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) X Company manufactures Key Rings that are printed with the logos of the various companies. Each Ring is priced at ₹10. The costs are as follows:

Cost Driver	Unit Variable Cost (₹)	Level of Cost Driver
Direct cost	5.00	---
Setups	450.00	40
Engineering hours	10.00	500

Other Data:

Total fixed cost (conventional)..... ₹96,000

Total fixed cost (ABC)..... ₹73,000

Required

(i) To compute the Break-even-point in units using activity-based analysis.

(ii) Suppose that company could reduce the setup cost by ₹ 150 per setup and could reduce the number of engineering hours needed to 430. How many units must be sold to break-even in this situation? ***(5 Marks)***

(b) GTC Limited, manufacturer of 'ORA' a leading brand of hair dye are planning the media mix for the next year with-in their advertisement budget of ₹ 45 lakhs. The characteristics of target audience for 'ORA' and weightage for each are as follows:

	Characteristics	Weightage (%)
Age	Over 40 years	45
Monthly income	Over ₹ 25,000	30
Education	Graduate & above	25

The audience characteristics for the three magazines under considerations, cost per insertion and total readership are as under:

	Characteristics	Magazine (A) (%)	Magazine (B) (%)	Magazine (C) (%)
Age	Over 40 years	50	60	30
Monthly income	Over ₹ 25,000	45	50	40
Education	Graduate & above	40	35	50
Cost per insertion (₹)		75,000	1,25,000	45,000
Readership (In lakhs)		18	25	12

The company has already decided that at least 12 insertions in Magazine A, 18 insertions in magazine B are necessary to create an impact whereas Magazine C should have not more than 8 insertions.

Formulate a linear programming model for the given problem to maximize the expected effective exposure. **(5 Marks)**

(c) *Nova Limited manufactures two products 'Super' and 'Bright'. The selling price and cost data are as under:*

	Super	Bright
Selling price per unit (₹)	384	525
Direct material per unit (₹)	158	240
Direct labour @ ₹ 40 per hour		
Department A	60	80
Department B	-	100
Department C	80	-
Variable overhead per unit (₹)	32	45

The company operates a single shift of 8 hours/day for 300 days in a year and the number of workers in each department are as under:

Department A - 78 workers

Department B - 54 workers

Department C - 48 workers

The employees cannot be increased nor can they be transferred from one department to another.

Required

Calculate the number of units of each-product that can be manufactured to yield maximum profit. **(5 Marks)**

(d) Century Electrical Company manufactures fans. As a first step to focus on quality improvements, the company has compiled the following operating data for the year ending 31.03.2018:

Cost of Quality	***Amount in ₹***
Re-inspecting Rework	*3,25,600*
Training	*3,75,500*
Warranty Repairs	*8,62,500*
Line Inspection	*2,12,500*
Downtime	*1,84,000*
Design Engineering	*3,62,800*
Product Testing Equipment	*4,15,800*
Litigation cost to defend allegations of defective products	*2,90,500*
Recording and reporting defects	*2,67,600*
Supplier evaluation	*2,96,800*
Storing and disposing waste	*1,72,000*
Product liability insurance	*1,08,000*
Expediting	*3,27,000*
Procedure verification	*2,54,000*
Recalls	*3,42,000*

Required

Classify the costs into cost of quality categories and determine the total amount being spent on each category. ***(5 Marks)***

Answer

(a) (i) Break Even Point

$$= \frac{\text{Fixed Cost} + (\text{Setup Cost} \times \text{No. of Setups}) + (\text{Engineering Costs} \times \text{No. of Engineering Hrs.})}{(\text{Price} - \text{Unit Variable Cost})}$$

$$= \frac{₹\,73{,}000 + (₹450 \times 40 \text{ Setups}) + (₹10 \times 500 \text{ hrs.})}{(₹\,10 - ₹\,5)}$$

= **19,200 units**

(ii) Break Even Point (Changed Scenario)

Break Even Point

$$= \frac{\text{Fixed Cost} + (\text{Setup Cost} \times \text{No. of Setups}) + (\text{Engineering Costs} \times \text{No. of Engineering Hrs.})}{(\text{Price} - \text{Unit Variable Cost})}$$

$$= \frac{₹\ 73,000 + (₹300 \times 40 \text{ Setups}) + (₹10 \times 430 \text{ hrs.})}{(₹\ 10 - ₹\ 5)}$$

= **17,860 units**

(b) Let x_1, x_2 and x_3 denote the number of advertisements inserted in the three magazines A, B, and C respectively. In order to formulate the objective function, we shall first calculate the effectiveness coefficient as follows:

Media	Effectiveness Coefficient
Magazine A	0.46 (**0.50** × 0.45 + **0.45** × 0.30 + **0.40** × 0.25)
Magazine B	0.5075 (**0.60** × 0.45 + **0.50** × 0.30 + **0.35** × 0.25)
Magazine C	0.38 (**0.30** × 0.45 + **0.40** × 0.30 + **0.50** × 0.25)

The effective exposures for all the three-media employed can be computed as follows:

Effective Exposure = Effectiveness Coefficient × Audience Size

Thus, effective exposure for

Media	Effectiveness Exposure
Magazine A	8,28,000 (0.46 × 18,00,000)
Magazine B	12,68,750 (0.5075 × 25,00,000)
Magazine C	4,56,000 (0.38 × 12,00,000)

The linear programming model for the problem:

Maximize

$Z = 8,28,000x_1 + 12,68,750x_2 + 4,56,000x_3$

Subject to the Constraints:

$75,000x_1 + 125,000x_2 + 45,000x_3 \leq 45,00,000$ (Budget Constraint)

$x_1 \geq 12$ (Advertisement Constraint)

$x_2 \geq 18$ (Advertisement Constraint)

$x_3 \leq 8$ (Advertisement Constraint)

Where x_1, x_2 and $x_3 \geq 0$ (Non- Negativity Constraint)

(c) Statement Showing Product Rank

Particulars	Super (₹/u)	Bright (₹/u)
Selling Price	384	525
Less: Direct Material	158	240
Less: Direct Labour p.u.		
Department A (₹40 × 1.5 hrs.; ₹40 × 2 hrs.)	60	80
Department B (₹40 × 2.5 hrs.)	---	100
Department C (₹40 × 2 hrs.)	80	---
Less: Variable Overheads	32	45
Contribution (₹/u)	54	60
Department A (hrs.)	1.5	2
Rate (p/h)	36	30
Rank	I	II

Statement Showing Maximum Possible Production

Particulars	Max. Hours	Production Super (units)	Production Bright (units)
Department A (78 Workers × 300 Days × 8 hrs.)	1,87,200	57,600	50,400 (1,87,200-57,600×1.5)/2
Department B (54 Workers × 300 Days × 8 hrs.)	1,29,600	---	51,840 (1,29,600/2.5 hrs.)
Department C (48 Workers × 300 Days × 8 hrs.)	1,15,200	57,600 * (1,15,200/2 hrs.)	---
Max. Possible Production		**57,600**	**50,400**

** Based on rank and availability of hours in department C.*

(d) Statement Showing Quality Costs

Particulars	Prevention Costs	Appraisal Costs	Internal Failure Costs	External Failure Costs
Re-inspecting Rework	---	---	3,25,600	---
Training	3,75,500	---	---	---
Warranty Repairs	---	---	---	8,62,500

Line Inspection	---	2,12,500	---	---
Downtime	---	---	1,84,000	---
Design Engineering	3,62,800	---	---	---
Product Testing Equipment	---	4,15,800	---	---
Litigation Costs to defend allegations of defective products	---	---	---	2,90,500
Recording and reporting defects	---	2,67,600	---	---
Supplier evaluation	2,96,800	---	---	---
Storing and disposing waste	---	---	1,72,000	---
Product liability insurance	---	---	---	1,08,000
Expediting	---	---	---	3,27,000
Procedure Verification	---	2,54,000	---	---
Recalls	---	---	---	3,42,000
Total	**10,35,100**	**11,49,900**	**6,81,600**	**19,30,000**

Question 2

(a) A division of XY Company produces two types of products, whose selling price and cost data are as follows:

	Product A	***Product B***
Selling price (₹ per unit)	*200*	*280*
Material cost (₹ per unit)	*80*	*100*
Variable conversion cost (₹ per unit)	*20*	*60*
Maximum Sales Potential (units)	*75,000*	*35,000*
Production per Machine hours (units)	*3.125*	*2.5*

Maximum capacity hours are 30,000. Total fixed overheads are ₹ 42 lakhs.

The stock of work-in-progress and finished goods are negligible because the company uses just-in-time system.

Required

(i) Determine the optimal product mix using marginal costing.

(ii) Calculate the throughput accounting ratio for each product and rank the products for manufacture.

(iii) Based on the concept of throughput accounting, compute the product mix to yield maximum profit.

Show calculations up to two decimal points. ***(8 Marks)***

(b) Joy Limited a toy manufacturing company is going to launch two new battery operated toys in the market. Both the products will be manufactured in Division BT. The estimated data are as under:

	Toy A	*Toy B*
Annual Production (units)	*48,000*	*72,000*
Direct Material (₹ per unit)	*126*	*158*
Direct labour (₹ 60 per hour)	*30*	*40*

Factory overheads (60% variable) are 80% of direct wages. Administrative overheads (100% fixed) are 10% of factory cost. Selling overheads (50% fixed) are ₹12 and ₹ 18 per unit of Toy A and Toy B respectively.

The fixed capital investment in the Division BT is ₹ 30 lakhs. Gross working capital requirement is equivalent to 20% of cost of sales and current liabilities are 10% of total cost of production. 15% return on capital employed is expected.

Required

Fix selling price of Toy A and Toy B so that contribution per labour hour is same for both the products.

Show amount to the nearest Rupee. ***(8 Marks)***

Answer

(a) (i) Contribution *per unit* as well as Contribution *per machine hour*

Particulars	**Maximum Sales Potential (Units)**	
	75,000	**35,000**
	Product A	**Product B**
Selling Price (₹/u)	200	280
Material Cost (₹/u)	80	100
Variable Conversion Cost (₹/u)	20	60
Contribution (₹/u)	100	120
Machine Hours *per unit*	0.32 (1 hr./3.125 units)	0.40 (1 hr./2.5 units)
Contribution (₹/hr.)	**312.50**	**300**
Rank [Contribution (₹/hr.)]	I	II

Allocation of Machine Hours *on the basis of ranking*

Produce A *as much as possible*	=	75,000 units
Hours Required	=	24,000 hrs (75,000 units × 0.32 hrs.)
Balance Hours Available	=	6,000 hrs (30,000 hrs. – 24,000 hrs.)
Produce 'B' (the Next Best)	=	15,000 units $\left(\frac{6,000\,\text{hrs.}}{0.40\,\text{hrs.}}\right)$

Optimum Product Mix A 75,000 units and B 15,000 units.

(ii) Ranking Based on 'TA Ratio'

Return *per machine hour* …(A) *(Throughput per unit/ product time on bottleneck resource)*	₹375	₹450
Total Factory Costs/ Total Time Available on Bottleneck Resources (₹66 lacs / 30,000 hrs.) …(B)	₹220	₹220
TA Ratio …(A)/(B)	**1.70**	**2.05**
Ranking Based on TA Ratio	**II**	**I**

Factory Costs: ₹42 lacs + 75,000 units × ₹20 + 15,000 units × ₹60 = ₹66 lacs

(iii) Calculation of Rank According to 'Throughput Accounting'

Particulars	Product A	Product B
Selling Price (per unit)	₹200	₹280
Material Cost (per unit)	₹80	₹100
Throughput (per unit)	₹120	₹180
Time Required on Bottleneck Resource (Hours *per unit)*	0.32	0.40
Return *per machine hour*	₹375	₹450
Ranking	II	I

Allocation of Machine Hours *on the basis of ranking*

Produce B *as much as possible*	=	35,000 units
Hours Required	=	14,000 hrs (35,000 units × 0.40 hrs.)
Balance Hours Available	=	16,000 hrs (30,000 hrs. – 14,000 hrs.)
Produce 'A' (the Next Best)	=	50,000 units $\left(\frac{16,000\,\text{hrs.}}{0.32\,\text{hrs.}}\right)$

Optimum Product Mix A 50,000 units and B 35,000 units.

(b) Workings

Statement Showing "Total Cost"

Particulars	Toy A (p/u) ₹	Toy B (p/u) ₹
Direct Material	126.00	158.00
Direct Labour		
A (1/2 hr. @ 60 ₹/hr.)	30.00	---
B (2/3 hr. @ 60 ₹/hr.)	---	40.00
Factory Overheads-Variable		
A (80% of ₹30 × 60%)	14.40	---
B (80% of ₹40 × 60%)	---	19.20
Factory Overheads-Fixed		
A (80% of ₹30 × 40%)	9.60	---
B (80% of ₹40 × 40%)	---	12.80
Factory Cost	180.00	230.00
Administrative Overheads-Fixed		
A (10% of ₹180 × 100%)	18.00	---
B (10% of ₹230 × 100%)	---	23.00
Cost of Production	198.00	253.00
Selling Overheads-Fixed		
A (50% of ₹12)	6.00	---
B (50% of ₹18)	---	9.00
Selling Overheads-Variable		
A (50% of ₹12)	6.00	---
B (50% of ₹18)	---	9.00
Cost of Sales	210.00	271.00

Statement Showing "Variable Cost"

Particulars	Toy A (p/u) ₹	Toy B (p/u) ₹
Direct Material	126.00	158.00
Direct Labour		
A (1/2 hr. @ 60 ₹/hr.)	30.00	---
B (2/3 hr. @ 60 ₹/hr.)	---	40.00

Factory Overheads-Variable		
A (80% of ₹30 × 60%)	14.40	---
B (80% of ₹40 × 60%)	---	19.20
Selling Overheads-Variable		
A (50% of ₹12)	6.00	---
B (50% of ₹18)	---	9.00
Total Variable Cost	176.40	226.20

Statement Showing Expected 'Return on Capital Employed'

	(₹)
Fixed Capital Investment …(A)	30,00,000
Gross Working Capital [20% × {(₹210 × 48,000 units) + (₹271 × 72,000 units)}…(B)	59,18,400
Current Liabilities [10% x {(₹198 × 48,000 units) + (₹253 × 72,000 units)}] …(C)	27,72,000
Capital Employed …(A) + (B) – (C)	61,46,400
Return on Capital Employed 15%	9,21,960

Let the Contribution per hour be ₹K

Contribution (p/u) from Toy A = ₹1/2K

Contribution (p/u) from Toy B = ₹2/3K

Total Contribution = Fixed Cost + Profit

₹1/2K × 48,000 units + ₹2/3K × 72,000 units = 48,000 units × (₹210.00 - ₹176.40) + 72,000 units × (₹271.00 - ₹226.20) + ₹ 9,21,960

K = ₹80.00

Contribution from Toy A = 1/2 × ₹ 80.00

= ₹40.00

Contribution from Toy B = 2/3 × ₹80.00

= ₹53.33

Statement Showing "Selling Price"

Particulars	Toy A (p/u) ₹	Toy B (p/u) ₹
Contribution	40.00	53.33
Add: Variable Cost	176.40	226.20
Selling Price	216.40	279.53

Question 3

(a) There are two profit centres namely Division A and Division B in XY Ltd. Division A produces four products P, Q, R, and S. Each product is sold in the external market also. The relevant data for Division A are as follows:

	P	Q	R	S
Market price per unit (₹)	700	690	560	460
Variable cost of production per unit (₹)	660	620	360	370
Labour hours required per unit (Hours)	6	8	4	6

The maximum sales in the external market are:

P: 3,000 units

Q: 3,500 units

R: 2,800 units

S: 1,800 units

Product S can be transferred to Division B also but the maximum quantity that might be required for transfer is 2,200 units of S.

Division B can also purchase the same product at a price of ₹ 420 per unit from market instead of receiving transfers of product S from Division A.

(a) You are required to calculate the transfer price for each unit for 2,200 units of product S, if the total labour hours. available in Division A are:

(i) 48,000 hours

(ii) 64,000 hours

(b) Whether is it profitable for Division B to get transfer 2,200 units of product S from Division A in above (a) situation?

Show calculation of units to nearest unit and rest up to two decimal points. ***(8 Marks)***

(b) JK Limited manufactures three Products D, E and F each requiring similar material, labour and production facilities. Trading results of the company for the year ending March, 2018 are as under:

(Amount in (₹)

	D	E	F	Total
Sales	38,50,000	13,90,000	30,20,000	82,60,000
Variable Cost:				
Material	10,78,000	6,25,500	9,06,000	26,09,500
Labour	9,24,000	4,86,500	6,04,000	20,14,500

Overheads	*7,39,200*	*2,91,900*	*4,83,200*	*15,14,300*
Total variable cost	*27,41,200*	*14,03,900*	*19,93,200*	*61,38,300*
Contribution	*11,08,800*	*(13,900)*	*10,26,800*	*21,21,700*
Fixed overheads				*12,60,000*
Profit				*8,61,700*

Product E, despite best efforts, does not show any good prospect to yield reasonable margins and it is not possible to raise its price so as to make it profitable. The company has decided to discontinue its production w.e.f. 1st April 2018. Products D and F have good potential to grow and the market can easily absorb the increased production. The company has decided to raise the production of Products D and F by diverting the 60% labour of Product E to Product D and balance 40% to Product F.

Following additional information is available for the year beginning April 2018:

(A) Total Direct wage bill for the year would be at the same level as for the year ending 31.03.2018. Material cost per unit will increase by 5%, however variable overheads per unit will remain same. Fixed overheads would increase by ₹96,500.

(B) Selling price per unit of Product D will increase by 4% and of Product F by 5%

Required:

(i) Prepare budget for the next year beginning April 2018 in the format as detailed above.

(ii) Compare and analyse the budget for the year 2018 and 2019 highlighting main features. Show calculation of amount to the nearest Rupee.

(iii) To advise the management on comparative contribution/ profitability if 60% labour of Product E is transferred to Product F instead of Product D as above and balance 40% to Product D instead of Product F. Show calculations up to three decimal points. Give detailed reasoning for your advice. ***(8 Marks)***

Answer

(a) Workings

Ranking of Products When Availability of Time is the Key Factor

Particulars	P	Q	R	S
Market Price per unit (₹)	700	690	560	460
Less: Variable Cost of Production per unit (₹)	660	620	360	370
Contribution *per unit* (₹)	40	70	200	90
Labour Hours *per unit*	6 hrs.	8 hrs.	4 hrs.	6 hrs.
Contribution *per Labour Hour*	6.67	8.75	50.00	15.00
Ranking	IV	III	I	II

Maximum Sales (units)	3,000	3,500	2,800	1,800
Total No. of Hours Required	18,000	28,000	11,200	10,800
(i) Allocation of 48,000 Hours on the Basis of Ranking	---	26,000*	11,200	10,800
(ii) Allocation of 64,000 Hours on the Basis of Ranking	14,000*	28,000	11,200	10,800

(*) Balancing Figure

Time required to meeting the demand of 2,200 units of Product S for Division B is 13,200 hrs. This requirement of time viz. 13,200 hrs. for providing 2,200 units of Product S for Division B can be met by sacrificing 13,200 hours of Product Q (1,650 units).

Transfer Price = Variable Cost + Opportunity Cost

$$= ₹370 + \frac{(13,200 \text{ hrs.} \times ₹8.75)}{2,200 \text{ units}}$$

= ₹422.50

Time required to meeting the demand of 2,200 units of Product S for Division B is 13,200 hrs. This requirement of time viz. 13,200 hrs. for providing 2,200 units of Product S for Division B can be met by sacrificing 13,200 hours of Product P (2,200 units).

Transfer Price = Variable Cost + Opportunity Cost

$$= ₹370 + \frac{(13,200 \text{ hrs.} \times ₹6.66....)}{2,200 \text{ units}}$$

= ₹410.00

Statement Showing Purchase from Outside vs Internal Transfer

	Option-1 (48,000 hrs.)	Option-2 (64,000 hrs.)
Purchase Price of S ...(A)	420.00	420.00
Internal Transfer Price (based on opportunity cost) ...(B)	422.50	410.00
Net Gain/ (loss) per unit ...(A) - (B)	(2.50)	10.00

It is profitable for the Division B to get transfer 2,200 units of Product S from Division A only if hrs. available in Division A are 64,000.

(b) (i) Budgeted Profitability Statement

	D (₹)	F (₹)	Total (₹)
Sales	52,68,904 (₹38,50,000×131.591%×1.04)	41,92,664 (₹30,20,000×132.219%×1.05)	94,61,568

Variable Cost:			
Material	14,89,479 (₹10,78,000×131.591%×1.05)	12,57,799 (₹9,06,000×132.219%×1.05)	27,47,278
Labour	12,15,900 (₹9,24,000+₹4,86,500 × 60%)	7,98,600 (₹6,04,000+₹4,86,500×40)	20,14,500
Overheads	9,72,721 (₹7,39,200×131.591%)	6,38,882 (₹4,83,200×132.219%)	16,11,603
Contribution	15,90,804	14,97,383	30,88,187
Fixed Overheads			13,56,500
Profit			17,31,687

$$\left(\frac{₹12,15,900-₹9,24,000}{₹9,24,000}\right)\times 100 = 31.591\% \text{ ; } \left(\frac{₹7,98,600-₹6,04,000}{₹6,04,000}\right)\times = 32.219\%$$

(ii) Sales Volume of both products D and F has been increased by 31.59% and 32.22% respectively. Due to change in price of cost and revenue components, Profit Volume Ratio (PVR) of product D has been increased to 30.19% from 28.80% while for product F, it has been increased to 35.71% from 34%. However, change in PVR for product F is slightly higher. Overall, discontinuing product E and diverting the labour and production facilities to Product D and F have increased the profitability of the company.

$$\left(\frac{₹11,08,800}{₹38,50,000}\right)\times 100 = 28.80\% \text{ ; } \left(\frac{₹15,90,804}{₹52,68,904}\right)\times 100 = 30.192\%$$

$$\left(\frac{₹10,26,800}{₹30,20,000}\right)\times 100 = 34.00\% \text{ ; } \left(\frac{₹14,97,400}{₹41,92,696}\right)\times 100 = 35.714\%$$

(iii) If company transfers 60% of labour to product F and balance to D, total contribution will be increased to ₹31,43,324.522 (₹14,63,503.047 + ₹16,79,821.475) which is 1.785% higher than contribution arrived in point (ii) due to *shift of higher proportion of labour of product E to the product yielding higher PVR*.

Hence, it is advisable to divert higher proportion of labour to product F, ***provided there is sufficient market for the product F.***

$$\left(\frac{₹15,90,804}{₹12,15,900}\times ₹11,18,600\right) = ₹14,63,503.047 \text{ ; } \left(\frac{₹14,97,383}{₹7,98,600}\times ₹8,95,900\right) = ₹16,79,821.475$$

☞

Nearby figures are also possible due to **rounding off difference**.

Question 4

(a) A company is manufacturing 50 products of various types. For the year ended 31st March 2018, the manufacturing overheads, for all the products are as follows:

	₹
Machine operating expenses	*1,00,000*
Machine maintenance expenses	*20,000*
Wages of technicians	*68,000*
Wages of store receiving men	*28,000*
Wages of dispatch staff	*32,000*
	2,48,000

Total 2,000 direct labour hours were worked and paid @ ₹ 9.60 per hour in the Company during the year.

Traditionally, The company was absorbing the overheads on the basis of direct labour hours. Now the company is going to change the distribution system, of overheads on the basis of Activity Based Costing (ABC) and the following significant activities were identified:

(i) Receiving material consignments from suppliers.

(ii) Setting up machines for production runs.,

(iii) Quality inspections and

(iv) Dispatching goods to customers.

(A) Machine operating and machine maintenance are apportioned as:

Material Stores 15%, Manufacturing Setup 70% and Goods dispatched 15%.

(B) Amount of Technician's wages was apportioned as:

Machine maintenance 30% with break-up as (A) above and balance 70% Technician's wages between Machine for Production Runs and Quality Inspection in the ratio of 4:3.

Show calculations up to two decimal points.

During the year the following Cost Drivers were identified for all products:

(i) 980 materials consignments were received from suppliers

(ii) 1,020 production runs were setup.

(iii) 640 Quality inspections were carried out and

(iv) 420 orders were dispatched to customers.

The following information is available for X, Y and Z products only for the year:

	Product X	Product Y	Product Z
Direct Materials (₹)	960	2,320	1,440
Direct labour hours worked	25	480	50
Materials consignments received	42	24.	28
Production Runs	16	18	12
Quality inspections	10	8	18
Orders (goods) dispatched	22	85	46
Quantity produced	560	12,800	2,400

Required:

(i) *Calculate per unit cost of product X, Y and Z, using Direct Labour hour absorption rate of overheads.*

(ii) *Calculate per unit cost of product X, Y and Z using ABC system for rate of overheads.*

Show calculations up to two decimal points. ***(10 Marks)***

(b) *Brown Limited has decided to analyse the profitability of its four retail customers. It buys product 'Jelly' at ₹ 218 per case and sells to them at list price less discount. The data pertaining to four customers are :*

	Customer			
	A	B	C	D
No. of cases sold	7,580	38,350	78,520	15,560
List selling price	250	250	₹ 250	₹ 250
Actual selling price	245	236	₹ 228	₹ 232
No. of sale visits	6	12	16	10
No. of purchase orders	12	18	35	24
No. of delivery Kilometres	280	350	450	400

It's four activities and cost drivers are:

Activity	Cost Driver Rate
Sale visits	₹750 per sale unit
Order taking	₹800 per purchase order
Deliveries	₹10.50 Per delivery Km travelled
Product handling cost	₹2.50 Per case sold

Required:

Compute the customer level operating income of each of four customers. Comment on the results and discount policy. ***(6 Marks)***

Answer

(a) (i) Single Factory Direct Labour Hour Overhead Rate = $\frac{₹2,48,000}{2,000 hrs.}$

= ₹124 per Direct Labour Hour

Computation of Unit Cost (Direct Labour Absorption Rate of Overheads)

	X (₹)	Y (₹)	Z (₹)
Direct Material	960	2,320	1,440
Direct Labour Cost @ ₹9.60 per Hour	240	4,608	480
Overheads (Hrs. × ₹124 per Hour)	3,100	59,520	6,200
Total Cost	4,300	66,448	8,120
Quantity Produced (No.s)	560	12,800	2,400
Cost *per unit*	7.68	5.19	3.38

(ii) Statement Showing Assignment of the Costs to Activities

₹' 000

Particulars	Receiving Material Consignments	Setting up	Quality Inspection	Dispatch	Total
Machine Operating Expenses (15:70:15)	15.00	70.00	---	15.00	100.00
Machine Maintenance Expenses (15:70:15)	3.00	14.00	---	3.00	20.00
Technician's Wages 30% (15:70:15)	3.06	14.28	---	3.06	20.40
Balance of Technicians Wages 70% (Allocated to Setting up and Quality Inspections) [4:3]	---	27.20	20.40	---	47.60
Wages of Store Receiving Men	28.00	---	---	---	28.00
Wages of Dispatch Staff	---	---	---	32.00	32.00
Total	49.06	125.48	20.40	53.06	248.00

Cost Driver Rate

Receiving Supplies $\left[\frac{₹49,060}{980 \text{Consignments}}\right]$ = ₹50.06 per Consignment

Performing Setups $\left[\frac{₹1,25,480}{1,020 \text{ProductionRuns}}\right]$ = ₹123.02 per Run

Dispatching Goods $\left[\frac{₹53,060}{420 \text{Orders}}\right]$ = ₹126.33 per Dispatch

Quality Inspection $\left[\frac{₹20,400}{640 \text{Inspections}}\right]$ = ₹31.88 per Quality Inspection

Statement Showing Assignment of Overhead Costs

Particulars	X	Y	Z
Receiving Supplies	₹ 2,102.52 (42 Receipts at ₹50.06)	₹ 1,201.44 (24 Receipts at ₹50.06)	₹1,401.68 (28 Receipts at ₹50.06)
Performing Setups	₹1,968.32 (16 Production Runs at ₹123.02)	₹2,214.36 (18 Production Runs at ₹123.02)	₹1,476.24 (12 Production Runs at ₹123.02)
Quality Inspections	₹318.80 (10 Inspections at ₹31.88)	₹255.04 (8 Inspections at ₹31.88)	₹573.84 (18 Inspections at ₹31.88)
Dispatching Goods	₹2,779.26 (22 Orders at ₹126.33)	₹10,738.05 (85 Orders at ₹126.33)	₹5,811.18 (46 Orders at ₹126.33)

Computation of Unit Cost (ABC System)

Particulars of Costs	X (₹)	Y (₹)	Z (₹)
Direct Materials	960.00	2,320.00	1,440.00
Direct Labour	240.00	4,608.00	480.00
Receiving Supplies	2,102.52	1,201.44	1,401.68
Performing Setups	1,968.32	2,214.36	1,476.24
Quality Inspections	318.80	255.04	573.84
Dispatching Goods	2,779.26	10,738.05	5,811.18

Total Costs	8,368.90	21,336.89	11,182.94
No of Units Produced	560	12,800	2,400
Cost *per unit*	14.94	1.67	4.66

(b) (i) Customer's Profitability Statement

Particulars	**Customer- A**	**Customer- B**	**Customer- C**	**Customer- D**
Sales (cases)	**7,580**	**38,350**	**78,520**	**15,560**
	(₹)	(₹)	(₹)	(₹)
List Price *per case*	250	250	250	250
Less: Discount (Quantity)	**5** (₹250 × 2%)	**14** (₹250 × 5.6%)	**22** (₹250 × 8.8%)	**18** (₹250 × 7.2%)
Actual Selling Price (Net of Discounts) *per case*	245	236	228	232
Less: Variable Cost *per unit*	218	218	218	218
Contribution *per unit*	27	18	10	14
Total Contribution	2,04,660 (₹27 × 7,580 units)	6,90,300 (₹18 × 38,350 units)	7,85,200 (₹10 × 78,520 units)	2,17,840 (₹14 × 15,560 units)
Less: Additional Overheads				
Visit Cost	4,500 (6 × ₹750)	9,000 (12 × ₹750)	12,000 (16 × ₹750)	7,500 (10 × ₹750)
Order Processing Cost	9,600 (12 × ₹800)	14,400 (18 × ₹800)	28,000 (35 × ₹800)	19,200 (24 × ₹800)
Delivery Cost	2,940 (280 × ₹10.50)	3,675 (350 × ₹10.50)	4,725 (450 × ₹10.50)	4,200 (400 × ₹10.50)
Product Handling Cost	18,950 (7,580 × ₹2.50)	95,875 (38,350 × ₹2.50)	1,96,300 (78,520 × ₹2.50)	38,900 (15,560 × ₹2.50)
Profit *per customer*	1,68,670 (11.8% of total)	5,67,350 (39.72% of total)	5,44,175 (38.10% of total)	1,48,040 (10.36% of total)
Profit *per customer per case*	**22.25**	14.79	6.93	9.51

Comment

Customer B is the most profitable customer, despite having only 48.84% of the unit volume of customer C. The main reason is that Customer C receives ₹22 per case discount while customer B receives only ₹14 per case discount. Customer D is less profitable, in comparison with customer A being profitable as customer D receives discount ₹18 per case. A has lower sales volume (only 5.4%), but it is contributing highest profit per case (₹22.25) as overall discount offered to customer A is quite less. Hence, company needs to review discount policy but *significance of profitability of customer B & C should also be kept in mind while doing so as they are contributing around 78% of total customer's profit and their order is for larger quantities*. Further, the reason for discount of ₹18 per case for customer D should be explored.

Question 5

(a) RFH Limited produces a product LEO for which the company has an assured market. The output for 2018 has been budgeted at 2,10,000 units at 80% capacity utilization. The cost sheet based on budgeted output (per unit) is as follows:

	(₹)
Selling price	*500*
Less: Direct material	*205*
Component X	*54*
Direct labour @ ₹48 per hour	*96*
Factory overheads (60% fixed)	*65*
Selling overheads (70% variable)	*30*
Administrative overheads (100% fixed)	*10*

Factory overheads are absorbed on direct labour hour basis.

RFH Limited at present manufactures component X, two units of which is required for the manufacture of one unit of product LEO. The cost details for 1,000 units of component X are as follows:

Direct material	*₹12,200*
Direct labour	*₹ 9,600*
Variable overheads	*₹3,200*
Fixed overheads	*₹2,000*

Component X can be brought from outside market at ₹ 26 per unit with minimum order of 78,000 units per annum.

To utilize the idle capacity and improve the profitability of the company, the following independent proposals were put up before the board of directors of the company:

(A) *An order has been received from abroad for 48,000 units of product RIO at a price of ₹ 466 per unit. Order can not be accepted partly. The cost data are: Direct material ₹ 239 per unit, direct labour 3 hours per unit, variable factory overheads are chargeable on the basis of direct labour hours. Variable selling overheads will increase by ₹ 2 per unit.*

(B) *Rent out the released capacity at ₹ 6 per hour.*

(C) *Manufacture component Z which has an assured market. Company can sell any number of units produced. Each unit of component Z requires 0.40 direct labour hour and will generate a contribution of ₹ 2.50 per unit.*

Required:

(i) *Prepare a statement of profitability under marginal costing. Show amount in Lakhs of ₹ with two decimal points.*

(ii) *Whether the component X should be manufactured or purchased from outside assuming there is no use of idle capacity.*

(iii) *Assuming Company has decided to buy component X from outside; which proposal for the use of idle/spare capacity will you select? Find out the increase in profits due to acceptance of those proposals.* ***(10 Marks)***

(b) *A company trading in motor vehicles spare parts wishes to determine the level of stock, it should carry for one of its costly item Z. Demand is not certain and lead time for stock replenishment is 2 days. (i.e. order is placed at the end of the day one, will arrive at the end of day three and will be available for day four) The probabilities of demand are given below:*

Demand (Units/day)	*Probability*
15	*0.25*
16	*0.20*
17	*0.15*
18	*0.18*
19	*0.12*
20	*0.10*

Carrying cost (per unit per day)…… ₹2.40

Ordering cost (per order)…… ₹150

Stock out cost (per unit)……... ₹ 125

Inventory carrying cost is calculated on the basis of average stock held per day. Stock in hand at the beginning of the simulation exercise was 52 units. Manager wants to order 50 units when present inventory plus any outstanding order falls below 50 units.

Required:

Using monte carlo simulation for 10 days, find out the total cost of inventory for the simulated period taking the following sequence of random numbers:

49	*39*	*94*	*16*	*81*	*60*	*92*	*63*	*13*	*73*

(6 Marks)

Answer

(a) (i) **Statement of Profitability**

	₹'lakhs 2,10,000 units	₹ Per unit
Sales	1,050	500.00
Less: Variable Costs		
Direct Material (2,10,000 units × ₹205)	430.50	205.00
Component X (2,10,000 units × 2 Nos. × ₹27)	113.40	54.00
Direct Labour (2,10,000 units × ₹48 × 2 hrs.)	201.60	96.00
Factory Overheads (2,10,000 units × ₹65 × 40%)	54.60	26.00
Selling Overheads (2,10,000 units × ₹30 × 70%)	44.10	21.00
Contribution	205.80	98.00
Less: Fixed Overheads		
Factory Overheads (2,10,000 units × ₹65 × 60%)	81.90	39.00
Selling Overheads (2,10,000 units × ₹30 × 30%)	18.90	9.00
Administrative Overheads (2,10,000 units ×₹10 ×100%)	21.00	10.00
Profit	**84.00**	40.00

(ii) Since the cost of purchase is more than cost of manufacturing by ₹1, hence component X should be manufactured as idle capacity is available.

Statement of Showing Cost to Make vs Buy

		₹ Per unit
Direct Material (₹12,200 units / 1,000 units)		12.20
Direct Labour (₹9,600 units / 1,000 units)		9.60
Variable Overheads (₹3,200 units / 1,000 units)		3.20
Relevant Make Cost	…(A)	25.00
Relevant Buy Cost	…(B)	26.00
Excess Buy Cost	…(A) - (B)	1.00

(iii) Statement of Showing Contribution per unit "RIO"

	₹ Per unit
Export Price	466
Less: Variable Cost	
Direct Material	239
Direct Labour (₹48 × 3 hrs.)	144
Variable Factory Overheads (₹13 × 3 hrs.)	39
Variable Selling Overheads (₹21 + ₹2)	23
Contribution	21

Statement Showing Rank of Proposals

Particulars	Proposal A	Proposal B	Proposal C
Contribution (₹/u)	21.00	6.00	2.50
Hrs. *per unit*	3.00	1.00	0.40
Rate (p/h)	7.00	6.00	6.25
Rank	I	III	II

Hence, company should utilize the Idle/ Spare capacity to execute export order first and then remaining idle capacity should be used to manufacture component Z.

Capacity Utilization and Production Analysis

Hours used to manufacture LEO = 2,10,000 units × 2 hrs.

= 4,20,000 hrs.

Hours used to manufacture Component X = $84{,}000 \text{ hrs.} \left(\frac{₹\ 9{,}600 \times 2 \text{ hrs.} \times 2{,}10{,}000 \text{ units}}{₹\ 48 \text{ hrs.} \times 1{,}000 \text{ units}} \right)$

Total hours used at 80% Capacity = 4,20,000 hrs. + 84,000 hrs.

= 5,04,000 hrs.

Total hours at Full Capacity = $6{,}30{,}000 \text{ hrs.} \left(\frac{5{,}04{,}000 \text{ hrs.}}{80\%} \right)$

Hours Available at Balance Capacity (20%)

= 6,30,000 hrs. – 5,04,000 hrs.

= **1,26,000 hrs.**

Hours Released Component X = 84,000 hrs

Total Hours Available	=	1,26,000 hrs. + 84,000 hrs. (Component X)
	=	**2,10,000 hrs.**
Hours Required for RIO (Rank-I)	=	48,000 units × 3 hrs.
	=	1,44,000 hrs.
Balance Hours	=	2,10,000 hrs. - 1,44,000 hrs.
	=	66,000 hrs.
Production of Z	=	1,65,000 units $\left(\frac{66,000\text{ hrs.}}{0.40\text{ hr.}}\right)$

Statement of Showing Incremental Contribution

	₹ RIO	₹ Z
Number of Units	48,000	1,65,000
Contribution (₹/u)	21	2.5
Total Contribution	10,08,000	4,12,500
Less: Opportunity Cost of Not Manufacturing Component X (₹1 × 2,10,000 × 2 in Ratio of hrs. 18,000:66,000)	(90,000)	(3,30,000)
Contribution	9,18,000	82,500

Total Profit of RFH Ltd. will increase by ₹10,00,500

☞

This question can also be solved by **evaluating *individual proposals*** *against the present budgeted profitability statement*.

(b) Random No. Allocation

Demand (Units/ day)	Probability	Cumulative Probability	Random Numbers
15	0.25	0.25	00 – 24
16	0.20	0.45	25 – 44
17	0.15	0.60	45 – 59
18	0.18	0.78	60 – 77
19	0.12	0.90	78 – 89
20	0.10	1.00	90 – 99

Simulation Sheet

Day	R. No. of Demand	Opening Stock	Demand	Sales Pcs.	Balance	Order Received	Total Closing Inventory	Order Initiated	Stock Out
1	49	52	17	17	35	---	35	50	---
2	39	35	16	16	19	---	19	---	---
3	94	19	20	19	---	50	50	---	1
4	16	50	15	15	35	---	35	50	---
5	81	35	19	19	16	---	16	---	---
6	60	16	18	16	---	50	50	---	2
7	92	50	20	20	30	---	30	50	---
8	63	30	18	18	12	---	12	---	---
9	13	12	15	12	---	50	50	---	3
10	73	50	18	18	32	---	32	50	---
		349					329		6

Statement Showing 'Total Cost of Inventory'

	Amount (₹)
Carrying Cost {349 units + 329 units)/2 × ₹2.40}	813.60
Ordering Cost (4 Orders × ₹150)	600.00
Stock Out Cost (6 units × ₹125)	750.00
Total	2,163.60

Question 6

(a) The time and cost estimate and precedence relationship of the different activities constituting a project are given below:

Activity	*Immediate Predecessor*	*Normal*		*Crash*	
		Time (days)	*Cost (₹)*	*Time (days)*	*Cost (₹)*
A	*None*	*8*	*50,000*	*7*	*62,500*
B	*None*	*8*	*90,000*	*6*	*1,20,000*
C	*B*	*10*	*1,50,000*	*8*	*1,85,000*
D	*B*	*12*	*1,80,000*	*10*	*2,20,000*
E	*A*	*14*	*1,96,000*	*14*	*1,96,000*

F	A	11	1,08,000	9	1,29,000
G	F	5	96,000	3	1,16,000
H	C, E, G	9	1,25,000	8	1,40,000
I	F	10	75,500	8	99,500

The contract includes a penalty of ₹ 12,500 per day over 30 days. The indirect cost per day of project is ₹ 10,500.

Required:

(i) Draw the project network and indicate the critical path,

(ii) Find the normal duration and cost of the project.

(iii) Optimum duration and associated cost.

(iv) Lowest time and associated cost. ***(8 Marks)***

(b) Given below is an iteration in a simplex table for a maximization objective linear programming product mix problem for products X, Y and Z. Each of these products is processed in three machines KA-07, KB-27 and KC-49 and each machine has limited available hours.

Cj→			30	40	20	0	0	0
C_B	Basis Variable (B)	Value of basic Variables b(=X_B)	x	y	z	s_1	s_2	s_3
30	x	250	1	0	-26/16	10/16	-12/16	0
40	y	625	0	1	31/16	-7/16	10/16	0
0	s_3	125	0	0	11/16	-3/16	1/8	1

S_1 S_2 and S_3 are slack variables for machine KA-07, KB-27 and KC-49 respectively.

Answer the following questions, giving appropriate reasons in brief:

(i) Does the above table give an 'Optimal Solution'?

(ii) Is there more than one 'Optimal Solution'/'Alternative optimal Solution'?

(iii) Is this solution feasible?

(iv) Is this solution 'degenerate'?

(v) Write down the 'objective function' of the problem.

(vi) Write the 'optimal product mix' and 'profit' shown by the above solution.

(vii) Which of these machines are being used to the full capacity when producing according to this solution?

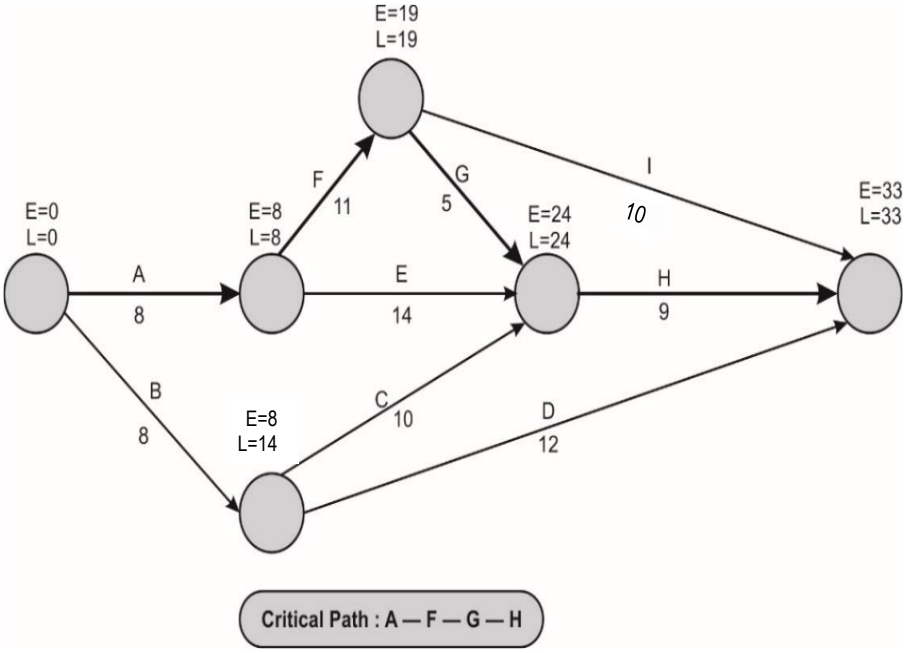
(viii) If the company wishes to expand the production capacity, which of three resources should be given priority?

(ix) What happens if 16 machine hours are lost due to some mechanical problems in Machine KB-27?

(x) A customer would like to have one unit of product Z and is willing to pay higher price for Z in order to get it. How much should the price be increased so that the company's profit remains unchanged? ***(8 Marks)***

Answer

(a) (i) The network for the given problem



(ii) Normal Duration = 33 Days

Cost of Project = ₹14,54,500

(Refer Statement Showing Project Cost & Duration)

(iii) Optimum Duration = 30 Days

Associated Cost = ₹14,18,000

(Refer Statement Showing Project Cost & Duration)

(iv) Lowest Time = 29 Days

Associated Cost = ₹14,22,500

(Refer Statement Showing Project Cost & Duration)

Workings

Statement Showing "Project Cost & Duration"

Project Length Days	Job Crashed	Crashing Cost	Normal Cost	Indirect Cost	Penalty	Total Cost
33	–	–	₹10,70,500	₹3,46,500 (₹10,500 × 33 Days)	₹37,500 (₹12,500 × 3 Days)	**₹14,54,500**
31	G	₹20,000 (₹10,000 × 2 Days)	₹10,70,500	₹3,25,500 (₹10,500 × 31 Days)	₹12,500 (₹12,500 × 1 Day)	₹14,28,500
30	A	₹32,500 (₹20,000 + ₹12,500 × 1 Day)	₹10,70,500	₹3,15,000 (₹10,500 × 30 Days)	₹0 (₹12,500 × 0 Days)	**₹14,18,000**
29	H	₹47,500 (₹32,500 + ₹15,000 × 1 Day)	₹10,70,500	₹3,04,500 (₹10,500 × 29 Days)	₹0 (₹12,500 × 0 Days)	**₹14,22,500**

Statement Showing "Cost Slope of *each activity*"

Activity	Normal		Crash		Cost Slopes		
	Duration (Days)	Cost (₹)	Duration (Days)	Cost (₹)	T (Days)	C (₹)	C/T (₹)
A	8	50,000	7	62,500	1	12,500	12,500
B	8	90,000	6	1,20,000	2	30,000	15,000
C	10	1,50,000	8	1,85,000	2	35,000	17,500
D	12	1,80,000	10	2,20,000	2	40,000	20,000
E	14	1,96,000	14	1,96,000	---	---	---
F	11	1,08,000	9	1,29,000	2	21,000	10,500
G	5	96,000	3	1,16,000	2	20,000	10,000
H	9	1,25,000	8	1,40,000	1	15,000	15,000
I	10	75,500	8	99,500	2	24,000	12,000

(b) (i) Yes, the given solution is optimal because all $C_j - Z_j$ are less than, or equal to, zero.

$C_j \rightarrow$			30	40	20	0	0	0
C_B	Basic Variable (B)	Value of Basic Variables b (=X_B)	x	y	z	s_1	s_2	s_3
30	x	250	1	0	-26/16	10/16	-12/16	0
40	y	625	0	1	31/16	-7/16	10/16	0
0	s_3	125	0	0	11/16	-3/16	1/8	1
		$Z_j = \sum C_{Bi}X_j$	30	40	115/4	5/4	5/2	0
		$C_j - Z_j$	0	0	-35/4	-5/4	-5/2	0

(ii) No, because for each of the non - basic variables z, s_1 and s_2, the $C_j - Z_j$ is strictly negative. Alternate optimal solution (s) exist when either of non-basic variables has a zero $C_j - Z_j$.

Non- Basic Variables	z	s_1	s_2
$C_j - Z_j$	-35/4	-5/4	-5/2

(iii) Yes, because the given solution has no artificial variable in the basis.

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

Basic Variables	x	y	s_3
Quantity	250	625	125

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

(v) Maximize Z = 30x + 40y + 20z

(vi) According to the given solution, 250 units of x and 625 units of y are being produced. The total profit is ₹32,500 (250 units × ₹30 + 625 units × ₹40).

(vii) Machine KA-07 and KB-27 are being used to the full capacity because, the slack variable s1 and s2 corresponding to them has a zero value in the solution.

(viii) Machine KB-27 may be given priority as its shadow price is the highest.

(ix) When 16 hours are lost, then production of x would increase by 12 units and that of y would decrease by 10 units and the total profit decrease by ₹40.

(x) Cj − Zj for z being -35/4, production of each unit of z would cause a reduction of 35/4 rupee. Thus, the price for z should be increased by at least 35/4 rupee to ensure no reduction of profits.

Question 7

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

(a) YAM Ltd. a manufacturing company is going to implement JIT system. You are required to state with reasons whether the following recommendations are valid or invalid:

(i) Introduction of piece rate system of payment of wages to workers.

(ii) It has been decided to introduce Kanban Card and Machine cells together in order to reduce the defective products.

(iii) Use of highly automated and costly machines to the full capacity.

(iv) Employ those workers who can operate and maintain single machine so that the work can be done effectively.

(b) Define Degeneracy and Prohibited routes.

(c) Discuss the role of central body in inter firm comparison.

(d) What are the essential requirements for implementing performance budgeting?

(e) Explain the various standards and their significance. (Any four) ***(4 × 4 = 16 Marks)***

Answer

(a)

S.No.	Recommendations to Implement JIT	Valid or Invalid with Reason
(i)	Introduction of piece rate system of payment of wages to workers.	**Invalid** A JIT system focuses on producing only what is needed. So, an employee who has incentive to create vast piles of stock is contrary to rules of system. Thus, any piece rate system must be eliminated and replaced with measures that focus on quality of output.
(ii)	It has been decided to introduce Kanban Card and Machine cells together in order to reduce the defective products	**Valid** Both kanbans and machine cells should be used together—they are not mutually exclusive. By doing so a company can achieve extremely low product defect rates, as well as vanishingly small investments in work-in-process inventory
(iii)	Use of highly automated and costly machines to the full capacity.	**Invalid** Use of highly automated and costly machines to the full capacity, can result in large amount of inventory piling up in the warehouse. This is generally done in

		traditional system but not a desirable end result in a JIT environment, where producing only what is actually needed is the underlying rule.
(iv)	Employ those workers who can operate and maintain single machine so that work can be done effectively.	**Invalid** In JIT environment each worker should have responsibility for a number of machines. Company must organise training classes to teach employees how to operate a multitude of different machines, perform maintenance on machines without having call maintenance staff, spot product errors and when to halt production process to fix problems.

Conceptual correct **brief reason** along with the validity of recommendation (valid or invalid) is sufficient.

(b) Degeneracy

A transportation problem's solution has m+n-1 basic variables, (where 'm' and 'n' are the number of rows and columns respectively) which means that the number of occupied cells in the initial basic solution are one less than the number of rows and number of columns.

When the number of occupied cells in an initial basic solution are less than m+n-1, the solution is called a degenerate solution.

Prohibited Routes

Sometimes in a given transportation problem, some routes may not be available. There could be several reasons for this such as bad road conditions or strike etc. In such situations, there is a restriction on the route available for transportation. To handle such type of a situation, a very large cost (or a negative profit for the maximization problem) represented by ∞ or 'M' is assigned to each of such routes which are not available. Due to assignment of very large cost, such routes would automatically be eliminated in the final solution. The problem is the solved in its usual way.

(c) Role of Central body for Inter-Comparison: For collection and analysing data received from member units, for doing a comparative study and for dissemination of the results of study a Central body is necessary. The functions of such a body may be:

(i) Collection of data and information from its members;

(ii) Dissemination of results to its members;

(iii) Undertaking research and development for common and individual benefit of its members;

(iv) Organising training programmes and publishing magazines

(d) A **Performance Budget (PB)** is one which presents the purposes and objectives for which funds are required, the costs of the programmes proposed for achieving those objectives, and quantities data measuring the accomplishments and work performed under each programme. For an enterprise that wants to adopt PB, it is thus imperative that:

- The objectives of the enterprise are spelt out in concrete terms.
- The objectives are then translated into specific functions, programmes, activities and tasks for different levels of management within the realities of fiscal; constraints;
- Realistic and acceptable norms, yardsticks or standards and performance indicators should be evolved and expressed in quantifiable physical units.
- A style of management based upon decentralized responsibility structure should be adopted, and
- An accounting and reporting system should be developed to facilities monitoring, analysis and review of actual performance in relation to budgets.

(e) Various types of standards used in Standard Costing are as below:

(i) Ideal Standards

These represent the level of performance attainable when prices for material and labour are most favourable, when the highest output is achieved with the best equipment and layout and when the maximum efficiency in utilisation of resources results in maximum output with minimum cost.

These standards are representative of long term goals rather than for short term performance measurement.

(ii) Normal Standards

These are standards that may be achieved under normal operating conditions. The normal activity has been defined as "the number of standard hours which will produce at normal efficiency sufficient good to meet the average sales demand over a term of years". These standards are, however, difficult to set because they require a degree of forecasting. The variances thrown out under this system are deviations from normal efficiency, normal sales volume, or normal production volume. If the actual performance is found to be abnormal, large variances may result and necessitate revision of standards.

Normal standards act as a good yardstick that represents challenging yet attainable results and can be used by management in such environment which is simple in nature and is not prone to great fluctuations.

(iii) Basic or Bogey Standards

These standards are used only when they are likely to remain constant or unaltered over a long period. According to this standard, *a base year is chosen for comparison purposes* in the same way as statisticians use price indices. Since basic standards

do not represent what should be attained in the present period, current standards should also be prepared if basic standards are used. Basic standards are, however, well suited to businesses having a small range of products and long production runs. Basic standards are set, on a long-term basis and are seldom revised. When basic standards are in use, variances are not calculated. Instead, the actual cost is expressed as a percentage of basic cost. The current cost is also similarly expressed and the two percentages are compared to find out how much the actual cost has deviated from the current standard. The percentages are next compared with those of the previous periods to establish the trend of actual and current standard from basic cost.

(iv) Current Standards: These standards reflect the management's anticipation of what actual costs will be *for the current period*. These are the costs which the business will incur if the anticipated prices are paid for the goods and services and the usage corresponds to that believed to be necessary to produce the planned output.

The variances arising from expected standards represent the degree of efficiency in usage of the factors of production, variation in prices paid for materials and services and difference in the volume of production.