QP CODE : 794300

(3 Hours)   [Total Marks : 80]

N.B: 1) Question No. 1 is compulsory.
   2) Attempt any THREE questions from remaining.
   3) Figures to the right indicate full marks.
   4) Answers to questions should be grouped & written together.

Q.1   Attempt **any four** of the following: 20
   A)   Give a brief account of applications of linear programming problem.
   B)   What is replacement problem? Describe some important replacement situations.
   C)   Distinguish between Assignment Problems and Transportation Problems.
   D)   Write a note on Economic Order Quantity.
   E)   State and explain Bellman's principle of optimality in Dynamic Programming.

Q.2   A)   A firm buys castings of P and Q type of parts and sells them as finished product after   10
         machining, boring and polishing. The purchasing cost for castings are Rs. 3 and Rs. 4 each
         for parts P and Q and selling costs are Rs. 8 and Rs. 10 respectively. The per hour capacity
         of machines used for machining, boring and polishing is given below:

Capacity per hour	Parts	
	P	Q
Machining	30	50
Boring	30	45
Polishing	45	30

The running costs for machining, boring and polishing are Rs. 30, Rs. 22.5 and Rs. 22.5 per
hour respectively. Only formulate the linear programming problem to find the product mix
to maximize the profit.

   B)   i) Explain the principle of dominance in Game Theory.   5
         ii) Two competitors A and B are competing for the same product. Their different strategies   5
         are given in the following payoff matrix:

		Company B			
		I	II	III	IV
Company A	1	8	10	9	14
	2	10	11	8	12
	3	13	12	14	13

Solve the above game problem using Dominance principle.

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Q.3   A)   Solve the following L. P. Problem by Simplex Method.   10

Minimize $z = x_1 - 3x_2 + 2x_3$
Subject to $3x_1 - x_2 + 3x_3 \leq 7$
                $-2x_1 + 4x_2 \leq 12$
                $-4x_1 + 3x_2 + 8x_3 \leq 10$
      and $x_1, x_2, x_3 \geq 0$

B)   To simulate interest and provide an atmosphere for intellectual discussion a finance faculty 10
in management school decides to hold special seminars on four contemporary topics:
leasing, portfolio management, private mutual funds, swaps and options. Such seminars
should be held one per week in the afternoons. However, scheduling these seminars has to
be done carefully so that the number of students unable to attend is kept to a minimum. A
careful study indicates that the number of students who cannot attend a particular seminar
on a specific day is as follows:

	leasing	portfolio management	private mutual funds	swaps and options
Monday	40	40	60	20
Tuesday	50	30	40	30
Wednesday	60	20	30	20
Thursday	30	30	20	30
Friday	10	20	10	30

Find the optimum assignment schedule.

Q.4   A)   Use two-phase simplex method to solve the following LPP: 10

Maximize $Z = 5x_1 + 3x_2$
Subject to $2x_1 + x_2 \leq 1$
                $x_1 + 4x_2 \geq 6$
                $x_1, x_2 \geq 0.$

B)   Customers arrive at a sales counter manned by a single person according to a Poisson 10
process with a mean rate of 20 per hour. The time required to serve a customer has an
exponential distribution with a mean of 100 seconds. Find the average waiting time of a
customer in the queue andaverage number of customers in the system. Also find the
probability that customer is required to wait and probability that there are atleast 4
custumers in the system.

Q.5   A)   The Deena Paints Ltd would like to improve its inventory management policies for its 10
supply of paints used for automobiles. Annual demand for such paint is 50,000 liter and the
paint which costs Rs. 20 per litre, is used at a constant rate. Annual carrying costs are
estimated at 15 percent of the value of paint held. Each order costs Rs. 80. Determine:

      (i)   How much paint should be ordered each time?
      (ii)   How often should paint be ordered?

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    (iii)   Time between two consecutive orders.

    (iv)   What is the total annual cost associated with this policy?

B)   A group of process plants in an oil refinery are fitted with valves. Over a period of time the   **10** failure pattern of these 400 valves has been observed and it is as follows:

Months	:	1	2	3	4	5	6	7	8	Total
Number of valves falling :		8	20	48	104	120	56	32	12	400

It costs Rs 100 to replace each valve individually. If all the valves are replaced at a time, it costs Rs 50 per valve. Suggest an optimum replacement policy if the maintenance department is considering following replacement policies:

    i.   To replace all valves simultaneously at fixed intervals, in addition to replacing valves as and when they fail.

    ii.   To replace valves as and when they fail.

Q.6   A)   Find the optimum solution to the following transportation problem in which the cells   **10** contain the transportation cost in rupees.

Factory	Warehouse					Available
	W1	W2	W3	W4	W5	
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Required	30	30	15	20	5	

B)   A company manufactures around 200 mopeds. Depending upon the availability of raw   **10** materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds, whose probability distribution is given below:

Production / day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed three-storeyed lorry that can accommodate only 200 mopeds. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54 and 10, simulate the process to find out

    i)   What will be the average number of mopeds waiting in the factory?

    ii)   What will be the number of empty spaces in the lorry?

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