Code No: RT32031 **R13** **SET - 1**

III B. Tech II Semester Regular/Supplementary Examinations, April - 2017

OPERATIONS RESEARCH

(Mechanical Engineering)

Time: 3 hours Maximum Marks: 70

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

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PART –A

1 a) Does the simplex method find the global solution? Explain [3M]

b) Give a brief outline of the procedure for solving a transportation problem. [4M]

c) Explain group replacement problem. [3M]

d) What do you understand by queue discipline, arrival process and service process? [4M]

e) Derive EOQ. [4M]

f) What are the applications of dynamic programming? [4M]

PART –B

2 a) Discuss the various phases in solving an OR problem. [6M]

b) A person requires 10, 12, and 12 units of chemicals A, B and C respectively for his garden. The liquid product contains 5 units, 2 units and 1 unit of A, B and C respectively per jar. The dry product contains 1 unit, 2 units and 4 units of A, B and C per jar. If the liquid product sells for Rs.3 per jar and dry product sells for Rs.2 per jar, how many of each should be purchased to minimize the cost and meet the requirements. Solve using graphical method. [10M]

3 a) Find the optimal solution to the following transportation problem [16M]

	W_1	W_2	W_3	W_4	Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Demand	5	8	7	14	34

4 a) Discuss in brief, replacement procedure for the items that deteriorate with time. [6M]

b) The initial cost of an item is Rs15000 and maintenance and running cost (in Rs) for different years are given below: [10M]

Year	1	2	3	4	5	6	7
Running cost	2500	3000	4000	5000	6500	8000	10000

What is the replacement policy to be adopted if the capital worth is 10% and there is no salvage value?

Code No: RT32031 **R13** **SET - 1**

5 a) Write the classification of queuing system. [6M]

b) Using dominance principle reduce the following game to a 2 x 4 game and solve it graphically [10M]

Player B

		I	II	III	IV
	I	8	15	-4	2
Player A	II	19	15	17	16
	III	0	20	15	5

6 a) Differentiate between ABC and VED analysis. [8M]

b) An annual requirements for a particular raw material is 8000 units costing Rs.1 each for its manufacture, the ordering cost is Rs.12.5 to carrying cost is 20% of average inventory planning. Find the Economic order Quantity and Total cost for the year, Number of orders required and How frequently should the orders to be placed? [8M]

7 a) What are the advantages and limitations of using simulation? [6M]

b) A production line turns out about 50 cars/day with the following probability distribution [10M]

Production/day	45	47	49	51	53	55	48
Probability	0.10	0.15	0.15	0.20	0.25	0.05	0.10

Finished cars are transported at the end of the day by train. If the train capacity is only 51, what will be the average number of cars waiting to be shipped and what will be the average number of empty spaces on the train? Simulate a 8 day operation with RN of 37,35,63,25,50,71,95,16.

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Code No: RT32031 **R13** **SET - 2**

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OPERATIONS RESEARCH

(Mechanical Engineering)

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PART –A

1 a) Define surplus and slack variables. [3M]
b) How do you overcome degeneracy in a transportation problem? [4M]
c) Explain the basic components of queue. [3M]
d) What are the situations which make the replacement of items necessary? [4M]
e) What is ABC analysis? Why is it necessary? [4M]
f) What is simulation? List the applications of simulation. [4M]

PART –B

2 a) Explain graphical method of solving an LPP. [6M]
b) Use simplex method to solve [10M]

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subject to the constraints

$$x_1 + 2x_2 + x_3 \leq 430$$
$$3x_1 + 2x_3 \leq 460$$
$$x_1 + 4x_2 \leq 420$$
$$x_1, x_2, x_3 \geq 0$$

3 a) Find the optimal solution to the following transportation problem [12M]

	D_1	D_2	D_3	D_4	Supply
O_1	23	27	16	18	30
O_2	12	17	20	51	40
O_3	22	28	12	32	53
Demand	22	35	25	41	

b) Write short notes on assignment maximization problem. [4M]

Code No: RT32031 **R13** **SET - 2**

4 a) Write a short note on group replacement and individual replacement polices. [6M]

b) The cost of a machine is Rs.6100 and its scrap value is only Rs.100. The maintenance costs are found from experience to be: [10M]

year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	100	250	400	600	900	1250	1600	2000

When should machine be replaced?

5 a) Briefly explain the important characteristics of queuing system. [6M]

b) Solve the following game graphically [10M]

1	2
4	5
9	-7
-3	-4
2	1

6 a) What are the various types of Inventories? Explain briefly? [6M]

b) A shopkeeper has a uniform demand for an item at the rate of 50 items per month. He buys from supplier at a cost of Rs.6 per item and the cost of ordering is Rs.10 each time. If the stock holding costs are 20% per year of stock value, how frequently should he replenish his stocks? [10M]
Now suppose the supplier offers a 5% discount, on orders between 200 and 999 items and a 10% discount on orders exceeding or equal to 1000. Can the shop keeper reduce his costs by taking advantage of either of these discounts?

7 a) Apply the dynamic programming problem to solve the following problem. [10M]

Minimize $f(x) = x_1^2 + x_2^2 + x_3^2$

Subject to

$x_1 + x_2 + x_3 \geq 15$

$x_1, x_2, x_3 \geq 0$

b) "When it becomes difficult to use an optimization technique for solving a problem, one has to resort to simulation". Discuss. [6M]

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Code No: RT32031 **R13** **SET - 3**

III B. Tech II Semester Regular/Supplementary Examinations, April - 2017

OPERATIONS RESEARCH

(Mechanical Engineering)

Time: 3 hours Maximum Marks: 70

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) Explain briefly the importance of artificial variables. [3M]
b) What is a travelling salesman problem? [4M]
c) Explain maximin and minimax principles. [3M]
d) Discuss in brief, replacement procedure for the items that deteriorate with time [4M]
e) Explain the optimum order quantity models. [4M]
f) Describe recursive equation approach to solve dynamic programming problems. [4M]

PART –B

2 a) How the degeneracy is resolved in LPP? [6M]
b) Use simplex method to solve [10M]

Maximize $Z = 5x_1 + 3x_2$
Subject to the constraints
$x_1 + 2x_2 \leq 2$
$5x_1 + 2x_2 \leq 10$
$3x_1 + 8x_2 \leq 12$
$x_1, x_2 \geq 0$

3 a) What is sequencing and what are the assumptions made for the processing of 'n' jobs through two machines? [6M]
b) Solve the following travelling salesman problem [10M]

To

From	A	B	C	D	E
A	-	4	7	3	4
B	4	-	6	3	4
C	7	6	-	7	5
D	3	3	7	-	7
E	4	4	5	7	-

4 a) What is a replacement problem? When does it arise? [4M]

Code No: RT32031 **R13** **SET - 3**

b) The following mortality rates have been observed for a certain type of light bulbs [12M]

week	1	2	3	4	5
% failing by the end of week	10	25	50	80	100

There are 1000 bulbs in use and its costs Rs. 1 to replace an individual bulb which has burnt out. If all bulbs were replaced simultaneously it would cost 25 paisa per bulb. It is proposed to replace all bulbs at fixed intervals whether or not they have burnt out and to continue replacing burnt out bulbs as they fail. At what intervals should all bulbs be replaced?

5 a) Define: (i) Pure Strategy; (ii) Mixed strategy; (iii) Zero sum Game; (iv) Non-Zero sum Game; (v Pay-off; (vi) Saddle Point [6M]

b) Solve the following game whose payoff matrix is given below [10M]

3	2	4	0
3	4	2	4
4	2	4	0
0	4	0	8

6 a) What are the assumptions involved in EOQ? Explain. [6M]

b) A particular item has demand of 9000 units per year. The cost of procurement is Rs.100 and the holding cost per unit is Rs.2.40/year. The replacement is instantaneous and no shortages are allowed. Determine: (i) the economic order quantity (ii) the time between orders (iii) the number of orders per year. [10M]

7 a) What are the applications of dynamic programming? [6M]

b) A tourist cab owner has 25 taxis in operation. He keeps 3 drivers as reserve to attend the call in case the scheduled driver reports sick. The probability distribution of sick drivers is as follows: [10M]

Number sick	0	1	2	3	4	5
probability	0.20	0.25	0.20	0.15	0.12	0.08

Use monte- carlo simulation to estimate the utilization of reserve drivers and the probability that at least one taxi will be off the road to non availability of a driver.

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Code No: RT32031 **R13** **SET - 4**

III B. Tech II Semester Regular/Supplementary Examinations, April - 2017

OPERATIONS RESEARCH

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Time: 3 hours Maximum Marks: 70

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3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) What are the essential characteristics of a linear programming model? [3M]
b) Describe the method of processing 'n' jobs through two machines. [4M]
c) Explain the principles of dominance. [3M]
d) What is group replacement? Give an example. [4M]
e) Explain the types of inventory. [4M]
f) State the advantages and disadvantages of simulation. [4M]

PART –B

2 a) Discuss in brief "duality" in linear programming and explain the primal-dual relationship. [6M]
b) Use Big-M method to solve [10M]

Minimize $Z = 4x_1 + x_2$

Subject to the constraints

$4x_1 + 3x_2 \geq 6$

$3x_1 + x_2 = 3$

$x_1 + 2x_2 \leq 3$

$x_1, x_2 \geq 0$

3 a) A book binder has one printing press, one binding machine and the manuscripts of a number of different books. The time required performing printing and binding operations for each book are shown below. Determine the order in which books should be processed, in order to minimize the total time required to turnout all the books. [12M]

Book	1	2	3	4	5	6
Processing time(hrs)	30	120	50	20	90	110
Binding time(hrs)	80	100	90	60	30	10

Determine also the idle time for both machines.

b) Describe the assignment problem giving a suitable example. Give two areas of its application. [4M]

Code No: RT32031 **R13** **SET - 4**

4 a) Explain the importance of time value of money? [6M]

b) The initial price of an equipment is Rs.5000. The running cost varies as shown below: [10M]

year	1	2	3	4	5	6	7
Running cost (Rs)	400	500	700	1000	1300	1700	2100

Taking a discount rate of 0.90, find out the optimum replacement interval.

5 a) Describe about Kendal's Notation for representing Queuing Models. [6M]

b) On an average 96 patients per 24 hour day require the service of an emergency clinic. Also on average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs.100 per patient treated to obtain an average servicing time of 10 minutes, and that each minute of decrease in this average time would cost Rs.10 per patient treated, how much would have to be budgeted by the Clinic to decrease the average size of the Queue from $1\frac{1}{3}$ patients to $\frac{1}{2}$ patient? [10M]

6 a) Explain the steps involved in ABC analysis. [6M]

b) A contractor has to supply 10000 bearings per day to an automobile manufacturer. He finds that when he starts production run, he can produce 25000 bearings per day. The cost of holding a bearing in stock for a year is Rs 2 and the setup cost of a production run is Rs 180.How frequently should production run be made. [10M]

7 a) Explain how simulation technique can be used in solving queuing problems. [6M]

b) Solve the following LP problem by dynamic programming approach [10M]

$$\text{Maximize } Z = 3x_1 + 5x_2$$

Subject to the constraints

$$\begin{aligned} x_1 &\le 4 \\ x_2 &\le 6 \\ 3x_1 + 2x_2 &\le 18 \\ x_1, x_2 &\ge 0 \end{aligned}$$

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