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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 is to be distributed along with this paper

Question 1

- (a) If Moonlite Limited operates its plant at normal capacity it produces 2,00,000 units from the plant 'Meghdoot'. The unit cost of manufacturing at normal capacity is as under:

	₹
Direct material	65
Direct labour	30
Variable overhead	33
Fixed overhead	<u>7</u>
	135

Direct labour cost represents the compensation to highly-skilled workers, who are permanent employees of the company. The company cannot afford to lose them. One labour hour is required to complete one unit of the product.

The company sells its product for ₹ 200 per unit with variable selling expenses of ₹ 16 per unit. The company estimates that due to economic down turn, it will not be able to operate the plant at the normal capacity, at least during the next year. It is evaluating the feasibility of shutting down the plant temporarily for one year.

If it shuts down the plant, the fixed manufacturing overhead will be reduced to ₹ 1,25,000. The overhead costs are incurred at a uniform rate throughout the year. It is also estimated that the additional cost of shutting down will be ₹ 50,000 and the cost of re-opening will be ₹ 1,00,000.

Required:

Calculate the minimum level of production at which it will be economically beneficial to continue to operate the plant next year if 50% of the labour hours can be utilized in another activity, which is expected to contribute at the rate of ₹ 40 per labour hour. The additional activity will relate to a job which will be off-loaded by a sister company only if the company decides to shut down the plant.

(Assume that the cost structure will remain unchanged next year. Ignore income tax and time value of money) (5 Marks)

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- (b) An investor is interested in investing ₹ 15,00,000 in a portfolio of investments. The investment choices and expected rates of return on each one of them are :

Investment	Projected Rate of Return
Mutual Fund 'XY'	15%
Mutual Fund 'HN'	9%
Money Market Fund	8%
Government Bonds	8.75%
Shares 'P'	17%
Share 'Q'	18%

The investor wants at least 40% of his investment in Government Bonds. Because of the higher perceived risk of the two shares, he has specified that the combined investment in these two shares not to exceed ₹ 2,60,000. The investor has also specified that at least 25% of the investment should be in the money market fund and that the amount of money invested in shares should not exceed the amount invested in Mutual Funds. His final investment condition is that the amount invested in mutual fund 'XY' should be no more than the amount invested in mutual fund 'HN'. The problem is to decide the amount of money to invest in each alternative so as to obtain the highest annual total return.

Required:

Formulate the above as a linear programming problem. (5 Marks)

- (c) PQR Limited sells two versions: Deluxe and Premium of its only product GoGo Juicer. The GoGo Juicer uses patented technology to extract the last drop of juice from most fruits. The 'Premium' version can handle larger fruit and has more options relative to the 'Deluxe' version. The following table provides the financial results of the most recent year of operations:

Particulars	Deluxe 90,000 units	Premium 10,000 units	Total 1,00,000 units
Revenue (₹)	63,00,000	9,00,000	72,00,000
Material cost (₹)	10,80,000	2,50,000	13,30,000
Direct labour cost (₹)	14,40,000	1,60,000	16,00,000
Contribution margin (₹)	37,80,000	4,90,000	42,70,000
Allocated fixed manufacturing overhead (₹)	34,20,000	3,80,000	38,00,000
Allocated fixed selling and administrative overheads (₹)	2,51,563	35,937	2,87,500
Profit margin (₹)	1,08,437	74,063	1,82,500
Profit margin per unit (₹)	1.2048	7.4063	

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Labour cost is ₹ 16 per hour and each product requires one hour of labour. The company currently allocates all fixed manufacturing overheads, using labour hours as the allocation basis. It allocates fixed selling and administrative overheads, using revenue as the allocation base.

Although the profit margin per unit of 'Deluxe' juicer is rather low, PQR Limited believes that it is important to keep this model in the product mix. However, PQR can tailor its promotion and sales strategies to improve the sales mix to 16:4 ratio from the current 9:1 ratio of 'Deluxe' to 'Premium' juicers, with total volume staying at 1,00,000 units.

PQR Limited finds that ₹ 1.1 million of the ₹ 3.8 million of fixed manufacturing overheads pertains to batch related activities such as scheduling production runs. Similarly, ₹ 1,15,000 is the amount of administrative overheads out of the ₹ 2,87,500 of selling and administrative overheads.

It is found that the 'premium' juicer is produced in smaller batches (250 units per batch) than that of 'Deluxe' juicer (500 units per batch). Similarly, it takes 10 sales visits to sell 1,000 units of the 'Deluxe' juicer, while it takes 25 visits to sell 1,000 units of 'Premium' juicer.

Required:

- (i) Prepare a profitability statement based on the proposed sales mix, using the most appropriate basis of allocating fixed overheads.  
(In absence of an appropriate basis, do not allocate overheads to products)
- (ii) Advise the company on whether it should go ahead with the propose change in sales mix. (10 Marks)

Answer

(a) Contribution per unit

Particulars	(₹)
Selling Price	200
Variable Cost (₹ 65 + ₹ 33 + ₹ 16)	114
Contribution per unit (Excluding direct labour, considered irrelevant and fixed)	86

Savings and earnings if the plant is shut down

Particulars	₹
Savings in Fixed Cost (₹ 14,00,000* – ₹ 1,25,000)	12,75,000
Contribution from Alternate Activity (₹ 40 x 50% of 2,00,000 hrs)	40,00,000
Shutting Down and Reopening Cost (₹ 50,000 + ₹100,000)	(1,50,000)
Total	51,25,000

\* [2,00,000 units x ₹ 7]

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Indifference Point: ₹51,25,000 / ₹86 = 59,593 units

Minimum level of production to justify continuation = 59,594 units

(b) Let

u = Investment in "Mutual Fund 'XY'"

v = Investment in "Mutual Fund 'HN'"

w = Investment in "Money Market Fund"

x = Investment in "Government Bonds"

y = Investment in "Share 'P'"

z = Investment in "Share 'Q'"

Maximize

$$Z = 0.15u + 0.09v + 0.08w + 0.0875x + 0.17y + 0.18z$$

₹ 15,00,000 to be invested -

$$u + v + w + x + y + z \leq 15,00,000$$

At least 40% of investment in Government Bonds-

$$x \geq (u + v + w + x + y + z) \times 0.40$$

Or

$$2u + 2v + 2w - 3x + 2y + 2z \leq 0$$

Combined Investment in two shares not to exceed ₹ 2,60,000-

$$y + z \leq 2,60,000$$

At least 25% of the investment in the money market fund-

$$w \geq (u + v + w + x + y + z) \times 0.25$$

Or

$$u + v - 3w + x + y + z \leq 0$$

Amount of money invested in shares should not exceed the amount invested in mutual funds-

$$y + z \leq u + v$$

Or

$$-u - v + y + z \leq 0$$

Amount invested in mutual fund 'XY' should be not be more than the amount invested in mutual fund 'HN'-

$$u \leq v$$


Or

$$u - v \leq 0$$

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<p>Maximize  <math>Z = 0.15u + 0.09v + 0.08w + 0.0875x + 0.17y + 0.18z</math>                  Subject to:  <math>u + v + w + x + y + z \leq 15,00,000</math>  <math>2u + 2v + 2w - 3x + 2y + 2z \leq 0</math>  <math>y + z \leq 2,60,000</math>  <math>u + v - 3w + x + y + z \leq 0</math>  <math>-u - v + y + z \leq 0</math>  <math>u - v \leq 0</math>  <math>u, v, w, x, y, z \geq 0</math></p>
---

 This problem can be solved with the assumption of 'Investment Exactly ₹ 15,00,000'

(c) (i) Profitability Statement New Mix -Most Appropriate Basis

Particulars	Deluxe 80,000 Units		Premium 20,000 Units		Total (₹)
	Per Unit (₹)	Amount (₹)	Per Unit (₹)	Amount (₹)	
Revenue	70.00	56,00,000.00	90.00	18,00,000.00	74,00,000.00
Material Cost	12.00	9,60,000.00	25.00	5,00,000.00	14,60,000.00
Direct Labour Cost (One hour per unit) 80,000 Hrs., 20,000 hrs.	16.00	12,80,000.00	16.00	3,20,000.00	16,00,000.00
Contribution Margin	42.00	33,60,000.00	49.00	9,80,000.00	43,40,000.00
Unit related Fixed Mfg. Overheads (Allocation on the basis of direct labour hours) 80,000:20,000 [W.N. 1]		21,60,000.00		5,40,000.00	27,00,000.00
Batch-related Fixed Mfg. Overheads (Allocation on the basis no. of batches) 160:80 [W.N. 1 & 4]		7,33,333.33		3,66,666.67	11,00,000.00

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Fixed Selling Overheads <i>(Allocated on the basis of sales visits) 800:500 [W.N. 2 &amp; 3]</i>	1,06,153.85	66,346.15	1,72,500.00
Profit Margin Ex Admin Overheads	3,60,512.82	6,987.18	3,67,500.00
Admin Overheads [W.N. 2]			1,15,000.00
Profit Margin			2,52,500.00

**Working Note**

**W.N.1**

₹	
Fixed Mfg. Overheads	38,00,000.00
<i>Less: Related to batch related activities</i>	11,00,000.00
Fixed Mfg. Overheads– unit related	27,00,000.00

**W.N.2**

₹	
Selling & Admn. Overheads	2,87,500.00
<i>Less: Admn. Overhaeds</i>	1,15,000.00
Selling Overheads	1,72,500.00

**W.N.3**

No. of Visits	10 Sales Visit for 1,000 Units (Deluxe)	25 Sales Visit for 1,000 Units (Premium)	Total
For Proposed Mix-Sales Visit	800	500	1,300

**W.N.4**

No. of Batches	1 Batch for 500 Units (Deluxe)	1 Batch for 250 Units (Premium)	Total
For Proposed Mix-Batches	160	80	240

- (ii) Change in product mix, yields profit of ₹ 70,000/- (₹ 2,52,500 - ₹ 1,82,500). Accordingly company should go with proposed change mix.

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☛ This problem can be solved by assuming that some portion of the fixed cost as fixed with respect to units of production, but variable with respect to certain activities. When the production size is altered, these activities are increased and therefore, the activity cost varies for the proposed production level. More batches of production and more sales visits will set off the incremental contribution.

**Question 2**

- (a) PEX is a manufacturing company of which division PQR manufactures a single standardized product. Some of the output is sold externally whilst the remainder is transferred to division RPO where it is a subassembly in the manufacture of that division's product. PQR has the capacity (annual) to produce 30,000 units of the product. The unit costs of division PQR's product are as under:

	₹
Direct material	40
Direct labour	20
Direct expenses	20
Variable manufacturing overheads	20
Fixed manufacturing overheads	40
Sells and packaging expenses-variable	<u>10</u>
	<u>150</u>

Annually 20,000 units of the product are sold externally at the standard price of ₹ 300 per unit.

In addition to the external sales, 10,000 units are transferred annually to division RPO at an internal transfer price of ₹ 290 per unit. This transfer price is obtained by deducting variable selling and packing expenses from the external price since those expenses are not incurred for internal transfers.

Division RPO incorporates the transferred-in goods into a more advanced product. The unit costs of this product are as follows:

	₹
Transferred-in-item (from division PQR)	290
Direct material and components	230
Direct labour	30
Variable overheads	120
Fixed overheads	120
Selling and packing expenses-variable	<u>10</u>
	<u>800</u>

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Division PQR's manager disagrees with the basis used to set the transfer price. He argues that the transfers should be made at variable cost plus an agreed (minimal) mark up because his division is taking output that division PQR would be unable to sell at the price of ₹ 300.

Partly because of this disagreement, a study of the relationship between selling price and demand has recently been carried out for each division by the company's sales director. The study has brought out the following demand schedule:

**Division PQR**

Selling price (₹)	200	300	400
Demand (units)	30,000	20,000	10,000

**Division RPQ**

Selling price (₹)	800	900	1,000
Demand (units)	14,400	10,000	5,600

The manager of the division RPQ claims that this study supports his case. He suggests that a transfer price of ₹ 120 would give division PQR a reasonable contribution to its fixed overheads while allowing division RPQ to earn a reasonable profit. He also believes that it would lead to an increase of output and an improvement in the overall level of company profits.

Required:

- (i) Calculate the effect of the transfer price of ₹ 290 per unit on company's operating profit. Calculate the optimal product mix.
- (ii) Advise the company on whether the transfer price should be revised to ₹ 120 per unit. (11 Marks)
- (b) Explain the term 'Degeneracy' in the context of a transportation problem. How can this be solved? (5 Marks)

**Answer**

**(a) Contribution Analysis of Divisions:**

**(i) Contribution – Division PQR**

Selling Price (₹)	200	300	400
Variable Cost (₹)	110	110	110
Contribution per Unit (₹)	90	190	290
Demand (units)	30,000	20,000	10,000
Total Contribution (₹)	27,00,000	38,00,000*	29,00,000

\*Optimal

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The above table shows ₹ 300 price to be the most profitable and that cutting prices would not result in increased profits.

(ii) Contribution – Division RPQ (transfer price at ₹ 290)

Selling Price (₹)	800	900	1,000
Variable Cost (₹)	680	680	680
Contribution per Unit (₹)	120	220	320
Demand (units)	14,400	10,000	5,600
Total Contribution (₹)	17,28,000	22,00,000*	17,92,000

\*Optimal

(iii) Contribution – Division RPQ (at alternative transfer price ₹ 120)

Selling Price (₹)	800	900	1,000
Variable Cost (₹)	510	510	510
Contribution per Unit (₹)	290	390	490
Demand (units)	14,400	10,000	5,600
Total Contribution (₹)	41,76,000*	39,00,000	27,44,000

\*Optimal

The maximum capacity of the PQR division is given as 30,000 units. Hence there is no question of internal transfer if the entire 30,000 units are sold by PQR in the external market. However, from the above computations it is clear that Division PQR would sell 20,000 units in external market to optimize its profit and therefore the maximum transfer to division RPQ is 10,000 units only. The question of transferring 14,400 units would arise as an alternative to analyze the overall profitability only when PQR sells 10,000 units in the external market. Based on the demand projection of RPQ, the demand level of 5,600 units is not relevant. It can be further noted from the question that Division RPQ will purchase the entire quantity only from Division PQR and not externally. Hence the various options would be as follows.

	Option-1	Option-2	Option-3
PQR External Sales (units)	20,000	10,000	10,000
Transfer to RPQ (units)	10,000	14,400	10,000

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Overall Profitability of the Company:

(iv) Transfer Price at ₹ 290

PQR External Sales (units)	20,000	10,000	10,000
Transfer to RPQ (units)	10,000	14,400	10,000
	₹	₹	₹
Contribution PQR (External) [Refer computation (i) above]	38,00,000	29,00,000	29,00,000
Contribution PQR (Transfer) @ ₹ 190 [₹ 290 less ₹ 100 Variable cost#]	19,00,000	27,36,000	19,00,000
Contribution RPQ [Refer computation (ii) above]	22,00,000	17,28,000	22,00,000
Total Contribution for the Company	79,00,000*	73,64,000	70,00,000
Fixed Costs [PQR 30,000 units x ₹40 + RPQ 10,000 units x ₹120]	24,00,000	24,00,000	24,00,000
Total Company Profit (Contribution-Fixed costs)	55,00,000	49,64,000	46,00,000

\*Optimal

(v) Transfer Price at ₹ 120

PQR External Sales (units)	20,000	10,000	10,000
Transfer to RPQ (units)	10,000	14,400	10,000
	₹	₹	₹
Contribution PQR (External) [Refer computation (i) above]	8,00,000	29,00,000	29,00,000
Contribution PQR (Transfer) @ ₹ 20 [₹ 120 less ₹ 100 Variable cost#]	2,00,000	2,88,000	2,00,000
Contribution RPQ [Refer computation (iii) above]	39,00,000	41,76,000	39,00,000
Total Contribution for the Company	79,00,000*	73,64,000	70,00,000
Fixed Costs [PQR 30,000 units x ₹40 + RPQ 10,000 units x ₹120]	24,00,000	24,00,000	24,00,000
Total Company Profit (Contribution-Fixed costs)	55,00,000	49,64,000	46,00,000

\*Optimal

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The revision of transfer price has no impact on the overall profitability of the company. However, it will alter the profitability of the Divisions.

\*The optimal level is 30,000 of PQR of which 20,000 units are for external sale and 10,000 units are transferred to RPQ under both the transfer prices.

#On internal transfers, PQR's variable cost per unit is ₹ 100, since the ₹ 10 on selling is not incurred.

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

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

Such a situation is handled by introducing an infinitesimally small allocation 'e' in the least cost and independent cell.

If the number of occupied cells  $< m+n-1$  by one, then only one 'e' needs to be introduced. If the number of occupied cells is less by more than one, to the extent of shortage, 'e's will have to be introduced till the condition that no. of occupied cells =  $m+n-1$ . For e.g. if no. of occupied cells in a solution is 7 and we have  $m+n-1 = 9$ , then, we have to introduce two quantities of 'e', say  $e_1$  and  $e_2$  in 2 of the least cost independent cells.

Degeneracy occurs because in any particular allocation (earlier than the last allocation), the row and column totals get simultaneously fulfilled. (In the last allocation, it is always that row and column get fulfilled). Then, we have a degeneracy by one number, i.e. no. of occupied cells  $+1 = m+n-1$ . We need to put one 'e'. In the subsequent allocation, if again row and column totals get fulfilled simultaneously, again there will be a shortage of occupied cells and another 'e' will be required.

Due to this concept, an assignment problem, solved by transportation technique taking demand quantity = supply quantity = 1 in every row and column will require an 'e' for each allocation other than the last one. For e.g. in a 5 x 5 assignment problem, there are 4 allocations other than the last one. therefore, 4 'e's will be required. i.e.  $m + n - 1$  will be  $5+5-1, =9$ , whereas, the no. of occupied cells will be 5. To resolve the degeneracy, we will need 4 'e's.

The 'e' has to be placed in the least cost independent cell, for arriving at the optimal solution as early as possible. If, by mistake, we place 'e' in the second least cost but independent cell, after the  $u_i, v_j$  step, the 'e' will be shifted to the least cost independent cell, thereby necessitating one more iteration. This is similar to the simplex table. If we bring in a wrong variable by mistake, it will go out in the next iteration. The only thing is that the solution will be reached later.

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FINAL EXAMINATION: NOVEMBER, 2012

**Question 3**

(a) *Sunglow Limited manufactures and sells a single product. From the records of the company the following information is available for November 2012:*

*The standard cost comprises the following:*

<i>Direct material</i>	<i>Unit</i>	<i>₹</i>
X	8	320
Y	24	1,680
Z	16	<u>400</u>
		2,400
<i>Direct wages (₹ 40 per hour)</i>		1,600
<i>Variable overhead (25% of direct wages)</i>		400
<i>Fixed overhead (based on budgeted production of 10,000 units of the final product per month)</i>		600
		<u>5,000</u>

*The budgeted selling price is ₹ 700 each and the budgeted sales for the month were 14,000 units.*

*The following were the transactions for the month:*

<i>Direct material:</i>	<i>Units</i>	<i>Purchased Price per unit</i>	<i>Issued unit</i>
X	44,000	42	82,400
Y	1,40,000	71	2,46,400
Z	60,000	24	1,64,000
<i>Direct Wages:</i>		<i>₹ 90,00,000 (3,98,000 hours)</i>	
<i>Overheads:</i>			
<i>Variable</i>		<i>₹ 2,00,000</i>	
<i>Fixed</i>		<i>₹ 3,00,000</i>	
<i>Production:</i>		<i>11,000 units</i>	
<i>Sales:</i>		<i>9,000 units at ₹ 700 each and 3,500 units at ₹ 750 each</i>	

*Required:*

*Calculate (i) Material price variance; (ii) Material mix variance; (iii) Labour rate variance (iv) Labour efficiency variance (v) Variable overhead efficiency variance; and (vi) Fixed overhead efficiency variance. (9 Marks)*

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- (b) An international tourist company deals with numerous personal callers each day and prides itself on its level of service. The time to deal with each caller depends on the client's requirements which range from, say, a request for a brochure to booking a round-the-world cruise. If a client has to wait for more than 10 minutes for attention, it is company's policy for the manager to see him personally and to give him a holiday voucher worth ₹15.

The company's observations have shown that the time taken to deal with clients and the arrival pattern of their calls follow the following distribution pattern:

Time to deal with clients	}	Minutes	2	4	6	10	14	20	30
		Probability	0.05	0.10	0.15	0.30	0.25	0.10	0.05
Time between call arrivals	}	Minutes	1	8	15	25			
		Probability	0.2	0.4	0.3	0.1			

Required:

- (i) Describe how you would simulate the operation of the travel agency based on the use of random number tables;
- (ii) Simulate the arrival and serving of 12 clients and show the number of clients who receive a voucher (use line 1 of the random numbers below to derive the arrival pattern and line 2 for serving times); and
- (iii) Calculate the weekly cost of vouchers; assuming the proportion of clients receiving vouchers derived from (ii) applies throughout a week of 75 operating hours.

Random Numbers

Line 1	03	47	43	73	86	36	96	47	36	61	46	98
Line 2	63	71	62	33	26	16	80	45	60	11	14	10

(7 Marks)

Answer

- (a) Statement showing 'Standard Cost of Material' and 'Actual Cost of Material'- Production 11,000 units

Direct Material Type	Standard Cost			Actual Cost			Revised Quantity*	Actual
	Quantity	Rate	Amount	Quantity Consumed	Rate	Amount		
X	88,000 Units	₹ 40	₹ 35,20,000	44,000 Units	₹ 42	₹ 33,84,000	82,133 Units	

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	(11,000 x 8)	(320/8)		38,400 Units	₹ 40		[4,92,800 / 5,28,000 x 88,000]
Y	2,64,000 Units (11,000 x 24)	₹ 70 (1,680/24)	₹ 1,84,80,000	1,40,000 Units 1,06,400 Units	₹ 71 ₹ 70	₹ 1,73,88,000	2,46,400 Units [4,92,800 / 5,28,000 x 2,64,000]
Z	1,76,000 Units (11,000 x 16)	₹ 25 (400/16)	₹ 44,00,000	60,000 Units 1,04,000 Units	₹ 24 ₹ 25	₹ 40,40,000	1,64,267 Units [4,92,800 / 5,28,000 x 1,76,000]
Total	5,28,000 Units		₹ 2,64,00,000	4,92,800 Units		₹ 2,48,12,000	4,92,800 Units

\* Actual Quantity in Standard Proportion.


**Statement showing 'Standard Cost of Wages' and 'Actual Cost of Wages'-  
Production 11,000 units**

Standard Cost			Actual Cost		
Hours	Rate	Amount	Hours	Rate	Amount
4,40,000 hrs [11,000 x (1,600/40)]	₹ 40	₹ 1,76,00,000	3,98,000 hrs	₹ 22.613 (Appx.)	₹ 90,00,000

- (i) **Material Price Variance** = Actual Quantity x Std. Price – Actual Cost
- Material 'X' = 82,400 Units x ₹ 40 – ₹ 33,84,000  
= ₹ 88,000 (A)
- Material 'Y' = 2,46,400 Units x ₹ 70 – ₹ 1,73,88,000  
= ₹ 1,40,000 (A)
- Material 'Z' = 1,64,000 Units x ₹ 25 – ₹ 40,40,000  
= ₹ 60,000 (F)
- Total = ₹ 88,000 (A) + ₹ 1,40,000 (A) + ₹ 60,000 (F)  
= ₹ 1,68,000 (A)
- (ii) **Material Mix Variance** = Std. Price x (Revised Actual Quantity – Actual Quantity)
- Material 'X' = ₹ 40 x (82,133 units – 82,400 units)  
= ₹ 10,680 (A)
- Material 'Y' = ₹ 70 x (2,46,400 units – 2,46,400 units)  
= ₹ 0
- Material 'Z' = ₹ 25 x (1,64,267 units – 1,64,000 units)  
= 6,675 (F)

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- Total = ₹ 10,680 (A) + ₹ 0+ ₹ 6,675 (F)  
= ₹ 4,005 (A)
- (iii) Labour Rate Variance = Actual hours x (Std. Rate – Actual Rate)  
= 3,98,000 hrs x ( ₹ 40 – ₹ 22.613)  
= ₹ 69,20,000 (F)
- (iv) Labour Efficiency Variance = Std. Rate x (Standard hours – Actual hours)  
= ₹ 40 x (4,40,000 hrs. – 3,98,000 hrs.)  
= ₹ 16,80,000 (F)
- (v) Variable Overhead Efficiency Variance  
= Std. Rate per Hour x (Standard Hours for Actual Production– Actual Hours)  
= (₹ 400/40 hrs.) x [ (11,000 units x 40 hrs.) – 3,98,000 hrs. ]  
= ₹ 4,20,000 (F)
- (vi) Fixed Overhead Efficiency Variance  
= Std. Rate per Hour x (Standard Hours for Actual Production– Actual Hours)  
= (₹ 600/40 hrs.) x [ (11,000 units x 40 hrs.) – 3,98,000 hrs. ]  
= ₹ 6,30,000 (F)

 It is assumed that Opening Inventory is valued at Standard Cost.

(b) Time to deal with clients

Time(Minutes)	Probability	Cumulative Probability	Assigned Numbers
2	0.05	0.05	00-04
4	0.10	0.15	05-14
6	0.15	0.30	15-29
10	0.30	0.60	30-59
14	0.25	0.85	60-84
20	0.10	0.95	85-94
30	0.05	1.00	95-99

Time between arrivals

Time(Minutes)	Probability	Cumulative Probability	Assigned Numbers
1	0.2	0.2	00-19
8	0.4	0.6	20-59

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15	0.3	0.9	60-89
25	0.1	1.0	90-99

Simulation table for time between arrivals and service time

Client	Time Between Arrivals	Arrival Time	Time In	Serving Time	Time Out	Waiting Time	Voucher
1	1	1	1	14	15	-	
2	8	9	15	14	29	6	
3	8	17	29	14	43	12	Yes
4	15	32	43	10	53	11	Yes
5	15	47	53	6	59	6	
6	8	55	59	6	65	4	
7	25	80	80	14	94	-	
8	8	88	94	10	104	6	
9	8	96	104	14	118	8	
10	15	111	118	4	122	7	
11	8	119	122	4	126	3	
12	25	144	144	4	148	-	

Total Clients in a Week of 75Hours = 75 Hours x 60 minutes / 10.4# minutes = 433

#Average time between arrivals =  $0.2 \times 1 + 0.4 \times 8 + 0.3 \times 15 + 0.1 \times 25 = 10.4$  minutes

2 out of the 12 clients receive ₹ 15 voucher. So the cost will be ₹ 1,082.50 or ₹ 1,083 [(2/12 x 433) x ₹15].

☞ Taking cycle time as 148 minutes, voucher cost can be computed as follows:

₹ 15 per Client x [(75 Hours x 60 minutes / 148 minutes) no. of cycles x 2 Clients per Cycle Time]

So, Voucher Cost will be ₹ 912.16

#### Question 4

- (a) A production supervisor is considering how he should assign five jobs that are to be performed to five operators. He wants to assign the jobs to the operators in such a manner that the aggregate costs to perform the job is the least. He has the following information about the wages paid to the operators for performing these jobs.

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Operators	Jobs				
	1	2	3	4	5
A	10	3	3	2	8
B	9	7	8	2	7
C	7	5	6	2	4
D	3	5	8	2	4
E	9	10	9	6	10

Required:

- Assign the jobs to the operators so that the aggregate cost is the least. (8 Marks)
- (b) Discuss the characteristics of zero base budgeting. (4 Marks)
- (c) Discuss the essential requisites for installation of uniform costing system. (4 Marks)

Answer

- (a) The given problem is a minimization problem

Subtracting minimum element of each row from all the elements of that row, the given problem reduces to the following:

	Job1	Job2	Job3	Job4	Job5
A	8	1	1	0	6
B	7	5	6	0	5
C	5	3	4	0	2
D	1	3	6	0	2
E	3	4	3	0	4

Subtracting the minimum element of each column from all the elements of that column

	Job1	Job2	Job3	Job4	Job5
A	<del>7</del>	0	0	0	<del>4</del>
B	6	4	5	0	3
C	4	2	3	0	0
D	0	2	5	0	0
E	2	3	2	0	2

Since the minimum number of lines covering all zeros is equal to 4, which is less than the number of columns/rows(=5), the above table does not provide the optimal solution.

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Subtracting the minimum uncovered element (=2) from all uncovered elements and adding the same to the elements lying at the intersection of two lines, we get the following matrix:

	Job1	Job2	Job3	Job4	Job5
A	9	0	0	2	6
B	6	2	3	0	3
C	4	0	1	0	0
D	0	0	3	0	0
E	2	1	0	0	2

Since the minimum number of horizontal and vertical lines to cover all zeros is equal to five, which is equal to the order of the matrix, the above table gives the optimal solution.

The optimal assignment is given below:

Operator	Job	Wages (₹)
A	2	3
B	4	2
C	5	4
D	1	3
E	3	9
Total		21

- (b) Zero base budgeting (ZBB) is defined as method of budgeting which requires each cost element to be specifically justified, as though the activities to which the budget relates were being undertaken for the first time. ZBB is prepared and justified from scratch (zero). Without approval, the budget allowance is zero.

Characteristics of ZBB:

- (i) Manager of a decision unit has to completely justify why there should be any budget allotment for his decision unit.
- (ii) Activities are identified in decision packages.
- (iii) Decision packages are ranked in order of priority
- (iv) Packages are evaluated by systematic analysis.
- (v) Decision packages are linked with corporate objectives, which are clearly laid down.
- (vi) Available resources are directed towards alternatives in order to prioritize to ensure optimal results.

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- (c) The following are the essential requisites for the installation of uniform costing system
- (i) Firms in the industry should be willing to share/furnish relevant data/information.
  - (ii) A spirit of collaboration and mutual trust should prevail among the participating firms.
  - (iii) Mutual exchange of ideas, methods, special achievements, research and knowhow should be frequent.
  - (iv) Larger firms should take the lead towards sharing their experience and knowhow with smaller firms to enable the latter to improve their performance.
  - (v) Uniformity must be established with regard to the following before introducing uniform costing:
    - ✓ Size of various units covered by uniform costing
    - ✓ Production method
    - ✓ Accounting principles, methods and procedures

**Question 5**

- (a) The Board of Directors XY Company Limited are considering a new type of handy sewing machine which their R & D Department has developed. The expenditure so far on research has been ₹ 95,000 and a consultant's report has been prepared at a cost of ₹ 22,500. The report provides the following information:

Cost of production per unit:

	₹
Material	45.00
Labour	75.00
Fixed overheads (Based on Company's normal allocation rates)	20.00
	<hr/> 140.00

Anticipated additional fixed costs:

Rent for additional space ₹ 1,25,000 per annum

Other additional fixed costs ₹ 70,000 per annum

A new machine will be built with the available facilities with a cost of ₹ 1,10,000 (material ₹ 90,000 and labour ₹ 20,000). The materials are readily available in stores which are regularly used. However, these are to be replenished immediately. The price of these materials have since been increased by 50%. Scrap value of the machine at the end of the 10<sup>th</sup> year is estimated at ₹ 20,000. The product scraps generated can be disposed off at the end of year 10 for a price of ₹ 1,43,000.

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Years 1-5		Years 6-10	
Demand (Unit)	Probability	Demand	Probability
40,000	0.15	24,000	0.30
20,000	0.60	16,000	0.50
12,000	0.25	4,000	0.20

*It is estimated that the commercial life of the machine will be no longer than 10 years and the after tax cost of capital is 10%. The full cost of the machine will be depreciated on straight line basis, which is allowed for computing the taxable income, over a period of 10 years. Tax rate is 30%.*

DCF factors at 10%:	
1 - 5 years (cumulative)	3.79
6 - 10 years (cumulative)	2.355
10th year	0.386

*Required:*

*Compute minimum selling price for the handy sewing machine. (12 Marks)*

- (b) *What are the distinctive features of learning curve theory in manufacturing environment? Explain the learning curve ratio. (4 Marks)*

**Answer**

- (a) (i) **Expected Sales Volume:**

Years 1-5:  $(40,000 \times 0.15 + 20,000 \times 0.60 + 12,000 \times 0.25) = 21,000$  units

Years 6-10:  $(24,000 \times 0.30 + 16,000 \times 0.50 + 4,000 \times 0.20) = 16,000$  units

- (ii) **Capital Cost:**

	₹
Materials (₹ 90,000 x 1.50)	1,35,000
(Replacement cost) Labour	20,000
Overheads (Not Relevant)	-
	1,55,000

- (iii) **Production Variable Cost:**

	₹
Materials	45
Labour	75

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Overheads (Not relevant)	—
Total	<u>120</u>

(iv) Profitability:

Details	Years 1-5	Years 6-10
Sales Units	21,000	16,000
Selling Price (₹)	X	X
Sales Value (₹) [A]	21,000X	16,000X
Material and Labour Cost @ ₹120	25,20,000	19,20,000
Incremental Fixed Cost (₹)	1,95,000	1,95,000
Depreciation (1,55,000/10)	15,500	15,500
Total Cost (₹) [B]	27,30,500	21,30,500
Profit (₹) [A-B]	21,000X – 27,30,500	16,000X – 21,30,500
Less: Tax @ 30%	6,300X – 8,19,150	4,800X – 6,39,150
Profit After Tax	14,700X – 19,11,350	11,200X – 14,91,350
Add: Depreciation	15,500	15,500
Cash Inflow	14,700X – 18,95,850	11,200X – 14,75,850

(v) Cash Inflow in the Terminal Year (year 10)

	₹
Sale Value of the Machine	20,000
Scrap Realization	<u>143,000</u>
Total	163,000
Tax @ 30%	<u>(48,900)</u>
After Tax Cash Inflow	<u>114,100</u>

(vi) Present Value of Cash Flows:

Details	Year 0	Year 1-5	Year 6-10	Year 10
Capital Cost	1,55,000	—	—	—
Cash Flow from Operation	—	14,700X – 18,95,850	11,200X – 14,75,850	—
Cash Flow Terminal Year	—	—	—	1,14,100
Discount Factor	1	3.79	2.355	0.386
Present Value of Cash Flows	-1,55,000	55,713X – 71,85,271.50	26,376X – 34,75,626.70	44,042.6

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(vii) Net Cash Inflows:

$$= (-1,55,000) + (55,713X - 71,85,271.50) + (26,376X - 34,75,626.70) + (44,042.60)$$

$$= 82,089X - 1,07,71,855.60$$

(viii) Computation of Minimum Selling Price:

For determining Minimum Selling Price, Net Cash Inflows should be equal to zero:

$$82,089X - 1,07,71,855.60 = 0$$

$$\text{Or } X = 131.22$$

Minimum selling price is ₹ 131.22

Note:

(a) R&D expenses of ₹ 95,000 is not relevant.

(b) Fee for consultant's report of ₹ 22,500 is not relevant.

(c) Tax element on irrelevant costs not considered, since the benefit will arise even without this product.

(b) Learning curve ratio:

$$= \frac{\text{Average Labour cost of first } 2N \text{ units}}{\text{Average Labour cost of first } N \text{ units}}$$

As the production quantity of a given item is doubled, the cost of the item decreases at a fixed rate. It occurs because of the following distinctive features of manufacturing environment.

- (i) Better tooling methods are developed and used
- (ii) Design bugs are detected and corrected
- (iii) More productive equipment is designed and used.
- (iv) Engineering changes decrease over time.
- (v) Earlier teething problems are overcome.
- (vi) Rejections and rework tend to diminish overtime.

Question 6

(a) XY Hotel has 40 bed rooms with a maximum occupancy of 490 sleeper nights per week. Average occupancy is 60% throughout the year. Meals provided to guests have been costed and the average food cost per person per day is as follows:

	₹
Breakfast	72.00
Lunch	220.00

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Dinner 268.00  
560.00

Direct wages and staff meals per week are as under:

	₹
Housekeeping	39,040.00
Restaurant and kitchen	68,600.00
General	35,200.00

Direct expenses per annum are ₹ 9,15,200 for house keeping and ₹ 10,40,000 for restaurant. Indirect expenses amount to ₹ 68,22,400, which should be apportioned on the basis of floor area. The floor areas are as follows:

	Sq. Mt.
Bed rooms	3,600
Restaurant	1,200
Service Area	600

A net profit of 10% must be made on the restaurant taking and also on accommodation takings.

Required:

Calculate what inclusive term per person should be charged per day and also show the split between meals and accommodation charges. (7 Marks)

- (b) In the context of Activity Based Costing System, explain the following statement:  
"Strategic cost analysis should exploit internal linkages" (4 Marks)
- (c) Write a short note on the distinction between PERT and CPM. (5 Marks)

Answer

- (a) Statement showing the charges per person per day

Particulars	Total (₹)	House keeping (₹)	Restaurant (₹)	General & Services (₹)
Direct Wages and Staff Meal per week	1,42,840	39,040	68,600	35,200
Other Direct Expenses per week [₹9,15,200/52; ₹10,40,000/52]	37,600	17,600	20,000	–
Sub Total – Direct Expenses	1,80,440	56,640	88,600	35,200

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Direct Expenses per week (General)* [39,040:68,600]	-	12,767	22,433	(35,200)
Indirect Expenses per week (Based on floor area) [3,600:1,200]	1,31,200	98,400	32,800	-
<b>Total</b>	<b>3,11,640</b>	<b>1,67,807</b>	<b>1,43,833</b>	<b>-</b>
Average Occupancy (490 x 60% = 294 Sleeper nights per week)				
<b>Particulars</b>	<b>Total</b>	<b>House keeping</b>	<b>Restaurant</b>	
	<b>(₹)</b>	<b>(₹)</b>	<b>(₹)</b>	
Cost per person per day [₹1,67,807/294; ₹1,43,833/294]	1,060.00	570.77	489.23	
Food Cost per person per day	560.00	-	560.00	
Total Cost per person per day	1,620.00	570.77	1,049.23	
Add: 1/9th of Cost	180.00	63.42	116.58	
Charges per person per day	1,800.00	634.19	1,165.81	

\* may be apportioned to house-keeping and restaurant on any other alternative logical basis.

- (b) Activity based costing is an accounting methodology that assigns cost to activities rather than to products or services. Activity based Costing tracks the flow of activities by creating internal link between activity/resource consumption and cost object. Exploiting internal linkages means taking advantage of the relationships among the activities that exist within a firm's segment of value chain. Activity cost and analysis are essential parts of this strategic analysis. Activities not based on production units/sales units, based on the variable activity drivers are analyzed. The traditional costing system is not rich enough to supply the information needed for thorough analysis of linkages.
- (c) The PERT and CPM models are similar in terms of their basic structure, rationale and mode of analysis. However, there are certain distinctions between PERT and CPM networks which are enumerated below:
- (i) CPM is activity oriented, while PERT is event oriented
  - (ii) CPM is a deterministic model. It completely ignores the probabilistic element of the problem. PERT is a probabilistic model. It uses three estimates of activity time. Optimistic, pessimistic and most likely, with a view to take into account time uncertainty.
  - (iii) PERT is primarily concerned with time. It helps the manager to schedule and coordinate various activities so that the project can be completed on scheduled time. CPM places dual emphasis on time and cost and evaluates the trade-off

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between project cost and project time. By deploying additional resources, it allows the project manager to manipulate project duration within certain limits so that the project duration can be shortened at an optimal cost.

- (iv) CPM is commonly used for those projects which are repetitive in nature and where one has prior experience of handling similar projects. PERT is generally used for those projects where time required to complete various activities are not known as prior.

#### Question 7

Answer any four of the following questions:

- (a) What is target costing? It is said that target costing fosters team work within the organisation. Explain how target costing creates an environment in which team work fosters. (4 Marks)
- (b) What qualitative factors should be considered in an decision to outsource manufacturing of a product? (4 Marks)
- (c) "Sunk cost is irrelevant in decision making, but all irrelevant costs are not sunk costs." Explain with examples. (4 Marks)
- (d) Write a short note on the characteristics of the dual problem. (4 Marks)
- (e) Brief the principles associate with synchronous manufacturing. (4 Marks)

#### Answer

- (a) Target cost is the difference between the estimated selling price of a proposed product with specified functionality and quality and target margin. This is a cost management technique that aims to produce and sell products that will ensure the target margin. It is an integral part of the product design. While designing the product the company allocates value and cost to different attributes and quality. Therefore, they use the technique of value engineering and value analysis. The target cost is achieved by assigning cost reduction targets to different operations that are involved in the production process. Eventually, all operations do not achieve the cost reduction targets, but the overall cost reduction target is achieved through team work. Therefore, it is said that target costing fosters team work.
- (b) The following qualitative factors should be considered in an outsourcing decision:
- Whether the vendor will acquire the technology and will emerge as a competitor?
  - Whether the vendor will be able to maintain the quality? If the vendor fails to maintain the quality, will the company lose customers?
  - Whether the company will lose its skills in manufacturing the product and it will find difficult to resume production internally?
  - Whether laying off employees will demoralize the work force?

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- (v) Whether the price quoted by the vendor is a penetrating price? If so, it is likely to increase i.e. Whether price will increase.
- (c) Sunk costs are costs that have been created by a decision made in the past and that cannot be changed by any decision that will be made in the future.

Example, the written down value of assets previously purchased are sunk cost. Sunk costs are not relevant for decision making because they are past cost.

But not all irrelevant costs are sunk cost. For example, a comparison of two alternative production methods may result in identical material costs for both the alternatives. In this case, the direct material cost will remain the same whichever alternative is chosen. In this situation, through direct material cost is the future cost to be incurred in accordance with the production, it is irrelevant, but it is not a sunk cost.

Irrelevant is only with respect to alternatives being considered and not for fund flows whereas for sunk cost there is no further cash flow. Cash flows have already been incurred.

- (d) Characteristic of the dual problem:
- (i) For any linear programming model called primal model, there exists a companion model called the dual model.
  - (ii) The number of constraints in the primal model equals the number of variables in the dual model.
  - (iii) The number of variables in the primal model equals the number of constraints in the dual model.
  - (iv) If the primal model has a maximization objective then the dual model will have a minimization objective and vice-versa. Inequalities get reversed.
  - (v) The solution of the primal model yields the solution of the dual model. Also, an optimal simplex table for the dual model yields the optimal solution to the primal model. Further, the objective functions of the two optimal tables will have identical values.
  - (vi) Dual of the dual problem is the original primal itself.
  - (vii) Feasible solutions to a primal and dual problem are both optimal if the complementary slackness conditions hold. If this relationship does not hold either the primal solution or the dual solution or both are not optimal.
  - (viii) If the primal problem has no optimal solution due to infeasibility, then the dual problem will have no optimal solution due to unboundedness.
  - (ix) If primal has no optimal solution due to unboundedness, then the dual will have no optimal solution due to infeasibility.

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- (e) **Synchronous Manufacturing:** In an all-encompassing management philosophy which includes a set of principles, procedures and techniques where every action is evaluated in terms of common goals of the organization.

The seven principles are:

- (i) Focus on synchronizing the production flow than on idle capacities.
- (ii) Value of time at a bottleneck resource is equal to the throughput rate of products processed by the bottleneck.
- (iii) Value of time at a non-bottleneck resource is negligible.
- (iv) Level of utilization of a non-bottleneck resource is controlled by other constraints within the system.
- (v) Resources must be utilized, not simply activated.
- (vi) Transfer batch should not be equal to process batch.
- (vii) A process batch should be variable both along its route and overtime.

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