Note: All questions are compulsory.

Question 1 (8 Marks)

Let the P_1, P_2 and P_3 be the three products to be manufactured. Then the data are as follows:

Products	Product ingredients			
	A	B	C	Inert Ingredients
P_1	5 %	10%	5%	80%
P_2	5%	5%	10%	80%
P_3	20%	5%	10%	65%
Cost per kg (`)	64	16	40	16

Cost of Product P_1

= 5% × `64 + 10% × `16 + 5% × `40 + 80% × `16 = `19.60 per kg

Cost of Product P2

= 5% × `64 + 5% × `16 + 10% × `40 + 80% × `16

= `20.80 per kg.

Cost of Product P3

= 20% × `64 + 5% × `16 + 10% × `40 + 65% × `16

= `28.00 per kg.

Let x_1, x_2, and x_3 be the quantity (in kg) of P_1, P_2, and P3 respectively to be manufactured. The LP problem can be formulated:

***Objective function:* (2 marks)**

Maximize Z = (Selling Price − Cost Price) × Quantity of Product

= (`32.60 − `19.60) x_1 + (`34.80 − `20.80) x_2 + (`36.00 − 28) x_3

= $13x_1 + 14x_2 + 8x_3$

Subject to Constraints: (6 marks)

$$\frac{1}{20}x_1 + \frac{1}{20}x_2 + \frac{1}{5}x_3 \le 100$$

Or $x_1 + x_2 + 4x_3 \le 2{,}000$

$$\frac{1}{10}x_1 + \frac{1}{20}x_2 + \frac{1}{20}x_3 \le 180$$

Or $2x_1 + x_2 + x_3 \le 3{,}600$

$$\frac{1}{20}x_1 + \frac{1}{10}x_2 + \frac{1}{10}x_3 \le 120$$

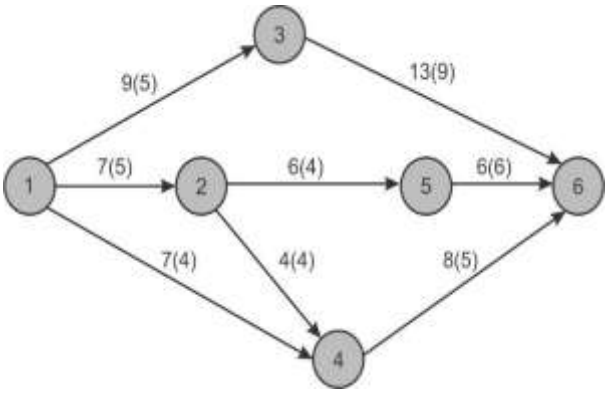
Or $x_1 + 2x_2 + 2x_3 \le 2{,}400$

$x_1 \le 30$

and $x_1, x_2, x_3 \ge 0$

Question 2 (8 Marks)

The **Network** for the given problem **(2 marks)**



Different Paths, Normal Duration and Minimum Duration:

Path	Normal Duration (Days)	Minimum Duration (Days)
1–3–6	22 (9 + 13)	14 (5 + 9)
1–2–5–6	19 (7 + 6 + 6)	15 (5 + 4 + 6)
1–2–4–6	19 (7 + 4 + 8)	14 (5 + 4 + 5)
1–4–6	15 (7 + 8)	9 (4 + 5)

Critical Path is **1–3–6**

Total Cost of the Project for the Normal Duration: (1 mark)

= Normal Cost + Overhead Cost + Penalty Cost = `6,000 + `150 × 22 Days + `80 × 3 Days

= `9,540

Crashing First Step: (2 mark)

Let us now crash activities on the Critical Path.

Activity	ΔT	ΔC/ΔT	Remark
1–3	4	100	Least Cost Slope
3–6	4	210	

As activity 1–3 has least cost slope, **crash activity 1–3 by 3 days at a crash cost of `100 per day.**

Total Cost of the Project for the 19 Days:

= Normal Cost + Overhead Cost + Crashing Cost

= `6,000 + `150 × 19 Days + `100 × 3 Days

= `9,150

The Various Paths in the Network with Revised Duration are:

1–3–6 with Project Duration = 19 Days (Critical Path.1)

1–2–5–6 with Project Duration = 19 Days (Critical Path.2)

1–2–4–6 with Project Duration = 19 Days (Critical Path.3)

1–4–6 with Project Duration = 15 Days

Crashing Second Step: (2 marks)

Let us now crash activities on the Critical Paths.

Critical Path	Activity	ΔT	ΔC/ΔT	Remark
1	1–3	1	100	Least Cost Slope
	3–6	4	210	
2	1–2	2	90	
	2–5	2	50	Least Cost Slope
	5–6	-	-	-
3	1–2	2	90	
	2–4	-	-	-
	4–6	3	60	Least Cost Slope

Possible Crashing Alternatives are:

(1 mark)

Critical Path- Activities	1–3, 2–5 & 4–6	1–3 & 1–2*
Cost Slopes (ΔC/ΔT)	`210 (`100 + `50 + `60)	`190 (`100 + `90)
Remark	Independent Activities	Independent Activity + Common Activity*

As crashing cost per day for every alternative is greater than `150 i.e. Overhead Cost per day. Therefore, any reduction in the duration of project will increase the cost of project completion.

Hence, the **Lowest Cost of Completion** is **`9,150** with the **Completion Time** of **19 Days**.

Question 3 (10 Marks)

(a) Workings **Statement Showing "Cost Driver Rate" (3 Marks)**

Overhead	Cost(`) - Lacs	Cost Driver	Cost Driver Rate (`)
Production Line Cost	2,310	60,000 Machine Hrs.	3,850 *per hr.* (2,310lacs / 60,000hrs.)
Transportation Cost			
Delivery Related (60%)	540	640 Deliveries	84,375 *per delivery* (540lacs / 640delivery)
Distance Related (40%)	360	2,25,000 Kms.	160 *per km* (360lacs / 2,25,000kms.)

(i) Forecast Total Cost using Activity Based Costing Principles (4 Marks)

Elements of Cost	`
Material	4,75,000.00
Labour	2,50,000.00
Overhead	
Production Line Cost (`3,850 × 6 hrs.)	23,100.00
Transportation Cost -	
Delivery Related $\frac{`84,375}{10 \text{ cars}}$	8,437.50
Distance Related $\frac{`160 \times 50,000 \text{ kms}}{1,000 \text{ cars}}$	8,000.00
Total	7,64,537.50

(ii) Calculation of Cost Gap Between Forecast Total Cost and the Target Total Cost (3 Marks)

Particulars	Amount (`)
Target Selling Price	9,75,000.00
Less: Operating Profit Margin (25%)	2,43,750.00
Target Cost (Target Selling Price – Operating Profit)	7,31,250.00
Forecast Total Cost	7,64,537.50
Cost Gap (`7,64,537.50 – `7,31,250)	33,287.50

Question 4 (8 Marks)

First of all, random numbers 00 − 99 are allocated in proportion to the probabilities associated with demand as given below: **(1 Mark)**

Demand	Probability	Cumulative Probability	Random Nos.
0	0.05	0.05	00 – 04
1	0.10	0.15	05 – 14
2	0.30	0.45	15 – 44
3	0.45	0.90	45 – 89
4	0.10	1.00	90 – 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 8 units and stock on order is 6 units (expected to receive on next day).

Let us now consider both the options stated in the Problem.

Option-A (3 Marks)

Order 5 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books:

Day	Random No.	Sales Demand	Op. Stock (in hand)	Qty. Order	Qty. Recd. at End of the Day	Total Qty. on Order	Closing Stock
1	89	3	8	---	---	6	5
2	34	2	5	---	6	---	9
3	78	3	9	---	---	---	6
4	63	3	6	5	---	5	3
5	61	3	3	---	---	5	0

6	81	3	0	5	5	5	2
7	39	2	2	5	---	10	0
8	16	2	0	---	5	5	3
9	13	1	3	---	5	---	7
10	73	3	7	5	---	5	4

Carrying Cost = `195 (39 Books × `5)

Ordering Cost = `400 (4 Orders × `100)

Total Cost = `595 (`195 + `400)

Option-B(3 Marks)

Order 8 Books, when the inventory at the beginning of the day plus orders outstanding is less than 8 books:

Day	Random No.	Sales Demand	Op. Stock (in hand)	Qty. Order	Qty. Recd. at End of the Day	Total Qty. on Order	Closing Stock
1	89	3	8	---	---	6	5
2	34	2	5	---	6	---	9
3	78	3	9	---	---	---	6
4	63	3	6	8	---	8	3
5	61	3	3	---	---	8	0
6	81	3	0	---	8	---	5
7	39	2	5	8	---	8	3
8	16	2	3	---	---	8	1
9	13	1	1	---	8	---	8
10	73	3	8	---	---	---	5

Carrying Cost = `225 (45 Books × `5)

Ordering Cost = `200 (2 Orders × `100)

Total Cost = `425 (`225 + `200)

Recommendation

Since **Option B** has *lower cost*, Manager should order 8 books. **(1 Mark)**

Question 5 (8 Marks)

Preparation of Production Cost Budget for 50,000 units for the year 2014 (4 Marks)

Particulars	Cost Per Unit	TotalAmount (`)
Materials (W.N.-1)	1.645	82,237.50
Wages (W.N.-2)	1.43	71,500.00
Variable Overhead	0.50	25,000.00
Fixed Overhead (`35,000 × 110%)	0.77	38,500.00
Total Cost	4.345 (Approx.)	2,17,237.50

Working Notes

1. Material Cost- (2 Marks)

(a) Increase in Material Price in the Year 2013-

$$= \frac{\text{ActualCost per unit in2013} - \text{BudgetedCost per unit in2013}}{\text{BudgetedCost per unit in2013}} \times 100$$

$$= \frac{\frac{`53,750}{43,000\text{units}} - `1}{`1} \times 100$$

= 25%

(b) Material Required to Produce 50,000 units-

$$= \frac{42{,}000 \text{ units}}{39{,}900 \text{ units}} \times 50{,}000 \text{ units}$$

= 52,632 units (rounded)

(c) Increased Cost for 50,000 units in the Year 2014-

$$= \frac{\text{`}\ 53{,}750}{43{,}000 \text{ units}} \times 125\% \times 52{,}632 \text{ units}$$

`82,237.50

Wages- (2 Marks)

Rate *per hour* in 2014-

$$\frac{\text{Wages Paidin the Year 2013}}{\text{Actual Units Produced}} + \text{`}\ 0.20$$

$$= \frac{\text{`}\ 44{,}660}{40{,}600 \text{ units}} + \text{`}0.20$$

= `1.30

(b) Wages to be paid for 50,000 units i.e. for 50,000 hours (1 hour per unit). When the labour efficiency is 90% only, then Total Wages will be-

$$= 50{,}000 \text{ hours} \times \frac{110}{100} \times \text{`}1.30$$

= `71,500

Note: **Fixed Overhead** can also be calculated on the basis of previous year's budgeted figure. **Variable Overhead** may also be calculated by taking ` 1 per unit.
This question can also be solve by taking 50,000 hrs. as 90% of total hrs. required to produce the 50,000 units.

Question 6 (8 Marks)

(i) Standard Price per Kg. of Direct Material (2 marks)

Material Price Variance = Standard Cost of Actual Quantity – Actual Cost

$\Rightarrow$ 5,000 (F) = Standard Cost of Actual Quantity – ` 5,20,000

Standard Cost of Actual Quantity = ` 5,20,000 + ` 5,000

` 5,25,000

Standard Cost of Actual Quantity

= Standard Price per Kg. × Actual Quantity

` 5,25,000 = Standard Price per Kg. × 1,05,000 Kg.

$$\text{Standard Price per Kg.} = \frac{\text{`}\ 5{,}25{,}000}{1{,}05{,}000 \text{Kg.}}$$

= ` 5

(ii) Standard Quantity for each unit of output (1 ½ marks)

Material Usage Variance = Standard Cost of Standard Quantity for Actual Output – Standard Cost of Actual Quantity

25,000 (A) = Standard Cost of Standard Quantity for Actual Output – ` 5,25,000

Standard Cost of Standard Quantity for Actual Output

= ` 5,25,000 – ` 25,000

= ` 5,00,000

Standard Cost of Standard Quantity for Actual Output

= Standard Price per Kg. ×Standard Quantity for Actual Output

⇒ ` 5,00,000 = ` 5 × Standard Quantity for Actual Output

Standard Quantity for Actual Output

$$= \frac{` 5,00,000}{` 5}$$

= 1,00,000 Kg.

Standard Quantity *for each unit of output*

$$\frac{1,00,000 \text{ Kg.}}{10 \text{ Kg.}} \quad 10,000 \text{ units}$$

(i) Standard Rate of Direct Labour Hour (1 ½ marks)

Direct Labour Rate Variance = Standard Cost of Actual Time – Actual Cost

15,500 (A) = Standard Cost of Actual Time – ` 3,08,000

Standard Cost of Actual Time = ` 3,08,000 – ` 15,500.

=` 2,92,500

Standard Cost of Actual Time = Standard Rate per hr. × Actual Hours

` 2,92,500 = Standard Rate per hr. × 19,500 hrs.

Standard Rate per hr. = ` 2,92,500 / 19,500 hrs. = 15

(i) Standard Time for Actual Production (1 ½ marks)

Labour Efficiency Variance = Standard Cost of Standard Time for Actual Production – Standard Cost of Actual Time

7,500 (F) = Standard Cost of Standard Time for Actual Production – ` 2,92,500

Standard Cost of Standard Time for Actual Production = ` 2,92,500 + ` 7,500 =` 3,00,000

Standard Cost of Standard Time for Actual Production = Standard Rate per hr.× Standard Time for Actual Production

300000 = ` 15 × Standard Time for Actual Production

Standard Time for Actual Production = 300000/15 = 20000 hours

(ii) Standard Variable Overhead Rate(1 1/2 marks)

Variable Overhead Variance = Standard Variable Overheadsfor Production – Actual Variable Overheads

10,000 (A) = Standard Variable Overheads for Production – ` 4,10,000

Standard Variable Overheads for Production = ` 4,10,000 – ` 10,000 =` 4,00,000

Standard Variable Overheads for Production = Standard Variable Overhead Rate Unit × Actual Production (Units)

` 4,00,000 = Standard Variable Overhead Rate Unit x 10000 units

Standard Variable Overhead Rate Unit = 40

Or

Standard Variable Overheads for Production = Standard Variable Overhead Rate per Hr × Std Hrs for Actual Production

` 4,00,000 = Standard Variable Overhead Rate per Hour × 20,000 hrs

Standard Variable Overhead Rate *per hour* = *20*

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