

4. The purchase price of a desktop is Rs. 26,000. The installation cost is Rs. 5,000 and the scrap value is Rs. 1,000. The software upgrade, antivirus protection, and in general, the repairs and maintenance expenses for the desktop are given in table. After how many years should the desktop be replaced ?

Year	Maintenance Cost (Rs.)
1	500
2	1500
3	2000
4	3000
5	4200
6	5800
7	8000
9	9600

### Unit III

5. A market has two girls ringing up sales at the counters. If the service time for each customer is exponential with mean 4 minutes, and if people arrive in a Poisson fashion at the rate

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**CC-85**

**M. Tech. EXAMINATION, Dec. 2017**

(Third Semester)

(Main & Re-appear)

(ME)

MEI-601-B

**ADVANCE OPERATION RESEARCH**

*Time : 3 Hours]*

*[Maximum Marks : 75*

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Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

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**Note :** Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.

## Unit I

1. A company makes three products A, B and C which must be processed through assembly, finishing and packaging departments. The three departments have maximum 60, 40 and 80 hours available. The profit on one unit of each of the products is Rs. 2 per A, Rs. 4 per B and Rs. 3 per C. The other data is given below : **15**

	Hours required for one unit of product		
	A	B	C
Assembly	3	4	2
Finishing	2	1	2
Packaging	1	3	2

- (i) Determine the product mix that will maximize the profit. Analyze the problem in terms of status of various resources and unit worth of each resource.
- (ii) Form the final optimum table write the solution to dual and give economic interpretation.

2. A salesman wants to visit cities X, Y, Z, P and Q. He does not want to visit and city twice before completing his tour of all the cities and wishes to return to the point of starting journey. Cost of going from one city to another (in rupees) is shown in the table. Find the least cost route. **15**

	X	Y	Z	P	Q
X	0	2	5	7	1
Y	6	0	3	8	2
Z	8	7	0	4	7
P	12	4	6	0	5
Q	1	3	2	8	0

## Unit II

3. Reduce the Game shown in table by dominance method and find the game value : **15**

		Player Y			
		1	2	3	4
Player X	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

of 10 per hour : **15**

- (a) What is the probability of having to wait for the service ?
- (b) What is the expected percentage of idle time for each girl ?
- (c) Find the average queue length and average number of units in the system.

6. The following table gives data on the normal time and cost and crash time and cost for a project : **15**

Activity	Normal		Crash	
	Time (weeks)	Cost (Rs.)	Time (weeks)	Cost (Rs.)
1-2	3	300	2	400
2-3	3	30	3	30
2-4	7	420	5	580
2-5	9	720	7	810
3-5	5	250	4	300
4-5	0	0	0	0
5-6	6	320	4	410
6-7	4	400	3	470
6-8	13	780	10	900
7-8	10	1000	9	1200
4220				

The indirect cost per week is Rs. 50

- (i) Draw the network for the project and identify the critical path.
- (ii) What is the normal project duration and associated cost ?
- (iii) Find out the total float for each activity.
- (iv) Crash the relevant activities systematically and determine the optimum project time and cost.

#### Unit IV

7. Determine the value of  $x_1$  and  $x_2$  so as to maximize the following objective function : **15**

$$\text{Max } z = x_1^2 + x_2^2$$

Subject to :

$$x_1 + x_2 \leq 10$$

$$x_1 + 2x_2 \leq 12$$

$$2x_1 + x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

8. Solve the following non-linear programming problem by calculus method : **15**

$$\text{Minimize } f(y) = y_1^2 + y_2^2 + y_3^2$$

Subject to :

$$y_1 y_2 y_3 = 27$$

$$y_1 y_2 y_3 \geq 0$$