PAPER – 16 : STRATEGIC COST MANAGEMENT

SUGGESTED ANSWERS

SECTION-A

1.

(i) (B)

(ii) (D)

(iii) (A)

(iv) (D)

(v) (D)

(vi) (A)

(vii) (D)

(viii) (B)

(ix) (C)

(x) (C)

(xi) (D)

(xii) (A)

(xiii) (B)

(xiv) (A)

(xv) (A)

SECTION– B

2. (a)

Statement Showing Allocation of Seats in the Aircraft:

Existing Situation for Destination A to B:	
Seating Capacity of the Aircraft	260 passengers
Average Number of Passengers per flight	240 passengers
Proposed Situation for Destination D to B	
Seat Booked by ZOMB Ltd.	50 Seats
For Destination A to B	
Seats Available {260 (Capacity) – 50 (booked by ZOMB Ltd. for Destination D to B)}	210 Seats
Requirement of Regular Passengers {240 (original no. of passengers) – 25 (no. of passengers drop out due to wastage of time)}	215 Seats
Possible Allocation of Seats to Regular Passengers	210 Seats
For Destination A to D	
Seats Available {260 (capacity) – 210 (seats allocated to regular passengers of destination A to B)}	50 Seats
Requirement of Agents (tickets can be sold by Airway's Travel Agents)	60 Seats
Possible Allocation to Agents of Airways Ltd.	50 Sets

(i) **Analysis of Profit Per flight**

	₹	₹
Revenue per passenger (Gross Fare)		5,000
Less: Total variable Cost per passenger		
10 % Commission on Fare	500	
Food	300	800
Contribution per passenger		4,200
Contribution per flight (Contribution for 240 Passengers)		10,08,000
Less: Fixed Costs per Flight		
Fuel Cost	90,000	
Annual Lease Cost	2,00,000	
Group Service, Baggage Handling / Checking in	40,000	
Flight Crew Salaries	48,000	3,78,000
Profit per Flight		6,30,000

(ii) Break-even number of Passengers for each flight from A to B

$$\text{Break-even number of Passengers} = \frac{\text{Total Fixed cost per flight}}{\text{Contribution per Passenger}}$$

$$\text{Break-even number of Passengers @} \left(\frac{₹\ 378000}{₹\ 4200} \right) = 90 \text{ Passengers}$$

2. (b) **Proposed Situation:**

Contribution per Passenger (A to D)

	₹	₹
Revenue per passenger (Gross Fare)		3,000
Less: Total Variable Cost per Passenger:		
10 % Commission on Fare	300	
Food #	300	600
Contribution per Passenger		2,400

(#) All the passengers booked for destination A to D are also served food.

(i) **Analysis of Additional Profit Per Flight earned by Airway Ltd. from the offer of ZOMB Ltd.**

	Additional	
	Cost (₹)	**Revenue (₹)**
Revenue from Destination D to B (50 Seats x ₹ 2,700)		1,35,000
Contribution from Destination A to D (50 Sets x ₹ 2,400)		1,20,000
Contribution Lost for Destination A to B (30 Seats x ₹ 4,200) *	1,26,000	
Snacks (260 Passengers x ₹ 200)	52,000	
Fuel Cost	45,000	
Airport Landing / Baggage Handling Charges	19,000	
Total	2,42,000	2,55,000
Profit (Additional) Per Flight (2,55,000 – 2,42,000)		13,000

(*) 240 Seats (existing) Less 210 Seats (Proposed)

(ii) **Advice:**

Since Airway Ltd. will gain of ₹ 13,000 per flight, it should accept the ZOMB Ltd's Offer.

3. (a)

(i) When Component is purchased by Division Y from outside:

	(₹)	(₹)
Division Y sales 2,500 x ₹ 540		13,50000
Less: Cost of purchase 2,500 x ₹ 270	6,75,000	
Own Variable cost 2,500 x ₹ 202.50	5,06,250	11,81,250
Division Y Contribution		1,68,750
Division X Contribution		Nil
Total Contribution		1,68,750

When component is purchased from Division X:

Division X	**(₹)**	**(₹)**
Sales 2,500 x ₹ 297	7,42,500	
Less: Variable cost 2,500 x ₹ 256.50	6,41,250	
Division X Contribution (A)		1,01,250
Division Y		
Sales 2,500 x ₹ 540	13,50,000	
Less: Variable Cost		
Purchase Cost 2,500 x ₹ 297	7,42,500	
Variable Cost of division Y 2,500 x ₹ 202.50	5,06,250	
Division Y Contribution(B)		1,01,250
Total Contribution (A+B)		2,02,500

Decision: Thus, it will be beneficial for the company as whole to buy component from division X.

(ii) When there is no alternative use of Division X and selling price of components reduces in the Market:

	(₹)	**(₹)**
Division Y sales 2,500 x ₹ 540	13,50,000	
Less: Cost of purchase 2,500 x 249.75	6,24,375	
Own Variable cost 2,500 x 202.50	5,06,250	
Division Y Contribution		2,19,375
Division X Contribution		NIL
Company's total contribution		2,19,375

Decision: When the component is purchased from outside market, total contribution comes to ₹ 2,19,375 which is more than the total contribution of ₹ 2,02,500, when the component is purchased from Division X (calculated above). Therefore, Division Y should purchase the component from outside supplier.

(iii) Transfer Price:

(a) Where there is no alternative use of capacity of division X, then variable cost i.e. ₹ 256.50 per component will be charged.

(b) If market price gets reduced to ₹ 249.75 and there is no alternative use of facilities of Division X, transfer should take place at incremental cost of production, which in this case is ₹ 256.50 per component.

3. (b)

(i) Calculation of Target Cost at Full Capacity:

Projected Demand:

Selling Price (₹ Per Unit)	Demand (Units)	Capacity Utilisation
100	20,000	25%
90	(20,000 × 2) = 40,000	50%
80	(40,000 × 2) = 80,000	100%

Selling Price at Full Capacity = ₹ 80.00;
Target Profit = 25% on Sales = ₹ 20.00
Target Cost at Full Capacity =₹ (80 – 20) = ₹ 60.00 per unit

(ii) Cost Reduction Scheme:

(a) Computation of Variable Cost per unit at the Present Capacity of 20,000 units
Selling Price = ₹ 100.00 per unit
Profit Margin = 25% on Sales = ₹ 25.00
Total Cost = (100 – 25) = ₹ 75.00
Variable Cost = 40% of total cost = 40% of 75 = ₹30.00

(b) Existing Projections of Total Cost at full capacity
Total Variable Cost = (₹ 30 × 80000) = ₹ 24.00 lakhs
Total Fixed Cost = ₹ 36.00 lakhs
Total Cost = ₹ (24.00 + 36.00) lakhs =₹ 60.00 lakhs

(c) Target Cost = (₹ 60 × 80,000) = ₹ 48.00 lakhs

(d) Cost Reduction Scheme
Cost Reduction needed = (Existing Cost – Target Cost) = (60.00 – 48.00) = ₹ 12.00 lakhs

(iii) Maximum Investment at full capacity:

a) Target Profit at full Capacity:
Sales = 80.00 × 80,000 units = ₹ 64.00 lakhs
Target Cost = ₹ 48.00 lakhs
Target Profit = (64.00 – 48.00) = ₹ 16.00 lakhs

b) Rate of Return on Investment = 16%

c) Maximum Investment
Investment needed
= (Target Profit ÷ Target Return on Investment)
= (16.00 ÷ 16%)
= ₹ 100.00 lakhs

4. (a)

(i)

Calculation of Activity Based Costing Recovery Rate:

Activity	Activity Cost Pool	Cost Driver	Quantity	ABC RATE
Set Up	20,000 + 28,000 = ₹ 48,000	No. of Production Runs	96	₹ 500 per Run
Stores Receiving	15,000 + 21,000 = ₹ 36,000	Requisitions raised	50 x 4 = 200	₹ 180 per Reqn.
Inspection	10,000 +14,000 = ₹ 24,000	No. of Production Runs	96	₹ 250 per Run
Material Handling	Given = ₹ 2,592	Orders executed	192	₹ 13.5 per Batch

Note:

1. Machine Operation and Maintenance Cost of ₹ 63,000 is apportioned to the first three activities in the ratio 4:3:2, i.e. ₹ 28,000, ₹ 21,000 and ₹ 14,000.

2. **Number of Production Runs and Number of Batches are computed as under:**

Product	A	B	C	D	Total
(a) Output Quantity	720 units	600 units	480 units	504 units	
(b) Quantity per Production Run	24 units	24 units	24 units	24 units	
(c) Number of Production Runs (a ÷ b)	30 runs	25 runs	20 runs	21 runs	96 runs
(d) Quantity per Batch Order	12 units	12 units	12 units	12 units	
(e) Number of Batches (a ÷ d)	60 batches	50 batches	40 batches	42 batches	192 batches

(ii) **Computation of OH Costs using Activity Based Costing System**

Product	A	B	C	D	Total
Setup	500 x 30 = ₹ 15,000	500 x 25 = ₹ 12,500	500 x 20 = ₹ 10,000	500 x 21 = ₹ 10,500	₹ 48,000
Stores Receiving	₹ 9,000	₹ 9,000	₹ 9,000	₹ 9,000	₹ 36,000
Inspection	250 x 30 = ₹ 7,500	250 x 25 = ₹ 6,250	250 x 20 = ₹ 5,000	250 x 21 = ₹ 5,250	₹ 24,000
Material Handling	13.50 x 60 = ₹ 810	13.50 x 50 = ₹ 675	13.50 x 40 = ₹ 540	13.50 x 42 = ₹ 567	₹ 2,592
Total OH Cost	₹ 32,310	₹ 28,425	₹ 24,540	₹ 25,317	₹ 1,10,592
Output	720 units	600 units	480 units	504 units	
OH Cost per unit	₹ 44.875	₹ 47.375	₹ 51.125	₹ 50.232	

4. (b)

The term quality is a perception which is personal to an individual. In plain terms, quality is "features" or "worth" or "value". Today, there is no single universal definition of quality. Some common definitions of quality are as under Conformance to specifications: It measures how well the product or service meets the targets and tolerances determined by its designers.

Fitness for use: It focuses on how well the product performs its intended function or use.

Value for price paid: It is a definition of quality that consumers often use for product or service usefulness.

Support services: These services provided are often how the quality of a product or service is judged.

Psychological criteria: It is a subjective definition that focuses on the judgmental evaluation of what constitutes product or service quality.

Costs of quality can be classified into the following groups for better quality costs management:
(i) Prevention costs, (ii) Appraisal costs, (iii) Internal failure costs and (iv) External failure costs.

(i) Prevention costs:

Prevention costs are all costs incurred in the process of preventing poor quality from occurring. They include quality planning costs, such as the costs of developing and implementing a quality plan. Also included are the costs of product and process design, from collecting customer information to designing processes that achieve conformance to specifications.

Example: Quality training, Quality circles, Statistical process control activities, System Development for prevention. Quality improvement.

(ii) Appraisal costs:

Appraisal costs are incurred in the process of uncovering defect. They include the cost of quality inspections, product testing, and performing audits to make sure that quality standards are being met. Also included in this category are the costs of worker time spent measuring quality and the cost of equipment used for quality appraisal.

Example: testing and inspecting materials, final product testing and inspecting, WIP testing and inspecting, package inspection and depreciation of testing equipment.

(iii) Internal failure costs:

Internal failure costs are associated with discovering poor product quality before the product reaches the customer site. One type of internal failure cost is rework, which is the cost of correcting the defective item. Sometimes the item is so defective that it cannot be corrected and must be thrown away. This is called scrap, and its costs include all the material, labor, and machine cost spent in producing the defective product.

Example: cost of scrap (net of realization), cost of spoilage, cost of rework, down time due to defect in quality and retesting.

(iv) External failure costs:

External failure costs are incurred when inferior products are delivered to customers. They include cost of handling customer complaints, warranty replacements, repairs of returned products and cost arising from a damaged company reputation.

Example: cost of field servicing, cost of handling complaints, warranty repairs, lost sales, warranty replacements.

5.

(i) Statement showing Standard Cost of output produced:

Element of Cost	Calculation	Amount (₹)
Direct Material	18,000 x ₹48	8,64,000
Direct Labour	18,000 x ₹35	6,30,000
Variable Production Overhead	18,000 x ₹10	1,80,000
Fixed Production Overhead	18,000 x ₹50	9,00,000
Total		25,74,000

(ii) Analysis of Variances:

1. Direct Material Cost variance:

Direct Material Price Variance

= (Standard price/Kg – Actual Price/Kg) x Actual Quantity

= (₹ 12 – ₹ 11) x 76,000 = ₹ 76,000 (F)

Direct Material Usage Variance

= Standard Price (Standard Quantity for actual production – Actual Quantity)

= ₹12 (4 x 18000 – 76000) = ₹ 48,000 (A)

2. Direct Labour Cost Variance:

Direct Labour Rate Variance

= (Standard rate per hour – Actual rate per hour) x Actual hour

= (₹ 7 – ₹ 7.2) x 84,000 = ₹ 16,800 (A)

Direct Labour Efficiency Variance

= SR / hour (Std. Hours for actual production – Actual Hours)

= ₹ 7 (5 hours x 18,000 – 84,000) = ₹ 42,000 (F)

3. Variable Overhead Cost Variance:

Variable Overhead Expenditure Variance

= (Standard rate / hour – Actual rate / hour) x Actual hours

= (₹ 2 – $\frac{Rs172,000}{84,000}$) x 84,000 = ₹ 4,000 (A)

Variable Overhead Efficiency variance

= Standard rate / hour (Std hours for Actual Output – Actual Hours)

= ₹ 2 (5 x 18,000 – 84,000) = ₹ 12,000 (F)

4. Fixed Overhead Cost Variance:

Fixed Overhead Expenditure variance

= Budgeted Fixed overhead – Actual Fixed Overhead

= 20,000 x ₹ 50 – ₹ 10,30,000 = ₹ 30,000 (A)

Fixed Overhead Volume variance

= Recovered Fixed overhead – Budgeted Fixed overhead

= ₹ 50 x 18,000 – ₹ 10,00,000 = ₹ 1,00,000 (A)

(iii) Statement showing reconciliation of Standard Cost with Actual Cost:

Standard Cost of Actual Output			₹ 25,74,000
Adjustment for Variances	Favourable	Adverse	
Direct Material Price Variance	76,000		
Direct Material Usage Variance		48,000	
Direct Labour Rate Variance		16,800	
Direct Labour Efficiency Variance	42,000		
Variable Overhead Expenditure Variance		4,000	
Variable Overhead Efficiency Variance	12,000		
Fixed Overhead Expenditure variance		30,000	
Fixed Overhead Efficiency variance		1,00,000	
	1,30,000	1,98,800	68,800 (A)
Actual Cost			₹ 26,42,800

Alternative Solution

(i) Statement showing Standard Cost of output produced:

Element of Cost	**Calculation**	**Amount (₹)**
Direct Material	18,000 x ₹ 48	8,64,000
Direct Labour	18,000 x ₹ 35	6,30,000
Variable Production Overhead	18,000 x ₹ 10	1,80,000
Fixed Production Overhead	18,000 x ₹ 50	9,00,000
Total		25,74,000

(ii) Analysis of Variances:

	For Direct Material Cost Variances	**Amount (₹)**
1.	M_1 – Actual cost of material used	8,36,000
	M_2 – Standard cost of actual material (76,000 kgs. x ₹ 12)	9,12,000
	M_4 – Standard material cost of output (18,000 x ₹ 48)	8,64,000
	Material price variance = (M_1 – M_2) = ₹ 8,36,000 –₹ 9,12,000	76,000 (F)
	Material usage variance = (M_2 – M_4) = ₹ 9,12,000 – ₹ 8,64,000	48,000 (A)
2.	For Direct Labour Cost Variances	
	L_1 — Actual payment made to workers for actual hours worked	6,04,800
	L_2 — Payment involved, if the workers had been paid at standard rate (84,000 hours x ₹ 7)	5,88,000
	L_5 — Standard labour cost of output achieved (18,000 units x ₹ 35)	6,30,000
	Labour Rate Variance = L_1 — L_2 = ₹ 6,04,800 —₹ 5,88,000	16,800 (A)
	Labour efficiency variance = L_2 — L_5 = ₹ 5,88,000 — ₹ 6,30,000	42,000 (F)
3.	For Variable Overhead Cost Variances	
	VO_1 — Actual Variable Overhead	1,72,000
	VO_2 — Actual hours worked at standard variable overhead rate (84,000 hrs. x ₹ 2)	1,68,000
	VO_3 — Standard variable overhead for the production (18,000 units x ₹10)	1,80,000
	V.O. Expenditure Variance = VO_1 — VO_2 = 172000 — 168000	4,000 (A)
	V.O Efficiency Variance V_2 – V_3 168000 — 180000	12,000 (F)
4.	For Fixed Overhead Cost Variance	
	FO_1 – Actual Fixed Overhead incurred	10,30,000
	FO_2 – Budgeted Fixed Overhead for the period 1,00,000 x ₹ 10	10,00,000
	FO_3– Standard Fixed Overhead for production 18,000 units x ₹ 50	9,00,000
	F.O. Expenditure variance = FO_1 – FO_2 = 10,30,000 – 10,00,000	30,000 (A)
	F.O. Volume variance = FO_2 – FO_3 = 10,00,000 – 9,00,000	1,00,000 (A)

(iii) Statement showing relevant variances and reconciliation of standard cost with actual cost

	Ref No.	Standard cost of output (₹)	Variances	Actual Cost (₹)
Direct Materials		8,64,000		
Price variance	(1)		76,000 (F)	
Usage variance	(1)		48,000 (A)	
Actual Direct Material cost				8,36,000
Direct labour		6,30,000		
Rate variance	(2)		16,800 (A)	
Efficiency variance	(2)		42,000 (F)	
Actual Direct Labour cost				6,04,800
Variable Production Overhead		1,80,000		
Expenditure variance	(3)		4,000 (A)	
Efficiency variance	(3)		12,000 (F)	
Actual Variable Prodn. OH				1,72,000
Fixed production overhead		9,00,000		
Expenditure variance	(4)		30,000 (A)	
Volume variance	(4)		100,000 (A)	
Actual Fixed Overhead				10,30,000
TOTAL		25,74,000	68,800 (A)	26,42,800

6. (a)

(i) The given problem is a balanced minimization transportation problem. The objective of the company is to minimize the cost. Let us find the initial feasible solution using Vogel's Approximation method (VAM).

	OUTLETS					
PLANTS	A	B	C	D	CAPACITY	DIFF.
X	4	[400] 6	8	[300] 6	700 / 300 / 0	2 2 0 0
Y	3	[50] 5	[350] 2	5	400 / 50 / 0	1 2 0 0
Z	[400] 3	9	6	[200] 5	600 / 200 / 0	2 2 4 –
Requirement	400 / 0	450 / 400 / 0	350 / 0	500 / 300 / 0		

Diff.	0	1	4	0
	0	1	-	0
	-	1	-	0
	-	1	-	1

The initial feasible solution obtained by VAM is given below:

	OUTLETS				
PLANTS	A	B	C	D	CAPACITY
X	4	400 6	8	300 6	700
Y	3	50 5	350 2	5	400
Z	400 3	9	6	200 5	600
Requirement	400	450	350	500	

Since the number of allocations = 6 = (m + n – 1), the above initial basic feasible solution is non-degenerate and hence an optimum solution can be obtained.

Test of Optimality:

Let us introduce $U_i\ (i = 1, 2, 3)$ and $V_j\ (J = 1, 2, 3, 4)$. We assume $U_1 = 0$ and other U_i and V_j can be calculated by using the relation $C_{ij} = U_i + V_j$ for allocated cells.

The opportunity costs for the unallocated cells can be calculated using the relation $\Delta_{ij} = C_{ij} - (U_i + V_j)$. The calculations of $U_i'S$, $V_j'S$ and $\Delta_{ij}'S$ are given below:

Plants	OUTLETS				
	A	B	C	D	U_i
X	0 4	400 6	5 8	300 6	0
Y	0 3	50 5	350 2	0 5	- 1
Z	400 3	4 9	4 6	200 5	- 1
V_j	4	6	3	6	

On Calculating $\Delta_{ij}'S$ for non-allocated cells, we found that all the $\Delta_{ij} \geq 0$, hence the initial solution obtained above is optimal.

(ii) **Calculations of the total costs:**

Plants	Outlet	Units		Cost		Total Cost
X	→ B	400	X	6	=	2,400
X	→ D	300	X	6	=	1,800
Y	→ B	50	X	5	=	250
Y	→ C	350	X	2	=	700
Z	→A	400	X	3	=	1,200
Z	→D	200	X	5	=	1,000
						7,350

The minimum cost = 7,350 thousand rupees.

6. (b)

Allocation of Random No- Selling Price:

Selling Price (₹)	Probability	Cumulative Probability	Allocation of RN
3	0.20	0.20	00-19
4	0.50	0.70	20-69
5	0.30	1.00	70-99

Allocation of Random No- Variable Cost:

Variable Cost (₹)	Probability	Cumulative Probability	Allocation of RN
1	0.30	0.30	00-29
2	0.60	0.90	30-89
3	0.10	1.00	90-99

Allocation of Random No- Sales Units:

Sales (Units)	Probability	Cumulative Probability	Allocation of RN
2,000	0.30	0.30	00-29
3,000	0.30	0.60	30-59
5,000	0.40	1.00	60-99

Calculation of Simulated Profit:

Trial	RN	SP	RN	VC	RN	Sales Units	Profit (₹)
1	81	5	32	2	60	5,000	(5-2)5,000-4,000 = 11,000
2	4	3	46	2	31	3,000	(3-2)3,000-4,000 = -1,000
3	67	4	25	1	24	2,000	(4-1)2,000-4,000 = 2,000
4	10	3	40	2	2	2,000	(3-2)2,000-4,000 = -2,000
5	39	4	68	2	8	2,000	(4-2)2,000-4,000 = 0
							Total = 10,000

Average Annual Profit = $\frac{₹\ 10{,}000}{5}$ = ₹ 2,000

Alternative Solution

Probability Distribution (Selling Price):

SP	Probability	Cum. Prob.	Probability range	Probability range for simulation
3	0.20	0.20	0 – 0.20	0 – 0.19
4	0.50	0.70	0.20 – 0.70	0.20 – 0.69
5	0.30	1.00	0.70 – 1.00	0.70 – 0.99

Probability Distribution (Variable Cost):

VC	Probability	Cum. Prob.	Probability range	Probability range for simulation
1	0.30	0.30	0 – 0.30	0 – 0.29
2	0.60	0.90	0.30 – 0.90	0.30 – 0.89
3	0.10	1.00	0.90 – 1.00	0.90 – 0.99

Probability Distribution (Sales Units):

Sale units	Probability	Cum. Prob.	Probability range	Probability range for simulation
2000	0.30	0.30	0 – 0.30	0 – 0.29
3000	0.30	0.60	0.30 – 0.60	0.30 – 0.59
5000	0.40	1.00	0.60 – 1.00	0.60 – 0.99

Simulated Profit:

Trial	RN	Profit (₹)
1	81, 32, 60	(5 – 2) (5,000) – 4,000 = 11,000
2	04, 46, 31	(3 – 2) (3,000) – 4,000 = -1,000
3	67, 25, 24	(4 – 1) (2,000) – 4,000 = 2,000
4	10, 40, 02	(3 – 2) (2,000) – 4,000 = -2,000
5	39, 68, 08	(4 – 2) (2,000) – 4,000 = 0
		Total = ₹10,000

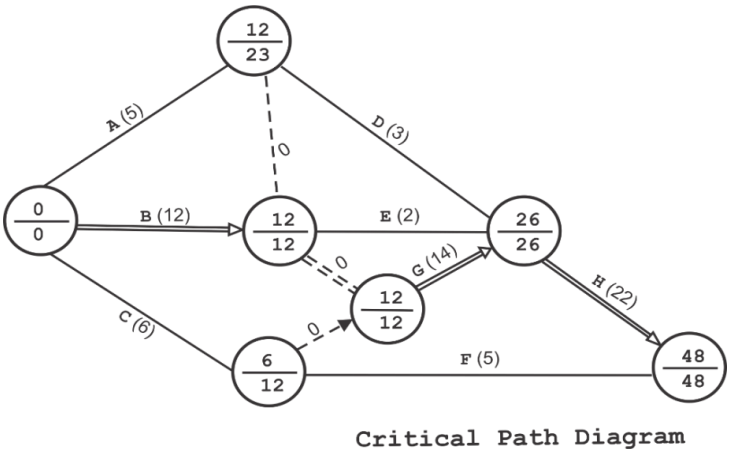
Average Annual Profit = $\frac{₹\ 10,000}{5}$ = ₹ 2,000

7.

(i) Calculation of Expected Project Duration:

Activity	Most Likely (M)	Optimistic (O)	Pessimistic (P)	Expected Duration (O+4M+P)/6 (Days)
A	5	4	6	5
B	12	8	16	12
C	5	4	12	6
D	3	1	5	3
E	2	2	2	2
F	5	4	6	5
G	14	10	18	14
H	20	18	34	22

(ii) Project Network Diagram



Critical Path Diagram

(iii) Critical Path, Expected project duration & Std. Deviation:

From the EST and LST calculated above, it is clear that, tasks B, G and H are in critical path. The overall project duration is 48 days.

Calculation of Standard Deviation of the activities in Critical Path

Activity	Pessimistic time	Optimistic Time	Standard Deviation
B	16	8	1.33
G	18	10	1.33
H	34	18	2.67

Standard Deviation of the Project = $\sqrt{(1.33^2 + 1.33^2 + 2.67^2)} = 3.27$

(iv) Calculation of probability that the project will be completed in 54 days:
Using Z value, we have Z = (54-48)/3.27= 1.84

Using area under standard normal curve, the probability of finishing the project in 54 days is 0.5-+0.4667=0.9667= **96.67%**

(v) Calculation of new probability:
The revised estimates do not affect the average task times as the reduction in optimistic time equals the increase in pessimistic times. Therefore, tasks B, G & H are still in critical path and the expected project duration is still 48 days.

However, increase in variability will affect the standard deviation of the project.

Calculation of Revised Standard Deviation of the project:

Activity	Pessimistic time	Optimistic Time	Standard Deviation
B	17	7	2.78
G	20	8	4.00
H	36	16	11.10

Standard Deviation of the project = $\sqrt{(2.78+4+11.10)} = 4.23$

Using Z value, we have Z = (54-48)/4.23= 1.42
Using area under standard normal curve, the probability of finishing the project in 54 days is 0.5-+0.4222=0.9222= 92.22%.

8. (a)
Price Discrimination:

$P_1 = 400 - 2\ Q_1$

$TR_1 = 400 Q_1 - 2\ Q_1^2$

$MR_1 = \frac{d\left(400 Q_1 - 2\ Q_1^2\right)}{d Q_1} = 400 - 4\ Q_1$

$P_2 = 300 - 2\ Q_2$

$TR_2 = 300 Q_2 - 2\ Q_2^2$

$MR_2 = \frac{d\left(\ 300 Q_1 - 2\ Q_2^2\ \right)}{d Q_2} = 300 - 4\ Q_2$

Total Cost Function (C) = 3000 + 60 Q

Where $Q = Q_1 + Q_2$

$MC = \frac{d\left(3000 + 60 Q\right)}{d Q} = 60$

To maximize profits, the discrimination monopolist should equate

$MR_1 = MC$ and $MR_2 = MC$

So, $400 - 4Q_1 = 60$

$Q_1 = 85$

Similarly, $300 - 4Q_2 = 60$

So, $Q_2 = 60$

Prices in the sub-markets are

$P_1 = 400 - (2 \times 85) = 230$

$P_2 = 300 - (2 \times 60) = 180$

$Q_1 = 85 \quad P_1 = 230$

$Q_2 = 60 \quad P_2 = 180$

Profit of the discriminating monopolist:

$= (TR_1 + TR_2) - TC$

$= (85 \times 230 + 60 \times 180) - [(3,000 + 60 \times (85 + 60)] = 30,350 - 11,700$

= ₹ 18,650

The maximum possible profit that can be earned by the monopolist from the two sub-division market with price discrimination is ₹18,650.

8. (b)

Statement Showing the Forecasted demand of Material unloaded (in Tons)

Year	Quarter of Year	Demand (in tons) (Y_i)	Previous Forecast U_i	Forecast Error $e_i = (Y_i - U_i)$		Correction $\sigma e(\sigma = 0.1)$	New Forecast
	(1)	(2)	(3)	(4)		(5)	(6)
				(2 - 3)		(4) x 0.1	(3) + (5)
2023	I	200	195.00	5.00		0.50	195.5
	II	188	195.50	– 7.50		– 0.75	194.75
	III	179	194.75	– 15.75		– 1.575	193.175
	IV	195	193.175	1.825		0.1825	193.3575
2024	I	210	193.3575	16.6425		1.6642	195.0217
	II	225	195.0217	29.9783		2.9978	198.0195
	III	200	198.0195	1.9805		0.1981	198.2176
	IV	202	198.2176	3.7824		0.3782	198.5958
2025	I		198.5958				

Hence Forecast Figure for 1st quarter of 2025 is 198.5958 i.e. 198.60 Tons