Code No: R1631034   **R16**   SET - 1

III B. Tech I Semester Supplementary Examinations, May - 2019
OPERATIONS RESEARCH
(Mechanical Engineering)

Time: 3 hours   Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain phases of operations research. [2M]
    b) State the characteristics of transportation problem. [2M]
    c) What is present worth factor and state its importance in replacement? [2M]
    d) What are the characteristics of game theory? [3M]
    e) Discuss about types of inventory models. [3M]
    f) What are the types of simulation languages? [2M]

PART -B

2. a) Solve the following linear programming problem by simplex method? [7M]
       Maximize $Z=5X_1+3X_2$ subject to constraints $3X_1+5X_2 \leq 15$, $5X_1+2X_2 \leq 10$ and $X_1, X_2 \geq 0$.

    b) Solve the following linear programming problem by Big-M method? [7M]
       Maximize $Z=X_1+2X_2+3X_3-X_4$ and subject to constraints $X_1+2X_2+3X_3=15$, $2X_1+X_2+5X_3=20$, $X_1+2X_2+X_3+X_4=10$ and $X_1,X_2,X_3,X_4 \geq 0$.

3. a) Solve the following transportation problem by North West corner rule? [7M]

	F_1	F_2	F_3	Supply
W_1	2	7	4	5
W_2	3	3	1	8
W_3	5	4	7	7
W_4	1	6	2	14
Demand	7	9	18	

    b) Solve the following problem by using Hungarian assignment problem? [7M]

4	6	7	5	11
7	3	6	9	5
8	5	4	6	9
9	12	7	11	10
7	5	9	8	11

4. a) An Engineering company is offered a material handling equipment A. The machine A is priced at Rs.60, 000 including cost of installation. The costs for operation and maintenance are estimated to be Rs 10, 000 for each of the first five years, increasing every year by Rs 3,000 in the sixth and subsequent years. The company expects a return of 10% on all its investments. What is the optimal replacement period? [7M]

b) The maintenance cost and resale price per year of a machine whose purchase price is Rs.7000 is given below. When should machine be replaced? [7M]

Year	1	2	3	4	5	6	7	8
Mainte nance cost in Rs.	900	1200	1600	2100	2800	3700	4700	5900
Resale price in Rs.	4000	2000	1200	600	500	400	400	400

5. a) Use the graphical method for solving the following game and find the value of game? [7M]

Player A	Player B			
	B1	B2	B3	B4
A1	2	2	3	-2
A2	4	3	2	6

b) A harbor has a single dock to unload the containers from the incoming ships. The arrival rate of ships at the harbor follows Poisson distribution and the unloading time for the ships follow exponential distribution and hence, the service rate also follows Poisson distribution. The arrival rate and service rate are 8 ships per week and 14 ships per week, respectively. Find the following [7M]
     a) Utilization factor of the dock
     b) Average number of waiting ships in the queue
     c) Average number of waiting ships in the system
     d) Average waiting time per ship in the queue
     e) Average waiting time per ship in the system

6. a) The annual demand for an automobile component is 36,000 units. The carrying cost is Rs.0.50 per unit per year, the ordering cost is Rs.25 per order and the shortage cost is Rs.15 per unit per year. Find the optimal values of the following i) Economic order quantity ii) Maximum inventory iii) Maximum shortage quantity iv) Cycle time v) Inventory period(t_1) vi) Shortage period(t_2) [7M]

b) In a manufacturing model without shortages an automobile manufacturing industry needs a particular type of gear within the factory. This gear is used in the final assembly. The particulars of this gear are: demand rate(r) is 14,000 units/year, production rate (k) is 35,000 units/year, set-up cost (C_o) is 500 per set-up and carrying cost is 15/unit/year. Find the economic batch quantity, period of production, period of consumption, cycle time and number of set-ups per year? [7M]

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7. a) Six crates of fruits are to be allocated to three different stores A, B and C. The expected returns from each of the stores, when different number of crates is allocated to them, are furnished in the following table. Find the optimal allocation of crates to these stores so as to maximize the total expected return.   [7M]

No. of crates	Store A	Store B	Store C
0	0	0	0
1	25	20	33
2	42	38	43
3	55	54	47
4	63	65	50
5	69	73	52
6	74	80	53

    b) Explain the advantages, disadvantages and applications of simulation.   [7M]

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