.

(d) Monthly lighting charges are ₹120 per room, except in four months of winter when it is ₹30 per room and this cost is on the basis of full occupancy for a month.

You are required to work out the room rent chargeable per day both during the season and the off-season months, on the basis of the above information. [8]

Answer:

2. (a)

1. Identification of Bottleneck Activity

Machine	Time required for products (Demand x M/Hrs p.u.)				Total time reqd (Hrs)	Time Available (Hrs)	Machine Utilization
	P	Q	R	S			
	(a)	(b)	(c)	(d)	(e)=(a+b+c+d)	(f)=given	(g)= (e/f)
X	4000	2400	800	400	7600	6000	126.67%
Y	4000	3600	1200	600	9400	6000	156.67%
z	4000	1200	400	200	5800	6000	96.67%

Since Machine Y has the highest machine utilization, it represents the Bottleneck Activity. Hence product, ranking & resource allocation should be based on contribution per machine hour of Machine Y.

2. Allocation of Resources and overall Profit

Particulars	P	Q	R	S	Total
(a)Contribution per unit (₹)	3000	2400	2000	1200	
(b) Time reqd. in Machine Y (Hrs)	20	18	6	3	
(c)Contribution per Machine hour	150	133.33	333.33	400	
(d)Rank based on (c)	III	IV	II	I	
(e)Allocation of Machine Y time (Hrs)	200x20 =4000	200 (bal.fig.)	200x6 =1200	200x3 =600	6000
(f) Production quantity (e/b)	200 units	11.11 units	200 units	200 units	

(g) Allocation of Machine X time (Hrs)	20x20 =4000	11.11x12 =133.32	200x4 =800	200x2 =400	5333.32
(h) Allocation of Machine Z time (Hrs)	200x20 =4000	11.11x6 =66.66	200x2 =400	200x1 =200	4666.66
(i) Contribution based on allocation	200x3000 =600000	11.11x2400 =26664	200x2000 =400000	200x1200 =240000	1266664
(j) Fixed cost for the month					(950000)
(k) Profit for the month					316664

Spare Capacity:
Machine X = 6000 – 5333.32 = 666.68 hours
Machine Z = 6000 – 4666.66 = 1333.34 hours

(b) (1) Calculation of No. of Room days in a year

		(Room days)
Season's occupancy	(50 rooms x 6 months x 30 days x 80/100)	7200
Off-season's occupancy	(50 rooms x 6 months x 30 days x 40/100)	3600
Total room days in a year		10800

(2) Calculation of lighting charges
Lighting charges ₹120 per room p.m. for 8 months = ₹120/30days = ₹4 per room day
Lighting charges ₹30 per room p.m. for 4 months = ₹30/30days = ₹1 per room day

		(₹)
During season for 6 months	(7200 x 4)	28800
During season for 2 months	(3600 x 2/6) x 4	4800
During winter for 4 months	(3600 x 4/6) x 1	2400
Total lighting charges p.a.		36000

Computation of Estimated costs for the year ending 31.03.2019		(₹)
Salary		275000
Repairs		130500
Laundry and linen		40000
Interior decoration		87500
Attendants' salary	(10800 room days @ ₹5)	54000
Lighting charges		36000
Sundry expenses		95400
Total estimated cost p.a.		718400

Total full room days p.a.		(Room days)
Season		7200
Off-season	(3600 room days x 50%)	1800
Total full room days p.a.		9000

		(₹)
Cost per room day	(₹718400/9000 room days)	79.82

Add: Profit	(20% of rent or 25% of cost)	19.96
Room rent		99.78

Room rent to be charged during season = ₹99.78 per room day

During off-season = ₹99.78 X 50% = ₹49.89 per room day

3. (a) A manufacturing unit of Ash Co. has presented the following details:

Average units produced and sold per month	**240000**
No. of workers	**80**
Sales value	**₹60 Lakhs**
Contribution	**₹24 Lakhs**
Wage rate	**₹5 per unit**

The production manager proposes to introduce a new automated machine due to which following changes will take place:

1. **No. Of units produced and sold are expected to increase by 20%.**
2. **No. Of workers will be reduced to 60.**
3. **With a view to provide incentive for increased production, Production manager intends to offer 1% increase in wage rate for every 3% increase in average individual output achieved.**
4. **Decrease in selling price by 2%.**

Required:Calculate amount of extra contribution after introduction of new automated machine and give your recommendations. [8]

(b) A manufacturing concerns has a multi-purpose Plant capable of operating at full capacity at 5000 machine hours per month. It may produce three products inter-changeably, for which the output and cost details are as follows:

Product	Output per Machine Hour	Material Costs
A	**500 units**	**₹42.50 per 1000 units**
B	**250 units**	**₹17.50 per 1000 units**
C	**1000 units**	**₹30.00 per 1000 units**

Labour Cost is ₹15 per machine hour while variable overheads will be ₹5 per machine hour. Fixed costs of this department are ₹100000 per monthly production period.

The company estimates from past experience that the full capacity can be used at all times if machine time can be freely moved from one product to another as dictated by demand and is anxious to establish suitable product selling prices (per 1000 units). The three price fixing methods under consideration are:

- **To fix prices at product cost plus 20%**
- **To fix prices so as to give a contribution of ₹35 per machine hour**

- **To fix prices arbitrarily (per 1000 units) as Product A –₹150, Product B –₹230 and Product C –₹90.**

Prepare a comparative statement of prices that would be charged under the three methods. Suggest which method should be adopted. [8]

Answer:

3. (a)

Particulars	Before Automation		After Automation	
1. Total Output	240000 units (Given)		240000 + 20% = 288000units	
2. No. Of Employees	80		60	
3.Output per Employee (1/2)	3000 units		4800	
	Per Unit	Total	Per Unit	Total
4.Selling Price / Sales	₹6000000/240000 = ₹25	₹6000000 (Given)	₹25 – 2 = ₹24.5	288000 x 24.5 = ₹7056000
5. Variable Costs: (a) Labour (b) Others (bal. Fig)	 ₹5 (Given) ₹10 (bal. Fig)		 ₹5 + 20% =₹6 ₹10 (same)	
6. Contribution (4-5)	₹2400000/240000 = ₹10	₹2400000 (Given)	₹8.5	288000 x8.5 = ₹2448000

Note: Average individual output increase = $\frac{4800 - 3000}{3000} = 60\%$

Since Average individual output has increased by 60%, Bonus entitlement will be 20%.

Decision: Increase in Monthly Contribution = ₹2448000 –₹2400000 = ₹48000. Hence the project is acceptable.

(b) Statement of Selling Prices under alternative strategies (per 1000 units) (₹)

S. No.	Particulars	Product A	Product B	Product C
a	Output per machine hour	500 units	250 units	1000 units
b	Labour time reqd per 1000 units = (1000/a)	2 hours	4 hours	1 hour
c	Material cost (given)	42.5	17.5	30
d	Labour cost –₹15 per hour	30	60	15
e	Variable OH @ ₹5 per hour	10	20	5
f	Total variable cost (c+d+e)	82.5	97.5	50
g	Fixed OH (100000/5000 hrs) = ₹20 per hour	40	80	20
h	Total cost (f+g)	122.5	177.5	70
i	Profit margin at 20% of Total cost	24.5	35.5	14
j	Selling price based on Cost plus basis (h+i)	147	213	84

k	Contribution @ ₹35 per hour	70	140	35
l	Selling price to guarantee contribution (f+k)	152.5	237.5	85
m	Selling price fixed arbitrarily (given)	150	230	90
n	Best selling price (highest)	152.5	237.5	90
o	Best method of fixing the price	Guaranteed contribution	Guaranteed contribution	Arbitrary method

Decision: On an overall basis, the method which guarantees contribution of ₹35 per machine hour may be considered as ideal as it will ensure a profit of (₹35 x 5000 hrs) less Fixed Cost ₹100000 = ₹75000 per month. This profit will be earned irrespective of the product mix decision.

The effect of other methods of pricing depends upon the sale quantity, sales mix and the impact of key factor.

4. (a) StanleyCassette Ltd. Has budgeted the following sales for Feb 2020

Cassette A	**1100 units @ ₹50 per unit**
Cassette B	**950 units @ ₹100 per unit**
Cassette C	**1250 units @ ₹80 per unit**

As against this, the actual sales were:

Cassette A	**1300 units @ ₹55 per unit**
Cassette B	**1000 units @ ₹95 per unit**
Cassette C	**1200 units @ ₹78 per unit**

The cost per unit of Cassettes A, B and C was ₹45, ₹85 and ₹70 respectively. Compute the different variances to explain the difference between the budgeted and actual profit. [10]

(b) A firm of printer is contemplating joining the Uniform costing system being operated by its trade association but the Managing Director is doubtful about the advantages of becoming involved in the scheme. Prepare a report to the Managing Director describing the advantages that the firm is likely to gain. [6]

Answer:

4. (a) Working Notes

(1) Calculation of Standard and Actual Profit Per Unit

Cassette	Standard			Actual		
	Selling Price	Cost	Profit	Selling Price	Cost	Profit
A	50	45	5	55	45	10
B	100	85	15	95	85	10
C	80	70	10	78	70	8

(2) Calculation of Budgeted and Actual Total Profit

Cassette	Budgeted			Actual		
	Sales qty. (units)	Profit per unit (₹)	Total Profit (₹)	Sales qty. (units)	Profit per unit (₹)	Total Profit (₹)
A	1100	5	5500	1300	10	13000
B	950	15	14250	1000	10	10000
C	1250	10	12500	1200	8	9600
			32250			32600

Calculation of Variances

(1) Total profit variance due to sales

Actual profit – Budgeted profit

= ₹32600 – ₹32250 = ₹ 350(F)

(2) Profit variance due to selling price

Actual qty. (Actual selling price – Standard selling price)

A = 1300(55 – 50) = ₹6500 (F)

B = 1000(95 – 100) = ₹5000 (A)

C = 1200(78 – 80) = ₹2400 (A)

= ₹900(A)

(2) Profit variance due to sales volume

Std. Profit (Actual qty. – Budgeted qty.)

A = 5(1300 – 1100) = ₹1000 (F)

B = 15(1000 – 950) = ₹750 (F)

C = 10(1200 – 1250) = ₹500 (A)

= ₹1250(F)

Profit variance due to sales is further analyzed into:

(a) Profit variance due to sales mix

Std. Profit (Actual qty. – Standard proportion for actual sales)

A = 5(1300 – 1167) = ₹665 (F)

B = 15(1000 – 1008) = ₹120 (A)

C = 10(1200 – 1325) = ₹1250 (A)

= ₹705(A)

Std. proportion for actual sales is calculated as below: (Units)

$A = \frac{3500}{3300} x1100$	1167
$B = \frac{3500}{3300} x950$	1008
$C = \frac{3500}{3300} x1250$	1325
	3500

(b) Profit variance due to sales quantity

Std. Profit (Standard proportion for actual sales – Budgeted qty.)

A = 5(1167 - 1100)	= ₹335 (F)
B = 15(1008 - 950)	= ₹870 (F)
C = 10(1325 - 1250)	= ₹750 (F)
	= ₹1955(F)

Verification

Volume Variance = Mix variance + Qty. variance

₹1250 (F) = ₹705(A) +1955 (F)

Statement of Profit showing Analysis of Variances (₹)

Particulars	Cassette		
	A	B	C
Budgeted sales	55000	95000	100000
Less: Budgeted cost	49500	80750	87500
Budgeted profit	5500	14250	12500
Variances			
Profit variance due to selling price	6500 (F)	5000 (A)	2400 (A)
Profit variance due to sales mix	665 (F)	120 (A)	1250 (A)
Profit variance due to sales qty.	335 (F)	870 (F)	750 (F)
	7500 (F)	4250 (A)	2900 (A)
Actual profit	13000	10000	9600

(b) For introduction of uniform costing in an industry, first of all, the top managements of the different concerns in the industry should understand the benefits that can be reaped by the individual firmsand the total industry on implementation of the uniform costing. The benefits which may accrue to the participating concerns from the use of uniform costing are as follows:

1. It provides a standard system for the maintenance of cost accounts useful to all members of the industry, especially small and new members. This helps to compare the efficiency of individual units.
2. The members can pool their resources and get the benefit of better R&D efforts at cheaper rate.
3. It helps the firms to submit reliable cost data to price fixing bodies to determine the average cost and fixing the fair selling price of various products. It facilitates realistic pricing policies.
4. Greater ease in operating can be achieved by thorough understanding of costs and competitive spirit inculcated in the industry.
5. It facilitates improvement in labour, machinery and production methods and techniques.
6. It facilitates cost comparison among different concerns producing same products and enables each concern to measure its own efficiency with its competitors.

5. (a) There are two Profit Centres namely Division A and Division B in Ditya Ltd. Division A produces four products P, Q, R and S. Each product is sold in the external market also. The relevant data for Division A are as follows:

	P	Q	R	S
Market price per unit (₹)	700	690	560	460
Variable cost of production per unit (₹)	660	620	360	370
Labour hours required per unit (Hours)	6	8	4	6

The maximum sales in the external market are: P – 3000 units, Q – 3500 units, R – 2800 units and S – 1800 units.
Product S can be transferred to Division B also but the maximum quantity that might be required for transfer is 2200 units of S.
Division B can also purchase the same product at a price of ₹420 per unit from the market instead of receiving transfers of Product S from Division A.

Required:

a) Calculate the Transfer Price for each unit for 2200 units of product S, if the Total Labour Hours available in Division A are – (i) 48000 hours, (ii) 64000 hours.

b) Whether is it profitable for Division B to get transfer 2200 units of Product S from Division A in above (a) situation?

Show calculation of units to nearest unit and rest upto two decimal points. [8]

(b) A Company produces three products P, Q and R for which the Standard Cost per unit and quantities produced are as under:

Products	P	Q	R
Units produced and sold	36000	48000	96000
Direct Material Cost per unit ₹	60	48	45
Direct Labour Cost per unit ₹	30	24	18
Machine Hours per unit (hours)	0.5	0.4	0.3

Total Production Overheads are absorbed on Machine Hour basis. The rate is ₹60 per Machine Hour.

The Company has analyzed its operations and determined that five activities act as Cost Drivers for Overheads. Data relating to five activities are given below:

Activity Area	Cost Driver	Cost of each activity as % of Total Production Overhead Cost
Store Receiving	Number of Requisitions	25%
Machine Set-up	Number of Set-ups	20%
Machine Running	Machine Hours worked	25%
Packing	Packing time in Hours	16%
Storage	Area in Square Meters	14%

The investigation into the Production Overhead Activities for the period revealed the following:

Activity	P	Q	R
Number of Requisitions	1200	1500	3900
Number of Machine Set-ups	60	120	320
Packing Hours	3000	4800	10200

Storage (sq. meters)	10800	12000	19200

Required:

1) **Calculate the Total Production Overheads.**
2) **Prepare Product Cost Statement showing per unit cost under Traditional Absorption Costing Method.**
3) **Calculate the Cost Driver Rates.**
4) **Prepare Product Cost Statement showing per unit cost under ABC Method.**
5) **What is the difference in Costs due to adoption of Traditional Absorption Costing Method and ABC Method? [8]**

Answer:

5. (a)

1. Key factor allocation for external sales

S.No	Particulars	P	Q	R	S	Total
a	Maximum external sales	3000 units	3500 units	2800 units	1800 units	
b	Hours reqd per unit	6 hrs	8 hrs	4 hrs	6 hrs	
c	Total DLH reqd for external sales (axb)	18000 hrs	28000 hrs	11200 hrs	10800 hrs	68000 hrs
d	Selling price per unit	₹700	₹690	₹560	₹460	
e	Variable costs per unit	₹660	₹620	₹360	₹370	
f	Contribution per unit (d-e)	₹40	₹70	₹200	₹90	
g	Contribution per hour (f/b)	₹6.67	₹8.75	₹50	₹15	
h	Ranking for production	IV	III	I	II	
i	Allocation of 48000 hrs for external sale	Nil	26000 hrs	11200 hrs	10800 hrs	48000 hrs
j	Allocation of 64000 hrs for external sale	14000 hrs	28000 hrs	11200 hrs	10800 hrs	64000 hrs

Note: Total hours reqd for meeting external sale is 68000 hours. However, the total labour hours available is only 64000 hours. Hence, only 64000 hours are allocated in step (i) for meeting the external sales.

2. Computation of Transfer Prices

Hours Available	48000 hours	64000 hours
Internal transfer qty. & Hrs	2200 units of S x 6 = 13200 hours	2200 units of S x 6 = 13200 hours
Total Opportunity Costs	13200 hrs from Q at ₹8.75 ph = ₹115500	13200 hrs from P at ₹6.67 ph = ₹88044
Opportunity Costs	$\frac{115500}{2200} = ₹52.50\ per\ unit$	$\frac{88044}{2200} = ₹40.02\ per\ unit$
Variable Costs	₹370 per unit	₹370 per unit
Minimum Transfer Price	₹422.50 per unit	₹410.02 per unit
Outside Market Price	₹420 per unit	₹420 per unit

Profitability of Internal Transfer/Decision	Not profitable, since outside market price is less. It is preferable to buy S from outside at ₹420pu.	Profitable, since transfer price is less. It is preferable to transfer 2200 units of S.

(b)

1. Total Machine Hours and POH

P	Q	R	Total
36000×0.5=18000 hrs	48000x0.4=19200 hrs	96000 x 0.30 =28800 hrs	66000 hours

So, Total POH = 66000 hours x ₹60 = ₹3960000

2. Computation of ABC Rates

Activity	%	Cost Pool (₹)	Cost Driver	Cost Driver Qty	ABC Rate
Store Receiving	25%	990000	Number of Requisitions	1200+1500+3900= 6600	₹150 per reqn
Machine Set-up	20%	792000	Number of Set-ups	60+120+320=500	₹1584 per set-up
Machine Running	25%	990000	Machine Hours worked	18000+19200+288 00=66000	₹15 per M/c Hour
Packing	16%	633600	Packing time in Hours	3000+4800+10200 =18000	₹35.2 per Pkg Hour
Storage	14%	554400	Area in Square Metres	10800+12000+192 00=42000	₹13.2 per Sq. M
Total		3960000			

3. Overhead Cost Allocation using ABC Rates (₹)

Activity Area	P	Q	R	Total
Store Receiving	1200x150=180000	1500x150=225000	3900x150=585000	990000
Machine Set-up	60x1584=95040	120x1584=190080	320x1584=506880	792000
Machine Running	18000x15=270000	19200x15=288000	28800x15=432000	990000
Packing	3000x35.2=105600	4800x35.2=168960	10200x35.2=359040	633600
Storage	10800x13.2=142560	12000x13.2=158400	19200x13.2=253440	554400
Total OH in ABC	793200	1030440	2136360	3960000
Production Qty.	36000 units	48000 units	96000 units	
OH Cost pu.	22.03	21.47	22.25	

4. Statement of Costs Per unit (₹)

S.No.	Particulars	P	Q	R
a	Direct Materials per unit	60	48	45
b	Direct labour per unit	30	24	18
c	Prime Cost per Unit (a+b)	90	72	63
d	OH Cost p.u. under Traditional System (Hrspu x ₹60)	0.5x60=30	0.5x60=24	0.3x60=18

e	Total Cost p.u. under Traditional System (c+d)	120	96	81
f	OH Cost p.u. under ABC System (as per WN3)	22.03	21.47	22.25
g	Total Cost p.u. under ABC System (c+f)	112.03	93.47	85.25
h	Difference between Traditional and ABC System (e-g)	7.97	2.53	4.25
i	Effect under Traditional System	Over costed	Over costed	Under costed

6. (a) A Company has just completed the manufacture of 40 units of a new product. The manufacturing costs are-

Direct Material	**200000**
Direct Labour: 8000 hours @₹20 per hour	**160000**
Variable Overheads	**80000**
Special Tools (re-usable)	**10000**
Fixed Overhead apportioned	**100000**
Total	**550000**

The Company's policy is to add a profit of 12% on Selling Price.

The Company received another order for 120 units of this product for which the Company quoted, based on its policy on absorption cost basis, a price of ₹15625 per unit. The Customer struck the order to ₹11000 per unit. The Company is short of work and so is keen to take up more orders but it is reluctant to accept this order price because it is against the policy to accept any price before its cost. The Company experiences a Learning Curve of 90%.

Compute the Gain or Loss arising from acceptance of the order of ₹11000 p.u. and advise the Company suitably. [8]

(b)Aditya Enterprises is having three plants manufacturing dry-cells, located at different locations. Production cost differs from plant to plant. There are five sales offices of the company located in different regions of the country. The sales prices can differ from region to region. The shipping cost from each plant to each sales office and other data are given below:

Product Data

Production Cost per unit (₹)	Max. capacity in no. of units	Plant no.
20	**150**	**1**
22	**200**	**2**
18	**125**	**3**

Shipping Costs (₹)

	Sales Offices

	A	B	C	D	E
Plant 1	**1**	**1**	**5**	**9**	**4**
Plant 2	**9**	**7**	**8**	**3**	**6**
Plant 3	**4**	**5**	**3**	**2**	**7**

Demand and Sales Prices

Demand (units)	**80**	**100**	**75**	**45**	**125**
Sales Price (₹)	**30**	**32**	**31**	**34**	**29**

Find the production and distribution schedule most profitable to the company. [8]

Answer:

6. (a)

1. Computation of Selling Price of First Order for 40 units

a	Total Costs	₹550000
b	Number of units	40 units
c	Average Cost per unit = (a/b)	₹13750
d	Since Profit is 12% on Price, it is 12/88 on Cost of ₹13750	₹1875
e	Price Quoted (Cost + Profit) (c+d)	₹15625

2. Computation of Time required for 120 units

No. of units	Time reqd per unit	Total time reqd	Cumulative time
40	8000 hrs/40 units = 200 hrs	8000 hrs (given)	8000 hrs
80	200 x 90% = 180 hrs	80 units x 180 hrspu	14400 hrs
160	180 x 90% = 162 hrs	160 units x 162 hrspu	25920 hrs

Time required for 120 units = Cum. Time for 160 units – Time required for first 40 units = 25920 – 8000 = 17920 hours.

3. Cost Sheet for order of 120 units

Particulars	Computation	₹
Direct Material	₹200000/40 = ₹5000 x 120 units	600000
Direct Labour	17920 hours x ₹20 per hour	358400
Variable Overheads	17920 hours x ₹10 per hour	179200
Special Tools (re-usable)	Hence, Relevant Cost is Nil	Nil
Fixed Overhead	Idle Capacity, hence Not Relevant	Nil
Total Cost		1137600
Cost per unit	₹1137600/120	9480
Price offered		11000
Profit per unit		1520

Decision: Total profit from 120 units is (₹1520 x 120 units) =₹182400. Hence, the order should be accepted.

(b) In order to solve the transportation problem, we use the given information to derive the profit matrix. This is being done as follows:

Profit = Sales price – Production cost – Shipping cost

Thus, if we transport one unit of dry cell from each of the three plants to each of the five sales office, the following matrix is obtained:

Table 1

Plant	A	B	C	D	E	Capacity (units)
1	9	11	6	5	5	150
2	-1	3	1	9	1	200
3	8	9	10	14	4	125
Demands	80	100	75	45	125	475 425

Here, if we transport one unit from plant 2 to sales office, the profit obtained will be calculated as follows (for above table):

Profit = ₹34 –₹22 –₹3 = ₹9

The objective of the company is to maximize profit. For achieving this objective, let us convert this maximization problem into minimization problem by subtracting all the elements of the above pay-off matrix from the highest pay-off, i.e., 14. Thus we have:

Table 2

Plant	Loss Matrix					Capacity (units)
	A	B	C	D	E	
1	5	3	8	9	9	150
2	15	11	3	5	13	200
3	6	5	4	0	10	125
Demands	80	100	75	45	125	475 425

The problem is an unbalanced problem, i.e., capacity is 475 and demand is 425. Hence, a dummy sales office is added with cost equal to zero for all plants and demand equal to 50 units. Now let us apply Vogel's Approximation Method to the resultant balanced matrix for finding the initial feasible solution.

Table 3

Plant	Sales office									
	A	B	C	D	E	Dummy	Capacity	Difference		
1	50 5	100 3	8	9	9	0	150	3	3	2
2	25 15	1 11	13	5	125 13	50 0	200	5	11	2
3	5 6	5	75 4	45 0	10	0	125	0	4	1
Demand	80	100	75	45	125	50	475 475			

Difference	1	2	4	5	1	0	
	1	2	4	-	1	-	
	1	2	4	-	1	-	

The initial solution obtained by VAM is given below, which is tested for optimality.

Table 4

Plant	Sales office						
	A	B	C	D	E	Dummy	Capacity (Units)
1	50 5	100 3	8	9	9	0	150
2	25 15	11	13	5	125 13	50 0	200
3	5 6	5	75 4	45 0	10	0	125
Demand	80	100	75	45	125		

Since, there are 8 allocations, the solution is non-degenerate. Let us now introduce $U_i - V_j$, i = (1,2,3); j = (1,2,…,6) such that $\Delta_{ij} = C_{ij} - (U_i + V_j)$ for allocated cells. We assume $U_2 = 0$ and remaining U_i's, V_j's and Δ_{ij}'s are calculated as below:

Table 5

Plant	Sales office							
	A	B	C	D	E	Dummy	Capacity	V_i's
1	50 5	100 3	8 5	9 10	9 0	0 -1 0	150	-10
2	25 -0 15	11 -2	13 10	+0 5 -4	125 13	50 0	200	0
3	5 +0 6	5 1	75 4	45 -0 0	10 6	0 9	125	-9
Demand	80	100	75	45	125	50	475 475	
V_j's	15	13	13	9	13	0		

(Note: For values of occupied and unoccupied cells refer to Note 1.)

Table 6

Plant	Sales office							
	A	B	C	D	E	Dummy	Capacity	V_i's
1	50 5	100 3	8 5	9 10	9 2	0 6	150	-6
2	15 4	11 2	13 4	25 5	125 13	50 0	200	0
3	30 6	5 1	75 4	20 0	10 2	0 5	125	-5
Demand	80	100	75	45	125	50	475 475	
V_j's	11	9	9	5	13	0		

***** Refer to Note 2 for values of occupied and unoccupied cells.

Since the values opportunity cost in all the unoccupied cells are positive, the solution obtained above is optimal. The allocation of plants to sales office and their profit amount is given below:

Plant	Sales office	Units	Profit per unit (₹)	Profit (₹)
1	A	50	9	450
1	B	100	11	1,100
2	D	25	9	225
2	E	125	1	125
2	Dummy	50	0	0
3	A	30	8	240
3	C	75	10	750
3	D	20	14	280
			Total profit	3,170

Working Notes

1. Values in Table 5 have been calculated as follows:

Occupied cells $C_{ij} = U_i + V_j$	Unoccupied cells $\Delta_{ij} = C_{ij} - (U_i + V_j)$
$C_{11} = U_1 + V_1 = 5$ or $U_1 = 5 - 15 = -10$	$C_{13} = 8 - (-10 + 13) = 5$
$C_{12} = U_1 + V_2 = 3$ or $V_2 = 3 + 10 = 13$	$C_{14} = 9 - (-10 + 9) = 10$
$C_{21} = U_2 + V_1 = 15$ or $V_1 = 15 - 0 = 15$	$C_{15} = 9 - (-10 + 13) = 6$
$C_{25} = U_2 + V_5 = 13$ or $V_5 = 13 - 0 = 13$	$C_{16} = 0 - (-10 + 0) = 10$
$C_{26} = U_2 + V_6 = 0$ or $V_6 = 0$	$C_{22} = 11 - (0 + 13) = -2$
$C_{31} = U_3 + V_1 = 6$ or $U_3 = 6 - 15 = -9$	$C_{23} = 13 - (0 + 13) = 0$
$C_{33} = U_3 + V_3 = 4$ or $V_3 = 4 + 9 = 13$	$C_{24} = 5 - (0 + 9) = -4$
$C_{34} = U_3 + V_4 = 0$ or $V_4 = 9$	$C_{32} = 5 - (-9 + 13) = 1$
	$C_{35} = 10 - (-9 + 13) = 6$

	$C_{36} = 0 – (-9) = 9$

2. Values in Table 6 have been calculated as follows:

Occupied cells $C_{ij} = U_i + V_j$	Unoccupied cells $\Delta_{ij} = C_{ij} – (U_i + V_j)$
$C_{11} = U_1 + V_1 = 5$ or $U_1 = 5 - 11 = -6$	$C_{13} = 8 – (-6 + 9) = 5$
$C_{12} = U_1 + V_2 = 3$ or $V_2 = 3 + 6 = 9$	$C_{14} = 9 – (-6 + 5) = 10$
$C_{24} = U_2 + V_4 = 5$ or $V_4 = 5$	$C_{15} = 9 – (-6 + 13) = 2$
$C_{25} = U_2 + V_5 = 13$ or $V_5 = 13$	$C_{16} = 0 – (-6 + 0) = 6$
$C_{26} = U_2 + V_6 = 0$ or $V_6 = 0$	$C_{21} = 15 – (0 + 11) = 4$
$C_{31} = U_3 + V_1 = 6$ or $V_1 = 6 + 5 = 11$	$C_{22} = 11 – (0 + 9) = 2$
$C_{33} = U_3 + V_3 = 4$ or $V_3 = 9$	$C_{23} = 13 – (0 + 9) = 4$
$C_{34} = U_3 + V_4 = 0$ or $U_4 = -5$	$C_{32} = 5 – (-5 + 9) = 1$
	$C_{35} = 10 – (-5 + 13) = 2$
	$C_{36} = 0 – (-5 + 0) = 5$

7. (a) You are provided with the following information:

Activity	Precedence	Time Estimates		
		Optimistic	Most likely	Pessimistic
A: 1-2	**None**	**1**	**2**	**3**
B: 2-3	**A**	**1**	**4**	**7**
C: 2-4	**A**	**1**	**2**	**9**
D: 3-5	**B**	**1**	**2**	**9**
E: 4-5	**C**	**2**	**3**	**4**
F: 5-6	**D , E**	**2**	**3**	**4**

Required:

(i) Draw a project network. Identify the critical path and expected length of the project.

(ii) Find out variance for different activities.

(iii) Find out standard deviation of the network.

(iv) What is the probability of completing the project in 12 days?

(v) What is the probability of completing the project in 14 days?

(vi) What is the probability of completing the project in 10 days? [8]

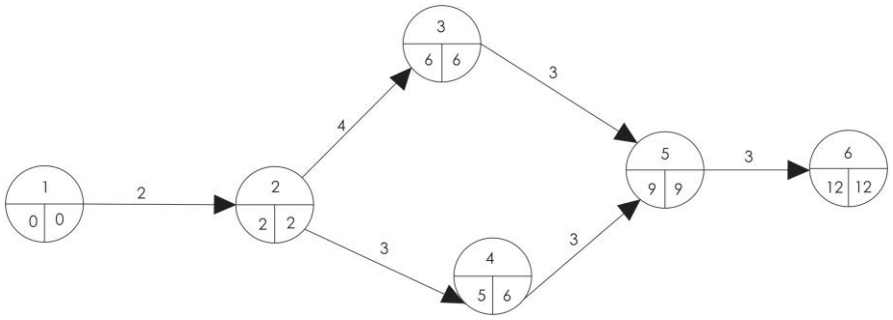
(b) Akash Ltd. manufactures 2 products X and Y and sells them at ₹90 and ₹80 respectively. Each product passes through two Departments P and Q before it becomes a finished product. The capacities of Departments P and Q are limited to 3400 hours and 3640 hours respectively. Each product requires 2 kg of Direct Materials "k", of which the maximum availability is 17000 kgs at ₹5 per kg. Product X and Y have a maximum market demand of 7400 units and 10000 units respectively. The time requirements of the products in the Production Department are as under-

Department	Machine Hour Rate	Product X	Product Y
P	₹40 per hour	0.50 hours	0.30 hours
Q	₹60 per hour	0.40 hours	0.45 hours

From the above data – (a) Identify the Limiting Factors, (b) Compute the Contribution per unit of P and Q, (c) Compute Contribution per unit of each Limiting Factor identified as above, (d) Determine what is the best possible combination of P and Q in order to maximize profit, if Fixed Costs for the period is ₹124750. [8]

Answer:

7. (a)(i)



Activity	Duration $[t_o \times 1 + t_m \times 4 + t_p \times 1]/6$
1-2	12/6 =2
2-3	24/6 = 4
2-4	18/6 = 3
3-5	18/6 = 3
4-5	18/6 = 3
5-6	18/6 = 3

Critical path = 1-2-3-5-6

Critical path duration = 12

(ii) Variance of activities are as follows:

Activity	t_p	t_o	S.D. = $(t_p - t_o)/6$	Var = $(SD)^2$
1-2	3	1	1/3	1/9
2-3	7	1	1	1
2-4	9	1	4/3	16/9
3-5	9	1	4/3	16/9
4-5	4	2	1/3	1/9
5-6	4	2	1/3	1/9

(iii) SD of network:

Variance of Critical path = Project variance

= 1/9 +1 +16/9 + 1/9

= (1+9+16+1)/9

= 3

SD = √3 = 1.732

(iv) $Z = (x - T_{CP})/ \sigma_{CP} = (12 – 12)/1.732 = 0$

Or, P(x≤12) = A(Z≤0)

= 0.5

= 50%

(v) $Z = (x - T_{CP})/ \sigma_{CP} = (14 – 12)/1.732 = 1.15$

Or, P(x≤14) = A(Z≤1.15)

= 0.5 + 0.3749

= 0.8749

= 87.49%

(vi) $Z = (x - T_{CP})/ \sigma_{CP} = (10 – 12)/1.732 = -1.15$

Or, P(x≤10) = A(Z≤-1.15)

= 0.5 - 0.3749

= 0.1251

= 12.51%

(b) 1. Identification of Key Factor(s)

Resource	Raw Material (kg)	Dept. P Hours	Dept. Q Hours
Requirement for 7400 units of X	7400 x 2 = 14800	7400 x 0.5 = 3700	7400 x 0.4 = 2960
Requirement for 10000 units of Y	10000 x 2 = 20000	10000 x 0.3 = 3000	10000 x 0.45 = 4500
Total Requirement	34800	6700	7460
Less: Availability	17000	3400	3640
Shortage	17800	3300	3820

Observation: Hence, all the 3 resources are Limiting Factors in this case.

2. Contribution and Ranking

Particulars	Product X	Product Y
Sale Price per unit	90	80
Variable Costs per unit		
Materials	2 kg x ₹5 = 10	2 kg x ₹5 = 10
Machine OH in Dept. P	0.50hrs x ₹40 = 20	0.30hrs x ₹40 = 12
Machine OH in Dept. Q	0.40 hrs x ₹60 = 24	0.45 hrs x ₹60 = 27
Sub-Total Variable Cost	54	49
Contribution per unit	36	31
Contribution per kg of Raw Material	$\frac{36}{2\text{kg}} = 18$	$\frac{31}{2\text{kg}} = 15.50$

Contribution per hour in Dept. P	$\frac{36}{0.50\,\text{hours}} = 72$	$\frac{31}{0.30\,\text{hours}} = 103.33$
Contribution per hour in Dept. Q	$\frac{36}{0.40\,\text{hours}} = 90$	$\frac{31}{0.45\,\text{hours}} = 68.89$

Product X has higher Ranking in terms of Raw materials and Dept. Q Resource, but Product Y has higher Ranking in Dept. P. In such case, i.e. multiple Key Factors with difference in Ranking Priority, Linear Programming Techniques are applied to arrive at the solution. This is a case of 2 Products – X and Y with 5 constraints.

3. Formulation of LPP

Objective Function: Maximise Profit Z = 36X + 31Y – 124750		
Constraints:	Subject to:	$2X + 2Y \leq 17000$
		$0.50X + 0.30Y \leq 3400$
		$0.40X + 0.45Y \leq 3640$
		$X \leq 7400$
		$Y \leq 10000$
Non-Negativity Assumption		$X, Y \geq 0$

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

(a) Socio Economic Costing

(b) Difference between Cost Control and Cost Reduction

(c) Six Sigma

(d) Applications of Learning curve

(e) Limitations of Simulation

Answer:

8. (a) Socio economics is the social science that studies how economic activity affects and is shaped by social processes. In general it analyzes how societies progress, stagnate, or regress because of their local or regional economy, or the global economy. Socio economists focus on the social impact of some sort of economic change. Such changes might include a closing factory, market manipulation, the signing of international trade treaties, new natural gas regulation, etc. Such social effects can be wide ranging in size, anywhere from local effects on a small community to changes to an entire society.

(b)

Cost Control	Cost Reduction
Cost control represents efforts made towards achieving target or goal.	Cost reduction represents the achievement in reduction of cost.
Cost control assumes the existence of standards or norms which are not challenged.	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.
Cost control is a preventive	Cost reduction is a corrective function.

function. Costs are optimized before they are incurred.	
Cost control lacks dynamic approach.	Cost reduction is a continuous process of analysis.

(c) Six Sigma is a set of practices originally developed by Motorola to systematically improve processes by eliminating defects. A defect is defined as non-conformity of a product or service to its specifications. Six sigma refers to the ability of highly capable processes to produce output within specification. In particular, processes that operate with six sigma quality produce at defect levels below 3.4 defects per one million opportunities. Six sigma's implicit goal is to improve all processes to that level of quality or better.

(d) Applications of Learning Curve are as follows:

- Learning curve helps to analyze CVP relationship during familiarization phase of product or process and thus is useful for cost estimates. It also assists in forecasting.
- Learning curve provides the base to set standards for the learning phase.
- It helps the Government to negotiate contracts. The Government receives full advantage of the decreasing unit cost in establishing the contract price.
- Cost data adjusted for learning effect helps in proper pricing decisions.

(e) Limitations of Simulations are:

- Simulations results are not precise. Unlike mathematical models, it does not give optimum solutions. At times one may not be able to assess the extent of error in a simulated result.
- Simulation may be expensive needing advanced computer supports.
- It is often long, complicated process to develop a model.
- Simulation by itself does not generate solutions, but only indicates a way of evaluating solutions.