Paper Code: OE-073	Roll No.										

B.TECH
(SEM-VII) THEORY EXAMINATION 2016-17
OPERATIONS RESEARCH

[Time: 3 Hours] **[Total Marks: 100]**

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

Q.1. **(a)** what are the advantages and disadvantages of operations research models? **(4)**

(b) Solve the following LP problem. **(10)**
Max $Z = 4x_1 + 2x_2$: subject to
$-x_1 + 2x_2 \leq 6$,
$-x_1 + x_2 \leq 2$,
$x_1, x_2 \geq 0$.

(c) Define the dual of a linear programming problem. State functional properties of duality. **(6)**

Q.2. **(a)** 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	2	5	4	6
P_2	8	10	8	12
P_3	4	6	2	7

Work out an optimal schedule for the above situation. Under what conditions would you change schedule? **(12)**

(b) 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	3	6	5	3	1
D	4	2	7	3	1
E	5	3	8	5	1

Q3. **(a)** Briefly discuss 'Shortest path model' network technique. **(4)**

(b) The activities involved in a certain project have been identified as follows: **(16)**

Activity	Preceding Activity	Duration (weeks)	No. of Men Required
A		4	1
B		7	1
C		8	2
D	A	5	3
E	C	4	1
F	B,E	4	2
G	C	11	2
H	G,F	4	1

i.) For the above project draw the network. Determine the critical path and its duration.
ii.) If there were only three men available at any one time how long would the project take and how would you allocate the activities.

Q.4 **(a)** Obtain the strategies for both the players and the value of the game for two-person zero-sum game through graphical method 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) Simply and formulate the above game into a LP problem. **(6)**

(c) 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 **(a)** Find the optimum order quantity for a product for which price breaks are as follows:

Quantity (units)	Price per units (Rs.)
$0 < Q_1 < 500$	10.00
$500 \leq Q_2$	9.00

The monthly demand for the product is 200 units, the cost of shortage is 2 per cent of the unit cost and cost of ordering is Rs.350. **(10)**

(b) The cost of a machine is Rs. 6,100 and its scrap value is Rs. 100. The maintenance costs found from experience are as follows:

Year	:	1	2	3	4	5	6	7	8
Maintenance cost (Rs)	:	100	250	400	600	900	1,200	1,600	2,000

When should the machine be replaced? **(10)**