Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
A Constituent Institution of Manipal University

VII SEMESTER B.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS, DEC/JAN 2016-17

SUBJECT: OPERATIONS RESEARCH (BME 433)
(REVISED CREDIT SYSTEM)
Monday, 26th December 2016: 2 to 5 PM.

TIME: 3 HOURS   **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer any FIVE full questions.**
2. **Missing data may be suitably assumed.**

1A. Explain the phases involved in carrying out an O.R Project. Also give any five applications of O.R. models.   **06**

1B. A city corporation plans to introduce a mass transit system that will alleviate the smog problem by reducing in-city driving. The table below summarizes the city engineer's findings and required number of buses over successive intervals of 4 hours each. Each bus can operate only 8 hours per day.   **14**

Time	0000-0400	0400-0800	0800-1200	1200-1600	1600-2000	2000-2400
Buses	4	8	10	7	9	4

Formulate LPP with the objective of minimizing the total number of buses in operation with structural constraints. Draw the first simplex tableau. Do not solve

2A. With example explain the L.P. Model of Fluid blending problem and give the basic assumptions.   **06**

2B. A company produces three products which require processing in 3 machine centres.. The L.P. model is formulated as   **14**

Maximize $Z = 3X_1 + 2X_2 + 5X_3$ (Total profit)

Subject to:
$$1X_1 + 2X_2 + 1X_3 \leq 430 \quad \text{Machine 1 hours available}$$
$$3X_1 + 3X_3 \leq 460 \quad \text{Machine 2 hours available}$$
$$1X_1 + 4X_2 \leq 420 \quad \text{Machine 3 hours available}$$
$$X_1, X_2, X_3 \geq 0$$

(i) Find the optimal product mix using simplex method and optimal profit.
(ii) Comment on the value of adding additional capacity in each of three resources.

3A. A company produces a special purpose equipment at its 3 plants A,B and C. Their **14** monthly capacities are 40, 60 and 50 units respectively. The company has contractual obligation to supply the equipment to 3 customers whose requirements are 55, 45,and 50 units respectively. The net profit ($00's) associated with shipping a unit from each plant to each customer is given below:

Customer	1	2	3
Plant A	7	6	7
Plant B	4	7	9
Plant C	5	10	8

Use transportation algorithm to determine optimal shipping schedule and total profit.
b) If the company desires to produce less at B and build the capacity of A and C for the same overall total of 60 units, what will be the effect on optimal profit?

3B A computer centre has 4 operators. It receives 4 jobs. Only one job can be assigned **06** to each operator. The profit matrix for assigning job is given as:

Job	1	2	3	4
Operator A	x	5	2	4
B	4	7	5	3
C	5	8	4	5
D	3	6	6	6

" x "   indicates that A cannot do Job 1. Determine the optimal profit using Assignment Algorithm .

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4A. A company has 6 salesmen and 3 market areas A, B, C. It is required to determine **14** the number of salesmen to allocate to each area to maximize the profit. The following table gives the profits from each market area as a function of number of salesman allocated.

	Salesmen						
	0	1	2	3	4	5	6
Area A	38	41	48	58	66	72	83
Area B	40	42	50	60	66	75	82
Area C	60	64	68	78	90	102	109

Use dynamic programming to determine the number of salesmen to be allocated to each area to maximize profit.

4B. Solve the following 2 person zero sum game and find the value of the game.　　　　**06**

Player B

Player A

4	0	1	7	-1
0	-3	-5	-7	5
3	2	3	4	3
-6	1	-1	0	5
0	0	6	0	0

Explain the criteria you have used in solving the game

5A. A firm has a single machinist in its repair shop. He works 8 hours a day. On an **12** average 6 machines break each day. It takes on the average one hour to repair a machine. Using poisson- exponential model determine (i) expected   number of machines in the repair shop (ii) expected number of machines waiting to be repaired (iii) average down time per machine (waiting for repairs or undergoing repairs) (iv) average time a machine waits for service. (v) expected proportion of the time the repair man is idle. (vi) Probability of 3 machines in the system.
 What are the managerial implications of the above operating characteristics?

5B. Explain the Monte Carlo simulation of queuing models. Also outline its major **08** advantages and limitations.

6A. Explain briefly steps involved in drawing CPM/PERT Network. Give any five **06** applications of CPM/PERT..

6B. Consider the following project with optimistic (a), most likely (m) and pessimistic (b) **14** estimates of durations in days for each activity..

Activity	Immediate predecessor	a	m	b
A	-----	5	8	11
B	-----	2	6	10
C	----	4	6	9
D	A	3	5	8
E	A	5	10	15
F	A	2	5	8
G	B,F	3	6	10
H	C	3	7	12

 (i) Constrict the PERT Network (ii) Find the expected duration and variance of all activities. (iii) Find the earliest and latest time for each event and and critical path.