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.

Wherever necessary, candidates may make appropriate assumptions and clearly state them.

Question 1

(a) *A company has continuous manufacturing process involving an output of 10 tonnes per hour valued at ₹ 80 per tonne. Process wages cost ₹ 40 per hour and raw material ₹ 60 per tonne of product. Regular maintenance works out to ₹ 1,15,750 per month. The company is experiencing breakdown due to mechanical reason 100 hours a month, costing ₹ 75,000 to repair. It is estimated that these breakdown can be reduced or eliminated if additional maintenance on the following scales were undertaken:*

Breakdown per month (hours)	*0*	*20*	*40*	*60*	*80*
Maintenance Cost (₹)	*2,23,000*	*1,53,000*	*1,46,500*	*1,26,000*	*1,22,500*
Repair Cost (₹)	*0*	*25,000*	*30,000*	*50,000*	*65,000*

Process labour during stoppages can be used elsewhere up to 40 hours per month.

Required

(i) *Present, in tabular form, the optimum amount of maintenance to be undertaken each month.*

(ii) *What is the additional revenue that will be resulting from the optimum level, compared with the present situation?* ***(5 Marks)***

(b) *Micro Industries manufactures 2 types of microwaves, "Best & Super". The following information is available on each microwave:*

Particulars	***Best***	***Super***
Units manufactured and sold	*8,000 units*	*7,000 units*
Selling Price per unit	*₹6,000*	*₹4,000*
Variable Costs per unit	*₹3,600*	*₹3,000*
Hours spent on design	*1,200 hours*	*500 hours*
Testing and inspection	*3*	*1*
Percentage of units reworked in plant	*5%*	*10%*
Re-work costs per unit	*₹1,000*	*₹600*

Percentage of units repaired at customer	*5%*	*7%*
Repair costs per unit	*₹1,250*	*₹ 750*
Estimated lost sales form poor quality	*--*	*200 units*

The Labour Rates per hour for design activities are ₹ 600 per hour.

Testing and inspection charges are ₹ 20 per hour.

Required

Calculate the total costs for quality for each of the two models after classifying them into Prevention, Appraisal, Internal Failure, and External Failure Categories.

(5 Marks)

(c) *Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products X_1 and X_2. Each of these product is processed on three machines A, B and C, each machine has limited available hours.*

C_B	Basic Variable (B)	C j	40	60	0	0	0
		Value of Basic Variables b(=X_B)	X_1	X_2	S_1	S_2	S_3
0	S_1	6	2	0	1	0	-1/2
0	S_2	40	13/3	0	0	1	-1/3
60	X_2	10	1/3	1	0	0	1/6
Z		600	20	60	0	0	10
C_j-Z_j			20	0	0	0	-10

(S_1, S_2 and S_3 are slack variables for machine A, B and C respectively)

Answer the following questions, giving reasons in brief:

(i) Is the above solution optimal? If not, then find the optimal solution.

(ii) Is the optimal solution arrived at (i) 'Degenerate'?

(iii) Which of the machine is not being used to full capacity when producing according to optimal solution? ***(5 Marks)***

(d) *ESS Ltd user a standard costing system in manufacturing of its single product 'ZED'. During the month of October 2020,18000 units of ZED' were produced and the same was found to be at 75% capacity of the budget. Following relevant information is available:*

Actual hours worked	*37,500 hours*
Actual Fixed overheads	*₹5,12,500*
Fixed overhead expenditure variance	*₹ 32,500 (Adverse)*
Standard total overhead rate	*(2 hours@ ₹ 16 per hour) ₹ 32 per unit*

Required

Compute the following variances clearly indicating Adverse (A) or Favourable (F):

(i) Variable overhead efficiency variance

(ii) Fixed overhead capacity variance

(iii) Fixed overhead efficiency variance ***(5 Marks)***

Answer

(a) (i) Determination of Optimum amount of maintenance to be undertaken each month

	Break down hours per month					
	0	**20**	**40**	**60**	**80**	**100**
Maintenance cost	2,23,000	1,53,000	1,46,500	1,26,000	1,22,500	1,15,750
Repair cost	0	25,000	30,000	50,000	65,000	75,000
Total cost	2,23,000	1,78,000	1,76,500	1,76,000	1,87,500	1,90,750
Add: Cost of Idle Time @₹ 40 p/hr over 40 hrs	-	-	-	800	1600	2400
	2,23,000	**1,78,000**	**1,76,500**	**1,76,800**	**1,89,100**	**1,93,150**

Therefore, optimum amount of maintenance to be undertaken is 40 hours breakdown per month.

(ii) Computation of additional revenue at optimum level of maintenance

		₹
Value of additional output 60 hrs x 10 tonnes x ₹ 80		**48,000**
Savings in maintenance and repair cost (1,93,150 - 1,76,500)		**16,650**
		64,650
Less: material (60hrs x 10tonnes @₹ 60)	**36,000**	
Wages 60hrs @₹ 40	**2,400**	38,400
Additional revenue		26,250

(b) Computation of Cost of Quality

	Best (₹)	Super (₹)
Prevention cost:		
Designing	**7,20,000** (1200 X 600)	**3,00,000** (500 X 600)
Appraisal cost: Testing & Inspection	**4,80,000** (8,000 X 3 X 20)	**1,40,000** (7,000 X 1 X 20)
Internal Failure cost: Re -work	**4,00,000** (8,000 X 5% X 1,000)	**4,20,000** (7,000 X 10% X 600)
External Failure cost:	**5,00,000**	**3,67,500**
Repair	(8,000 X 5% X 1,250)	(7,000 X 7% X 750)
Loss of contribution	**---**	**2,00,000** [(4,000 – 3,000) X 200]
Total Cost of Quality	**21,00,000**	**14,27,500**

(c) (i) The given solution is not optimal; since the c_j-z_j row contains one positive value (i.e. all c_j-z_j are should be less than or equal to zero)

Improved solution

c_j			40	60	0	0	0	Min ratio
C_B	(B)	b=(X_B)	X_1	X_2	S_1	S_2	S_3	
0	S_1	6	2	0	1	0	-1/2	3
0	S_2	40	13/3	0	0	1	-1/3	120/13
60	X_2	10	1/3	1	0	0	1/6	30
z_j			20	60	0	0	10	
c_j-z_j			20	0	0	0	-10	

Optimal solution

c_j			40	60	0	0	0
C_B	(B)	b=(X_B)	X_1	X_2	S_1	S_2	S_3
40	X_1	3	1	0	1/2	0	-1/4
0	S_2	27	0	0	-13/6	1	3/4
60	X_2	9	0	1	-1/6	0	1/4
z_j		660	40	60	10	0	5
c_j-z_j			0	0	-10	0	-5

(ii) Solution is not degenerate. Since none of the basic variables has zero quantity (that is X_1=3; S_2=27 and X_2=9).

(iii) Machine B is not being used to full capacity. Because the slack variable of B i.e., S_2 has a value of 27. It indicates 27 hours of machine B are idle.

(d) Basic calculations

Standard hours = 18,000 X 2 = 36,000 hours

Therefore, budgeted hours = 36,000 X 100 / 75 = 48,000 hours

* Fixed Overhead Expenditure Variance = Budgeted FO - Actual FO

32,500 A = Budgeted FO – 5, 12,500

Therefore, budgeted FO = 5,12,500 – 32,500 = ₹ 4,80,000 *

Standard FO recovery rate = 4, 80,000 / 48,000 = ₹ 10 per hour *

Standard Variable Overhead recovery rate = 16 – 10 = ₹ 6 per hour *

(i) Variable Overhead Efficiency Variance

= (Std. VO for actual output – Std. VO for actual hours worked)

= (18,000 X 2 X 6) – (37,500 X 6)

= 2,16,000 – 2,25,000 = **₹ 9,000 A**

(ii) Fixed Overhead Capacity Variance = Bud. FO for actual hours worked – Bud. FO

= (37,500 X 10) – (4,80,000)

= (3,75,000 - 4,80,000) = **₹ 1,05,000 A**

(iii) Fixed Overhead Efficiency Variance = Absorbed FO – (Bud. FO for actual hours worked)

= (18,000 X 2 X 10) – (37,500 X 10)

= 3,60,000 – 3,75,000 = **₹ 15,000 A**

Note- fixed overhead variances can also be calculated alternatively based on output.

Question 2

(a) Kay Ltd manufactures many products. To compute manufacturing costs, it uses a costing System with one direct cost category (Direct Materials) and three Indirect cost categories as under:

- *Batch related-Set up, production order, and materials handling costs-all of which very with number of batches.*
- *Manufacturing Operation costs that very with machine hours.*

- *Costs of engineering changes that very with the number of engineering changes made.*

In response to competitive pressure at the end of year 2019, product designer at the company employed value engineering technique to reduce manufacturing costs. Actual Information for year 2019 to year 2020 are as follows:

Particulars	***Actual Result for Year 2019***	***Actual Result for year 2020***
Total setup, Production order and Material handling costs	*₹84,00,000*	*₹96,00,000*
Total number of batches	*1,200*	*1,500*
Total manufacturing operation costs	*₹1,35,00,000*	*₹1,37,20,000*
Total number of machine hours worked	*2,50,000*	*2,80,000*
Total cost of engineering changes	*₹16,00,000*	*₹11,37,500*
Total number of engineering changes made	*200*	*175*

The company wants to evaluate whether value engineering has succeeded in reducing the target manufacturing cost per unit of one of its main product CAT-36 by 10%. Actual results for year 2019 and year 2020 for CAT-36 are:

Particulars	***Actual Result for year 2019***	***Actual Result for year 2020***
Units of CAT- 36 produced	*3,000*	*4,000*
Direct materials costs per unit of CAT -36	*₹ 1,500*	*₹1,400*
Total no. of batches required to produce CAT-36	*55*	*65*
Total machine hours required to produce CAT-36	*19,500*	*21,000*
Number of engineering changes made	*10*	*6*

Required:

(i) Calculate the manufacturing cost per unit of CAT-36 for year 2019 year 2019 and year 2020.

(ii) Did the company achieve the target manufacturing cost per unit for CAT-36 in 2020?

(iii) Explain briefly how the components of target costing system help in achieving cost reduction. ***(8 Marks)***

(b) DJ Ltd. manufactures product 'Rust' in addition to other products by using the same machines in Department X and Department Y. The cost data are as under:

Direct Material	*FM 4kg*	*@ ₹ 12/kg used in Dept. X*
	ST 8kg	*@ ₹ 5/kg used in Dept. Y*
Direct Labour	*2 hours*	*@ ₹ 8per hour in Dept. X*
	3 hours	*@ ₹ 6 per hour in Dept. Y*

Overheads:	***Dept. X***	***Dept Y***
	Per rupee of direct Material	***Per direct labour hour***
	₹	***₹***
Variable	*0.80*	*2.00*
Fixed	*2.20*	*3.00*
Depreciation Component in		
Fixed overhead rate	*0.80*	*0.10*
Other relevant data:		
Net plant and equipment value	*60,00,000*	*1,40,000*
Total depreciation per month	*60,000*	*1,000*

Total working capital requirement of product 'Rust' based on a target volume of output of 1,200 units per month is estimated at ₹ 19,800 per month.

Required:

(i) Indicate the selling price of product 'Rust" assuming that price is adequate to ensure contribution equivalent to 25% on total asset employed for 'Rust'.

(ii) Calculate the selling price in a situation where product is well established in the market so as to yield return of 16% on total asset employed for 'Rust'. ***(8 Marks)***

Answer

(a) (i) Computation of cost per unit of CAT – 36

	2019	**₹**	**2020**	**₹**
Direct materials	1,500 X 3000	45,00,000	1,400 X 4000	56,00,000
Indirect costs:				
Set – up etc.	84,00,000 X 55/1,200	3,85,000	96,00,000 X 65/1500	4,16,000
Mfd. Operation costs	1,35,000000 X 19,500/ 2,50,000	10,53,000	1,37,20,000 X 21,000/ 2,80,000	10,29,000
Engg. Changes	16,00,000 X 10/ 200	80,000	11,37,500 X 6/ 175	39,000

Total cost of production		**60,18,000**		**70,84,000**
No. of units produced		3,000		4,000
Cost per unit		**2,006**		**1,771**

(ii) Checking the achievement of desired reduction in target manufacturing cost

	₹
Cost per unit in 2019	2006.00
Less: Desired reduction 10% on cost	200.60
Targeted cost	**1805.40**

As the actual cost of production in 2020 (₹ 1771) is less than the targeted cost (₹ 1805.40), it is concluded that the company achieved the target manufacturing cost per unit.

Alternatively

Since there is a reduction of 11.71% [(2006-1771)/2006x100] in target manufacturing cost per unit against the desired reduction of 10%, it is concluded that the company achieved the target manufacturing cost per unit.

(iii) Role of components of target costing in cost reduction

Value Engineering finds opportunities to modify the design of each component / part of a product to reduce cost without reducing functionality or quality of the product.

Value Analysis studies the various activities involved in producing a product and detects non - value adding activities that may be eliminated or minimised to save costs without reducing the functionality or quality of the product.

Kaizen Costing, an ongoing continuous improvement program, focuses on the reduction of waste in the production process to reduce costs.

(b) W.N. 1 Computation of cost per unit of product "Rust"

	Dept. X	Dept. Y	Total (₹)
Direct material	4 X 12 =48	8 X5=40	88.00
Direct labour	2 X 8 = 16	3 X 6 = 18	34.00
Variable overhead	48 X 0.8 = 38.40	3 X 2 = 6	44.40
Total variable cost			**166.40**
Fixed Overhead	48 X 2.20 = 105.60	3 X 3 = 9	**114.60**
Total cost			281.00

W.N 2 Computation of proportionate value of plant and equipment used to produce "Rust"

	Dept. X (₹)	Dept. Y (₹)
Annual depreciation	60,000 X 12 = 7,20,000	1,000 X 12 = 12,000
Depreciation for Rust	48 X 0.80 X 1200 X 12 = 5,52,960	3 X 0.1 X 1200 X 12 = 4320
Total value of plant & equip.	60,00,000	1,40,000
Prop. Value of plant & equip.	60,00,000 X 5,52,960 / 7,20,000	1,40,000 X 4,320 / 12,000
	= **46,08,000**	= **50,400**

W.N 3 Computation of total asset employed for "Rust"

	₹
Value of plant and equipment in Dept. X	46,08,000
Value of plant and equipment in Dept. Y	50,400
Value of working capital 19,800 X 12	2, 37,600
Total value of asset employed	48,96,000

(i) Computation of selling price to give to a contribution of 25% on total asset employed

	₹
Valued of asset employed	48,96,000
Expected percentage of contribution on asset employed =	25%
Therefore, required contribution = 48, 96,000 X 25%	12,24,000
Contribution required per unit = 12, 24,000 / 14,400 =	85

Selling price to be charged = Variable Cost + contribution = 166.40 + 85 = ₹ 251.40

(ii) Computation of selling price to yield a return of 16% on total asset employed

	₹
Value of asset employed	48,96,000
Expected rate of return	16%

Therefore, required return = 48, 96,000 X 16% = ₹ 7, 83,360

Required return per unit = 7, 83,360 / 14,400 = **₹ 54.40**

As the product is well established in the market, the company can charge both variable and fixed costs with the profit to the customers.

Total cost per unit	₹ 281.00
Add: Required return per unit	₹ 54.40
Selling price to be charged	**₹ 335.40**

Question 3

(a) *Managing Director of TEE Ltd thinks that Standard Costing has Little to offer in the reporting of material variances due to frequently change in price of materials.*

TEE Ltd. can utilize one of two equally suitable raw materials and tries to purchase the raw materials which will lead to most economical total production cost. However TEE Ltd. is frequently trapped by price changes and the material actually used often provides, after the event, to have been more expensive than the alternative which was originally not considered.

During last accounting period, to produce a unit of single product 'RT' the company could use either 5kg of 'SP' or 5 kg of 'NP'. The company planned to use 'SP' as it appeared to be cheaper of the two and plans were based on cost of 'SP' of ₹ 12 per kg. Due to market fluctuations the actual prices changed and if the company had purchased efficiently the cost would have been:

'SP' ₹ 14 per kg

'NP' ₹12.5 per kg

Production of 'RT' was 9,000 units and usage of 'SP; amounted to 47,600 kg at a total cost of ₹ 7,02,100.

Required:

(a) Analyse the material variance of 'RT' by:

(i) Traditional variance Analysis and

(ii) An approach which distinguish between Planning and Operational variances.

(b) Briefly explain the approach to variance analysis which distinguish between Planning and Operational variance and indicate the usefulness of the approach to company in general. ***(8 Marks)***

(b) *A project consists of eight activities. At the end of activity 6-7, the project is to be launched based on the normal duration of activities as given below. Activities have been subcontracted by the project manager to contractor A,B,C,D,E,F,G and H. Each subcontractor offers a discount on his contract price for each day given to him in addition to the normal days. The relevant information for all the activities for this project are given below:*

Activity	*1-2*	*1-3*	*1-4*	*2-5*	*3-5*	*4-6*	*5-6*	*6-7*
Duration (Days)	*7*	*2*	*14*	*6*	*9*	*6*	*5*	*8*

Contractor	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Discount ₹/Day	*600*	*400*	*2,400*	*1,000*	*800*	*2,000*	*1,200*	*1,000*

Required:

(i) Draw a network diagram for the project.

(ii) Find the critical path after estimating the earliest and latest event times for all nodes.

(iii) Calculate the free and independent float for each activity.

(iv) What will be the maximum discount that the project manager may earn for the company without delaying the launch of the project? ***(8 Marks)***

Answer

(a) (i) Traditional Variance Analysis (Actual Vs Budgeted)

Material Usage Variance = (Std. Quantity – Actual Quantity) Std. price

= [(9,000 X 5) – 47,600] X 12 = **₹ 31, 200 A**

Material Price Variance = (Std. Price – Actual Price) Actual Quantity

= [12-(7, 02,100 / 47,600)] X 47,600

= (12- 14.75) X 47,500 = **₹ 1, 30,900 A**

(ii) Operational Variance Analysis (Actual Vs Revised)

Material Usage Variance = (RSQ – AQ) Revised Selling Price

= [(9,000 X 5) – 47,600] 14 = **₹ 36, 400 A**

Material Price Variance = (Revised Selling Price – Actual Selling Price) AQ

= (14 – 14.75) 47,600 = **₹ 35, 700 A**

Planning Variance Analysis (Revised Vs Budgeted)

Controllable Variance = (12.5 – 14) 45,000 = **₹ 67, 500 A**

Uncontrollable Variance = (12 – 12.5) 45,000 = **₹ 22,500 A**

Total Variance = 67,500 A + 22,500 A = 90,000 A

Verification:

Traditional Variance = Operational Variance + Planning Variance

₹ 1,62,100A = ₹ 72,100 A+ ₹ 90,000 A

(b) New approach in Variance Analysis

In today's competitive business environment, managers must react quickly and accurately to meet the challenges due to changes. For this many new management accounting techniques/approaches were introduced. One among them is advanced variance analysis.

In this analysis, variances are approached by classifying them in the following manner to serve the purpose specifically:

Planning Variance: This variance brings out the management's forecasting ability by comparing the original standard and revised standard based on known factors.

Operational Variance: This variance indicates the management's current level of operating efficiency by comparing the actual with revised standard.

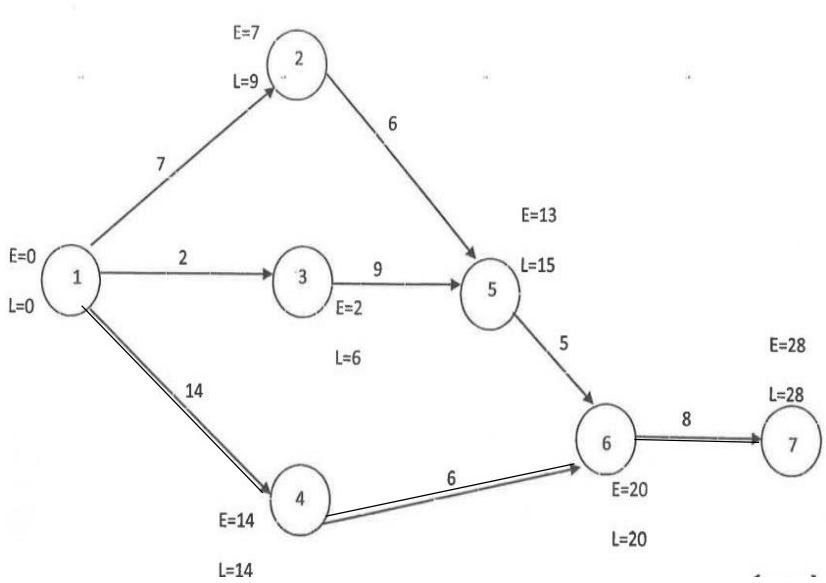
Controllable variances: These are those variances which arises due to inefficiency of a cost centre/department.

Uncontrollable variances: These are those variances which arises due to factors beyond the control of management/department of the organisation.

Usefulness of the approach to company:

- In time of inflation when there are frequent price level changes, the variance due to inflation can be distinguished from other variances.
- This approach distinguishes between controllable and uncontrollable variances
- This analysis shows the effect of setting unrealistic standards / targets.

(b) (i) Network Diagram



(ii) & (iii) Critical Path

	Paths	Duration (Days)
Path X	1-2-5-6-7	7+6+5+8=26
Path Y	1-3-5-6-7	2+9+5+8=24
Path Z	**1-4-6-7**	**14+6+8=28 (Critical Path)**

Estimation of event times

Activity	Days	ES	EF	LS	LF	Total Float	Free Float	Independent Float
1-2	7	0	7	2	9	2	0	0
1-3	2	0	2	4	6	4	0	0
1-4	14	0	14	0	14	0	0	0
2-5	6	7	13	9	15	2	0	0
3-5	9	2	11	6	15	4	2	0
4-6	6	14	20	14	20	0	0	0
5-6	5	13	18	15	20	2	2	0
6-7	8	20	28	20	28	0	0	0

(iv) Path X has a time advantage of 2 days and Path Y has 4 days time advantage. Activity 5-6 is a common activity on Path X & Y, offering more time to a single contractor will not give maximum discount.

In Path X, either 1-2 or 2-5 can be delayed for 2 days. Activity 6-7 cannot be delayed as it lies on the critical path. Of the above two activities, 2-5 has the maximum discount of ₹ 1000 per day.

Therefore, it is more profitable to allot 2 more days to contractor D and earn a discount of ₹ 2000.

In Path Y, either 1-3 or 3-5 can be delayed for 4 days. Between these two activities, 3-5 has the maximum discount of ₹ 800 per days. Hence, it is preferable to allot 4 more days to Contractor E and avail a discount of ₹ 3200.

Therefore, maximum discount possible is ₹ 2000+₹ 3200=₹ 5200

Question 4

(a) Maple Ltd (ML) has a chain of retail outlets of uniform sizes across the country. Mainly three products are sold through these retail outlets namely 'Mango', 'Tango' and 'Icy Cool'. ML maintains stocks for all retail outlets in a centralized warehouse. Goods are released from the warehouse to the retail outlets as per requisition raised by the outlets. Two types of van i.e. normal and refrigerated, transport these goods to the outlets. These vans are taken on hire by ML.

Costs per month of ML are as follows:

Warehouse Cost:	*₹*
Labour and staff cost	*1,28,000*
Refrigeration cost	*4,08,000*
Material handling cost	*1,32,000*
Total	*6,68,000*
Head office cost:	
Salary to H.O. staff	*2,50,000*
Office administrative cost	*2,94,000*
Total	*5,44,000*
Retail outlet cost:	
Labour related cost	*1,52,000*
Refrigeration cost	*4,56,000*
Other cost	*2,08,000*
Total	*8,16,000*

Average transportation cost of ML per trip to any retail outlet is as follows:

Refrigerated van *₹21,600*

Normal Van *₹15,600*

The Chief Financial Manager has asked his Finance managers to calculate profitability based on three products sold through these retail outlets rather than traditional method of calculating profitability. The following information regarding retail outlets are gathered:

	Mango	*Tango*	*Icy Cool*
No. of cartons per cubic meter (m^3)	*50*	*30*	*44*
No. of items per carton (units)	*300*	*150*	*100*
Sales per month (units)	*52,000*	*15,216*	*4,504*
Time in warehouse (in months)	*1*	*1.5*	*0.5*
Time in Retail Outlets (in months)	*1.5*	*2*	*0.75*
Selling price per unit (₹)	*190*	*96*	*70*
Purchase price per unit (₹)	*170*	*78*	*60*

Mango and Icy Cool are required to be kept under refrigerated conditions.

Additional information:

Total volume of all goods sold per month *1,00,000 m^3*

Total volume of refrigerated goods sold per month *60,000 m^3*

Carrying volume of each van *120 m^3*

Required:

Calculate the profit per unit using Direct Product Profitability (DPP) method. ***(10 Marks)***

(Make calculations up to three decimal points)

(b) A company manufactures 27 items per day. Daily sale of items and the corresponding probabilities are given below:

Daily sale (units)	*25*	*27*	*29*	*24*	*26*	*28*
Probability	*0.20*	*0.28*	*0.15*	*0.10*	*0.22*	*0.05*

The production and sale price of each unit is ₹50 and ₹60 respectively. Any unsold product at the end of the day is to be disposed off at a loss of ₹15 per unit. There is a penalty of ₹5 per unit if the demand is not met.

Using the following random numbers estimate daily profit/loss for the company for the next 8 days:

80, 15, 99, 35, 52, 89, 65, 18 ***(6 Marks)***

Answer

(a) WN 1 Computation of Warehouse related cost p.m per m^3

Costs	General Costs (₹)	Refrigeration related cost (₹)
Labour and Staff Cost	1,28,000	-
Refrigeration Cost	-	4,08,000
Material handling cost	1,32,000	-
Total Cost	2,60,000	4,08,000
Volume of goods sold (m^3)	1,00,000	60,000
Cost per m^3 p.m. (₹)	**2.60**	**6.80**

WN 2 Computation of product wise Warehouse cost in the proportion of warehousing time

Product	Nature of Product	Warehousing Time in months	Cost p.m^3 p.m (₹)	Proportionate Cost (₹)
Mango	Refrigeration	1	2.60+6.80=9.40	**9.40**
Tango	Ordinary	1.5	2.6	**3.90**
Icy Cool	Refrigeration	0.5	2.60+6.80=9.40	**4.70**

WN3 Computation of Retail Outlet Related cost p.m. p.m^3

Item	Cost related with	
	All Goods (₹)	Refrigerated goods (₹)
Labour	1,52,000	-
Refrigeration	-	4,56,000
Other Cost	2,08,000	-
Total Cost	3,60,000	4,56,000
Volume of goods sold (m^3)	1,00,000	60,000
Cost per m^3 p.m	**3.60**	**7.60**

WN 4 Computation of product wise Retail outlet cost in the proportion of Retail Outlet Time

Product	Nature of Product	Retail Outlet Time in months	Cost p.m^3 p.m (₹)	Proportionate Cost (₹)
Mango	Refrigeration	1.5	3.60+7.60=11.20	**16.80**
Tango	Ordinary	2	3.6	**7.20**
Icy Cool	Refrigeration	0.75	3.60+7.60=11.20	**8.40**

WN 5 Computation of Transportation Cost

	Normal Van	Refrigerated Van
Avg. cost per trip (₹)	15600	21600
Volume of van (m^3)	120	120
Cost p m^3 (₹)	**130**	**180**

WN 6 Computation of No. of units per m^3

Product	No. of Cartons (m^3)	No of Units per Carton	Total No. of Units
Mango	50	300	**15000**
Tango	30	150	**4500**
Icy Cool	44	100	**4400**

Direct Product Profitability (DPP) Statement

	Mango (Rs)	Tango (Rs)	Icy Cool (Rs)
Selling Price p.u.	190.00	96.00	70.00
Less. Purchase Price p.u.	170.00	78.00	60.00

Gross Profit (A)	20.00	18.00	10.00
Direct Product Costs:			
Warehouse Cost per m^3 (WN 2)	9.40	3.90	4.70
Retail Outlet Cost per m^3 (WN 4)	16.80	7.20	8.40
Transportation Cost per m^3 (WN 5)	180.00	130.00	180.00
Total DPP cost per m^3 (a)	206.20	141.10	193.10
No. of units per m^3 (b) (WN 6)	15,000	4,500	4,400
DPP Cost per unit (a)/(b) =(B)	0.0137	0.0314	0.0439
Direct Product Profit p.u (A)-(B)	19.9863	17.9686	9.9561
(or)	19.986	17.969	9.956

(b) Allocation of Random Numbers

Daily Sale (Units)	Probability	Cum. Probability	Random Numbers
24	0.10	0.10	00-09
25	0.20	0.30	10-29
26	0.22	0.52	30-51
27	0.28	0.80	52-79
28	0.05	0.85	80-84
29	0.15	1.00	85-99

Simulation Table

Days	RN	Demand (Units)	Production (Units)	Daily Profit/Loss (₹)
1	80	28	27	(27x10)-(1x5) = **265**
2	15	25	27	(25x10)-(2x15) = **220**
3	99	29	27	(27x10)-(2x5) = **260**
4	35	26	27	(26x10)-(1x15) = **245**
5	52	27	27	(27x10) = **270**
6	89	29	27	(27x10)-(2x5) = **260**
7	65	27	27	(27x10) = **270**
8	18	25	27	(25x10)-(2x15) = **220**

Question 5

(a) *BGL Company has two manufacturing divisions operating on profit center basis. Division Q makes product A which requires a particular component which can be sourced only from Division P. Each unit of product A requires two unit of that particular component.*

The demand for product A is not steady and order for increased quantities can be obtained by reduction in the price. The Manager of Division Q has given the following forecast:

Sales per day (units)	***Average Price per unit of A(Rs)***
3,000	*500*
6,000	*450*
9,000	*400*
12,000	*340*
15,000	*290*
18,000	*240*

The manufacturing cost (excluding cost of component from Division P) of A in Division Q is ₹ 10,80,000 on first 3,000 units and @ ₹90 per unit in excess of 3,000 units for up to 9,000 units and thereafter @ ₹75 per unit for units in excess of 9,000 units Division P incurs a total cost of ₹ 4,92,500 per day for an output up to 6,000 units of component and then total cost will increase by ₹ 2,27,500 per day for every additional 6,000 components manufactured. The manager of Division P has set the transfer price for component at ₹ 60 per unit to optimize the performance of his Division.

You are required to:

(a) Prepare a divisional profitability statement at each level of output for Division P and Q separately.

(b) Find out the profitability to the company as a whole at the output level where

(i) Division P's net profit is maximum.

(ii) Division Q's net profit is maximum.

(c) Find out at what level of output the company will earn maximum profit, if the company is not organized on profit center basis. ***(8 Marks)***

(b) *The following table shows all the necessary information on the available supply from each plant, the requirement of each market and unit transportation cost from each plant to each market:*

Plant	***Market***				***Supply***
	I	*II*	*III*	*IV*	
P_1	*12*	*6*	*10*	*8*	*27*

P_2	*10*	*-*	*4*	*14*	*18*
P_3	*10*	*14*	*16*	*12*	*10*
Requirement	*12*	*18*	*17*	*8*	*55*

Note: Units cannot be transported form P_2 to II due to unavoidable reasons.

From the past experience, the shipping clerk has worked out the following schedule:

18 units from P_1 to II, 1 units from P_1 to III, 8 units from P_1 to IV, 16units from P_2 to III, 2 units from P_2 to I and 10 units from P_3 to I.

Required:

(i) Check and see if the clerk has the optimal schedule.

(ii) Find the optimal schedule and minimum transportation cost.

(iii) In case all the 10 units produced at P3 are shipped through the route (P3, II), what should be the transportation cost per unit from P3 to II to maintain the same transportation cost for optimal schedule calculated at point on. (ii). ***(8 Marks)***

Answer

(a) (a) Preparation of Divisional Profitability Statement

Division – P

No of Components	Transfer Price @ ₹ 60 p.u	Total Cost of Components (₹)	Profit/ Loss (₹)
6000	3,60,000	492500	-1,32,500
12000	7,20,000	492500+227500 = 7,20,000	---
18000	10,80,000	492500+(2x227500) = 9,47,500	1,32,500
24000	14,40,000	492500+(3 x 227500) = 11,75,000	2,65,000
30000	18,00,000	492500+(4x227500) = 14,02,500	3,97,500
36000	21,60,000	492500+(5 x 227500) = 16,30,000	5,30,000

Division – Q

No. of Units of A	Sales Revenue at avg Price (₹)	Cost of Component @ ₹ 120	Manufacturing Cost in Div Q	Total Cost (₹)	Profit/Los s (₹)
3000	3000 x 500 = 1500000	3,60,000	10,80,000	14,40,000	60,000

6000	6000 x 450 = 2700000	7,20,000	1080000 + (90 x 3000) = 1350000	20,70,000	6,30,000
9000	9000 x 400 = 3600000	10,80,000	1080000 + (90 x 6000) = 1620000	27,00,000	9,00,000
12000	12000 x 340 = 4080000	14,40,000	1080000 + (90 x 6000) + (75 x 3000) = 1845000	32,85,000	7,95,000
15000	15000 x 290 = 4350000	18,00,000	1080000 + (90 x 6000) + (75 x 6000) = 2070000	38,70,000	4,80,000
18000	18000 x 240 = 4320000	21,60,000	1080000 + (90 x 6000) +(75 x 9000) = 2295000	44,55,000	(1,35,000)

(b) (i) Computation of total profit of the company as a whole when Division P's net profit is maximum

	₹
Maximum profit (at the output level of 36,000 units) of Division P	5,30,000
At the corresponding level (18,000 units of production) loss of Division Q	1,35,000
Total profit to the whole company	3,95,000

(ii) Computation of total profit of the company as a whole when Division Q's net profit is maximum

	₹
Maximum profit (at the output level of 9,000 units) of Division Q	9,00,000
At the corresponding level (18,000 units of production) profit of Division P	1,32,500
Total profit to the whole company	10,32,500

(c) Level of output for maximum profit for the company when it is not organised on profit centre basis

No. of. Product A	Sales revenue (₹)	Cost of Comp. At Div.P (₹)	Mfd. cost at Div. (₹)	Total cost (₹)	Profit / Loss (₹)
3,000	15,00,000	4,92,500	10,80,000	15,72,500	(72,500)
6,000	27,00,000	7,20,000	13,50,000	20,70,000	6,30,000
9,000	36,00,000	9,47,500	16,20,000	25,67,500	10,32,500
12,000	40,80,000	11,75,000	18,45,000	30,20,000	**10,60,000**
15,000	43,50,000	14,02,500	20,70,000	34,72,500	8,77,500
18,000	43,20,000	16,30,000	22,95,000	39,25,000	3,95,000

(b) (i) The Initial basic solution worked out by the shipping clerk is as follows-

Plant	Market I	Market II	Market III	Market IV	Supply
P1	12	6 **18**	**1**	**8**	27
			10	8	
P2	10 **2**	X	**16**	14	18
			4		
P3	**10**	14	16	12	10
	10				
Req.	12	18	17	8	55

The initial solution is tested for optimality. The total number of independent allocations is 6 which is equal to the desired (m +n –1) allocations. We introduce ui's (i = 1, 2, 3) and vj's (j = 1, 2, 3, 4) such Δij = Cij – (ui +vj). Let us assume u1 = 0, remaining ui's and vj's are calculated as below-

(ui + vj) Matrix for Allocated / Unallocated Cells

					ui
	16	6	10	8	0
	10	X	4	2	-6
	10	0	4	2	-6
vj	16	6	10	8	

Now we calculate Δij = Cij – (ui +vj) for non basic cells which are given in the table below-

Δij Matrix

-4			
	X		12
	14	12	10

Since one of the Δij's is negative, the schedule worked out by the clerk is not the optimal solution.

(ii) Introduce in the cell with negative Δij [R1C1], an assignment. The reallocation is done as follows-

+1	18	-1 1	8
2 -1	x	+1 16	
10			

Revised Allocation Table

1	18		8
1	X	17	
10			

Now we test the above improved initial solution for optimality-

(ui + vj) Matrix for Allocated / Unallocated Cells

					ui
	12	6	6	8	12
	10	X	4	6	10
	10	4	4	6	10
vj	0	-6	-6	-4	

Now we calculate Δij = Cij – (ui +vj) for non basic cells which are given in the table below-

Δij Matrix

		4	
	X		8
	10	12	6

Since all Δij for non basic cells are positive, the solution as calculated in the above table is the optimal solution.

The supply of units from each plant to markets, along with the transportation cost is given below:

Plant	Market	Units	Cost per unit	Total Cost (₹)
P1	I	1	12	12
P1	II	18	6	108
P1	IV	8	8	64
P2	I	1	10	10

P2	III	17	4	68
P3	I	10	10	100
Minimum Total Transportation Cost				**362**

(iii) If it is required to consider the route P3 to II, in that case only 8 units are required to be transported from P1 to II i.e., up to the balance requirement of market II. The balance amount of supply of P1 i.e., 10 units can be supplied in other markets, but requirements of market III and IV are already exhausted. Hence, P1 to market I can only be the option.

Plant	Market	Units	Cost per unit	Total Cost
P1	I	11	12	132
P1	II	8	6	48
P1	IV	8	8	64
P2	I	1	10	10
P2	III	17	4	68
P3	II	10	4*	**40 (Balance)**
Minimum Total Transportation Cost				362

*40/10

In case all 10 units produced at P3 are shipped through the route (P3, II), then transportation cost must be less than or equal to ₹ 4 per unit to maintain the same transportation cost for optimal schedule calculated at point (ii)

Workings

Plant	Market				Supply
	I	II	III	IV	
P1	11 (12)	6 8	10	8 (8)	27
P2	1 (10)	X	4 17	14	18
P3	(10)	14 10	16	12	10
Req.	12	18	17	8	55

Question 6

(a) The following information is extracted from the budgets of Damson Limited:

Sales and Stock Budget (units)

Particulars	***Period I***	***Period II***	***Period III***	***Period IV***	***Period V***
Opening stock of finished goods	*6,000*	*3,750*	*4,950*	*3,750*	*4,500*
Sales	*22,500*	*30,000*	*24,750*	*31,500*	*27,000*

Cost Budget

	Period I	***Period II***	***Period III***
	₹	***₹***	***₹***
Direct Material	*8,10,000*	*12,48,000*	*9,42,000*
Direct labour	*20,25,000*	*33,30,000*	*23,55,000*
Production Overhead (excluding depreciation)	*7,56,250*	*10,30,000*	*8,38,750*
Depreciation	*2,00,000*	*2,00,000*	*2,00,000*
Administrative Overhead	*5,27,500*	*6,37,000*	*5,60,500*
Selling Overhead	*3,37,500*	*3,75,000*	*3,48,750*

Additional Information:

- *If in any period production exceeds 27,000 units, a bonus is paid to the workers in addition to normal wage rate for the additional units produced.*
- *Any variable costs contained in selling overheads are assumed to very with units sold.*
- *All other variable costs are assumed to very with units produced.*

Required:

(i) Prepare the production budget (units) for the period I to IV.

(ii) Prepare a suitable cost budget for period IV. ***(8 Marks)***

(b) Apex Ltd manufactures a product AXE using three components named P, Q and R. Number of units of each component required to manufacture product AXE are as under:

Component P: One

Component Q: Two

Component R: Four

These components can be either manufactured by the company or sub-contracted and following are the relevant data:

Particulars	***Component P***	***Component Q***	***Component R***
Direct Material cost per component (₹)	*2,000*	*1,000*	*1,100*
Direct labour hours per component	*50*	*25*	*5*
Sub- contract price per component (Rs)	*4,000*	*1,750*	*1,325*

Sale of product AXE is currently 10,000 units per month at a selling price of ₹15,000 per unit. A capacity constraint of 3,00,000 direct labour hours per month obligates the company to sub-contract the components. The variable overheads vary with direct labour hours worked and are incurred at rate of ₹ 4 per hour. Fixed costs are ₹ 15,00,000 per month and labour cost is ₹ 11 per hour.

Required

(a) Indicate which of the component (s) should be purchased and in what quantities so as to achieve the maximum possible profit. Also calculate the expected monthly profit from your suggestion.

(b) What is the maximum monthly profit that could be earned if demand of product AXE is 15,000 units per month? ***(8 Marks)***

Answer

(a) (i) Production Budget (Units) for the Period I to IV

	Period I	**Period II**	**Period III**	**Period IV**
Sales	22,500	30,000	24,750	31,500
Add: Closing stock	3,750	4,950	3,750	4,500
	26,250	34,950	28,500	36,000
Less: Opening stock	6,000	3,750	4,950	3,750
PRODUCTION	**20,250**	**31,200**	**23,550**	**32,250**

(ii) Cost Budget for Period IV

Direct material 32,250 X 40		12,90,000
Direct labour:		
Normal wage 32,250 X 100	32,25,000	
Bonus (32,250 – 27,000) X 50	2,62,500	34,87,500

Production Overhead:		
Variable 32,250 X 25	8, 06,250	
Fixed	2, 50,000	10,56,250
Depreciation – Fixed		2,00,000
Administrative Overhead:		
Variable 32,250 X 10	3,22,500	
Fixed	3,25,000	6,47,500
Selling Overhead:		
Variable 31,500 X 5	1,57,500	
Fixed	2,25,000	3,82,500
	TOTAL	70,63,750

WN. 1 Computation of Direct Material Cost per Unit

Direct Material – Period I = 8, 10,000 / 20,250 = ₹ 40

WN. 2 Computation of Direct Labour Cost per Unit

Direct Labour Cost – Period I = 20, 25,000 / 20,250 = ₹ 100

Production of Period II exceeds 27,000 units, hence Labour cost of this period includes bonus.

Total Direct Labour of Period II	₹ 33, 30,000
Less Normal Labour Cost 31,200 X 100	₹ 31, 20,000
	2,10,000

Rate of bonus = 2, 10,000 / (31,200 – 27,000) = ₹ 50 p.u

WN. 3 Computation Production Overhead per units

Variable production overhead = Diff. in overhead / Diff. in production units between Period I & II

= (10, 30,000 – 7, 56,250) / (31,200 – 20,250)

= 2, 73,750 / 10,950 = ₹ 25

Fixed production overhead = 10, 30,000 – (31,200 X 25)

= 10, 30,000 – 7, 80,000 = **₹ 2, 50,000**

WN. 4 Computation of Administrative Overhead per unit

Variable administrative overhead = Diff. in overhead / Diff. in production

= (6, 37,000 – 5, 27,500) / (31,200 – 20,250)

= 1, 09,500 / 10,950 = ₹ 10

Fixed administrative overhead = 6, 37,000 – (31,200 X 10)

= 6, 37,000 – 3, 12,000 = **₹ 3, 25,000**

WN. 5 Computation of Selling Overhead per unit

Variable selling overhead = Diff. in overhead / Diff. in sales

= (3, 75,000 – 3, 37,500) / (30,000 – 22,500)

= 37,500 / 7,500 = ₹ 5

Fixed selling overhead = 3, 75,000 – (30,000 X 5)

= 3, 75,000 – 1, 50,000 = **₹ 2, 25,000**

(b) (i) If Demand of AXE is 10,000 units

	Demand Components (c)		
	10,000 c	**20,000 c**	**40,000 c**
	P	**Q**	**R**
Material Cost (₹ /component)	2,000	1,000	1,100
Labour Cost (₹ /c)	550 (50 hrs.× ₹ 11)	275 (25 hrs.× ₹ 11)	55 (5 hrs.× ₹ 11)
Variable Overheads (₹ /c)	200 (50 hrs.× ₹ 4)	100 (25 hrs.× ₹ 4)	20 (5 hrs.× ₹ 4)
Make Cost (₹ /c)	**2,750**	**1,375**	**1,175**
Sub-Contract Price (₹ /c)	**4,000**	**1,750**	**1,325**
Incremental Cost (₹ /c)	1,250	375	150
hrs./component	50	25	5
Incremental Cost (₹ /h)	25	15	30
Rank	**II**	**III**	**I**

Allocation of Hours on the basis of ranking

Produce R as much as possible	=	40,000 units
Hours Required	=	2,00,000 hrs (40,000 c × 5 hrs.)
Balance Hours Available	=	1,00,000 hrs (3,00,000 hrs. – 2,00,000 hrs.)
Produce the Next Best	=	2,000 components of P (1,00,000 hrs/ 50 hrs)

Profit on the basis of ranking

Product	Particulars	Cost/ unit /c (₹)	Total '000 (₹)
	Sales AXE: 10,000 units	**15,000**	**1,50,000**

P	Produce: 2,000 components	2,750	5,500
	Subcontract: **8,000** components	4,000	32,000
Q	Produce: NIL components	1,375	---
	Subcontract: **20,000** components	1,750	35,000
R	Produce: 40,000 components	1,175	47,000
	Subcontract: NIL components	1,325	---
Contribution			**30,500**
Less: Fixed Cost			1,500
Net Profit			**29,000**

(ii) Allocation of Hours on the basis of ranking Produce R as much as possible = 60,000 units

Profit on the basis of ranking

Product	Particulars	Cost/unit/ c (₹)	Total '000 (₹)
	Sales AXE: 15,000 units	15,000	2,25,000
P	Produce: NIL components	2,750	---
	Subcontract: 15,000 components	4,000	60,000
Q	Produce: NIL components	1,375	---
	Subcontract: 30,000 components	1,750	52,500
R	Produce: 60,000 components	1,175	70,500
	Subcontract: NIL components	1,325	---
Contribution			42,000
Less: Fixed Cost			1,500
Net Profit			**40,500**

Question 7

*Answer any **four** out of the following **five** questions:*

(a) State whether and why the following are valid or not for learning curve theory.

(i) Learning curve theory applies to a division of a company which is fully automated.

(ii) Learning curve theory helps in setting standards.

(iii) Learning curve helps in pricing decisions.

(iv) Experienced workmen are prone to learning effect. ***(4 Marks)***

(b) What is product life cycle costing? What are the costs that you would include in product life cycle cost? ***(4 Marks)***

(c) What do you mean by back flushing in JIT system? What are the problems that must be corrected before it will work properly? ***(4 Marks)***

(d) Answer the following independent situation relating to an assignment problem with a minimization objective:

(i) Under the usual notation, where A_{12} means the element at the intersection of the 1st row and 2nd column, we have, in a 4x4 assignment problem, A_{12} and A_{33} figuring in the optimal solution. What can you conclude about the remaining assignment? Why?

(ii) Just after the row and column minimization operations, we find that a particular row has two zeros. Does this implies the two corresponding numbers in original matrix before any operation were equal? Why? ***(4 Marks)***

(e) What are the cost and non-cost factors to be considered in shout down decisions?

(4 Marks)

Answer

(a) (i) Invalid – It can be very effective in labour oriented industry but not in fully automated company.

(ii) Valid – If budgets and standards are set without considering the learning effect, meaning less variances are likely to occur. The learning curve is quite helpful in setting standards in learning phase.

(iii) Valid – The use of cost data adjusted for learning effect helps in development of advantageous pricing decisions.

(iv) Invalid – After the limits of experimental learning are reached, productivity tends to stabilize and no Further improvement is possible.

(b) Product life cycle costing is a system of costing which traces costs and revenues of each product over several calendar periods throughout the entire life cycle of the product.

The costs that are included in the different stages of a product life cycle are: Development stage – R & D cost / Design cost.

Introduction stage – Promotional cost / Capacity costs.

Growth / Maturity stage – Manufacturing cost / Distribution / Product support cost.

Decline/ Replacement stage – Plants Reused / Sold / Scrapped / Related costs.

(c) Backflushing requires no data entry of any kind until a finished product is completed. At that time the total amount finished is entered into the computer system, which multiples it by all the components listed in the bill of materials for each item produced. This yields a lengthy list of components that should have been used in the production process and which is subtracted from the beginning inventory balance to arrive at the amount of inventory that

should now be left of hand. Back the entire production process. Given the large transaction volumes associated with JIT, this is an ideal solution to the problem.

The following problems must be corrected before it will work properly:

(i) Production reporting

(ii) Scrap reporting

(iii) Lot tracing

(iv) Inventory accuracy.

(d) (i) The order of matrix in the assignment problem is 4 × 4. The total assignment (allocations) will be four. In the assignment problem when any allocation is made in any cell then the corresponding row and column become unavailable for further allocation. Hence, these corresponding row and column are crossed mark to show unavailability. In the given assignment matrix two allocations have been made in a_{12} (1^{st} row and 2^{nd} column) and a_{33} (3^{rd} row and 3^{rd} column). This implies that 1^{st} and 3^{rd} row and 2^{nd} and 3^{rd} column are unavailable for further allocation.

Therefore, the other allocations are at either at a_{21} and a_{44} or at a_{24} and a_{41}.

(ii) Under the Hungarian Assignment Method, the prerequisite to assign any job is that each row and column must have a zero value in its corresponding cells. If any row or column does not have any zero value then to obtain zero value, each cell values in the row or column is subtracted by the corresponding minimum cell value of respective rows or columns by performing row or column operation. This means *if any row or column have two or more cells having same minimum value then these row or column will have more than one zero.* However, having two zeros does not necessarily imply two equal values in the original assignment matrix just before row and column operations. *Two zeroes in a same row can also be possible by two different operations i.e. one zero from row operation and one zero from column operation*.

(e) Cost and non – cost factors in shut down decision:

Cost factors: The decision is based on marginal cost analysis. As to whether the contribution is more than the difference between the fixed expenses incurred in normal operation and the fixed expenses incurred when the plant is shut down.

Non – cost factors: While deciding in favour of shut down, the following non-cost factors are worthy for consideration:

- Interest of workers, if the workers are discharged, it may become difficult to get skilled workers later, On reopening of the factory. Also shut-down may create problems.
- In the face of competition it may difficult to re-establish the market for the product.
- Plant may become obsolete or depreciate at a faster rate or get rusted. Thus, heavy capital expenditure may have to be incurred on re-opening.