Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (OPEN ELECTIVE - II)
END SEMESTER MAKE UP EXAMINATION, JUNE - 2018
SUBJECT: INTRODUCTION TO OPERATIONS RESEARCH (MME 3288)
REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data if any may be suitable assumed.

1A. A bakery produces a speciality cake in either of its two plants. Plant A and Plant B has a daily production capacity of 2500 and 2100 cakes respectively. Four retailers are willing to purchase their cakes. The demand of four retailers R1, R2, R3 and R4 are 1800, 2300, 550 and 1750 respectively. Following table is showing the profit per unit of cake sold by plants A and B to each retailer. **(05)**

From / To	R1	R2	R3	R4
Plant A	10	6	6	4
Plant B	2	6	7	6

Determine a delivery schedule for the bakery that will maximize its total profit from this cake.

1B. Sketch the methodology used in operations research. **(05)**

2A. Solve the following LPP by simplex method **(05)**

Max $Z = 32X_1 + 26X_2$

Subject to

$3X_1 + X_2 \leq 8$

$3X_1 + 6X_2 \leq 18$

$4X_1 + 5X_2 \leq 30$

$X_1, X_2 \geq 0$

2B. Firm X is fighting for its life against the determination of firm Y to drive it out of the industry. Firm X has the choice of increasing the price, leaving it unchanged or lowering it. Firm Y has the same three options. Firm X's gross sales in the event of each of the pairs of choices are shown below. **(05)**

Firm X's pricing strategies	Firm Y's pricing strategy		
	Increase Price	Do not change	Reduce price
Increase Price	90	80	110
Do not change	110	100	90
Reduce price	120	70	80

Assuming firm X as the maximising one, Find the value of the game.

3A. Solve the travelling salesman problem for the following data.

C_{12}= 30; C_{13}= 5; C_{14}= 20; C_{23}= 10; C_{34}= 15; C_{25}= 20; C_{35}= 15; C_{45}= 30; **(05)**

where $C_{ij} = C_{ji}$ and there is no route between i and j if the value of c_{ij} is not shown.

3B. i) What steps are to be followed in crashing an activity in a project network?

ii) Differentiate between a PERT and CPM network. **(05)**

iii) What is a dummy activity?

4A. Write the dual for given LPP.

Minimise $Z = 3X_1 - 6X_2 + 4X_3$

Subject to

$4X_1 + 3X_2 + 6X_3 \geq 9$

$6X_1 - 2X_2 - 2X_3 \leq 10$

$2X_1 + 5X_2 - 3X_3 \geq 6$ **(05)**

$X_1 + 2X_2 + 3X_3 \geq 6$

$X_1 - 2X_2 + 6X_3 \geq 4$

$X_1, X_2, X_3 \geq 0$

4B. Information on the activities required for a project is as follows:

Activity	A	B	C	D	E	F	G	H	I
Node	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration (Days)	4	6	8	7	4	6	5	19	10

(05)

Draw the CPM network and calculate earliest start, earliest finish, latest start and latest finish times of each of the activities. Also compute total float & free float for all the activities.

5A. A linear programming model and its simplex table is shown below.

Maximize Profit = $20X_1 + 40X_2 + 25X_3$

Subject to the constraints:

$3X_1 + 4X_2 + 2X_3 \leq 60$ (i)

$2X_1 + X_2 + 2X_3 \leq 36$ (ii)

$X_1 + 3X_2 + 2X_3 \leq 62$ (iii)

$X_1, X_2, X_3 \geq 0$

C_B	X_B	20	40	25	0	0	0	bi
		X_1	X_2	X_3	S_1	S_2	S_3	
40	X_2	1/3			1/3	-1/3		8
25	X_3	5/6			-1/6	2/3		14
0	S_3	-5/3			-2/3	-1/3		10

(05)

a) Complete all the table entries.

(a) Carry out sensitivity analysis for the changes in objective function coefficients and RHS values of constraints

5B. Customers arriving at a counter in the post office are randomly distributed. They are served by the clerk as per their requirements and hence service time is also random. A study of 100 arrivals gave the following inter-arrival time frequency distribution and service distribution.

Inter arrival time (min)	Frequency	Service time (min)	Frequency
2	50	1	10
4	30	2	30
6	10	3	30
8	10	4	20
-	-	5	10

(05)

Simulate the queue for first 10 arrivals and compute the following

(i) Proportion of time the clerk is idle.

(ii) The average waiting time of the customer.

Use the following set of random numbers taken from the pool of 00-99, taking first 10 numbers for arrival time and the remaining for service time.

06 96 64 49 49 24 55 60 73 33 56 76 42 22 06 12 99 57 79 81