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PAPER – 5 : ADVANCED MANAGEMENT ACCOUNTING

Question No.1. is compulsory.

Answer any five out of the remaining six questions

Working notes should form part of the answer.

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

Graph sheet will be provided to candidates along with this paper.

Question 1

- (a) A company has decided to launch a new product X which is, expected to have demand of 10,000 units during the year at ₹160 per unit. The following information is furnished by the company:

- (i) Material - The manufacture of one unit of X requires one unit of each of materials A, B and C.

Raw Material	Current stock (units)	Cost per unit (₹)		
		Original cost	Current Purchase Price	Resale Value
A- Regularly being used	10,000	16	20	14
B- Old stock (Not in use)	6,000	28	24	8
C- New stock	---	---	48	---

- (ii) Direct labour

Skilled labour is paid at ₹80 per hour. It takes 0.25 hours/unit. Skilled labour has to be drawn from another production line which has a contribution of ₹240 per unit, with each unit requiring 2 hours of skilled labour.

Unskilled labour - 2 hours/unit @ ₹56 per hour. There is abundant Unskilled labour in the factory, but according to an agreement with the labour union, no unskilled worker can be retrenched.

- (iii) Variable overhead - ₹10 per unit.

- (iv) Fixed Costs –no increase.

Using relevant cost approach, you are required to find out the average variable cost per unit of X. (5 Marks)

- (b) The following table gives the unit transportation costs and the quantities demanded/supplied at different locations for a minimization problem:

Demand \ Supply	C_1	C_2	C_3	C_4	Total Units
R_1	100	120	200	110	20000
R_2	160	80	140	120	38000
R_3	180	140	60	100	16000
Total Units	10000	18000	22000	24000	

You are required to find out which cell gets the 3rd allocation in the initial basic feasible solution under each of the following methods and to give the cell reference, cost per unit of that cell and the quantity allocated to that cell :

- (i) North West Corner Rule
- (ii) Vogel's Approximation Method
- (iii) Least Cost Method

(Candidates may use the standard notation of $C_i R_j$ for cell reference.(e.g. $C_2 R_3$ means the cell at the intersection of Column 2 and Row 3)

(Note: The full solution is not required to be worked out). (5 Marks)

- (c) XY Ltd. makes two products X and Y, whose respective fixed costs are F_1 and F_2 . You are given that the unit contribution of Y is one-fifth less than the unit contribution of X, that the total of F_1 and F_2 is ₹1,50,000, that the BEP of X is 1,800 units (for BEP of X F_2 is not considered) and that 3,000 units is the indifference point between X and Y.(i.e. X and Y make equal profits at 3,000 unit volume, considering their respective fixed costs). There is no inventory build up as whatever is produced is sold.

You are required to find out the values F_1 and F_2 and units contributions of X and Y.

(5 Marks)

- (d) State whether each of the following independent activities is value-added or non-value-added:

- (i) Polishing of furniture used by a systems engineer in a software firm.
- (ii) Maintenance by a software company of receivables management software for a banking company.
- (iii) Painting of pencils manufactured by a pencil factory.
- (iv) Cleaning of customers' computer key boards by a computer repair centre.
- (v) Providing, brake adjustments in cars received for service by a car service station.

(5 Marks)

Answers

(a) Average variable cost per unit of X

Cost Element	Relevancy		Total Cost (10,000 units) ₹	Average Cost per unit ₹
Raw material A	Replacement Cost	Current Purchase price	2,00,000	20.00
Raw material B	Opportunity Cost	Opportunity Cost (6,000 units * ₹8 per unit)	48,000	
Raw material B	Incremental Cost	Current Purchase Price (4000 units * ₹24 per unit)	96,000	
		Sub total- Raw material B	1,44,000	14.40
Raw material C	Incremental Cost	Current Purchase Price (10,000 units * ₹48 per unit)	4,80,000	48.00
Skilled Labour	Opportunity Cost	Contribution Lost $10,000 \times 0.25 \times 240/2$	3,00,000	30.00
Unskilled Labour	Sunk Cost		NIL	NIL
Variable Overhead	Incremental Cost	10,000* ₹10 per unit	<u>1,00,000</u>	<u>10.00</u>
		TOTAL	<u>12,24,000</u>	<u>122.40</u>

(b)

Sl. No	Method	Cell Reference	Cost/unit	Quantity
		I	II	III
i)	North West Corner Rule	C ₂ R ₂	80	8,000
ii)	Vogel's method	C ₃ R ₂	140	6,000
		or		
		C ₁ R ₁	100	10,000
iii)	Least Cost Method	C ₁ R ₁	100	10,000

(c)

Let C_x be the Contribution per unit of Product X.

Therefore Contribution per unit of Product Y $= C_y = 4/5 C_x = 0.8 C_x$

Given $F_1 + F_2 = 1,50,000$,

$F_1 = 1,800 C_x$ (Break even volume * contribution per unit)

Therefore $F_2 = 1,50,000 - 1,800 C_x$.

$3,000 C_x - F_1 = 3,000 * 0.8 C_x - F_2$ or $3,000 C_x - F_1 = 2,400 C_x - F_2$ (Indifference point)

ie., $3,000 C_x - 1,800 C_x = 2,400 C_x - 1,50,000 + 1,800 C_x$

ie., $3,000 C_x = 1,50,000$, Therefore $C_x = ₹ 50/-$ ($1,50,000 / 3,000$)

Therefore Contribution per unit of X = ₹ 50

Fixed Cost of X = $F_1 = ₹ 90,000$ ($1,800 * 50$)

Therefore Contribution per unit of Y is $₹ 50 * 0.8 = ₹ 40$ and

Fixed cost of Y = $F_2 = ₹ 60,000$ ($1,50,000 - 90,000$)

The value of $F_1 = ₹ 90,000$, $F_2 = ₹ 60,000$ and X = ₹ 50 and ₹ 40

(d)

Sl. No	Item	
i)	Polishing furniture used by a Systems Engineer in a software firm	Non-value added
ii)	Maintenance by a software company of receivables management software for a banking company	Value-added
iii)	Painting of pencils manufactured by a pencil factory	Value-added
iv)	Customers' computer key board cleaning by a computer repair centre	Value-added
v)	Providing brake adjustments in cars for repairs by a care service station.	Value-added

Question 2

- (a) AB Ltd. makes component 'C' and billing machines. Division A makes component 'C' that is used in the final assembly of the machine in Division B.

(One unit of Component 'C' is used per machine). Component C has an outside market also. A and B operate as profit centres and each can take its own decisions. The following data is given in the existing scenario for Divisions A and B, under which Division A has enough special and external demand to use its capacity and hence is offering B rates of 800 ₹/Unit for quantity up to 750 units and 900 Rs/unit for more than 750 units, so that its outside contribution is not affected by transfers to B. A

and B can sell any quantity up to the maximum indicated under 'units sold', without affecting their future demands.

	Division A		Division B	
	External Market (normal sales)	Special sales	External Market (normal sales)	
Selling Price (₹/u)	1,000	800	4,000	
Variable manufacturing cost (₹/u)	600	600	1,500*	(* excluding component C)
Variable selling cost (₹/u)	100**	--	200**	(** Not incurred on inter division transfers)
Total variable cost (₹/unit)	700	600	1,700*	(* excluding component C)
Contribution (₹/unit)	300	200		
Units Sold	1,250	750	900	
Production capacity	2,000 units		900 units	

For the next period, A requires for its own use in its selling outlets, 50 units of billing machines produced by B. B's manager proposes as follows:

Option I - B will supply 50 machines to A on its variable manufacturing cost basis provided A supplies to B, 500 units of Component C at A's variable manufacturing cost basis.

Option II - Both A and B resort to total variable cost per unit basis applicable to normal external sale, though neither A nor B incurs any selling cost on inter division transfers. A will be given 50 machines for its use. A will have to supply B all the 900 units that B requires.

Option III - Both A and B use the external market selling price (i.e. 1,000 and 4,000 ₹/Unit for 900 units of Component 'C' and 50 machines respectively).

From a financial perspective, advise Division A's manager what he should choose. Support your advice with relevant figures.

What is the change in the rate of discount per unit given by B to A (based on unit transfer price to market price ratio) from option I to option II?

(Note: Students need not work out the total cost statements. Steps showing relevant figures for evaluation are sufficient). (10 Marks)

- (b) The standard set for a chemical mixture of a company is as under:

Material	Standard Mix(%)	Standard Price ₹/Kg
A	80	50
B	20	100

Standard yield in production is 75 %.

The actual quantity produced was 1800 kg of output from the following:

Material	Quantity (kg)	Actual Price
A	1400	60
B	600	90

Calculate the total material price, mix and yield variances, indicating whether they are favorable (F) or adverse (A or U). (6 Marks)

Answer

- (a) Note : The basic strategy for division A is to first divert the Special Sales and then the Normal Sales in the external market to minimize the opportunity loss. The analysis is done on this basis.

	Option 1	Option 2	Option 3
Opportunity Lost (Units)			
Special Sales	500	750	750
External Market	-	150	150
Agreed Selling Price by Division A	600	700	1,000
Agreed Selling Price by Division B (Including the Transfer price of Division A)	2,100	2,400	4,000
Contribution (Lost) / Gain ₹ per unit			
Special Sales	(200)	(100)	200
External Market	-	(200)	100
Total Contribution (Lost) / Gain (₹)			
Special Sales	(1,00,000)	(75,000)	1,50,000

External Market	-	(30,000)	15,000
Total	(1,00,000)	(1,05,000)	1,65,000
Contribution Gain per unit by buying from B (₹/u)	1,900	1,600	-
Total Contribution Gained (50 Machines) ₹	95,000	80,000	-
Net Contribution Gained (50 Machines) ₹	(5,000)	(25,000)	165,000

Decision : Option 3 is preferred.

Rate of change in discount $(1900 - 1600)/4000 = 7.5\%$

(b)

	(I) SP x SQ	(II) SP x RSQ	(III) SP x AQ	(IV) AQ x AP
A	50*1920 = 96,000	50*1600 = 80,000	50*1400 = 70,000	1400*60 = 84,000
B	100*480 = 48,000	100*400 = 40,000	100*600 = 60,000	600*90 = 54,000
TOTAL	1,44,000	1,20,000	1,30,000	1,38,000

SP- Standard Price per Kg, SQ- Standard Quantity for actual production

RSQ- Revised Standard Quantity, AQ- Actual Quantity used, AP- Actual Price per kg.

Variances : (Figures ₹)

Variances	Material Yield Variance (I-II)	Material Mix Variance (II-III)	Material Price Variance (III-IV)
A	16,000 F	10,000 F	14,000 A
B	8,000 F	20,000 A	6,000 F
TOTAL	24,000 F	10,000 A	8,000 A

Note : Standard Input = $1800 / 0.75 = 2,400$ kgs. Hence Standard quantity of A is $2,400 * 0.8 = 1920$ kgs and B = $2400 * 0.2 = 480$ kgs.

Question 3

- (a) A company is operating at 60 % of its capacity with a turnover of ₹ 43.20 lacs. If the company works at 100 % capacity, the sales-cost relation is:

Factory cost is two thirds of sales value. Prime cost is 75% of factory cost. Administration and selling expenses (75% variable) are 20% of the sales value. Factory overhead will vary according to operating capacity as given below:

Operating capacity (%)	60	80	100	120
Factory overheads (₹ in lacs)	9.90	10.80	12	15

The company has planned to operate at 80 % of its capacity. Moreover, it has received an export order and its execution will involve 40 % of the capacity.

The prime cost of the order is estimated at ₹6.0 lacs and the shipping involved will be around ₹ 1.0 lac. Administration and selling expenses will be avoided on the export order. Taking the same percentage of profits as on the domestic sales, determine the minimum price to be quoted for the export order. (8 Marks)

- (b) In a transportation problem for cost minimization, there are 4 rows indicating quantities demanded and this totals up to 1,200 units. There are 4 columns giving quantities supplied. This totals up to 1,400 units. What is the condition for a solution to be degenerate? (3 Marks)
- (c) State with a brief reason whether you would recommend an activity based system of costing in each of the following independent situations:
- (i) Company K produces one product. The overhead costs mainly consist of depreciation.
 - (ii) Company L produces 5 different products using different production facilities.
 - (iii) A consultancy firm consisting of lawyers, accountants and computer engineers provides management consultancy services to clients.
 - (iv) Company S produces two different labour intensive products. The contribution per unit in both products is very high. The BEP is very low. All the work is carried on efficiently to meet the target costs. (5 Marks)

Answer

(a)

	Capacity	
	80% (Domestic sale)	40% (Export order)
	₹ in lakhs	
Sales Value	57.60	
Prime cost (50% of Sales Value ie., $2/3 \times 75\%$)	28.80	6.00
Fixed Cost (Factory Overheads, as given)	10.80	4.20
Administration and selling - variable ($20\% \times 75\% = 15\%$ of Sales Value)	8.64	
- fixed	3.60	
Shipping		1.00
Total Cost	51.84	11.20

Profit	5.76	
Add : Profit (Domestic Profit @80% Capacity = 10% of Sales. Hence 11.11% on Cost)		1.24
Minimum Export price		12.44

- (b) The condition for degeneracy is that the number of allocations in a solution is less than $m+n-1$.

The given problem is an unbalanced situation and hence a dummy row is to be added, since the Column quantity is greater than that of the Row quantity. The total number of Rows and Columns then = 9 i.e. (5+4). Therefore, $m+n-1 = 8$, i.e. if the number of allocations is less than 8, then degeneracy would occur.

- (c)

Sl. No	Description	Recommend ABC Yes/No	Reason
i)	K produces one product. Overhead is mainly depreciation	No	- One product situation. For allocation of overhead, ABC is not required. - ABC for cost reduction not beneficial since most of the overhead is depreciation.
ii)	L produces 5 different products with different facilities.	Yes	- Multi product situation. ABC is required for allocation of overhead. - ABC is necessary for pricing. - Cost drivers are likely to be different. - Cost reduction may be possible. - Production facilities are different.
iii)	Professional services – lawyers/ accountants/ computer engineers	Yes	- Variety of services. Hence ABC is required for cost allocation. - Services are very different. - ABC is necessary for pricing. - Cost reduction possible.
iv)	S produces 2 different labour intensive products. High unit contribution and efficient operations.	No	- Different products, but labour intensive. Hence, overhead allocation based on readily traceable direct labour cost will be accurate. Hence, ABC not required for cost allocation. - Low BEP level implies low level of fixed cost as a % of sale price or as a % of

			total cost. Many fixed cost activity drivers are likely to align with the direct labour costs. Hence not required for cost allocation. Efficient operation. Hence ABC not required even for cost reduction or ABC management.
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Question 4

- (a) Ezee Ltd makes two products, E and Z. All units produced are sold. There is no inventory build up. Production facilities may be used interchangeably for both the products. Sales units are the limiting factor. The following information is given:

	Price Level			Proposed increase
	E	Z	Total	Total
Contribution ₹/units	25	20		
Fixed Cost ₹			46,000	47,500
Sales units (nos)	3,000	2,000	5,000	4,000

For increase in quantities above 4,000 units for each product, there will be an increase in variable selling costs, (for the increased portion only), thereby reducing the contribution per unit to the following figures:

Units	Contribution per unit (₹)	
	E	Z
4001-5000	20	15
5001-6000	15	10
Above 6000	No Sales possible	

- For the present level, find the break-even point with the present product
- What is the minimum number of incremental units to be sold to recover the additional fixed cost off ₹ 47,500 to be incurred? (Present product mix need not be maintained):
- If you are allowed to choose the best product mix for the incremental level, (while taking the present mix given in the first table above for the present level), what would be the individual product quantities and the corresponding total contributions, the total average contribution per unit and the total profits for the complete production? (8 Marks)

(b) The following linear program is presented to you:

Objective: Maximize $Z = 30x + 45Y$

Subject to: (i) $2x + 3y \leq 1,440$

(ii) $9x + 12y \geq 2,160$

(iii) $3x + 4y \geq 1,080$

(iv) $x, y \geq 0$

You are required to draw the graph taking quantities of x and y in the respective axes in steps of 60 units (scale 1 cm. = 60 units), determine the optimality and offer your comments on the solution and the constraints. (8 Marks)

Answer

(a) (i) Present Level:

Weighted average contribution per unit

$(3,000 \times 25 + 2,000 \times 20)/(3,000 + 2,000)$ Or, $(3 \times 25 + 2 \times 20)/(2+3) = 23 \text{ ₹/unit.}$

BEP = Present level Fixed cost/ weighted average Contribution per unit

$= 46,000/23 = 2000 \text{ units.}$

or (E 1200 units & Z 800 units)

(ii) Minimum units for incremental level:

next 1,000 units of E get contribution of $25 \times 1000 = 25,000$

next 1,000 units of E or Z get 20/unit as Contribution = 20,000

next 125 units of E or Z get 20/unit as Contribution = 2,500

Total 2,125 units are the minimum requirement for 47,500

incremental fixed cost

Minimum units required:

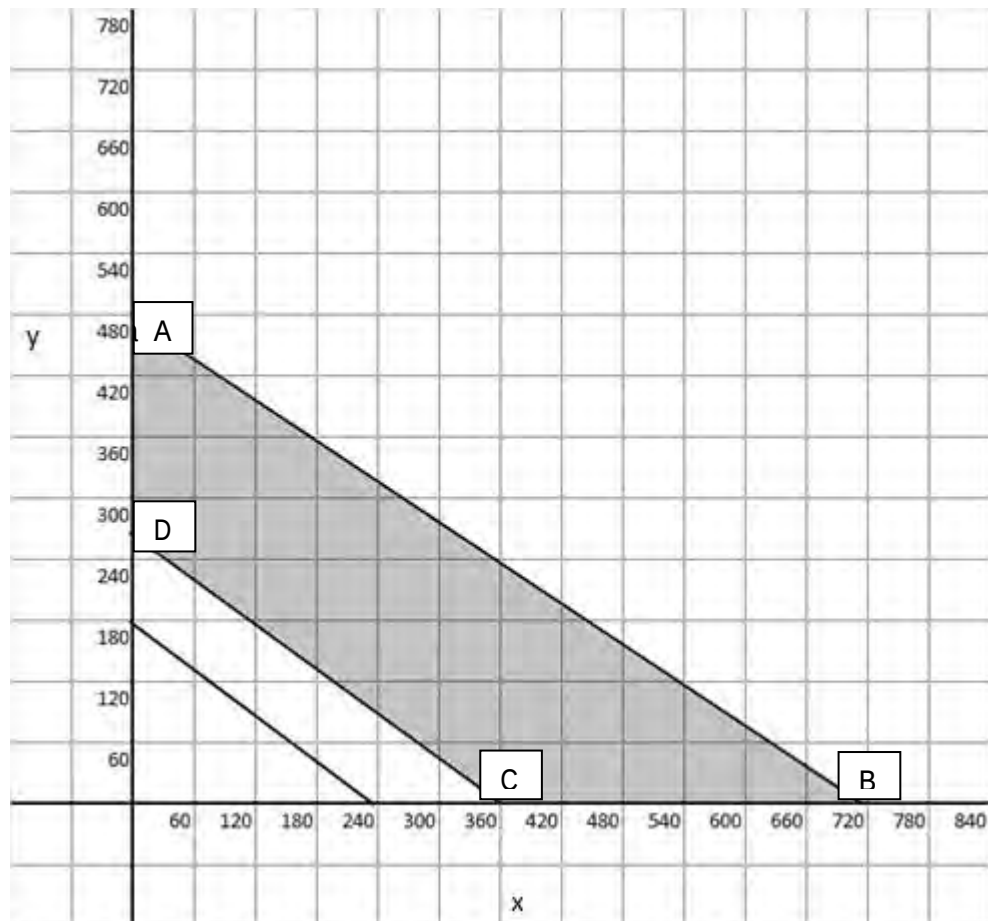
E	Z	Total
2,000	125	2,125
or		
1,000	1,125	2,125

(iii) Optimal profit – best mix:

	Product E		Product Z		Total quantity
	Units	Contribution/u	Units	Contribution/u	
Present	3,000	25	2,000	20	5,000

Next	1,000	25			1,000
Next	1,000	20	1,000	20	2,000
Next	-	-	1,000	20	1,000
Total for best mix	5,000		4,000		
Contribution value (₹)	4,000 x 25 + 1,000 x20 = 1,20,000		4,000 x 20 = 80,000		2,00,000
Average Contribution per unit (₹) = 2,00,000 / 9,000 = 22.22					
Maximum profits (₹) = 2,00,000 – 93,500 = 1,06,500					

(b)



Boundary points

	x	y	Max Profit	
A	0	480	21,600	*
B	720	0	21,600	*
C	360	0	10,800	
D	0	270	12,150	
* Optimum profit.				

Comment: 1 – Solution – Multiple Optimal solution exists because the objective function line $30x + 45y$ falls on the constraint line $2x+3y$ i.e., any point on the line will yield the same profit of ₹ 21,600/-.

Comment 2: - Constraint –Between Constraints (ii) $9x+12y \geq 2,160$ and (iii) $3x+4y \geq 1,080$ in the problem, constraint (iii) dominates constraint (ii).

Question 5.

(a) A machine manufacturing company needs four components A, B, C and D.

The components may be procured from outside. The cost, market price for the components and other information are given below.

Number of units required	3,000	3,500	2,000	3,000
	Figs. ₹ per unit			
	A	B	C	D
Direct Material	120	140	150	120
Direct Wages	60	80	120	80
Direct expenses at ₹40 per machine hour	80	60	80	80
Fixed Cost	40	40	30	50
Total Cost	300	320	380	330
Market Price	300	320	400	270

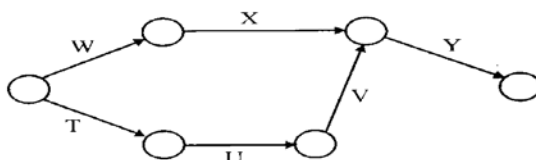
There are constraints on the machine time in manufacturing all the components. Total machine hours available is only 12,000 hours.

It is possible to use the machine time in a second shift which will attract 20 % extra wages and other fixed overheads at ₹6,000 for every 1,000 hours or part thereof.

With relevant supporting figures, advise the best course of action to maximize the profits.

(Note: Students need not work out the complete profitability statement). (8 Marks)

(b) The following network and table are presented to you:



Activity	Normal Duration (Days)	Normal Cost (₹)	Crash Duration (Days)	Crash Cost (₹)
T	8	2,250	6	2,750
U	16	1,875	11	2,750
V	14	2,250	9	3,000
W	12	3,000	9	3,750
X	15	1,000	14	2,500
Y	10	2,500	8	2,860

Perform step by step crashing and reduce the project duration by 11days while minimizing the crashing cost. What would be the cost of the crashing exercise? (8 Marks)

Answer

(a)

	A	B	C	D
Quantity	3,000	3,500	2,000	3,000
Market price (₹)	300	320	400	270
Total Variable cost/unit (₹)	260	280	350	280
Contribution per unit (₹)	40	40	50	(10)*
*Decision: do not make D				
Machine Hours per unit	2	1.5	2	
Contribution per Machine Hour	20	26.67	25	

Ranking	III	I	II	
Hours required	6,000	5,250	4,000	15250 total hours
Allocation of Available hours	2,750**	5,250	4,000	12,000 hours
** (Balancing figure)				

Hours required in 2nd Shift 3250 hours 1625 units of A

Contribution per unit for Product A in second shift

₹ 40 – ₹12 = ₹ 28 (Direct wages will go up by ₹12)

For every 1000 hours in second shift the Contribution from A would be

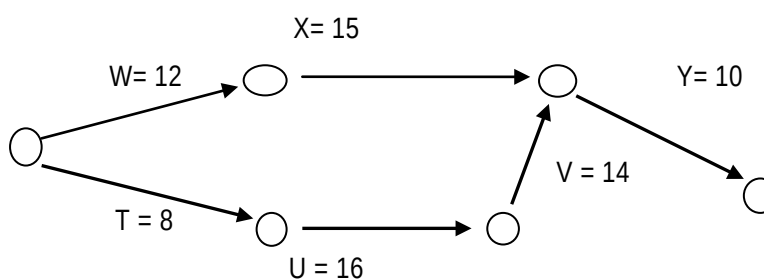
₹14,000 i.e., $1,000/2 \times 28$

The increase in Fixed Cost is ₹6,000. After 3,000 hours the Contribution will be only ₹ 250/2 * 28 i.e. ₹3,500, whereas the increase in fixed cost will be ₹6,000. Hence it is not advantageous to go beyond 3,000 hours in the second shift.

Best Course of action:

- (i) Purchase D from outside: 3,000 units.
- (ii) Make B and C fully in-house in the normal shift, B:3,500 units, C:2,000 units.
- (iii) Make and buy A as follows:
 - Normal shift: 1,375 units
 - 2nd shift: 1,500 units
 - Purchase: 125 units

(b)



Paths: TUVY 8+16+14+10 = 48 days (critical path)
 WXY 12+15+10 = 37 days

	T	U	V	Y
Crash days possible	2	5	5	2
Crash cost-normal cost	500	875	750	360
Crashing cost/day	250	175	150	180
Step I crash V – 5 days			750	
Step II crash U – 5 days		875		
Step III crash Y- 1 day				180
Minimum cost of crashing exercise (₹)	750+875+180 = 1805 (for 11 days)			

Question 6

- (a) PQR Ltd is considering introducing a new product at a price of ₹105 per unit. 'PQR Ltd's controller has compiled the following incremental cost information based on an estimate of 1,20,000 units of sales annually for the new product:

Direct material cost	₹ 36,00,000
Direct Labour cost	₹ 24,00,000
Flexible manufacturing support	₹ 12,00,000
Sales commission	10% of sales
Capacity- related cost	₹ 20,00,000

The average inventory levels for the new product are estimated as follows:

Raw materials:	2 months' production
Work-in-progress (100% complete for Materials and 50% complete for labour and Flexible manufacturing support)	1 month production
Finished goods	2 months' production

Annual inventory carrying costs not included in the flexible manufacturing support listed earlier are estimated to be 12% of inventory value. In addition, the sales manager expects the introduction of new product to result in a reduction in sales of existing product from 3,00,000 to 2,40,000 units. The contribution margin for the existing product is ₹20 per unit.

Prepare a statement showing the budgeted impact on PQR's profits on the introduction of the new product. Should the new product be introduced? (8 Marks)

- (b) Explain the features of a balanced scored card. (4 Marks)
- (c) Classify the following items under the more appropriate category:

Category (CC) – Cost Control Or Category (CR) – Cost Reduction:

- (i) Costs exceeding budgets or standards are investigated.
- (ii) Preventive function
- (iii) Corrective function
- (iv) Measures to standardize for increasing productivity
- (v) Provision of proper storage facilities for materials.
- (vi) Continuous comparison of actual with the standards set.
- (vii) Challenges the standards set
- (viii) Value analysis

(4 Marks)

Answer

(a)

Budgeted production = 120,000 per annum (10,000 units per month)		
	₹ per unit	Total ₹
Sales Value	105.00	1,26,00,000
Less: Variable Cost		
Direct material	30.00	36,00,000
Direct Labour	20.00	24,00,000
Flexible mfg. support	10.00	12,00,000
Commission 10% of sales	10.50	12,60,000
Total Variable Cost	70.50	84,60,000
Contribution	34.50	41,40,000
Fixed mfg. cost (Capacity related cost)		20,00,000
Inventory carrying cost (Refer working)		2,70,000
Profit from new product		18,70,000
Less: Loss of contribution due to lower sale of existing product 60,000 units * ₹20		12,00,000
Net incremental profit		6,70,000

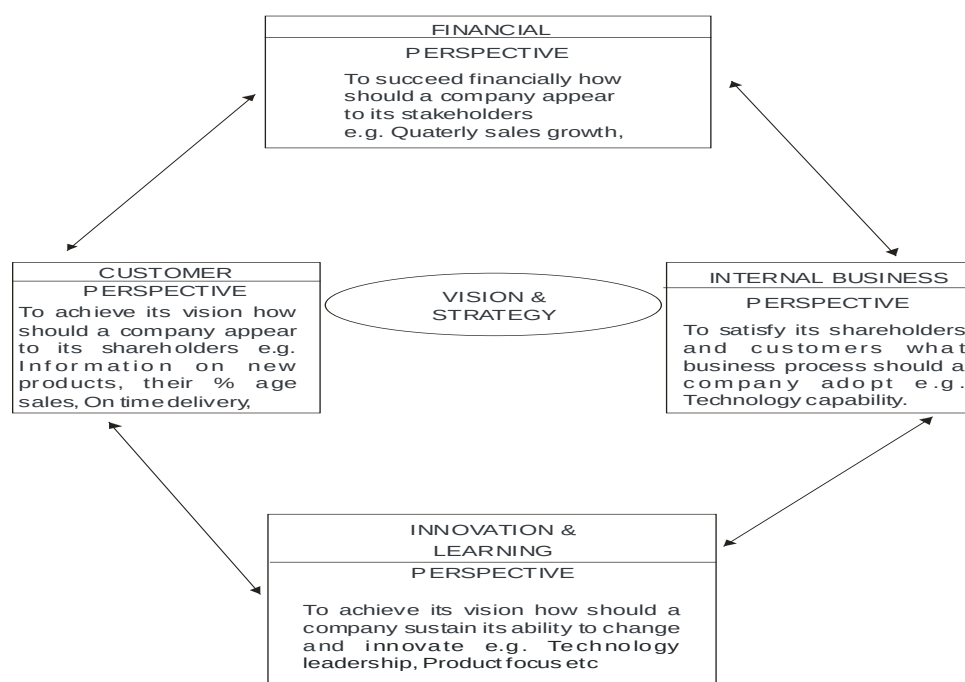
(Decision: Recommend new product)

Value of Inventory

Raw materials (36,00,000 /6)		6,00,000
Work in progress		
Materials (36,00,000/ 12)	3,00,000	

Labour (24,00,000/ 24)	1,00,000	
Flexible Manufacturing support (12,00,000 / 24)	50,000	4,50,000
Finished Goods		
(Raw materials + Labour + Flexible manufacturing support) / 6		12,00,000
TOTAL INVENTORY VALUE		22,50,000
Inventory Carrying cost - 12%		2,70,000

(b)



A Balanced score card includes information, both financial and non-financial elements under 4 perspectives with a long term goal of improved financial performance.

Perspective	Parameters
Customer	Sales % Delivery time New product information
Internal business perspective	Business process to be adopted Technological capability Internal efficiency parameters
Innovation/ learning perspective	How a company should sustain its ability to

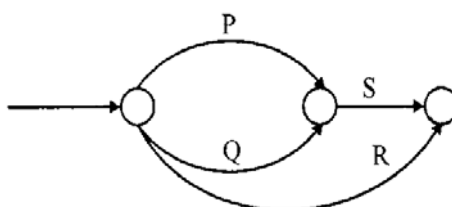
Financial perspective	change and innovate Technology leadership Product focus Kaizen approach Sales growth How the company should appear to its shareholders Operating income by segments
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(c) Classification of items under cost reduction/ cost control

Sl. No.	Item	Category Cost Control (CC) Cost Reduction (CR)
(i)	Costs exceeding budgets or standards are investigated	CC
(ii)	Preventive function	CC
(iii)	Corrective function	CR
(iv)	Measures to standardize for increasing productivity	CR
(v)	Provision of proper storage facilities for materials	CC
(vi)	Continuous comparison of actual with the standards set	CC
(vii)	Challenges the standards set	CR
(viii)	Value analysis	CR

Question 7

(a) The following is a part of a network.



What are activities P and Q called? How would you rectify the situation? (4 Marks)

(b) The following matrix was obtained after performing row minimum operations on rows R_1 and R_2 in an assignment problem for minimization. Entries "xx" represent some positive numbers. (It is not meant that all "xx" numbers are equal). State two circumstances under which an optimal solution is obtained just after the row minimum and column minimum operations.

(Candidates may use cell references as $C_i R_j$ for uniformity. e.g. $C_1 R_1$ represents the cell at the intersection of Column1 (C_1) and Row 1 (R_1) etc.

	C_1	C_2	C_3
R_1	0	xx	xx
R_2	xx	0	xx
R_3	xx	xx	xx

(4 Marks)

- (c) A refreshment centre in a railway station has two counters - (i) self-service (opted by 60 % of the customers) and (ii) attended service (opted by 40 % of the customers). Both counters can serve one person at a time. The arrival rate of customers is given by the following probability distribution:

No. of arrivals	1	3	4	0	2
Probability	0.10	0.30	0.05	0.20	0.35

Formulate the associated interval of 2 digit random numbers for generating

(i) the type of service and

(ii) the arrival rate

(4 Marks)

- (d) Define the following:

(i) maximum capacity (theoretical capacity)

(ii) practical capacity

(iii) normal capacity

(iv) principal budget factor

(The first three relate to a manufacturing plant)

(4 Marks)

- (e) Suggest suitable cost units for the following services:

(i) Hospital

(ii) Hotel

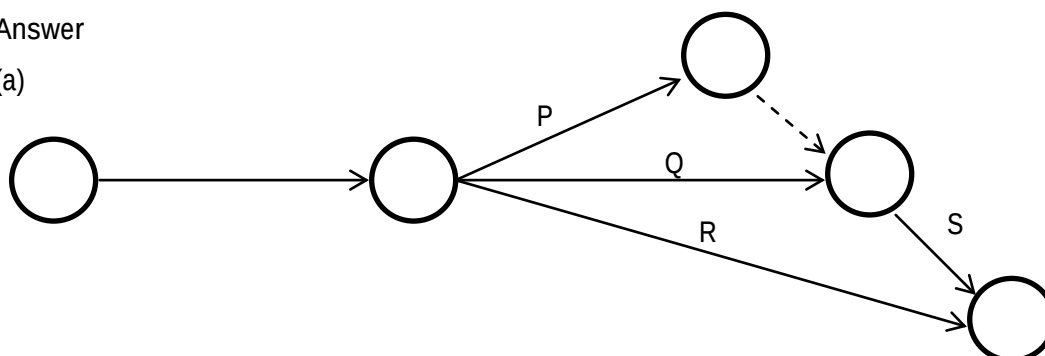
(iii) Transport

(iv) Staff canteen

(4 Marks)

Answer

(a)



Activities P and Q are called duplicate activities (or parallel activities) since they have the same head and tail events. The situation may be rectified by introducing a dummy either between P and S or between Q and S or before P or before Q (i.e. introduce the dummy before the tail event and after the duplicate activity or Introduce the dummy activity between the head event and the duplicate activity).

- (b) Situation 1 :On performing minimum operation in Row 3, if C_3R_3 is zero, the optimal solution is obtained.

0	xx	xx
xx	0	xx
xx	xx	0

Optimal solution = C_1R_1 , C_2R_2 & C_3R_3

Situation 2:On performing minimum operation in Row 3, if C_2R_3 is zero, then it necessitates the performance of minimum operation in C_3 . On account of this, if either C_3R_3 or C_3R_2 is zero then the optimal solution is obtained

0	xx	xx
xx	0	xx
xx	0	xx

And

0	xx	xx
xx	0	xx
xx	0	0

or

0	xx	Xx
xx	0	0
xx	0	Xx

Optimal = C_1R_1 , C_2R_2 & C_3R_3

OR

Optimal = C_1R_1 , C_2R_3 & C_3R_2

(i.e., C_2R_3 and C_3R_3 are zero after Row minimum and column minimum operation respectively)

(or C_2R_3 and C_3R_2 are zero after Row minimum and column minimum operation respectively).

Situation 3 :On performing minimum operation in Row 3, if C_1R_3 is zero, then it necessitates the performance of minimum operation in C_3 . On account of this, if either C_3R_3 or C_3R_1 is zero then the optimal solution is obtained.(i.e., C_1R_3 and C_3R_3 are zero after Row minimum and column minimum operation respectively).

0	xx	xx	and	0	xx	xx	or	0	xx	0	Optimal = C_1R_1 , C_2R_2 & C_3R_3 OR Optimal = C_1R_3 , C_2R_2 & C_3R_1
xx	0	xx		xx	0	0		Xx	0	Xx	
0	xx	xx		0	xx	0		0	0	Xx	

(ie., C_1R_3 and C_3R_3 are zero after Row minimum and column minimum operation respectively)

or C_1R_3 and C_3R_1 are zero after Row minimum and column minimum operation respectively).

(c)

Type of Service	Probability	Cumulative Probability	Random No. Interval
Self- Service	0.60	0.60	00 - 59
Attended Service	0.40	1.00	60 - 99

Arrival Rate:

No. of arrivals	Probability	Cumulative Probability	Random Number Interval
0	0.20	0.20	00 - 19
1	0.10	0.30	20 - 29
2	0.35	0.65	30 - 64
3	0.30	0.95	65 - 94
4	0.05	1.00	95 - 99

(d) (i) Maximum Capacity = Maximum no. of days in a period x no. of workers or

Maximum no. of hours x no. of workers

or

The maximum no. of units that can be produced by a manufacturing facility in a certain period.

(ii) Practical Capacity = Maximum capacity (minus) Sundays, holidays, normal maintenance & idle time

(iii) Normal Capacity = Average of past 3 years' normal performance excluding abnormal data.

(iv) Principal budget factor = The factor that limits the activities of the functional budgets of the organization.

- (e) (i) Hospital Patient days, or room days or patient nights
(ii) Hotel Room nights/ Room days
(iii) Transport Passenger – km or Tonne- km or quintal – km
(iv) Staff canteen No. of meals or no. of staff