

**Seventh Semester B.E. Degree Examination, Dec.2015/Jan.2016**  
**Operations Research**

Time: 3 hrs.

Max. Marks: 100

**Note: Answer any FIVE full questions, selecting at least TWO questions from each part.**

**PART – A**

- 1 a. Briefly explain the scope of operations research and what are its limitations. (08 Marks)  
b. The manager of an oil refinery has to decide upon the optimal mix of two possible blending process of which the inputs and outputs per production run as follows:

| Process | Input     |           | Output       |              |
|---------|-----------|-----------|--------------|--------------|
|         | Crude 'A' | Crude 'B' | Gasoline 'X' | Gasoline 'Y' |
| 1       | 5         | 3         | 5            | 8            |
| 2       | 4         | 5         | 4            | 4            |

The maximum amount available of crude 'A' and 'B' are 200 units and 150 units respectively. Market requirement shows that at least 100 units of gasoline 'X' and 80 units of Gasoline 'Y' must be produced. The profit per production run from process 1 and 2 are Rs 30 and Rs 40 respectively. Formulate the problem as a LPP and solve it graphically.

(12 Marks)

- 2 a. What is degeneracy in simplex method? How do you overcome it? (04 Marks)  
b. Solve the following LPP by Big M method:

$$\text{Minimize } Z = 10x_1 + 6x_2 + 2x_3$$

$$\text{Subject to } -x_1 + x_2 + x_3 \geq 1$$

$$3x_1 + x_2 - x_3 \geq 2$$

$$x_1, x_2, x_3 \geq 0.$$

(16 Marks)

- 3 a. Give a mathematical formulation of the transportation problem. (03 Marks)  
b. "Assignment problems are inherently degenerate", explain the concept. (03 Marks)  
c. A company has 3 plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 800 units respectively. units transportation cost in Rs are given below:

|   | D | E | F | G | H |
|---|---|---|---|---|---|
| A | 5 | 8 | 6 | 6 | 3 |
| B | 4 | 7 | 7 | 6 | 6 |
| C | 8 | 4 | 6 | 5 | 4 |

Determine the optimum distribution for the company in order to minimize the total transportation cost. (14 Marks)

- 4 a. Explain the importance of integer programming. (04 Marks)  
b. Use Gomory's fractional cutting plane method to solve the following IPP.

$$\text{Maximize } Z = x_1 + 4x_2$$

$$\text{Subject to } 2x_1 + 4x_2 \leq 7$$

$$5x_1 + 3x_2 \leq 15$$

$$x_1, x_2 \geq 0 \text{ and are integers.}$$

(16 Marks)

## PART – B

- 5 a. Differentiate between PERT and CPM. (04 Marks)  
 b. Table below shows jobs, their normal time and cost and crash time and cost for a project.

| Job   | Normal time (days) | Normal cost (Rs) | Crash time (days) | Crash cost (Rs) |
|-------|--------------------|------------------|-------------------|-----------------|
| 1 – 2 | 6                  | 1400             | 4                 | 1900            |
| 1 – 3 | 8                  | 2000             | 5                 | 2800            |
| 2 – 3 | 4                  | 1100             | 2                 | 1500            |
| 2 – 4 | 3                  | 800              | 2                 | 1400            |
| 3 – 4 | Dummy              | –                | –                 | –               |
| 3 – 5 | 6                  | 900              | 3                 | 1600            |
| 4 – 6 | 10                 | 2500             | 6                 | 3500            |
| 5 – 6 | 3                  | 500              | 2                 | 800             |

Indirect cost for the project is Rs 300/day

- i) Draw the network of the project  
 ii) What is the normal duration and normal cost of the project  
 iii) If all the activities are crashed, what will be the project duration and corresponding cost?  
 iv) Find the optimum duration and minimum project cost. (16 Marks)
- 6 a. Briefly explain the following :  
 i) Queue discipline    ii) Service pattern    iii) Traffic intensity. (06 Marks)  
 b. A box office window is being served by a single server where customers arrive to purchase tickets according to Poisson fashion with a mean rate of 30 per hour. The time required to serve a customer has negative exponential with a mean of 90 sec. Determine :  
 i) Fraction of the time the server is busy  
 ii) The average number of customer in the queue  
 iii) The probability of having more than 10 customers in the system  
 iv) The probability that the customer has to queue for more than 3 minutes. (14 Marks)
- 7 a. Explain the following terms :  
 i) Pay off matrix    ii) Saddle point    iii) Maximin and Minimax principle. (06 Marks)  
 b. Solve the following game by reducing it to a  $(2 \times 2)$  game by graphical method.

|                | B <sub>1</sub> | B <sub>2</sub> |
|----------------|----------------|----------------|
| A <sub>1</sub> | -4             | 2              |
| A <sub>2</sub> | -7             | 1              |
| A <sub>3</sub> | -2             | -4             |
| A <sub>4</sub> | -5             | -2             |
| A <sub>5</sub> | -1             | -6             |

(14 Marks)

- 8 a. State the assumptions of Johnson's algorithm. (05 Marks)  
 b. Find the sequence for the following eight jobs that will minimize the total elapsed time. Each job is processed in the order CAB.

| Job       | 1 | 2  | 3 | 4 | 5  | 6 | 7  | 8  |
|-----------|---|----|---|---|----|---|----|----|
| Machine A | 4 | 6  | 7 | 4 | 5  | 3 | 6  | 2  |
| Machine B | 8 | 10 | 7 | 8 | 11 | 8 | 9  | 13 |
| Machine C | 5 | 6  | 2 | 3 | 4  | 9 | 15 | 11 |

Also find the idle time.

(15 Marks)

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