Roll No. | | | | | | | | | | |

Paper Code: MTME102

M TECH
(SEM I) ODD SEMESTER EXAMINATION 2016-17
OPERATIONS RESEARCH

Time: 3 Hours ***Maximum Marks: 70***

Note: Attempt any five questions, all questions carry equal marks.
Use of graph paper is allowed.

Q.1. **(a)** Model building is the essence of the operations research approach. Discuss. **(4)**
(b) Solve the following LP problem using simplex method. **(10)**
Max $Z = 5x_1 + 3x_2$: subject to
$x_1 + x_2 \leq 2$,
$5x_1 + 2x_2 \leq 10$,
$3x_1 + 8x_2 \leq 12$;
$x_1, x_2 \geq 0$.

Q.2. **(a)** Write a short note on sensitivity analysis. **(4)**
(b) A firm manufactures industrial chemicals has got three plants P_1, P_2, and P_3, each having capacities 300 kg, 200kg, and 500kg respectively of a particular chemical per day. The production costs per kg in plants P_1, P_2, and P_3 respectively are Re 0.70, Re 0.60, and Re 0.66. Four bulk consumers have placed orders for the products on the following basis; Shipping costs (paisa per kg) from plants to consumers are given in table below:

Consumer	Kg per day	Offered price Rs/kg
I	400	1.00
II	250	1.00
III	350	1.02
IV	150	1.03

	COMSUMER			
	C_1	C_2	C_3	C_4
P_1	3	5	4	6
P_2	8	11	9	12
P_3	4	6	2	8

Work out an optimal schedule for the above situation. Under what conditions would you change schedule? **(10)**

Q.3. **(a)** Five men are available to do five different jobs. From past records, the time in hours that each men takes to do each job is known and given in the following table, find out how men should be assigned the jobs in way that will minimize the total time taken. **(8)**

	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

(b) Explain, in brief, the main characteristics of the 'queuing system'. **(6)**

Q.4 **(a)** Obtain the strategies for both the players and the value of the game for two-person zero-sum game whose payoff matrix is given as follows: **(8)**

	Player B					
player A	B_1	B_2	B_3	B_4	B_5	B_6
A_1	1	3	-1	4	2	-5
A_2	-3	5	6	1	2	0

(b) Customers arrive at a box office window, being manned by a single individual, according to a Poisson input process with a rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 90 seconds. Find the average waiting time of a customer. Also determine the average number of customers in the system and average queue length. **(6)**

Q.5 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?

Medical Teams	Thousands of additional Person-Years of Life		
	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

Q.6 The production function of a commodity is given by: $Q=40F+3F^2 – (F^3/3)$, where Q is the total output and F is the units of inputs.

i) Find the number of units of input required to give the maximum output.
ii) Find the maximum value of marginal product.
iii) Verify that when the average product is maximum, it is equal to marginal product.

--OR—

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.

Q. 7 (a) Write advantages and disadvantages of simulation **(6)**
(b) Discuss Integer programming **(8)**