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B.E. (Mechanical Engineering) (Insem.)
OPERATIONS RESEARCH
(2019 Pattern) (Semester - VII) (402045D) (Elective - IV)

Time : 1 Hour]   *[Max. Marks : 30*

Instructions to the candidates :
1) *Answer Q.1 Or Q.2 and Q.3 Or Q.4.*
2) *Answers in One answer Books.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data, if necessary*

Q1) a) Discuss the following characteristics related to game theory with suitable example **[6]**
   i) Pure and mixed Strategy
   ii) Saddle point

b) A food products company is contemplating the introduction of a revolutionary new product with new packaging or replacing the existing product at much higher price (S1). It may even make a moderate change in the composition of the existing product, with a new packaging at a small increase in price (S2), or may a small change in the composition of the exisisting product, backing it with the word New" and a negligible increase in price (S3). The three different possible states of nature or events are high increase in sales (N1), no change in sale (N2) and decrease in sale (N3). The marketing department of the company worked out the payoff's in terms of the yearly net profits for each of the strategies of three events . This is represented in the following table. Which strategy should be concerned executive choose on the basis of **[9]**
   i) Maxi-min criteria,   ii) Maxi-max criteria,
   iii) Mini-max criteria   iv) Laplace criteria

Strategies	States of nature		
	N1	N2	N3
S1	7,00,000	3,00,000	1,50,000
S2	5,00,000	4,50,000	0
S3	3,00,000	3,00,000	3,00,000

OR

Q2) a) Discuss in brief the methodology of solving Operation research (OR) problem. **[6]**

b) Two players "P" and "Q" lay a game. Each of them has choose one of the three colours, white (W), Black (B) and the red (R) independently of the other. Thereafter the colours are compared, If both "P" and "Q" have chosen white (W,W) neither wins anything. If P select white and Player Q select Black (W,B) player P loose Rs. 2 or player Q wins the same amount and so on. The payoff matrix is as shown blow. Find the optimum strategies for player "P" and "Q" and the value of the game.**[9]**

Colour chosen by player "Q"

Colour chosen by player "P"		W	B	R
	W	2	-2	7
	B	2	5	6
	R	3	-3	8

Q3) a) Six jobs are to be process on three machines. The processing time is as follows, Find the optimal schedule so that the total elapsed time is minimized. **[12]**

Job	J1	J2	J3	J4	J5	J6
Machine M1 [Turning]	3	12	5	2	9	11
Machine M2 [Threading]	8	6	4	6	3	1
Machine M3 [Knurling]	13	14	9	12	8	13

b) Explain Kendall's notation for representing queuing models? **[3]**

OR

Q4) a) A repair shop attended by a single mechanic has an average of four customers an hour who bring small appliances for repair. The mechanic inspects them for defects and takes six minutes an average. Arrivals are Poisson and service rate has the exponential distribution. **[8]**

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You are required to

i) Find the proportion of time during which there is no customer in the shop.

ii) Find the probability of finding at least one customer in the shop.

iii) What is the average number of customers in the system?

iv) Find the average time spent by a Customer in the shop including service.

b) Processing time (in Minute) of six jobs on two machines are given below. Find out the sequence that minimizes the total elapsed time required to complete the tasks on two machines. **[7]**

Job	J1	J2	J3	J4	J5
Machine M1	5	1	9	3	10
Machine M2	2	6	7	8	4

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