USN ⬚⬚⬚⬚⬚⬚⬚⬚⬚⬚   **15MT552**

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Operations Research

Time: 3 hrs.   Max. Marks: 80

Note: *1.* **Answer any FIVE full questions, choosing
ONE full question from each module.**
2. Use of normal distribution tables are permitted.

Module-1

1   a.   Define operations research. List the phases of OR.   **(04 Marks)**

     b.   A company produces two types of leather belts A and B. Profits on the two types of belts are 40 and 30 rupees per belt respectively. Each belt of type 'A' requires twice as much time as required by belt 'B'. If all the belts were sold of type 'B', the company could produce 1000 belts per day. The supply of leather is sufficient only for 800 belts per day. Belt 'A' requires a fancy buckle and only 400 fancy buckles are available per day. For belt 'B' only 700 buckles are available per day. How should the company manufacture the two types of belts in order to have maximum overall profit? Solve graphically.   **(12 Marks)**

OR

2   a.   Define the following terms in connection with LPP i) slack variable ii) optimal solution.
                                                               (04 Marks)

     b.   Solve the given problem by simplex method :
$$\text{Max } Z = 3x_1 + 2x_2$$
Subjected to conditions $x_1 + x_2 \leq 40$
$$x_1 - x_2 \leq 20$$
$$x_1, x_2 \geq 0.$$
                                                            (12 Marks)

Module-2

3   A company has 3 factories manufacturing the same product at 4 sole agencies in different parts of the country. The production cost differs from factory to factory and sale price differs from agency to agency. The shipping cost/unit is known. Given the following data, determine the production and distribution schedule most profitable to the company.

	S_1	S_2	S_3	S_4	Requirements
F_1	3	9	5	4	180
F_2	1	7	4	5	120
F_3	5	8	3	6	150
Production capacity	10	180	50	100	

Production cost/unit	15	18	14	13
Raw material cost/unit	10	9	12	9

                                                               (16 Marks)

OR

4   There are three factories A, B and C supplying goods to four dealers D_1, D_2, D_3 and D_4. The production capacities of these factories are 1000, 700 and 900 units respectively. The requirements from the dealers are 900, 800, 500 and 400 units per month respectively. The per unit return (excluding transportation cost) are Rs. 8/-, Rs. 7/- and Rs. 9/- at the three factories. The following table gives the unit transportation costs from the factories to dealers. Determine the optimum solution to maximize total returns.

	D_1	D_2	D_3	D_4
A	2	2	2	4
B	3	5	3	2
C	4	3	2	1

(16 Marks)

Module-3

5   a. List the differences between PERT and CPM.   (04 Marks)
     b. Draw the network for the following project. Identify the critical path and calculate project duration and float for each activity.

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	–	–	A	A	B, C	B, C	E	E	D, G	F, H, I
Time (weeks)	15	15	3	5	8	12	1	14	3	14

(12 Marks)

OR

6   Following data refer to a project :

Activity	Immediate predecessor	Optimistic time (hrs)	Most likely time (hrs)	Pessimistic time (hrs)
A	–	4	6	8
B	–	1	4.5	5
C	A	3	3	3
D	A	4	5	6
E	A	0.5	1	1.5
F	B, C	3	4	5
G	B. C	1	1.5	5
H	E, F	5	6	7
I	E, F	2	5	8
J	D, H	2.5	2.75	4.5
K	G, I	3	5	7

     a. Draw the network diagram
     b. Find out variance and standard deviation for critical path
     c. Determine probability of completing the project in 24 hours.   (16 Marks)

Module-4

7 a. Briefly explain the characteristics of queuing system. **(06 Marks)**
   b. Telephone users arrive at a booth following a Passion distribution with an average time of 5 minutes between one arrival and the next. The time taken for a telephone call is an average 3 minutes and it follows an exponential distribution. What is the probability that the booth is busy? How many more booths should be established to reduce waiting time to less than or equal to half of the present waiting time? **(10 Marks)**

OR

8 a. Define : i) customer   ii) Server   iii) Queue   iv) Arrival. **(04 Marks)**
   b. At a certain petrol pump customers arrive according to a Poisson process with an average time of 5 minutes between the arrivals. The service time is exponentially distributed with mean time of 2 minutes.
   i)   The average queue length
   ii) The average number of customers in queuing system
   iii) Average time spent by customer before receiving service
   iv) Average time spent by customer in petrol pump
   v)   If waiting time in queue is 4 minutes, a second pump will be opened. What should be arrival rate for opening second pump? **(12 Marks)**

Module-5

9 a. Define : i) Pay –off matrix   ii) saddle point. **(04 Marks)**
   b. The following matrix represents pay off matrix of P in a rectangular game between two persons P_1 and P_2.

$$
\begin{array}{c}
 & & \text{P}_2 \\
 & & \begin{array}{cccc} \text{I} & \text{II} & \text{III} & \text{IV} \end{array} \\
\text{P}_1 \begin{array}{c} 1 \\ 2 \\ 3 \end{array} & &
\begin{bmatrix}
8 & 15 & -4 & -2 \\
19 & 15 & 17 & 16 \\
0 & 20 & 15 & 5
\end{bmatrix}
\end{array}
$$

   Solve graphically. **(12 Marks)**

OR

10 a. List the assumptions made while dealing with sequencing problem. **(04 Marks)**
   b. Find the sequence that minimizes the total elapsed time required to complete following tasks. Each job is processed in the order ACB. Also calculate idle time for all machines.

		Jobs						
		1	2	3	4	5	6	7
Machine	A	12	6	5	11	5	7	6
	B	7	8	9	4	7	8	3
	C	3	4	1	5	2	3	4

(12 Marks)

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