

PAPER – 5 : COST MANAGEMENT

Answer all the questions.

Working notes should form part of the answer

Question 1

- (a) X Ltd. is engaged in the production of four products: A, B, C and D. The price charged for the four products are Rs.180, Rs.175, Rs.130 and Rs.180 respectively, Market research has indicated that if X Ltd can reduce the selling prices of its products by Rs.5, it will be successful in getting bulk orders and gain a significant share of market of those products. The company's profit markup is 25 per cent on cost of the product. The relevant information of products are as follows:

Products	A	B	C	D
Output in units	600	500	400	600
Cost per unit:				
Direct material (in Rs.)	40	50	30	60
Direct labour (in Rs.)	28	21	14	21
Machine hours (per unit)	4	3	2	3

The four products are usually produced in production runs of 20 units and sold in batches of 10 units. The production overhead is currently absorbed by using a machine hour rate, and the total of the production overheads for the period has been analysed as follows:

	(Rs.)
Machine department costs	52,130
Setup costs	26,250
Stores receiving	18,000
Inspection/Quality Control	10,500
Material handling and dispatch	23,100

The cost drivers to be used for the overhead costs are as follows:

Cost	Cost drivers
Setup costs	Number of production runs
Store receiving	Requisitions raised
Inspection/Quality control	Number of production runs
Materials handling and dispatch	Order executed

The number of requisitions raised in the stores was 100 for each product and the number of orders executed was 210, each order being for a batch of 10 units of a product.

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You are required:

- (i) To compute the target cost for each product.
 - (ii) To compute total cost of each product using activity based costing.
 - (iii) Compare target cost and activity based cost of each product and comment whether the price reduction is profitable or not. (12 Marks)
- (b) A company is launching a new product and has made estimates of the time for the various activities associated with the launch as follows:

Activity	Predecessor	Times (Days)		
		Optimistic	Most likely	Pessimistic
A	None	1	3	5
B	None	3	4	5
C	A, B	1	3	11
D	B	3	3	9
E	A	1	2	3
F	C	2	5	14
G	E, F	2	3	4
H	D, F	2	2	2
I	G, H	10	10	10

Required:

- (i) Draw the network diagram.
 - (ii) Calculate the expected time and variance of each activity.
 - (iii) Find out the expected length of critical path and its standard deviation.
 - (iv) Find the probability that the launching will be completed in 27 days.
 - (v) Find the duration, which has 95% probability of completion. (8 Marks)
- (c) The following information is provided by a firm. The factory manager wants to use appropriate average learning rate on activities, so that he may forecast costs and prices for certain levels of activity.
- (i) A set of very experienced people feed data into the computer for processing inventory records in the factory. The manager wishes to apply 80% learning rate on data entry and calculation of inventory.
 - (ii) A new type of machinery is to be installed in the factory. This is patented process and the output may take a year for full fledged production. The factory manager wants to use a learning rate on the workers at the new machine.
 - (iii) An operation uses contract labour. The contractor shifts people among various jobs once in two days. The labour force performs one task in 3 days. The manager wants to apply an average learning rate for these workers.

You are required to advise to the manager with reasons on the applicability of the learning curve theory on the above information. (4 Marks)

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Answer

- (a) (i) The target cost of each product after reduction is computed as follows:

Product	Present Price (Rs)	Proposed Price (Rs)	Target Cost (Rs) (with 25% Margin)
A	180	175	140
B	175	170	136
C	130	125	100
D	180	175	140

- (ii) Statement showing cost/unit of Driver as per ABC

Cost	Amount	Driver	No.	Cost/unit of Driver
Set-ups	26,250	Production runs	105*	Rs.250.00
Stores receiving	18,000	Requisition	400**	Rs.45.00
Inspection/Quality	10,500	Production runs	105	Rs.100.00
Handling/Dispatch	23,100	Orders	210	Rs.110.00
Machine Department	52,130	Machine Hrs.	6,500	Rs.8.02

* Production runs = $(600/20) + (500/20) + (400/20) + (600/20) = 105$

** Requisitions = 100 for each product or 400 total

Machine hours = $2,400 + 1,500 + 800 + 1,800 = 6,500$ hours.

Statement showing Total Cost and Cost Per Unit as per ABC

Item	A Rs.	B Rs.	C Rs.	D Rs.
Direct Material	24,000	25,000	12,000	36,000
Direct Labour	16,800	10,500	5,600	12,600
Set-up	7,500	6,250	5,000	7,500
Stores receiving	4,500	4,500	4,500	4,500
Inspection/Quality	3,000	2,500	2,000	3,000
Handling/Dispatch	6,600	5,500	4,400	6,600
Machine Dept. Cost	19,248	12,030	6,416	14,436
Total Cost	81,648	66,280	39,916	84,636
Output (Units)	600	500	400	600
Cost per unit	136.08	132.56	99.79	141.06

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(iii) Comparison of Actual Cost and Target Cost

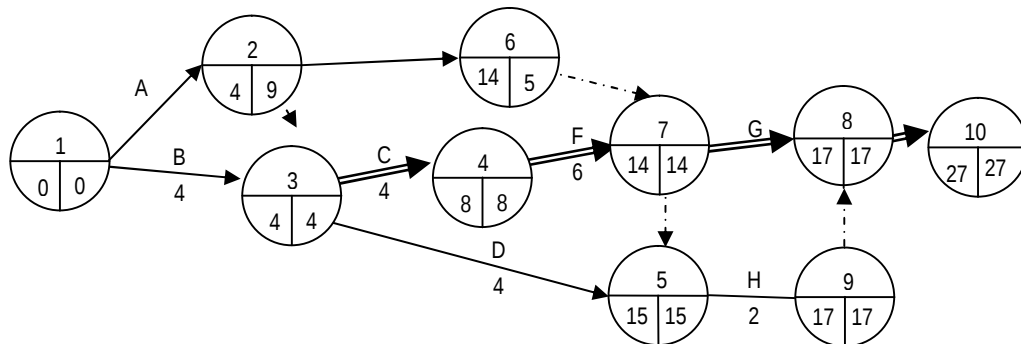
Cost	A	B	C	D
	Rs.	Rs.	Rs.	Rs.
Actual	136.08	132.56	99.79	141.06
Target	140.00	136.00	100.00	140.00
Difference	(-) 3.92	(-) 3.44	(-) 0.21	(+) 1.06

Comment:

The total actual cost of A, B and C product is less than the target cost so there is no problem in reducing the cost of these product by Rs.5 from the present price. It will increase the profitability of the company but the cost of D is slightly more than the target cost, it is therefore, suggested that the company should either control it or redesign it.

(b) (i) Network Diagram

Critical Path B → C → F → G → Z



(ii) Calculation of Expected Time, Standard Deviation and Variance of Activities

Activity	Expected Time $t_e = \frac{t_0 + 4t_m + t_p}{6}$	Standard Deviation $S = \frac{t_p - t_0}{6}$	Variance σ^2
A (1-2)	$\frac{1+12+5}{6} = 3$	$\frac{5-1}{6} = 0.67$	0.44
B (1-3)	$\frac{3+16+5}{6} = 4$	$\frac{5-3}{6} = 0.33$	0.11

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C (3-4)	$\frac{1+12+11}{6} = 4$	$\frac{11-1}{6} = 1.67$	2.78
D (3-5)	$\frac{3+12+9}{6} = 4$	$\frac{9-3}{6} = 1.00$	1.00
E ((2-6)	$\frac{1+8+3}{6} = 2$	$\frac{3-1}{6} = 0.33$	0.11
F (4-7)	$\frac{2+20+14}{6} = 6$	$\frac{14-2}{6} = 2.00$	4.00
G (6-8)	$\frac{2+12+4}{6} = 3$	$\frac{4-2}{6} = 0.33$	0.11
H(5-9)	$\frac{2+8+2}{6} = 2$	$\frac{2-2}{6} = 0$	0
I (8-10)	$\frac{10+40+10}{6} = 10$	$\frac{10-10}{6} = 0$	0

(iii) S.D. of Critical Path

$$= \sqrt{\text{Total of variance of Critical Activities}}$$

$$= \sqrt{0.44 + 2.78 + 4 + 0.11 + 0}$$

$$= \sqrt{7.33}$$

$$= 2.71$$

(iv) Probabilities of completion of job in 27 days.

$$X = 27 \text{ Days}$$

$$Z = \frac{27 - 27}{2.71} = 0$$

For $Z = 0$ the probability is 0.5 from the table of area under normal curve or 50%.

(v) For 95% of area the corresponding Z value is 1.64 (from the table).

Therefore,

$$1.64 = \frac{X - 27}{2.71}$$

$$X = 27 + 4.44 = 31.44 \text{ Days}$$

(c) The learning curve does not apply to very experienced people for the same job, since time taken can never tend to become zero or reduce very considerably after a certain range of output. This is the limitation of the learning curve.

(i) Data entry is a manual job so learning rate theory may be applied. Calculation of

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inventory is a computerized job. Learning rate applies only to manual labour.

- (ii) Learning rate should not be applied to a new process which the firm has never tried before.
- (iii) The workers are shifted even before completion of one unit of work. Hence learning rate will not apply.

Question 2

- (a) The following information relates to a manufacturing concern:

Standard	Rs.
Material A 24,000 kgs @ Rs.3 per kg.	72,000
Material B 12,000 kgs @ Rs.4 per kg	48,000
Wages 60,000 hours @ Rs.4 per hour	2,40,000
Variable overheads 60,000 hours @ Re.1 per hour	60,000
Fixed overheads 60,000 hours @ Rs.2 per hour	1,20,000
Total Cost	5,40,000
Budgeted profit	60,000
Budgeted sales	6,00,000
Budgeted production (units)	12,000
Actual	Rs.
Sales (9,000 units)	4,57,500
Material A consumed 22,275 kgs.	62,370
Material B consumed 10,890 kgs.	44,649
Wages paid (48,000 hours)	1,91,250
Fixed Overhead	1,20,900
Variable overhead	45,000
Labour hours worked	47,700
Closing work in progress	900 units
Degree of completion:	
Material A and B	100%
Wage and overheads	50%

You are required to:

- (i) Calculate all the material and labour variances.
- (ii) Calculate variable overhead expenditure and efficiency variances, fixed overhead expenditure and volume variances and sales price and sales volume variances.

(10 Marks)

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- (b) Mr. X has taken a shop on lease and made a down payment of Rs.2,50,000. Additionally, the rent under lease amount is Rs.96,000 per annum. If lease agreement is cancelled by Mr. X, then the initial payment is forfeited. Mr. X plans to use the shop for the shop for the general stores business, and has estimated operations for the next year as follows:

Sales	Rs.25,00,000	
Less: value added tax (VAT)	Rs.2,80,000	
Sales after VAT		22,20,000
Cost of goods sold		
Wages and wages related cost	12,50,000	
Rent including down payment	2,76,000	
Rent including down payment	3,46,000	
Rates, lighting and insurance	2,80,000	
Audit, legal and general expenses	50,000	22,02,000
Net profit before tax		18,000

In the business, Mr. X will be devoting of half time, however no provision has been made for his remuneration/salary. Mr. X also has an option to sublet the shop to his friend for a monthly rent of Rs.18,000, if he does not use the shop himself.

You are required to:

- (i) Identify the sunk and opportunity cost in the above problem.
 - (ii) State most profitable decision, which should be taken by Mr. X, supporting with appropriate calculation. (5 Marks)
- (c) Explain four P's of quality improvement principles. (4 Marks)

Answer

- (a) (i) Statement of Equivalent Production in Units

Particulars	Materials		Wages & Overheads	
	% age	Units	% age	Units
Units Completed	100%	9000	100%	9000
Closing W.I.P.	100%	900	50%	450
Equivalent Units		9900		9450

Material Variances				
Standard qty for actual output ** x std price			Actual qty X actual price	
Material A	19,800 @ 3	= 59,400	22,275@2.8*	= 62,370
Material B	9,900 @ 4	= 39,600	10,889 @4.1*	= 44,649
	29,700	99,000	33,165	1,07,019

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*Actual Cost / Actual Quantity

** Standard Quantity for actual output = (std qty/ budgeted prod) x actual output

MCV = TSC – TAC

$$= 99,000 - 1,07,019 = 8,019 \text{ (A)}$$

MPV = AQ (SP – AP)

$$\text{A} = 22,275 (3 - 2.80) = 4,455 \text{ (F)}$$

$$\text{B} = 10,890 (4 - 4.10) = \underline{1,089 \text{ (A)}}$$
$$3,366 \text{ (F)}$$

MUV = SP (SQ – AQ)

$$\text{A} = 3 (19,800 - 22,275) = 7,425 \text{ (A)}$$

$$\text{B} = 4 (9,900 - 10,890) = \underline{3,960 \text{ (A)}}$$
$$11,385 \text{ (A)}$$

MMV = SP (RSQ – AQ)

$$\text{A} = 3 \{19,800 \div 29,700 \times 33,165 - 22,275\} = 495 \text{ (A)}$$

$$\text{B} = 4 \{9,900 \div 29,700 \times 3,165 - 10,890\} = \underline{660 \text{ (F)}}$$
$$\underline{165 \text{ (F)}}$$

MYV = S. C Per Unit (S. O. For Actual Mix – A. O.)

$$= 99,000 \div 9,900 \{9,900 \div 29,700 \times 33,165 - 9,900\}$$

$$= 10 (11.055 - 9,900) = 11,550 \text{ (A)}$$

Labour Variances:

LCV = TSC – TAC

$$= 2,40,000 \div 12,000 \times 9,450 - 1,91,250 = 2,250 \text{ (A)}$$

LRV = AH (SR – AR)

$$= 48,000 \{4 - (1,91,250 \div 48,000)\} = 750 \text{ (F)}$$

LITV = No. of Idle hours × SR

$$= 48,000 - (47,500 \div 4) = 1,200 \text{ (A)}$$

LEV = SR (SH – AH)

$$= 4 \{(60,000 \div 12,000) \times 9,450 - 47,700\} = 1,800 \text{ (A)}$$

(ii) Variable Overhead Variances

VOC = Recovered Overheads – Actual Overheads

$$= 9,450 \times 5 - 45,000 = 2,250 \text{ (F)}$$

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V.O (Exp.) V = Standard V.O. – Actual V.O.

$$= 47,700 \times 1 - 45,000 = 2,700 \text{ (F)}$$

V.O. (Eff.) V = Recovered Overheads – Standard Overheads

$$= 9,450 \times 5 - 47,700 = 450 \text{ (A)}$$

Fixed Overheads Variances

FOCV = Recovered Overheads – Actual Overheads

$$= (1,20,000 \div 12,000) \times 9,450 - 1,20,900 = 94,500 - 1,20,900$$

$$= 26,400 \text{ (A)}$$

F.O.(Exp.) V = Budgeted Overheads – Actual Overheads

$$= 1,20,000 - 1,20,900 = 900 \text{ (A)}$$

FOVV = Recovered Overheads – Budgeted Overheads

$$= 95,500 - 1,20,000 = 25,500 \text{ (A)}$$

Sales Variances

Sales Price Variance = Actual Unit Sold (SP – AP)

$$= 9,000 \{50 - (4,57,500 \div 9,000)\} = 7,500 \text{ (F)}$$

Sales Volume Variance (Contribution Loss)

$$= \text{S. R. of Profit (Budgeted Qty. – Actual Qty.)}$$

$$= (60,000 \div 12,000) (12,000 - 9,000) = 15,000 \text{ (A)}$$

- (b) (i) The down payment of Rs.2,50,000 represents a sunk cost.

The lost profit from subletting the shop of Rs.1,20,000 per annum arrived as:

$$(18,000 \times 12) - 96,000 = 1,20,000 \text{ is an example of an opportunity cost.}$$

The salary amount is not given is also an opportunity cost lost.

- (ii) The relevant information for running the shop is:

	(Rs.)
Net Sales	22,20,000
Less: Costs (22,02,000 – 2,50,000) (sunk cost excluded for decision making purpose)	19,52,000
Gross Margin	2,68,000
Less: Opportunity cost from subletting	<u>1,20,000</u>
Profit	<u>1,48,000</u>

As profit is more than opportunity cost, the most profitable decision is to carry on business in the shop.

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(c) The Four P's quality improvement principles are as below:

1. People: It will quickly become apparent that some individuals are not ideally suited to the participatory process. Lack of enthusiasm will be apparent from a generally negative approach and a tendency to have prearranged meeting which coincide with the meetings of TOM teams.
2. Process: The rhetoric and inflexibility of a strict Deming approach will often have a demotivating effect on group activity.
3. Problem: Experience suggests that the least successful groups are those approaching problems that are deemed to be too large provide meaningful solutions within a finite time period.
4. Preparation: A training in the workings of Deming- like processes is an inadequate preparation for the efficient implementation of a quality improvement process.

Question 3

- (a) At a small store of readymade garments, there is one clerk at the counter who is to check bills, receive payments and place the packed garments into fancy bags. The arrival of customer at the store is random and service time varies from one minute to six minutes, the frequency distribution for which is given below:

Time between arrivals (minutes)	Frequency	Service Time (in minutes)	Frequency
1	5	1	1
2	20	2	2
3	35	3	4
4	25	4	2
5	10	5	1
6	5	6	0

The store starts work at 11 a.m. and closes at 12 noon for lunch and the customers are served on the "first came first served basis".

Using Monte Carlo simulation technique, find average length of waiting line, average waiting time, average service time and total time spent by a customer in system.

You are given the following set of random numbers, first twenty for arrivals and last twenty for service:

64	04	02	70	03	60	16	18	36	38
07	08	59	53	01	62	36	27	97	86
30	75	38	24	57	09	12	18	65	25
11	79	61	77	10	16	55	52	59	63

(9 Marks)

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- (b) What is Margin of safety? How, margin of safety can be improved? (5 Marks)
- (c) Explain briefly stages involved in the process of Bench marking. (5 Marks)

Answer

- (a) From the frequency distribution of arrivals and service times, probabilities and cumulative probabilities are first worked out as shown in the following table:

Time between arrivals	Frequency	Probability	Cum. Prob.	Service Time	Frequency	Prob.	Cum. Prob.
1	5	0.05	0.05	1	1	0.10	0.10
2	20	0.20	0.25	2	2	0.20	0.30
3	35	0.35	0.60	3	4	0.40	0.70
4	25	0.25	0.85	4	2	0.20	0.90
5	10	0.10	0.95	5	1	0.10	1.00
6	5	0.05	1.00	6	0	0.00	1.00
Total	100				10		

The random numbers to various intervals have been allotted in the following table:

Time between arrivals	Probability	Random numbers allotted	Service Time	Probability	Random numbers allotted
1	0.05	00-04	1	0.10	00-09
2	0.20	05-24	2	0.20	10-29
3	0.35	25-59	3	0.40	30-69
4	0.25	60-84	4	0.20	70-89
5	0.10	85-94	5	0.10	90-99
6	0.05	95-99	6	0.00	-

Simulation Work Sheet

Random Number	Time till next arrival	Arrival Time a.m.	Service begins a.m.	Random number	Service time	Service Ends a.m.	Clerk Waiting time	Customer waiting Time	Length of waiting line
64	4	11.04	11.04	30	3	11.07	04	-	-
04	1	11.05	11.07	75	4	11.11	-	2	1
02	1	11.06	11.11	38	3	11.14	-	5	2
70	4	11.10	11.14	24	2	11.16	-	4	2

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03	1	11.11	11.16	57	3	11.19	-	5	2
60	4	11.15	11.19	09	1	11.20	-	4	2
16	2	11.17	11.20	12	2	11.22	-	3	2
18	2	11.19	11.22	18	2	11.24	-	3	2
36	3	11.22	11.24	65	3	11.27	-	2	1
38	3	11.25	11.27	25	2	11.29	-	2	1
07	2	11.27	11.29	11	2	11.31	-	2	1
08	2	11.29	11.31	79	4	11.35	-	2	1
59	3	11.32	11.35	61	3	11.38	-	3	1
53	3	11.35	11.38	77	4	11.42	-	3	1
01	1	11.36	11.42	10	2	11.44	-	6	2
62	4	11.40	11.44	16	2	11.46	-	4	2
36	3	11.43	11.46	55	3	11.49	-	3	2
27	3	11.46	11.49	52	3	11.52	-	3	1
97	6	11.52	11.52	59	3	11.55	-	-	-
86	5	11.57	11.57	63	3	12.00	2	-	-
20	57				54		6	56	26

$$\text{Average queue length} = \frac{\text{Number of customers in waiting line}}{\text{Number of arrivals}} = \frac{26}{20} = 1.3$$

$$\text{Average waiting time per customer} = \frac{56}{20} = 2.8 \text{ minutes}$$

$$\text{Average service time} = \frac{54}{20} = 2.7 \text{ minutes}$$

Time a customer spends in system = 2.8 + 2.7 = 5.5 minutes.

- (b) **Margin of Safety:** The margin of safety refers to sales in excess of the break even point of sales. It represents the difference between sales at given activity level and sales at Break even point. A low margin of safety usually indicates high fixed overheads so that the profits are not made until there is a high level of activity of absorb the fixed costs. A margin of safety provides strength and stability to a concern.

Steps to increase margin of safety :

1. Increase in Selling Price; provided the demand is inelastic so as to absorb the increased prices.
2. Increase in Sales Volume: by increasing sales volume provided capacity is available.
3. Change in Product Mix: By the substitution or introduction of a product mix such that more profitable lines are introduced. Consequently, the contribution will

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increase and it will increase the margin of safety.

4. Reduction in fixed expenses: The reduction in fixed expenses will reduce the break even sales. As a result, margin of safety will improve.
 5. Reduction in variable cost: The reduction in variable cost will increase the contribution. As a result, the margin of safety will improve
- (c) Process of Benchmarking: The process of benchmarking requires a Company to identify the areas i.e. processes, activity etc. which are central to its business and then selects the top-performing companies in those areas.

The benchmarking process is comprised of following stages. These stages are:

1. Planning:
 - (i) Determination of benchmarking goal statement: This requires identification of areas to be benchmarked. In practice, one should start with the identification of those areas which have to be really good to be really successful.
 - (ii) Identification of best performance: Once the benchmarked goal statement are defined, the step is seeking the best of the breed or best of the best.
 - (iii) Establishment of the benchmarking or process improvement team: Ideally this should include the persons who are most knowledgeable about the internal operations and will be directly affected by changes due to benchmarking.
 - (iv) Defining the relevant benchmarking measurement: Relevant measures will not include the measures used by the organisation today but they will be refined measures that comprehend the true performance differences.
2. Collection of data and information:

The data gathering for benchmarking could be done through national/international clearing houses, mail surveys, suppliers, company visits, telephone, interviews etc. In recent years national and international clearing houses have been set up.
3. Analysing the findings: The analysing of finding of step (2) requires following:
 - (i) Review the findings and produce tables, charts and graphs to support the analysts.
 - (ii) Identify gaps in performance between our organisation and better performers.
 - (iii) Seek explanations for the gaps in performance. The performance gaps can be positive, negative or zero.
 - (iv) Ensure that comparisons are meaningful and credible.
 - (v) Communicate the findings to those who are affected.
 - (vi) Identify realistic opportunities for improvements.

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4. Recommendations: This involves:

Making recommendation: This requires:

- (i) Deciding the feasibility of making the improvements in the light of the conditions that apply within own organisation.
- (ii) Agreement of the improvements that are likely to be feasible.
- (iii) Producing a report on the Benchmarking in which the recommendations are included.
- (iv) Obtaining the support of key stakeholder groups for making the changes needed.
- (v) Developing action plan(s) for implementation.

5. Monitoring and reviewing: This involves:

- (i) Evaluating the benchmarking process undertaken and the results of the improvements against objectives and success criteria plus overall efficiency and effectiveness.
- (ii) Documenting the lessons learnt and make them available to others.
- (iii) Periodically re-considering the benchmarks

Question 4

- (a) An agro-products producer company is planning its production for next year. The following information is relating to the current year:

Products/Corps	A1	A2	B1	B2
Area occupied (acres)	250	200	300	250
Yield per acre (ton)	50	40	45	60
Selling price per ton (Rs.)	200	250	300	270
Variable cost per acre (Rs.)				
Seeds	300	250	450	400
Pesticides	150	200	300	250
Fertilizers	125	75	100	125
Cultivations	125	75	100	125
Direct wages	4,000	4,500	5,000	5,700

Fixed overhead per annum (Rs.) 53,76,000.

The land that is being used for the production of B1 and B2 can be used for either crop, but not for A1 and A2. The land that is being used for A1 and A2 can be used for either crop, but not for B1 and B2. In order to provide adequate market service, the company must produce each year t least 2,000 tons each of A1 and A2 and 1,800 tons each of B1 and B2.

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You are required to:

- (i) Prepare a statement of the profit for the current year.
 - (ii) Profit for the production mix by fulfilling market commitment.
 - (iii) Assuming that the land could be cultivated to produce any of the four products and there was no market commitment, calculate: Profit amount of most profitable crop and break-even point of most profitable crop in terms of acres and sales value. (11 Marks)
- (b) An oil refinery can blend three grades of crude oil to produce quality A and quality B petrol. Two possible blending processes are available. For each production run, the older process uses 5 units of crude Q, 7 units of crude P and 2 units of crude R and produces 9 units of A and 7 units of B. The newer process uses 3 units of crude Q, 9 unit of crude P and 4 units of crude R to produce 5 units of A and 9 units of B.
- Because of prior contract commitments, the refinery must produce at least 500 units of A and at least 300 units of B for the next month. It has 1,500 units of crude Q, 1,900 units of crude P and 1,000 of crude R. For each unit of A, refinery receives Rs.60 while for each unit of B, it receives Rs.90
- Formulate the problem as linear programming model so as to maximize the revenue. (4 Marks)
- (c) Explain the term degeneracy in a transportation problem. (4 Marks)

Answer

- (a) (i) Calculation of selling price and contribution per acre:

Products	A1	A2	B1	B2	Total
Yield per acre in (tones)	50	40	45	60	
Selling price per tones (Rs.)	200	250	300	270	
Sales revenue per acre (Rs.)	10,000	10,000	13,500	16,200	
Variable cost per acre (Rs.)	4,700	5,100	5,950	6,600	
Contribution per acre (Rs.)	5,300	4,900	7,550	9,600	
Area (acres)	2,50	200	300	250	
Total contribution (Rs.)	13,25,000	9,80,000	22,65,000	24,00,000	69,70,000
Less: Fixed Cost					53,76,000
Profit (Rs.)					15,94,000

- (ii) Profit Statement for recommended mix

Products	A1	A2	B1	B2	Total
Contribution per acre	5300	4900	7550	9600	
Rank	1	2	2	1	

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Minimum Sales Requirement in acres		2000/40 = 50	1800/45 = 40		
Recommended Mix (in Acres)	400	50	40	510	
Total Contribution (Rs.)	21,20,000	2,45,000	3,02,000	48,96,000	75,63,000
Less: Fixed Cost					53,76,000
Profit					21,87,000

- (iii) Most profitable crop: Production should be concentrated on B2 which gives highest contribution per acres Rs.9,600.

Overall contribution if complete land is used for B2 (1,000 × 9,600) = Rs.96,00,000

Less: Fixed Cost = Rs.53,76,000

Profit: = Rs.42,24,000

Break even point in acres for B2 = 5376000 ÷ 9600 = 560 acres

Break even point in sales value = 560 × (270 × 60) = Rs.90, 72,000

- (b) Maximize Z = 60 (9x₁ + 5x₂) + 90 (7x₁ + 9x₂)
= 1170x₁ + 1110x₂

Subject to 9x₁ + 5x₂ ≥ 500 commitment for A

7x₁ + 9x₂ ≥ 300 commitment for B

5x₁ + 3x₂ ≤ 1500 availability of Q

7x₁ + 9x₂ ≤ 1900 availability of P

2x₁ + 4x₂ ≤ 1000 availability of R

and x₁ ≥ 0, x₂ ≥ 0.

- (c) If a basic feasible solution of transportation problem with m origins and n destinations has fewer than m + n – 1 positive x_{ij} (occupied cells) the problem is said to be a degenerate transportation problem. Such a situation may be handled by introducing an infinitesimally small allocation e in the least cost and independent cell.

While in the simple computation degeneracy does not cause any serious difficulty, it can cause computational problem in transportation problem. If we apply modified distribution method, then the dual variable u_i and v_j are obtained from the C_{ij} value to locate one or more C_{ij} value which should be equated to corresponding C_{ij} + V_{ij}.

Question 5

- (a) B Ltd. makes industrial power drills, which is made by the use of two components A (electrical and mechanical components and B (plastic housing). The following table shows the cost of plastic housing separately from the cost of the electrical and mechanical components:

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	A Electrical and Mechanical Components Rs.	B Plastic Housing Rs.	A & B Industrial Drills Rs.
Sales 1,00,000 units @ Rs.100			1,00,00,000
Variable Costs:			
Direct materials	44,00,000	5,00,000	49,00,000
Direct Labour	4,00,000	3,00,000	7,00,000
Variable factory overhead	1,00,000	2,00,000	3,00,000
Other Variable Costs	1,00,000	-	1,00,000
Sales commission @10% of sales	10,00,000	-	10,00,000
Total variable costs	60,00,000	10,00,000	70,00,000
Contribution	-	-	30,00,000
Total fixed costs	22,20,000	4,80,000	27,00,000
Operating income			3,00,000

Answer the following questions independently:

- (i) During the year, a prospective customer offered Rs.82, 000 for 1,000 drills. The drills would be manufactured in addition to the 1,00,000 units sold. B Ltd. would pay the regular sales commission rate on the 1,000 drills. The Chairman rejected the order because "it was below our costs". Calculate operating income if B Ltd. accepts the offer.
- (ii) A supplier offers to manufacture the yearly supply of 1,00,000 units plastic housing components for Rs.13.50 each. Assume that B Ltd. would avoid Rs.3,50,000 of the costs assigned to plastic housing if it purchases. Calculate operating income if B Ltd. decides to purchase the plastic housing from the supplier.
- (iii) Assuming that B Ltd. could purchase 1,20,000 units (plastic housing components) for Rs.13.50 each and use the vacated plant capacity for the manufacture of deluxe version of drill of 20,000 units (and sell them for Rs.130 each in addition to the sales of the 1,00,000 regular units) at a variable cost of Rs.90 each, exclusive of housings and exclusive of the 10% sales commission. All the fixed costs pertaining to the plastic housing would continue, because these costs are related to the manufacturing facilities primarily used. Calculate operating income of B Ltd. purchases the plastic housings and manufacture the deluxe version of drills.

(8 Marks)

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- (b) LMV Limited manufactures product Z in departments A and B which also manufacture other products using same plant and machinery. The information of product Z is as follows:

Items	Department A (Rs.)	Department B (Rs.)
Direct material per unit	30	25
Direct labour per unit (Rs.10 per hour)	30	40
Overhead rates:		
Fixed	8 per hour	4 per hour
Variable	6 per hour	3 per hour
Value of Plant and Machinery	25 lakhs	15 lakhs

Overheads are recovered on the basis of direct labour hours. Variable selling and distribution overheads relating to product Z are amounting to Rs.30, 000 per month. The product requires a working capital of Rs.4, 00,000 at the target volume of 1,500 units per month occupying 30 per cent of practical capacity.

You are required:

- (i) To calculate the price of product Z to yield a contribution to cover 21 percent rate of return on investment.
- (ii) Set the minimum selling price of the product if (1) the product is well established in the market; (2) the product is first time launched in the market. (7 Marks)
- (c) "Sunk costs are irrelevant in decision-making, but irrelevant costs are not sunk cost." Explain with examples. (4 Marks)

Answer

- (a) (i) The costs of filling the special order of 1000 drills:

	Rs.
Direct Materials	49,000
Direct Labour	7,000
Variable Factory Overhead	3,000
Other Variable Cost	1,000
Sales commission @ 10% of Rs.82,000	<u>8,200</u>
Total Variable Costs	68,200
Selling Price	<u>82,000</u>
Contribution	<u>13,800</u>

Operating income would have been Rs.3,00,000 + Rs.13,800 = Rs.3,13,800, if B Ltd had accepted the order.

- (ii) Assuming that B Ltd. could have avoided Rs.3,50,000 of the fixed costs by not making the housings and that the other fixed costs would have continued, we can summarize the alternatives as follows:

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	Make	Buy
Purchase Cost		Rs.13,50,000
Variable Costs	Rs.10,00,000	
Avoidable fixed Costs	<u>Rs.3,50,000</u>	<u> </u>
Total relevant Costs	<u>Rs.13,50,000</u>	<u>Rs.13,50,000</u>

If the facilities used for plastic housings became idle, the B Ltd. would be indifferent whether to make or buy. The present operating income would be unaffected.

- (iii) The effect of purchasing the plastic housings and using the vacated facilities for the manufacture of a deluxe version of its drill is as follows:

Increase in sales 20,000 units @ Rs.130		26,00,000
Increase in Variables cost 20,000 units, @Rs.90	18,00,000	
Plus: Sales commission, 10% of Rs.26,00,000	<u>2,60,000</u>	<u>20,60,000</u>
Contribution on 20,000 units		5,40,000
Housings: 1,20,000 rather than 1,00,000 would be needed		
Buy 1,20,000 @ Rs.13.50	16,20,000	
Less: Make 1,00,000 @ Rs.10 (only the variable costs are relevant)	<u>10,00,000</u>	
Excess cost of outside purchase		<u>6,20,000</u>
Loss on making deluxe units		<u>Rs.80,000</u>

Conclusion: Operating income would decline to Rs.2, 20,000 (3, 00,000 – 80,000).

- (b) (i) Statement showing price of Product Z

Direct Material	Deptt. A	30	
	Deptt. B	<u>25</u>	55
Direct Labour	Deptt. A	30	
	Deptt. B	<u>40</u>	70
Variable overhead	Deptt. A 3×6	18	
	Deptt B 4×3	<u>12</u>	30
Variable selling and distribution overhead 30,000/1,500			20
Total Variable Cost per unit			<u>175</u>
Total hours required for a target of 1,500 units of product Z			
Deptt. A 1500 × 3			4500 hours
Deptt. B 1500 × 4			<u>6000 hours</u>
			<u>10500 hours</u>

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10500 hours represent 30% capacity

So total capacity per month $10500 / 0.30 = 35000$ hours.

Yearly capacity is $35000 \times 12 = 420000$ hours.

Fixed capital employed in both department = 40.00 Lakhs

(25 lakhs + 15 Lakhs)

Expected return = $0.21 \times 40,00,000 = 840000$

Contribution per hour = $840000 / 420000 = 2.00$ per hour

Working Capital = $0.21 \times 400000 = 84000$

Contribution per unit $84000 / 18000$ unit = 4.67 per unit

Total contribution required Rs.

To cover fixed cost 3 hours of A and 4 of B = $7 \times 2 = 14.00$

To working capital = 4.67

18.67

Fixed charges recovery is based on usage. Full capacity is not being used by product Z and departments are also producing other products using same plant and machinery. Price of Product = Variable cost + contribution required = $175 + 18.67 = 193.67$ per unit.

(ii) Price of product when product is well established in market:

Variable Cost 175

Fixed Cost (24 + 16) 40

Total price 215

The product is first time launched in the market, and then variable cost Rs.175 should form the basis for price fixation.

- (c) The sunk cost is one for which the expenditure has taken place in the past. This cost is not affected by a particular decision under the consideration. Sunk costs are always results of decision taken in past. Investment in plant and machinery as soon as installed, its cost is sunk cost and is not relevant for decision making. The relevant cost is a cost appropriate in adding to make specific management decisions. A relevant cost is a future cost which differ with alternatives and one which is expected to be incurred and not a sunk cost which has already been incurred. If the cost remain constant between different alternatives, treated as irrelevant cost however that is not a sunk cost. Sunk costs are based on past, always irrelevant for decision making. Relevant cost must be an incremental or avoidable cost. For example fixed over heads which are allocated by head office are not relevant, but incremental or avoidable fixed overheads are relevant.