Paper Code: EME-051	**Roll No.**									

B.Tech.
(SEM VIII) EVEN SEMESTER EXAMINATION, 2015-16
OPERATIONS RESEARCH

[Time: 3 hrs.] **[Max. Marks: 100]**

Note: - Attempt all questions. All questions carry equal marks.

1. Attempt any two parts of the following: - **[10x2=20]**

   (a) What is operations research and what are its characteristics?

   (b) Let x_1, x_2 and x_3 = units of types A, B and C belts at be manufactured, respectively.
   Maximize $Z = 3x_1 + 5x_2 + 4x_3$ Subject to: $2x_1 + 3x_2 \leq 8$; $2x_1 + 5x_3 \leq 10$; $3x_1 + 2x_2 + 4x_3 \leq 15$ and $x_1, x_2, x_3 \geq 0$.

   (c) What is Duality? What is the significance of dual variables in an LP model?

2. Attempt any two parts of the following: - **[10x2=20]**

   (a) A steel company has three open hearth furnaces and five rolling mills. The transportation cost (rupees per quintal) for shipping steel from furnaces to rolling mills is given below:

	M_1	M_2	M_3	M_4	M_5	Supply
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	7	14
Demand	4	4	6	8	8	

   (b) (i) Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and is given below:

	I	*II*	*III*	*IV*	*V*
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

   Find out how men should be assigned the jobs in way that will minimize the total time taken.

   (ii) What is principle of optimality?

   (c) The WORLD HEALTH COOUNCIL is devoted to improving health care in underdeveloped countries of the world. It now has five medical teams available to allocate among three such countries to improve their medical care, health education and training programs. Therefore, the council needs to determine how many teams (in any) to allocate to each these countries to maximize the total effectiveness of the five teams. The teams must be kept intact, so the number allocated to each country must be an integer.
   The measure of performance being used is additional person-years of life.(For a particular country, this measure equals the increased *life expectancy* in years time country's population.) Table gives the estimated additional person-years life (in multiples of 1000) for each country for each possible allocation of medical teams. What allocation maximizes the measure of performance?

	Thousands of additional		
Medical	Person-Years of Life		
Teams	Country 1	Country 2	Country 3
0	0	0	0
1	45	20	50
2	70	45	70
3	90	75	80
4	105	110	100
5	120	150	130

3. Attempt any two parts of the following: - **[10x2=20]**

(a) (i) Explain the difference between expected opportunity loss and expected value of perfect information.

(ii) Write a note on Utility Curve.

(b) Find a saddle point (if any) of the following payoff matrix. Transform the zero-sum game into an equivalent linear programming problem.

	B_1	B_2	B_3
A_1	1	-1	3
A_2	3	5	-3
A	6	2	-2

(c) A book binder has one printing press, one binding machine and manuscripts of seven different books. The time required for performing printing and binding operations for different books are shown below:

Book	1	2	3	4	5	6	7
Printing time (hours)	20	90	80	20	120	15	65
Binding time (hours)	25	60	75	30	90	35	50

Decide the optimal sequence of processing of books in order to minimize the total time required to bring out all the books.

4. Attempt any two parts of the following: - **[10x2=20]**

(a) (i) Why is it desirable to classify items into groups? Explain with help of example.

(ii) Write advantages and disadvantages of simulation.

(b) Formulate and solve a discrete stochastic model for a single product with lead time zero. The storage and shortage costs are independent of time. The set-up cost is constant.

(c) Discuss Monte-carlo simulation.

5. Attempt any two parts of the following: - **[10x2=20]**

(a) Western National Bank is considering opening a drive-through window for customer service. Management estimates that customers will arrive at the (Poisson) rate of 15 per hour. The teller who will staff the window can service customer at the rate (exponential) of one every three minutes. Find (i) Average number in system, (ii) Average waiting time in line, iii) Average waiting time in system, including service.

(b) Draw the network and find the least-cost schedule using the data given below:

Activity	Normal Time (weeks)	Crash Time (weeks)	Cost of Crashing (Rs. Per Week)
1-2	9	4	300
2-3	5	2	400
2-4	7	3	200
3-4	4	2	200

Time related overhead expenses for the project is Rs. 250.00.

(c) Explain 'Total float', 'Free float' and 'Independent float' of activities and their significance in management decisions.