

## PAPER – 5: ADVANCED MANAGEMENT ACCOUNTING

Question No.1 is compulsory.

Answer any **five** questions from the remaining **six** questions.

Working notes should form part of the answer.

No statistical or other table will be provided with this question paper.

### Question 1

- (a) ABC Ltd. manufactures luxury brand lady handbags. The company has a diversified product portfolio handled by different divisions and Division "Light" is one amongst them. Division "Light" manufactures brand "Folly" which is famed for the elegance of its uniquely designed webbing straps. The webbing straps are being procured at the going market price of ₹ 500 and the recent development is, it's newly owned subsidiary Elegance Ltd. has the competence of manufacturing the equivalent quality straps.

Further financial information is as follows.

(Fig. in Lakhs)

		Division Light	Elegance
Sales	10,000 bags @ ₹10,000 1,50,000 Straps @ ₹500	₹1,000 lakhs	₹ 750 lakhs
Variable Expenses	10,000 bags @ ₹6,000 1,50,000 Straps @ 120	₹600 lakhs	₹ 180 lakhs
Maximum Capacity			2,00,000 Straps
Each bag requires the support of 3 webbing straps			

Required:

- Calculate the savings to Division Light if the webbing straps are obtained from Elegance Ltd. instead of current procurement policy of buying in open market at going market price.
  - Determine the maximum and minimum transfer price and who fixes these.
  - If ABC Ltd. top management has mandated a transfer pricing policy of variable cost-plus 45 percent on all related party transactions, ascertain. the benefit of Division Light and Elegance Ltd. from the internal transfer.
  - Determine the mutually beneficial transfer price and profit of each division. (consider only the financial factors). **(5 Marks)**
- (b) Charan, a management graduate is an expert in giving turnaround to ailing units. He believes, for any company to be successful, achieving customer satisfaction is of

paramount importance. He is recently examining one consumer durable company which is burdened with host of problems.

He identifies main problems the firm is facing, reasons for the problems and scores them with the number of customers complains.

Sl. No.	Problem	Cause	Score
1	Customer calls are not attended to quickly	Less customer care staff	18
2	Few employees are not well thought off people and many times need to schedule subsequent visits to bring spare parts	Poor preparation and less organized	3
3	Customer service staff doesn't seem to know what they are doing	Lack of training	29
4	Customers waiting all the day for service engineer's visit as they are not punctual in maintaining time.	Poor preparation and less organized	5
5	Staff under work pressure	Less customer care staff	4
6	Customers are often booked in for an appointment with an engineer, only to discover that the issue could have been solved on the phone.	Lack of training	9

Required:

- (i) Carry out Pareto Analysis and identify the biggest issue faced by the firm.
  - (ii) Discuss your findings with appropriate recommendations.
  - (iii) "What is important is rarely urgent and what is urgent is rarely important"? Briefly explain this statement in the context of Pareto Analysis. **(5 Marks)**
- (c) The following information relates to video game console Vx 3.0 developed by Standard Corporation designer of children gaming equipment.

Particulars	Year 1	Year 2
Selling price (per unit)	₹ 3,000	₹ 2,500
Material Cost (per unit)	₹ 900	₹ 800
Labour Cost (per unit)	₹ 450	₹ 400
Fixed Production Overhead cost	₹ 1,80,00,000	₹ 2,00,00,000
Selling and distribution Cost	₹ 24,00,000	₹ 36,00,000
Sales Volume	50,000 units	80,000 units

Standard Corporation believes that the Vx. 3.0 is likely to have a life cycle of 2 years before getting obsolete and would be substituted by a totally advanced version.

Further data furnished by the management suggests that:

- Standard Corporation has spent lot of time and energy on developing Vx 3.0 apart from a monetary spending of ₹525 lakhs, The company has forgone an opportunity which could have yielded an estimated ₹35 lakhs due to its dependence on Vx 3.0.
- The technology used is patented with an initial expenditure of ~ 60 lakhs. The fee for renewal of license is ₹10 lakhs per six months.

	Year-1	Year-2
Advertisement Cost ₹	₹ 1,44,00,000	₹ 1,20,00,000

**Required:** Calculate the total Life Cycle Cost of Vx 3.0 for the two years and ascertain the profitability. **(5 Marks)**

(d) The final simplex tableau for maximisation problem of linear programming is given below:

$C_j$			5	-2	3	0	0	0
$C_B$	Basic Variables	Quantity $X_B$	$x_1$	$x_2$	$x_3$	$s_1$	$s_2$	$s_3$
5	$x_1$	23/3	1	0	4	0	1/3	4/3
0	$s_1$	70/3	0	0	15	1	2/3	14/13
-2	$x_2$	5	0	1	3	0	0	1
$Z_j$			5	-2	14	0	5/3	14/3
$C_j - Z_j$			0	0	-11	0	-5/3	-14/3

$Z$  is expressed in rupees in lakh, while  $x_1$ ,  $x_2$  and  $x_3$  are expressed in units

Required:

- Is the above solution optimal? Give brief reason.
- Is there an alternate optimal solution? Give brief reason.
- Is this solution degenerate? Give brief reason.
- Write down the objective function of the problem.
- According to this solution, how many units of the three products  $x_1$ ,  $x_2$  and  $x_3$  would be produced and what would be the total profit? **(5 Marks)**

**Answer****(a) (i) Savings to Division LIGHT:**

Particulars	₹	₹
Existing Buy Cost		500
Less: Make cost of subsidiary		120
Saving to Division LIGHT		<b>380</b>
X Qty required	10,000 bags x 3	30,000
Total Savings		<b>1,14,00,000</b>

**(ii) Computation of Transfer Price**

TP		₹
<b>Maximum TP</b> (Equal to buy cost)	Fixes by BUYER Dept. "Division LIGHT"	<b>500</b>
<b>Minimum TP</b>	Fixes by Seller Dept. "Elegance Ltd." VC: ₹120 Additional FC: 0 Opportunity Cost: 0	<b>120</b>

**(iii) TP = VC + 45%**

$$TP = ₹ 120 + 45\% \quad \text{or} \quad TP = ₹ 174$$

**Savings to Division LIGHT:**

Particulars	₹	₹
Existing Buy Cost		500
Less: TP		174
Saving to Division LIGHT		<b>326</b>
X Qty required	10,000 bags x 3	30,000
Total Savings		<b>97,80,000</b>

**Benefit to Elegance Ltd.**

Particulars	₹	₹
TP		174
Less: Make cost		120

Benefit		<b>54</b>
X Qty transferred	10,000 bags x 3	30,000
Total Savings		<b>16,20,000</b>

- (iv) **The mutually beneficial transfer price means that the Elegance Ltd and Division Light would share ₹ 380 (500-120) per unit equally.** i.e., the buyer division would obtain a saving of ₹ 190 and the seller division would get an equal amount in profit. The total profit in this case **on internal transfer** would work like this.

Division Light =  $30,000 \times 190 = ₹ 57,00,000$

Division Light =  $30,000 \times 190 = ₹ 57,00,000$

(b) (i)

Problem cause	Score	%	Cumulative %
Lack of training	38	55.89	55.89
Less customer care staff	22	32.35	88.24
Poor preparation and less organized	8	11.76	100.00

The biggest issue faced by the consumer durable company is lack of training to its employees.

- (ii) Pareto Analysis is based on the 80/20 rule which implies that 20% of the products account for 80% of the revenue. Likewise, 20% of customers generate 80% of revenue. **In present case the causes of problems being faced by the consumer durable company are three in number and lack of training and less customer care staff are the great causes of worry.** Both of them account for 88.24% of the total causes. **The above data further suggests that lack of training account for 55.89% and hence company should review its training policy and to further strengthen it to make it more meaningful and productive. Poor preparation and less organized staff, form the data given above seems to be less intensive and the management need not apply the same levels of concentration as it should apply to the initial two causes viz... lack of training and less customer care staff.**
- (iii) This phrase helps to determine which tasks are most important and which are to be addresses first. If something is urgent and important do it first and if anything is only urgent or only important delegate it to someone else are reserve for a relatively free data or time. If it is neither, forget it. **This is the basic premise of pareto analysis i.e., 80: 20 rule and helps managers to focus first on what is most important and urgent and not what is important or urgent.**

## (c) Computation of total life cycle costs and profitability

Particulars	Working	₹
Life Cycle Costs		
R & D cost		
• Monetary amount	525 lacs	
• Opportunity cost	35 lacs	560 lacs
Technology patent		
• Initial cost	60 lacs	
• Renewal fees	10 lacs x 3	90 lacs
Material cost	$(900 \times 50,000) + (800 \times 80,000)$	1090 lacs
Labour cost	$(450 \times 50,000) + (400 \times 80,000)$	545 lacs
Fixed Production cost	$1,80,00,000 + 2,00,00,000$	380 lacs
Selling and distribution cost	$24,00,000 + 36,00,000$	60 lacs
Advertisement costs	$1,44,00,000 + 1,20,00,000$	264 lacs
Total Cost (A)		<b>2,989 lacs</b>
Sales revenue (B)	$(3,000 \times 50,000) + (2,500 \times 80,000)$	3,500 lacs
Life time Profit (B – A)		<b>511 lacs</b>

- (d) (i) **Yes**, the given solution is optimal because all  $C_j - Z_j$  are less than, or equal to, zero.
- (ii) **No**, because for each of the non - basic variables  $X_3$ ,  $S_2$  and  $S_3$ , values of  $C_j - Z_j$  is strictly negative. Alternate optimal solution (s) exist when either of non-basic variables has a zero value in  $C_j - Z_j$ .

Non Basic Variables	$X_3$	$S_2$	$S_3$
$C_j - Z_j$	-11	-5/3	-14/3

- (iii) No, solution is **not degenerate** as none of the basic variables has zero quantity.

Basic Variables	$X_1$	$S_1$	$X_2$
Quantity	23/3	70/3	5

(A solution degenerates if the Quantity of one or more basic variables is zero)

- (iv) Maximize  $Z = 5X_1 - 2X_2 + 3X_3$
- (v) Production =  $X_1 = 23/3$  units,  $X_2 = 5$  units,  $X_3 = 0$ ; Profit =  $23/3 \times 5 - 2 \times 5 = 85/3$  lakh = ₹ 28.33 lakh

**Question 2**

- (a) Domestic Airlines Ltd. operates an extensive network of flights throughout the country. Most of the flights operate to or from the company's hub airport in Mumbai. Any loss-making routes are considered for closure based on the profitability reports of each flight route.

The following report shows the average loss on each one-way flight between Mumbai and Agartala (in either direction):

Particulars	(₹)	(₹)
Revenue from sale of air tickets		6,75,000
Less: Operating Costs:		
Aviation fuel	2,60,000	
Flight crew salaries	90,000	
Airport security charge	35,000	
Ground staff	60,000	
Depreciation	1,80,000	
Insurance	2,00,000	
Advertisement	45,000	
Overnight allowance for flight crew	30,000	9,00,000
Loss		2,25,000

Additional information available in respect of the flight route is:

- Aircraft seating capacity is 150 out of which average occupancy rate is 60%
- Ground starts are outsourced from an agency.
- Aircraft depreciation is mainly because of obsolescence and not because of usage,
- Airport security charge is based on the number of seats occupied on each departing flight.
- Flight crew are permanent employee.
- Insurance includes ₹30,000 relating to the flight towards public liability insurance policy. The remaining ₹1,70,000 is allocated insurance costs of the company.
- Advertisement costs relates to the advertising campaign for public awareness about the route.

Required:

On the basis of the financial information provided above, advise whether Domestic Airlines Ltd. should discontinue flight between Mumbai and Agartala ? (in either direction),

Your answer should include dear explanations as to why you consider particular operating costs to be relevant or irrelevant to the decision. **(8 Marks)**

- (b) A dealer in washing machines wants to use a scientific method to reduce his investment in stock. The daily demand for a washing machine is random and varies from day to day in an unpredictable pattern. From the past sales records, the dealer has been able to establish a probability distribution of the demand as given below:

Daily demand (units)	2	3	4	5	6	7	8	9	10
Probability	0.06	0.14	0.18	0.17	0.16	0.12	0.08	0.06	0.03

From the past experience, it was ascertained that the lead time is 5 days. The dealer adopted the inventory policy of ordering 30 units, whenever the inventory at the end of the day is 20 units or below. The inventory on hand is 30 units.

Use the following random numbers:

03	48	88	71	27	80	33	90	78	55
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Required:

Using simulation process, repeat the trial. 10 times, calculate lost sales unit, if any, and offer your comment on the ordering and inventory policy of the dealer. **(8 Marks)**

**Answer**

- (a) **Statement of Relevancy**

Particulars	Relevant?	Explanation	₹
Relevant Cost			
1. Revenue from sale of air tickets	Yes	Since inflow to be avoided, thus a relevant cost	6,75,000
			<u>6,75,000</u>
Relevant revenue			
1. Aviation fuel	Yes	Since outflow to be avoided due to discontinuation of flight, thus relevant revenue.	2,60,000
2. Airport security charge	Yes	Since outflow to be avoided due to discontinuation of	35,000



		flight, thus relevant revenue.	
3. Ground staff	Yes*	Since outflow to be avoided due to discontinuation of flight, thus relevant revenue.	60,000
4. Insurance	Yes	₹ 30,000 is relevant since it can be avoided by closure of the flight. But the remaining 1,70,000 is an allocated one, thus irrelevant.	30,000
5. Advertisement	Yes	Since the route will no longer be operated, thus amount spent can be saved.	45,000
6. Overnight allowance	Yes	Since outflow to be avoided due to discontinuation of flight, thus relevant revenue.	30,000
			<u>4,60,000</u>
Irrelevant			
1. Flight crew salaries	No	Since anyhow to be incurred due to employees are permanent.	NIL
2. Depreciation	No	Since part of past cost, thus irrelevant. Also, depreciation is based on time and not on usage	NIL

\*Payment to outsource partner is payable per flight.

**Decision:**

Since the Relevant cost exceeds the Relevant Revenue, thus it's not advisable to discontinue the flight.

- (b) First of all, random numbers 00-99 are allocated in proportion to the probabilities associated with demand as given below:

Demand	Probability	Cumulative Probability	Random Nos.
2	0.06	0.06	00 – 05
3	0.14	0.20	06 – 19

4	0.18	0.38	20 – 37
5	0.17	0.55	38 – 54
6	0.16	0.71	55 – 70
7	0.12	0.83	71 – 82
8	0.08	0.91	83 – 90
9	0.06	0.97	91 – 96
10	0.03	1.00	97 – 99

Based on the ten random numbers given, we simulate the demand per day in the table given below:

It is given that stock in hand is 30 units and lead time is 5 days.

Order 30 units, when the inventory at the end of the day is 20 units or below:

Day	Random No.	Demand	Op. Stock (in hand)	Qty. Recd.	Total Qty. on Order	Closing Stock	Qty. Ordered	Stockout
1	03	2	30	---	---	28	---	---
2	48	5	28	---	---	23	---	---
3	88	8	23	---	---	15	30	---
4	71	7	15	---	30	8	---	---
5	27	4	8	---	30	4	---	---
6	80	7	4	---	30	0	---	3
7	33	4	0	---	30	0	---	4
8	90	8	0	30*	---	22	---	---
9	78	7	22	---	---	15	30	---
10	55	6	15	---	30	9	---	---

Assumed received well in time so that demand for the 5<sup>th</sup> day (lead time) can be met.

**Comment:** On day 6 & 7, there is stock out position of 3 & 7 units respectively. This accounts for 12% of sales (7/58). This is due to lead time of 5 days. A reduction in lead time by two days can avoid the stock out situation.

#### Alternative

##### Simulation Table

Day	Random No.	Opening inventory (units)	Daily demand (units)	Closing inventory (units)	Lost Sales (units)	Stock received at the end of the day	Quantity ordered (units)
1	03	30	2	28	-	-	-
2	48	28	5	23	-	-	-
3	88	23	8	15	-	-	30

4	71	15	7	8	-	-	-
5	27	8	4	4	-	-	-
6	80	4	7	0	3	-	-
7	33	0	4	0	4	-	-
8	90	0	8	0	8	30	-
9	78	30	7	23	-	-	-
10	55	23	6	17	-	-	30

**Comment:** From the table above, it is observed that the policy of ordering 30 units whenever stock falls to 20 units is not desirable as quite a number of lost sales units have arisen over a short period of 10 days. The dealer needs to review its inventory policy.

### Question 3

- (a) DKB Ltd. manufactures plastic components which it sells to three manufacturing firms P, Q and R. DKB Ltd. has entered into long term supply agreements with these customers. The unique selling proposition of DKB Ltd. is its ability to quickly customize products to meet specific customer requirements at short notice on a just-in-time basis.

Product prices are determined in accordance with a cost-based formula. Costs of raw materials and direct labour are traced to each customer, and marked up at rates of 70% and 60% respectively. Production overhead is marked up by 50% and then allocated to customers P, Q and R in proportion to direct labour cost. These mark-up percentages are considered to be lower than those applied by its competitors. Recently one customer e-mailed to the Marketing Manager that they consider prices to be too high and is seriously considering taking their business elsewhere. DKB Ltd. has long believed that its pricing formula should enable it to retain the loyalty of its three customers. Therefore, the management of DKB Ltd. surprised on receiving such an e-mail from one of its customers, which would have serious impact on its profitability-so the company decided to pay immediate attention to the matter. Production overhead costs of last month were as follows:

Activity	Cost Driver	Cost
Determining customer requirements	Number of meetings	₹ 85,500
Making design change	Number of design changes	₹ 90,000
Machine set-up	Number of production batches	₹ 42,000
Total		₹ 2,17,500

The following is the work carried out last month for three customers P, Q and R:

Particulars	P	Q	R	Total
Raw material cost	₹ 40,000	₹ 60,000	₹ 35,000	₹ 1,35,000
Direct labour cost	₹ 34,000	₹ 65,000	₹ 46,000	₹ 1,45,000

Number of meetings	13	10	13	36
Number of design changes	15	17	28	60
Number of productions batches	8	10	3	21

Required:

- (i) Calculate the prices charged to each of the three customers as per the pricing formula of the company.
- (ii) Prepare a customer profitability statement of last month showing profit from each customer and the profit margin (consider production overhead costs based on the relevant cost drivers).
- (iii) Identify the customer who is most likely to be unhappy with the pricing policy of the company and the root cause of overcharging, if any.
- (iv) In order to retain customers, recommend the prices to be charged and calculate the profit margin for each customer, in accordance with the company's cost-based pricing formula by allocating production overhead based on relevant cost drivers.

**(10 Marks)**

- (b) Gum Care Limited is maker of two-tone toothpaste. The company is currently throwing out 1,000 tubes of toothpaste per hour, all downstream of the constrained resource. Its constrained resource is the packaging machine, which uses a multi-nozzle dispenser to fill different colours of toothpaste into the toothpaste tube. The machine produces 5,000 tubes of toothpaste per hour, which generates ₹ 1,50,000 of throughput contribution per hour.

The company is concerned about the scrap rejection rate of its product. It is considering quality improvement investments at downstream from the constrained resource, since it would prevent the loss of constraint time.

The company is evaluating a proposal to reduce the scrap rejection rate of its product. The proposal is intended to eliminate downstream bursting of the tubes through overfilling, which requires an investment of ₹ 3,00,00,00 in replacement of multi-nozzle dispenser by an imported dispenser that more precisely fins each tube. The dispenser will require replacement once a year. The company runs on an eight hour day and 25 days in a month:

Required:

- (i) Evaluate the costs and benefits to the company arising from the quality improvement initiative.
- (ii) Do you consider that four types of quality costs – prevention costs, appraisal costs, internal failure costs and external failure costs are independent?
- (iii) A company incurred costs as a result of discovering product defects prior to shipment and also incurred costs when low quality products are shipped to customers

Identify quality cost categories into which these quality costs fall.

**(6 Marks)**

**Answer**(a) (i) **Computation of price charged to each customer by existing formula:**

Particulars	Customers		
	P	Q	R
Raw Material	40,000	60,000	35,000
Direct Labour cost	34,000	65,000	46,000
Production OH*	<b>76,500</b>	<b>1,46,250</b>	<b>1,03,500</b>
Mark up			
• On Material @ 70%	28,000	42,000	24,500
• On Labour @ 60%	20,400	39,000	27,600
<b>Sale Price</b>	<b>₹ 1,98,900</b>	<b>₹ 3,52,250</b>	<b>₹ 2,36,600</b>

\*(2,17,500 + 50%) in the ratio of 34:65:46

(ii) **Customer Profitability Statement**

( Amount in ₹ )

Particulars	Customers		
	P	Q	R
<b>Sale Price</b>	<b>1,98,900</b>	<b>3,52,250</b>	<b>2,36,600</b>
<b>Less: Cost</b>			
Raw Material	40,000	60,000	35,000
Direct Labour cost	34,000	65,000	46,000
Production OH*	69,375	69,250	78,875
<b>Profit</b>	<b>55,525</b>	<b>1,58,000</b>	<b>76,725</b>
<b>Profit Margin (Profit/sales)</b>	<b>27.92%</b>	<b>44.85%</b>	<b>32.43%</b>

\*Computation of ABC recovery rates

Activity	Activity cost pool	Cost driver	Qty. of cost driver	ABC recovery rate
Determining customer requirements	85,500	No. of meetings	36	2,375
Making design change	90,000	No. of design changes	60	1,500

Machine set up	42,000	No. of production batches	21	2,000
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**OH Customer wise**

Activity	Customers		
	P	Q	R
Determining customer requirements (2,375 x no. of meetings)	30,875	23,750	30,875
Making design change (1,500 x no. of design changes)	22,500	25,500	42,000
Machine set up (2,000 x no. of production batches)	16,000	20,000	6,000
	<b>69,375</b>	<b>69,250</b>	<b>78,875</b>

- (iii) **Customer “Q”** is most likely to be unhappy with the pricing policy of the company.

Root cause of overcharging: Company has adopted “Blanket Recovery Rate” for recovery of

OH, which completely ignores the quantum of different services used by the customer.

- (iv) **Computation of SP and Profit Margin**

(Amount in ₹)

Particulars	Customers		
	P	Q	R
Raw Material	40,000	60,000	35,000
Direct Labour cost	34,000	65,000	46,000
Production OH*	<b>1,04,063</b>	<b>1,03,875</b>	<b>1,18,313</b>
Mark up			
• On Material @ 70%	28,000	42,000	24,500
• On Labour @ 60%	20,400	39,000	27,600
<b>Sale Price</b>	<b>2,26,463</b>	<b>3,09,875</b>	<b>2,51,413</b>
Profit (Markup on material, labour and OH)	83,088	1,15,625	91,538
<b>Profit Margin in %</b>	<b>36.69%</b>	<b>37.31%</b>	<b>36.41%</b>

\*OH as per ABC Method + 50% markup

Particulars	Customers		
	P	Q	R
OH as per ABC	69,375	69,250	78,875
Add: 50 % markup	34,688	34,625	39,438
OH after markup	<b>1,04,063</b>	<b>1,03,875</b>	<b>1,18,313</b>

(b) (i)

Current rejection rate	1,000 tubes per hour.
Throughput contribution per unit is 1,50,000/5,000 tubes	₹30 per tube
Loss of contribution per hour	30 x 1,000
	<b>₹ 30,000 per hour</b>
Total Loss per annum	30,000 x 8 hours x 25 days x 12 months ₹ 7,20,00,000

#### Cost Benefit Statement

Benefit – Increase in contribution	<b>₹ 7,20,00,000</b>
Cost – Dispenser cost	₹ 3,00,00,000
Net benefit	<b>₹ 4,20,00,000</b>

Hence, the investment proposal should be accepted.

- (ii) **These four types of quality costs are not independent.** If more time and effort are spent ensuring that defective goods do not leave the company, lower external failure costs are likely to occur.

If more resources are consumed in the prevention and appraisal costs categories, **the costs associated with internal and external failures will decline**

- (iii) **Classification of Quality Cost:**

Particulars	Quality Cost Category
Discovering product defects prior to shipment	Internal Failure Costs
Low Quality products shipped to customers	External Failure Costs

**Question 4**

- (a) APZ Ltd. manufactures a line of fast moving consumer goods which are replaced on regular interval based on customer choice and preference as disclosed by company's market research. Accordingly, the company has decided to introduce a new kind of multigrain digestive biscuits in two months, replacing two kinds of cream biscuits C1 and C2. The company has already launched its advertisement campaign for the new product.

Material M1 and M2 are used exclusively for production of C1 and C2. At present 20,000 kg of material M1 and 10,000 kg of material M2 are lying in stock and will not be used in production of multigrain digestive biscuit. Both M1 and M2 are having a shelf life of another six months. These materials have no other uses. So, the management wishes to exhaust the present stock of M1 and M2 during the next month before introduction of the new product

Selling price and cost per box of C1 and C2 containing 25 packets in each box are as follows:

	C1 (Per Box)	C2 (Per Box)
Selling price per box	₹500	₹400
Raw material M1 (4 kg @ ₹30 per kg), (2 kg@ ₹ 30 per kg)	₹120	₹60
Raw material M2 (1 kg @ ₹ 20 per kg), (2 kg@ ₹20 per kg)	₹20	₹40
Direct labour (2.5 DLH x ₹ 30 per DLH)	₹75	₹75
Variable manufacturing over head (8% of direct labour cost)	₹60	₹60
Fixed manufacturing overhead-allocated (120% of direct labour cost)	₹90	₹90
Tota cost per box	₹ 365	₹325

As per the market survey report, the company can sell a maximum of 2,500 boxes of C1 and 5,000 boxes of C2 in the next month. A maximum of 20,000 direct labour hours are available for the next month. All the suppliers of materials supplies M1 and M2 for a minimum quantity of 25,000 kg or more for each categories of material.

Required:

- (i) Determine the number of boxes of C1 and C2 to be produced during the next month to maximise profit and calculate the resultant profit based on the product mix recommended by you.



- (ii) Assume that one of the suppliers has agreed to supply material M2 at a higher price of ₹ 40 per kg than the regular price of ₹ 20 per kg for a minimum supply of 3,000 kg. Would you still stick to your answer given in (i) above?

If not, calculate the number of boxes of C1 and C2 to be produced during the next month to maximise overall profit. Show calculations in support of your answer.

**(8 Marks)**

- (b) NTP Ltd. is a power generation and distribution company. It has three electric power plants with capacities of 25, 40 and 30 million kilowatt- hour (kWh) which supply electricity to three cities. The maximum demands at the three cities are estimated at 30, 35 and 25 million kWh. The electricity price (rupees in thousands) per million kWh at the three cities is given in the following table:

Plant	City		
	1	2	3
P1	60	70	40
P2	34	30	35
P3	50	48	45

During the month of April, there is a 20% increase in demand at each of the three cities, which can be met by purchasing electricity from another thermal power plant network at a higher rate of ₹1,00,000 per million kWh. However, the thermal power plant network is not linked to City-3, NTP Ltd. wants to determine the most economical plan for the distribution and purchase of additional energy-

Required:

- (i) Formulate the above as a transportation problem. Using Vogel's Approximation Method (VAM) find the optimal distribution plan and the total cost of distribution of electricity.
- (ii) Do you consider that the solution determined in (i) above is a unique solution?
- (ii) Determine the cost' of the additional electricity purchased by the cities. **(8 Marks)**

**Answer**

**(a) Working Notes**

**(1) Identification of KF**

Components of cost	Availability	Demand	Key Factor?
Raw Material M1	20,000	20,000 (2500x4) + (5000x2)	No

Raw Material M2	10,000	12,500 (2500x1) + (5000x2)	Yes
Labour Hours	20,000	18,750 (2500+5000) x 2.5	No

## (2) Priority of production

Particulars	C1	C2
SP	500	400
Less: VC [Relevant]	135	135
Contribution p.u.	365	265
÷ Qty. of M2 per unit	1	2
Contribution per kg of M2	<b>365</b>	<b>132.5</b>
Priority	I <sup>st</sup>	II <sup>nd</sup>

**Allocation of 10,000 M2:**

Max to Product C1: 2500 x 1 = 2,500 kgs.

Remaining to C2: 7,500 kgs

## (i) Product MIX

Particulars	Boxes
C1	2,500
C2	3,750 (7500 M2 / 2 kgs)

**Profit**

Particulars	C1	C2
Sales Revenue	2,500 x 500	3,750 x 400
Less: Relevant Cost	2,500 x (75+60)	3,750 x (75+60)
Contribution/ Incremental Benefit	<b>₹ 9,12,500</b>	<b>₹ 9,93,750</b>

## (ii) Product MIX

Particulars	Boxes
C1	2,500
C2	5,000

- Additional cost per kg of M2 is Rs 20 (40 -20)

- RM M2 is not required for product C1, since its demand is already fulfilled.
- Product C2 requires 2 kgs. of M2, total requirement is 2,500 kgs [(5,000 – 3750) x 2 kgs], while the min. Purchase qty is 3,000 kgs, thus, 500 kgs will be wasted, the resultant cost per unit of C2 will be ₹ 96 [3,000 kgs x 40 / 1,250 units]
- Revised Contribution per unit of Product C2: 400–96 – 75–60 = ₹ 169
- Since there is still positive contribution, we will produce the remaining qty of C2 by purchasing M2 at higher price.
- Total Incremental Contribution will be ₹ 2,11,250 on 1,250 boxes of C2

#### Alternative Presentation

- (i) To meet next month's maximum demand of C1 and C2 resources required are as follows:

Material M1 (2,500 × 4) + (5,000 × 2)	20,000 kg
Material M2: (2,500 × 1) + (5,000 × 2)	12,500 kg
Direct labour hour: (2,500 × 2.5) + (5,000 × 2.5)	18,750 direct labour hrs.

**So, the only limiting factor is material M2 because** there is a shortage of 2,500 kg, which can be arranged by purchasing from the supplier. But the minimum quantity to be purchased is 25,000 kg. So, if M1 is purchased, then remaining 22,500 kg will be of no use.

In calculation of contribution below, the cost of materials M1 and M2 are not considered, because these materials are in stock and once consumed will not be replaced. The costs of materials are, therefore, sunk cost and not relevant for the purposes of decision.

	C1 (₹)	C2 (₹)
Selling price per box	500	400
Less: Relevant variable cost of manufacturing:		
Direct labour	75	75
Variable manufacturing Overheads	60	60
Contribution per box	365	265
Material M2 required per box	1 kg	2 kg
Contribution per kg of material M2	<b>365</b>	<b>132.50</b>
Priority	I <sup>st</sup>	II <sup>nd</sup>

Production Plan to exhaust material M1 and M2:

	Use of M1	Use of M2
C1: 2,500 Boxes: $(2,500 \times 4)$ , $(2,500 \times 1)$	10,000 kg	2,500 kg
C2: 3,750 Boxes: $[= 7,500 \text{ kg}/2\text{kg}]$ , $(3,750 \times 2)$	7,500 kg	7,500 kg (Bal. fig)
Total usage of materials	17,500 kg	10,000 kg
Remaining stock of materials	2,500 kg	Nil

Produce 2,500 boxes of C1 and 3,750 boxes of C2 in order to exhaust the present stock of M1 and M2.

**Profitability of the above decision:**

	₹
C1: $(2,500 \times ₹ 500)$	12,50,000
C2: $(3,750 \text{ Boxes} \times ₹ 400)$	15,00,000
	27,50,000
Relevant cost of manufacturing:	
Material M1 (Not relevant)	-
Material M2 (Not relevant)	-
Direct labour $[(2,500 \times ₹ 75) + (3,750 \times ₹ 75)]$	4,68,750
Variable overheads $[(2,500 \times ₹ 60) + (3,750 \times ₹ 60)]$	3,75,000
	8,43,750
Contribution	<b>19,06,250</b>

- (ii) If one of the suppliers has agreed to supply material M2 at a higher price of ₹ 40 per kg than the regular price of ₹ 20 per kg for a minimum supply of 3,000 kg, then the production plan would be as follows:

Unsatisfied demand of 1,250 boxes  $(= 5,000 - 3,750)$  of C2 requires 2,500 kg of M1 and 2,500 kg of M2. The required quantity of material M1 is already available in stock. Only M2 has to be purchased. If 3,000 kg is purchased, out of that 500 kg will remain unutilized. Even though M2 is purchased at a price double the normal rate, it would improve profitability than as per the decision given in (i) above.

Incremental revenue from sale of 1,250 boxes of C2 $(1,250 \times ₹ 400)$		<b>₹ 5,00,000</b>
Less: Incremental costs:		

Material M1 (not relevant)		
Material M2 (3,000 × 40)	1,20,000	
Director labour (1,250 × 75)	93,750	
Variable overheads (1,250 × 60)	75,000	₹ 2,88,750
		<b>₹ 2,11,250</b>

**Revised Production Plan: 2,500 Boxes of C1 and 5,000 boxes of C2****Alternative presentation of profitability**

	<b>2,500 Boxes of C1 and 3,750 Boxes of C2 ₹</b>	<b>2,500 Boxes of C1 and 5,000 Boxes of C2 ₹</b>	<b>Difference</b>
Sales: C1	12,50,000	12,50,000	-
C2	15,00,000	20,00,000	5,00,000
Relevant costs of manufacturing	27,50,000	<b>32,50,000</b>	5,00,000
Material M1 (Not relevant)	-	-	-
Material M2	-	1,20,000	1,20,000
Direct labour	4,68,750	5,62,500	93,750
Variable overheads	3,75,000	4,50,000	75,000
	8,43,750	11,32,500	2,88,750
Contribution	19,06,250	<b>21,17,500</b>	<b>2,11,250</b>

**Revised Production Plan: 2,500 Boxes of C1 and 5,000 Boxes of C2****Alternative Solution Answer 4****(a) Working Notes:****(1) Identification of KF**

<b>Components of cost</b>	<b>Availability</b>	<b>Demand</b>	<b>Key Factor?</b>
Raw Material M1	20,000	20,000 (2500x4) + (5000x2)	No
Raw Material M2	10,000	12,500 (2500x1) + (5000x2)	Yes
Labour Hours	20,000	18,750 (2500+5000) x 2.5	No

## (2) Priority of production

Particulars	C1	C2
SP	500	400
Less: VC [Total cost – FC]	275	235
Contribution p.u.	225	165
÷ Qty. of M2 per unit	1	2
Contribution per kg of M2	<b>225</b>	<b>82.5</b>
Priority	I <sup>st</sup>	II <sup>nd</sup>

Allocation of 10,000 M2:

Max to Product C1:  $2500 \times 1 = 2,500$  kgs. And remaining to C2: 7,500 kgs

## (i) Product MIX

Particulars	Boxes
C1	2,500
C2	3,750 (7500 M2 / 2 kgs)

## Profit

Particulars	C1	C2
Sales Revenue	$2,500 \times 500$	$3,750 \times 400$
Less: Costs	$2,500 \times 365$	$3,750 \times 325$
Profit	<b>3,37,500</b>	<b>2,81,250</b>

## (ii) Product MIX

Particulars	Boxes
C1	2,500
C2	5,000

- Additional cost per kg of M2 is Rs 20 (40 -20)
- RM M2 is not required for product C1, since its demand is already fulfilled.
- Product C2 requires 2 kgs. of M2, total requirement is 2,500 kgs [(5,000 – 3750) x 2 kgs], while the min. Purchase qty is 3,000 kgs, thus, 500 kgs will be wasted, the resultant cost per unit of C2 will be ₹ 96 [ $3,000 \text{ kgs} \times 40 / 1,250 \text{ units}$ ] or (₹ 56 additional)

- Revised Contribution per unit of Product C2:  $165 - 56 = 109$
- Since there is still positive contribution, we will produce the remaining qty of C2 by purchasing M2 at higher price.
- Total Incremental Contribution will be ₹ 1,36,250 on 1,250 boxes of C2

**(b) Initial Solution by VAM**

	City 1	City 2	City 3	Supply	Difference
<b>P1</b>	60	70	40 25	25/0	20 - -
<b>P2</b>	34	30 40	35	40/0	4 4 -
<b>P3</b>	50 23	48 2	45 5	30/25/23/0	3 3 3 2
<b>P4</b>	100 13	100	M	13/0	0 0 0 -
Revised Demand	36/13/0	42/2/0	30/5/0	108	
Difference	16	18	5		
	16	18	10		
	50	52	M-45		
	50	52	-		

Since, initial solution obtained is equal to  $m + n - 1$  i.e. 6. Now we test this initial solution for optimality as under-

 **$(u_i + v_j)$  Matrix for Allocated / Unallocated Cells**

				$u_i$
	45	43	40	-5
	32	30	27	-18
	50	48	45	0
	100	98	95	50
$v_j$	50	48	45	

Now we calculate  $\Delta_{ij} = C_{ij} - (u_i + v_j)$  for non basic cells which are given in the table below-

$\Delta_{ij}$  Matrix

15	27	
2		8
	2	M-95

Since, all the values in the above  $\Delta_{ij}$  Matrix is  $\geq 0$ , hence, the above allocation is optimal.

	Demand million kWh	Cost per million kWh (₹'000)	Total Cost (₹ '000)
P <sub>1</sub> C <sub>3</sub>	25	40	1,000
P <sub>2</sub> C <sub>2</sub>	40	30	1,200
P <sub>3</sub> C <sub>1</sub>	23	50	1,150
P <sub>3</sub> C <sub>2</sub>	2	48	96
P <sub>3</sub> C <sub>3</sub>	5	45	225
P <sub>4</sub> C <sub>1</sub>	13	100	1,300
			<b>4,971</b>

(ii) Since, none of the values of  $\Delta_{ij}$  Matrix is 0, hence, the above solution is unique.

(iii) Cost of additional electricity purchased by Cities is ₹ 13,00,000

#### Question 5

- (a) AMP Limited has developed a new product having short life cycle. It enjoyed 88% learning curve. The learning effect stopped after 32 units were produced and a steady-state production level was reached that is when no further improvement is expected and the regular efficiency level is reached. Standard wage rate is ₹150 per hour.

After production of 32 units, the following information was placed for review of performance:

Standard labour hours per unit (based on time taken for the first unit)	25 hours
Actual labour hours worked	.450 hours
Standard wage rate	₹ 150 per hour
Direct labour efficiency variance	₹ 52,500 (Fav)



Once the steady-state was reached, the standard labour hour requirement per unit was then revised to the average labour hours consumed for production of 32 units. Subsequently, during the year the company produced another 50 units in 650 hours.

Required:

- (i) Considering the learning effect, calculate average labour hours per unit for 32 units produced by the company.
- (ii) Comment on the direct labour efficiency variance as computed by the company.
- (iii) Calculate direct labour efficiency planning variance and direct labour efficiency operational variance in respect of production of 32 units enjoying learning curve.
- (iv) Calculate direct labour efficiency operational variance for production of 50 units during steady state production level.
- (v) Discuss the behavioural impact of attainable standards on the workers of a company.

**(8 Marks)**

- (b) (i) Akaar Limited manufactures hi-tech insulators. Management is trying to revamp its pricing policy. Details pertaining to each unit of Insulator and the recommended pricing policy is given here under.

Variable Cost	₹ 4,50,000	
Selling Price	₹ 10,00,000	No order is likely to be received
If price reduced by	₹ 10,000	Demand will be increased by 2 units with every such reduction

Required:

Determine the unit selling price of the Insulator that will maximize the profit of Akaar Ltd.

- (ii) Pleasure Trip Travels based in Mumbai, organizes holiday packages to Dubai.

The tour packages offers

- 4 Nights and 5 Days.
- Stay in 5 star hotels.
- Continental breakfast, buffet lunch and dinner for all the days.
- Sightseeing covering 21 prominent spots in Dubai.
- Cost of the package is ₹ 5,00,000 for a family of 4 (2 Adults and 2 Children).

Pleasant Trip Tours another travel agency based in Dubai, covers all the above inclusions at ₹ 4,50,000 only. It further offers -

- Airport pick up and drop at India worth ₹ 3,000

- Premium dinner in a world famous hotel for 1 day - The monetary value of the incremental benefit of that dinner would be ₹ 6,000.
- Dubai desert safari which is not covered by Pleasure Trip travel package worth ₹ 10,000

Required:

Calculate True Economic Value.

- (iii) Describe the term perceived value. (8 Marks)

**Answer**

- (a) (i) **Computation of Avg labour hours for 32 units through DOUBLING Approach:**

Units	Calculation	Avg. hours per unit
1		25
2	25 x 88%	22
4	22 x 88%	19.36
8	19.36 x 88%	17.0368
16	17.0368 x 88%	14.9923
32	14.9923 x 88%	<b>13.1933</b>

**Or 13.2 hrs.**

- (ii) Standard labour hours computed as considering time taken by every unit will be 25 hours,

thus SHs are 800 [25 x 32 units]

AHs are 450 hours

Labour efficiency variance

= [SH – AH] x Std. rate of labour

= [800 – 450] x 150

**= 52,500 F**

- (iii)

SH x SR	RSH X SR	AH X SR
800 X ₹ 150	13.1933 X 32 UNITS X ₹ 150	450 X ₹ 150
₹ 1,20,000	₹ 63,328	₹ 67,500
(1)	(2)	(3)

**Computation of Variances:**

Planning variance	Col 1 – col 2	₹ 56,672 F
Operational Variance	Col 2 – col 3	₹ 4,172 A

Or

SH x SR	RSH X SR	AH X SR
800 X ₹ 150	13.2 X 32 UNITS X ₹ 150	450 X ₹ 150
₹ 1,20,000	₹ 63,360	₹ 67,500
(1)	(2)	(3)

**Computation of Variances:**

Planning variance	Col 1 – col 2	₹ 56,640 F
Operational Variance	Col 2 – col 3	₹ 4,140 A

(iv) Total Labour Hours for **first 32 units** based on learning curve of 88%.

$$\begin{aligned}
 y &= 25 \times (32)^{-0.184} \\
 &= 25 \times 0.526 \\
 &= 13.2 \text{ hrs.}
 \end{aligned}$$

Total Time Required for 32 units = 422.4

Total Labour Hours for **first 31 units** based on learning curve of 88%.

$$\begin{aligned}
 y &= 25 \times (31)^{-0.184} \\
 &= 25 \times 0.5316 \\
 &= 13.29
 \end{aligned}$$

Total Time Required for 31 units = 411.99 hrs.

Time Required for **32<sup>nd</sup> Unit** = 422.4 – 411.99 = 10.41 hrs.

SHs = 50 units x **10.41 hours** = 520.50 hours

Efficiency Variance = (520.50 – 650) x 150 = **₹ 19,425 A**

**OR Alternative Solution to (iv) part**

Revised standard hours per unit = 13.20 hours

Actual output = 50 units and actual hours taken = 650 hours

Revised standard hours for 50 units = 13.2 X 50 = 660 hours

DL Efficiency operational variance = (Revised Std hours – AH) = (660 – 650) X ₹ 150  
= ₹ 1500 F

- (v) Workers will be motivated when the standard is attainable one.

They feel they will be rewarded due to their efficiency, since the target is achievable

- (b) (i) **Step 1: Price at which demand is zero (denoted by “a”) is ₹ 10,00,000**

**Step 2: Computation of Optimal Qty.**

$$MR = a - 2bq$$

Where. a is price at which demand is zero

B is slope of demand curve (change in price/change in volume) & Q is Qty. demanded

Profit is maximum when marginal revenue (MR) is equal to marginal cost (MC)

$$₹ 4,50,000 = ₹ 10,00,000 - 2 \times (₹ 10,000/2)q$$

$$Q = 55 \text{ units}$$

**Step 3: Computation of Optimal Price**

$$P = a - bq$$

$$P = ₹ 10,00,000 - (₹ 10,000/2) \times 55$$

$$P = ₹ 7,25,000$$

- (ii) **TEV= Cost of next best alternative + Value of performance differential**

TEV of the package offered by Pleasant Trip Tours

Price charged by competitor	₹ 5,00,000
Add: Price differentials	
• Airport pick up and drop	₹ 3,000
• Dinner	₹ 6,000
• Desert Safari	₹ 10,000
<b>True Economic Value</b>	<b>₹ 5,19,000</b>

OR

**TEV of the package offered by Pleasure Trip Travels.**

Price charged by competitor	₹ 4,50,000
Less: Price differentials	
• Airport pick up and drop	₹ 3,000
• Dinner	₹ 6,000
• Desert Safari	₹ 10,000
<b>TRUE ECONOMIC VALUE</b>	<b>₹ 4,31,000</b>

- (iii) This is the value that consumer understands the product deliver to it. It is the price of a product that a consumer is willing to spend to have that product.

At the time of fixing price, it is to be kept in the mind that any price which is set below the perceived value but above the cost of goods sold give incentives to both buyers and the seller.

### Question 6

- (a) MNP Ltd. produces and sells a single product. The company is preparing its budget for the forthcoming financial year 2022-23. The following are the budgeted selling price, variable costs and the fixed costs to be incurred

Particulars	Per Unit of output (₹)
Selling price	530
Variable Cost	
Direct material X @ ₹15 per kg	120
Direct material Y @ ₹20 per kg	80
Direct labour @ ₹25 per hour	150
Variable overheads @ ₹10 per hour	6
	For the year 2022-23
Fixed Costs	(₹)
Production overheads	36,00,000
Administration overheads	24,00,000
Selling overheads	12,00,000

The company's budgeted profit for the year 2022-23 is ₹24, 00,000. Sales of each month of 2022-23 are expected to follow the below mentioned pattern (monthly sale occurs evenly under each category):

April, August, February, and March	20% of the total budgeted sales quantity
May, July, November, and January	30% of the total budgeted sales quantity
June, September, October and December	50% of the total budgeted sales quantity

The production of each month's sales is planned as follows:

40% of next month's budgeted sales unit
60% of current month's budgeted sales unit

The requirement of direct materials for each month's production is planned to be purchased as follows:

50% of each month's requirement of direct materials is to be purchased in the month before the month in which materials will be consumed
50% of each month's requirement of direct materials is to be purchased in the month in which materials will be consumed

The stock of direct materials and finished goods at the beginning of the year 2022-23 are in accordance with the above mentioned policies of the company. Materials X and Y are mixed in production of the finished goods. Normal production capacity of the company is ₹ 10,000 units per month.

Required:

- (i) Prepare the sales budget (in units) for the year 2022-23 showing sales of each of the months.
  - (ii) Prepare the production budget for each of the first three months of 2022-23
  - (iii) Prepare the direct materials purchase budget (in kilogram and in rupee value) for each of the first three months of 2022-23.
  - (iv) Identify the months of 2022-23 in which the budgeted production is equal to the normal production capacity, **(10 Marks)**
- (b) A firm has four men (P, Q, R and S) available for work on four different jobs. Only one man can work on anyone job. The cost of assigning each man to each job is given in the following table:

Job Man	1	2	3	4
P	40	45	42	48
Q	35	38	43	37
R	39	37	41	44
S	45	43	44	44

The task was to work out the optimal assignment so that the total cost of assignment is a minimum, A candidate has prepared the following table after row and column operation and could not proceed further:

Job Man	1	2	3	4
P	0	5	1	7
Q	0	3	7	1

R	2	0	3	6
S	2	0	0	0

Required:

- Determine the optimal assignment schedule and the total cost of assignment.
- Is the solution determined in (i) above a unique solution? If not, determine the alternate optimal solution and the total cost of assignment.
- Suppose you have been given an assignment problem where you have to assign five machines to five operators (one for each) to maximise the profit per week. What would be your first step to solve this assignment problem and how would you do it?
- In an assignment problem, state the necessity of introducing a dummy row or column. What is the cost (or time) assigned to the elements of dummy row or column?

(6 Marks)

**Answer**

**(a) (i) Sales Budget (in units) for year 2022-23**

Sales Units

= Total contribution/Contribution p.u.

= ₹ 96,00,000/₹ 120 p.u. = **80,000 units**

**Sales budget (in units) for each of the months of year 2022-23**

Month	Calculation	Sales units
April, 2022	80,000 x 20% / 4 months	4,000
May, 2022	80,000 x 30% / 4 months	6,000
June, 2022	80,000 x 50% / 4 months	10,000
July, 2022	80,000 x 30% / 4 months	6,000
August, 2022	80,000 x 20% / 4 months	4,000
September, 2022	80,000 x 50% / 4 months	10,000
October, 2022	80,000 x 50% / 4 months	10,000
November, 2022	80,000 x 30% / 4 months	6,000
December, 2022	80,000 x 50% / 4 months	10,000
January, 2023	80,000 x 30% / 4 months	6,000
February, 2023	80,000 x 20% / 4 months	4,000
March, 2023	80,000 x 20% / 4 months	4,000

- (1) VC p.u. =  $120 + 80 + 150 + 60 = ₹410$   
 (2) Contribution p.u. =  $530 - 410 = ₹120$   
 (3) Total Contribution = Fixed cost + Profit  
       =  $[36 + 24 + 12] \text{ Lacs} + 24 \text{ lacs} = ₹ 96 \text{ lacs}$

**(ii) Production Budget****For first three months of year 2022-23**

Formula = [Sales of next month x 40%] + [Sales of current month x 60%]

Month	Working	Production units
April, 2022	$[6,000 \times 40\%] + [4,000 \times 60\%]$	<b>4,800</b>
May, 2022	$[10,000 \times 40\%] + [6,000 \times 60\%]$	<b>7,600</b>
June, 2022	$[6,000 \times 40\%] + [10,000 \times 60\%]$	<b>8,400</b>

**(iii)****Direct Material Purchase Budget****For first three months of year 2022-23**

Formula = [Production of next month x 50%] + [Production of current month x 50%]

**Direct Material "X"**

Month	Working	RM "X" in kgs	RM "X" in ₹ (Qty x ₹ 15)
April, 2022	$[7,600 \times 50\%] + [4,800 \times 50\%] \times 8 \text{ kgs}$	<b>49,600</b>	<b>7,44,000</b>
May, 2022	$[8,400 \times 50\%] + [7,600 \times 50\%] \times 8 \text{ kgs}$	<b>64,000</b>	<b>9,60,000</b>
June, 2022	$[5,200^* \times 50\%] + [8,400 \times 50\%] \times 8 \text{ kgs}$	<b>54,400</b>	<b>8,16,000</b>

\* $[4,000 \times 40\%] + [6,000 \times 60\%] = 5,200$  Production units in month of July, 2022

**Direct Material "Y"**

Month	Working	RM "Y" in kgs	RM "XY" in ₹ (Qty x ₹ 20)
April, 2022	$[7,600 \times 50\%] + [4,800 \times 50\%] \times 4 \text{ kgs}$	24,800	4,96,000
May, 2022	$[8,400 \times 50\%] + [7,600 \times 50\%] \times 4 \text{ kgs}$	32,000	6,40,000



June, 2022	$[5,200 \times 50\%] + [8,400 \times 50\%] \times 4 \text{ kgs}$	27,200	5,44,000
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(iv) Months in which budgeted production is equal to normal production capacity

Month	Working	Production units
Sep, 2022	$[10,000 \times 40\%] + [10,000 \times 60\%]$	10,000

(b) (i) Matrix after Row and Column Operation (given). Draw the minimum number of lines horizontal or vertical so as to cover all zeros.

	1	2	3	4
P	0	5	1	7
Q	0	3	7	1
R	2	0	3	6
S	2	0	0	0

Since the minimum number of lines covering all zeros is equal to 3 which is less than the number of columns / rows (=4), the above table will not provide optimal solution. Subtract the minimum uncovered element (=1) from all uncovered elements and add to the elements lying on the intersection of two lines, we get the following matrix

	1	2	3	4
P	0	4	0	6
Q	0	2	6	0
R	3	0	3	6
S	3	0	0	0

Since the minimum number of horizontal and vertical lines to cover all zeros is equal to four which is equal to the order of the matrix, the above table will give the optimal solution. The optimal assignment/ cost is made below-

Man	Job	Total Cost
P	1	40
Q	4	37
R	2	37
S	3	44
Total		158

Alternative presentation for part (i)

- (i) Matrix after Row and Column Operation (given). Draw the minimum number of lines horizontal or vertical so as to cover all zeros.

	1	2	3	4
P	0	5	1	7
Q	0	3	7	1
R	2	0	3	6
S	2	0	0	0

Since the minimum number of lines covering all zeros is equal to 3 which is less than the number of columns / rows (=4), the above table will not provide optimal solution. Subtract the minimum uncovered element (=1) from all uncovered elements and add to the elements lying on the intersection of two lines, we get the following matrix

	1	2	3	4
P	0	5	0	6
Q	0	3	6	0
R	2	0	2	5
S	3	1	0	0

Since the minimum number of horizontal and vertical lines to cover all zeros is equal to four which is equal to the order of the matrix, the above table will give the optimal solution. The optimal assignment/ cost is made below-

Man	Job	Total Cost
P	1	40
Q	4	37
R	2	37
S	3	44
Total		158

- (ii) Alternate assignment/ cost -

Man	Job	Total Cost
P	3	42
Q	1	35

R	2	37
S	4	44
Total		158

- (iii) The case would be a maximization problem. In that case, firstly we have to convert it (matrix) into an **opportunity loss matrix** by subtracting all the elements of the given table from the **highest element** of the table.
- (iv) Dummy row or column is inserted to make it a balanced matrix and cost (or time) assigned to the elements will be **Zero**.

### Question 7

Answer any four out of the following five questions:

- (a) State the validity of following statements along with reasons;
- PERT is considered as deterministic and CPM is considered as Probabilistic.
  - Resource levelling is a network technique which is used for reducing the requirement of a particular resource due to its paucity.
  - Backward pass and forward pass computations are coined words related to CPM.
  - PERT is incapable of handling uncertainty in timing.
- (b) There are some serious problems with black flushing that must be corrected before it will work properly". Explain Scrap Reporting and Lot tracing in the context of the above statement.
- (c) What are structural cost drivers and executional cost drivers?
- (d) Given below are certain types of reports which are to be prepared and submitted to different levels of management regularly at required time intervals. Please match the type of reports that are predominantly required to be submitted with the given Levels of Management.

Production Management	Sales Management	Top Management
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Types of Reports:

- Status report on new or doubtful customers.
- Position of stocks.
- Statistics on sales and production.
- General works operating statements.
- Department scrap report.
- Bad debts and accounts which are difficult in collection.

(vii) *Production trend and utilization capacity.*

(viii) *Cash flow statements.*

- (e) *State the reasons why. Balanced Scorecards sometimes fail to provide for the desired results.* **(4 x 4 = 16 Marks)**

**Answer**

**(a)**

Sr. no.	Validity	Reason
(i)	Invalid	PERT is considered as Probabilistic approach and CPM is considered as Deterministic Approach
(ii)	Valid	It is also a network technique which is used for reducing the requirement of a particular resource due to its paucity. The process of resource levelling utilize the large floats available on non-critical activities of the project and thus cuts down the demand on the resource.
(iii)	Valid	In the forward pass, the Early Start and Early Finish values for each activity, along with the overall Project Duration, are calculated. Through this backward pass, the Late Start and Late Finish values are calculated.
(iv)	Invalid	PERT (Program Evaluation and Review Technique) is more relevant for handling such projects which have a great deal of uncertainty associated with the activity durations. To take these uncertainty into account, three kinds of times estimates are generally obtained- the Optimistic Times Estimate, the Pessimistic Time Estimate, The Most Likely Time Estimate.

- (b) Scrap reporting:** All abnormal scrap must be diligently tracked and recorded; otherwise these materials will fall outside the backflushing system and will not be charged to inventory.

Since scrap can occur anywhere in a production process, a lack of attention by any of the production staff can result in an inaccurate inventory.

Once again, high production turnover or a low level of employee training increases this problem.

**Lot tracing:** Lot tracing is impossible under the backflushing system.

It is required when a manufacturer need to keep records of which production lots were used to create a product in case all the items in a lot must be recalled.

Only a picking system can adequately record this information. Some computer system allows picking and backflushing system to coexist, so that pick transactions for lot tracing purpose can still be entered in the computer.

Lot tracing may then still be possible if the right software is available; however, this feature is generally present only on high-end systems.

**(c) Structural cost drivers**

Structural cost drivers consist of organisational factors that determine the economic structure driving the cost of a firm's products.

These cost drivers reflect a firm's long-term decisions, which position the firm in its industry and marketplace.

Structural cost drivers may change. For example, large pharmaceutical companies enjoy economies of scale that lower their unit costs for expensive R&D.

**Executional cost drivers**

Executional cost drivers capture a firm's operational decisions on how best to employ its resources to achieve its goals and objectives.

These cost drivers are determined by management policy, style and culture. How well a firm executes its use of human and physical resources will determine its level of success or failure.

For example, worker empowerment and flattened organisations are helping many firms in their continuous improvement efforts.

**(d) Reports to be submitted to different management:**

Management	Reports
Production	<ul style="list-style-type: none"> <li>• Position of stocks</li> <li>• General works operating statements</li> <li>• Departmental scrap report</li> <li>• Production trend and utilisation capacity</li> </ul>
Sales	<ul style="list-style-type: none"> <li>• Status report on new or doubtful customers</li> <li>• Bad debts or accounts which are difficult in collection</li> </ul>
Top	<ul style="list-style-type: none"> <li>• Statistics on sales and production</li> <li>• Cash flow statements</li> </ul>

- (e) The following are some reasons why Balanced Scorecards sometimes fail to provide for the desired results;
- Managers mistakenly think that since they already use non – financial measures, they already have a Balanced Scorecard.
  - Senior executives misguidedly delegate the responsibility of the Scorecard implementation to middle level managers.
  - Company's try to copy measures and strategies used by the best companies rather than developing their own measures suited for the environment under which they function.
  - There are times when Balanced Scorecards are thought to be meant for reporting purposes only. This notion does not allow a Business to use the Scorecard to manage Business in a new and more effective way.

It may be noted that the above-mentioned difficulties refer to the internal use of the Scorecard, unless it is used internally successfully, it should not be used as a basis for external reporting