b) The following table gives data on normal time, cost, crash time and cost for a project:

| Activity | Normal Time (days) | Normal Cost (Rs.) | Crash Time (days) | Crash Cost (Rs.) |
|----------|----------|----------|----------|----------|
| 1 – 2 | 8 | 100 | 6 | 210 |
| 1 – 3 | 4 | 150 | 2 | 350 |
| 2 – 4 | 2 | 50 | 1 | 90 |
| 2 – 5 | 10 | 100 | 5 | 400 |
| 3 – 4 | 5 | 100 | 1 | 200 |
| 4 – 5 | 3 | 80 | 1 | 100 |

Indirect cost is Rs. 70 per day.

You are require to-

i) Draw the network, Identify the critical path and determine the normal project completion time and cost.

ii) Crash the activities systematically and determine the optimum project completion time and cost.

**(*Internal Assessment :10 marks*)**

**2015**

**M. Com.**

**1ˢᵗ Semester Examination**

**OPERATIONS RESEARCH**

**PAPER – COM – 103**

*Full Marks : 50*

*Time : 2 Hours*

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*UNIT – I*

1. **Answer any two questions of the following:          5 X 2**

(a) What is Artificial Variable? What strategy would you follow to derive it out of the simplex method of solving LPP?          2+3

(b) What do you mean by 'Dual' in Linear Programming? Write the Dual for the following LPP

Minimize $Z=4x_1+x_2$

Subject to $3x_1+x_2 \leq 2$,  $4x_1+3x_2 \geq 6$,  $x_1+x_2 \leq 3$,  where $x_1, x_2 \geq 0$    2+3

(c) Demonstrate graphical method of solving linear programming problem with the help of the following problem:

Maximize          $Z=4x_1 + 8x_2$

Subject to          $2x_1 + x_2 \leq 30$

$X_1 + 2x_2 \leq 50$          where $x_1, x_2 \geq 0$

(Use manually prepared graph paper)

(d) What do you understand by 'Loop' in a Transportation problem? Explain with example.

*(Turn Over)*

**2. Answer any one questions of the following:**  **10 X 1**

a) Solve the following linear programming problem

Max $Z = 3x_1 + 2x_2 + x_3$ Subject to $-3x_1 + 2x_2 + 2x_3 \leq 8$, $-3x_1 + 4x_2 + x_3 \leq 7$ where $x_1$, $x_2$ & $x_3 \geq 0$  **10**

b) There are four jobs – A, B, C and D and these are to be performed on four machine entres – I, II, III and IV. One job is to be allocated to one centre. Each of the centres can performs any of the jobs excepting that job C is to be assigned only to centre III. The costs of performing different jobs at different centres are given by the following matrix:

(Figures in Rs.)

| Centres Jobs | I | II | III | IV |
|---|---|---|---|---|
| A | 21 | 30 | 40 | 50 |
| B | 15 | 14 | 12 | 16 |
| C | 23 | 22 | 24 | 25 |
| D | 30 | 34 | 32 | 33 |

Find the allocation of jobs to the machine centres such that the total cost of processing is minimum.  **10**

## UNIT – II

**3. Answer any two questions of the following:**  **5 X 2**

a) Distinguish between PERT and CPM.

b) ABC Ltd has a single cashier. During peak hours, customers arrived at a rate of 20 customers per hour. The average number of customers that can be served by the cashier is 24 per hour. Assuming single channel queuing model,

i) Calculate the probability that the cashier is idle.

ii) What is the average number of customer in the queuing system?

iii) What is the average time a customer spends in the system?

1+2+2

c) Explain the role of 'indirect cost' in PERT analysis. What are the direct costs?  2+3

d) What do you mean by 'inventory'? What problems are involved in managing inventory?  2+3

**4. Answer any one questions of the following:**  **10 X 1**

a) A shop keeper has a uniform demand of an item at the rate of 50 items per month. He buys from a supplier at a cost of Rs. 6 per item and the cost of ordering is Rs. 10 in each time. If the stock holding costs are 20% per year of stock value, what is the EOQ? Now, if the supplier offers a 5% discount on an order between 200 - 999 items and a 10% discount on an order exceeding or equal to 1000 items, what would be Optimal Order Quantity?  4+6