Roll No……..….. **Total No. of Printed Pages: 2**

Total No. of Questions: [11]

M.Sc. (Mathematics) (Semester – 4th)
ADVANCED OPERATIONS RESEARCH
Subject Code: MMAT1458
Paper ID: 19220520

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It carries 16 marks. It consists of 4 questions of 4 marks each.
2. Section B consist of 4 questions of 8 marks each. The student has to attempt any 3 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(4 marks each)**

Q1. In a railway yard goods train arrive at a rate of 30 trains/day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the average number of trains in the queue and in the system.

Q2. A Particular item has demand of 9000 units/year. The cost of procurement is Rs. 100 and the holding cost unit is Rs. 2.40/year. The replacement is instantaneous and no shortages are allowed. Determine: (i) The economic lot size (ii) The time between orders (iii) The total cost per year if the cost of one unit is Rs. 1

Q3. The cost of the machine is 12200 and its scrap (resale) value is 200. The maintenance cost are

Year	1	2	3	4	5	6	7	8
Maintenance cost	200	500	800	1200	1800	2500	3200	4000

Find the replacement age of the machine.

Q4. Write the difference between PERT and CPM.

Section – B **(8 marks each)**

Q5. A super market has two girls at the counters. The service time for each customer is exponential with the mean 4 minutes and the people arrive in a Poisson fashion at the counter at the rate of 10/hour.
(a) Calculate the probability that an arrival will have to wait for service.
(b) Find the expected percentage of idle time for each girl.
(c) The length of the queue at each counter.
(d) Find the waiting time in the queue.

Q6. A machine is priced at Rs. 5000 and running costs are estimated at Rs. 800 for each of the first five years and increasing by Rs. 200 per year in the sixth and subsequent years. If the money is worth 10% per year, determine the year at which machine is replaced.

Q7. Draw the network diagram for the following set of operations represented by separate letters.

Events	A	B	C	D	E	F
Precedes	B, C	D, E	D	F	G	G

Q8. Given the data for an item of uniform demand, instantaneous delivery time and back order facility. Annual demand = 800 units; cost of an item = Rs. 40; Ordering cost = Rs. 800/order; inventory carrying cost = 40%/unit/year and back order cost = Rs. 10/unit/year. Find:

(a) The economic order quantity
(b) The maximum number of backorders
(c) The time between orders
(d) The total annual cost
(e) The maximum inventory

Section – C **(10 marks each)**

Q9. Consider the data of the project, find its critical path and project duration:

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	-	-	A	B	C, D	B	E	E	F, G	H, I
Duration (in days)	4	6	9	7	5	4	3	6	9	4

Q10. For the following data, determine approximately the economic order quantities when the total value of average inventory level of three products is Rs. 1000.

Costs	1	2	3
Holding cost (Rs. /unit/year)	20	20	20
Setup cost (Rs.)	50	40	60
Purchasing cost per unit (Rs.)	6	7	5
Yearly demand	10000	12000	7500

Q11. Consider the following network. The distance (in miles) between different stations is shown on each link. Determine the shortest route from station 1 to station 8.

