

**2014**

**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.*

*Illustrate the answers wherever necessary.*

**Unit—I**

*[ Marks : 20 ]*

1. Answer any two of the following questions : 5×2
- (a) Explain with an example various steps in having an Initial Feasible Solution to a Transportation problem, using Vogel's Approximation Method.
  - (b) How would you solve an assignment problem where two jobs are to be assigned to a particular individual? Explain with an example.

*(Turn Over)*

- (c) Define operation research. State the significance of operations management. 2+3
- (d) Write the dual of the following linear programming problem :

$$\text{Minimize } Z = 3x_1 + 4x_2 + 7x_3$$

$$\text{Subject to : } x_1 - x_2 + x_3 \leq 10$$

$$4x_1 - x_2 - x_3 \geq 15$$

$$x_1 + x_2 + x_3 = 7$$

Where  $x_1, x_2 \geq 0$ ,  $x_3$  is unrestricted.

2. Answer any one of the following : 10×1

- (a) A manufacturer has distribution centres at X, Y and Z. These centres have available 40, 20 and 40 units of his product. His retail outlets of A, B, C, D and E require 25,10,20, 30 and 15 units respectively. The transport cost (in rupees) per unit between each centre and each outlet is given in the following table. Determine the cheapest distribution schedule.

Distribution Centres ↓	Retail outlets				
	A	B	C	D	E
X	11	6	9	10	8
Y	7	6	10	9	12
Z	10	12	11	7	6

- (b) A firm makes two types of furniture — chair and table. The contribution to project for each product as calculated by the accounting department is Rs. 20 per chair and Rs. 30 per table. Both products are to be processed on three machine  $M_1$ ,  $M_2$ ,  $M_3$ . The time required in hours by each product and total time available in hours per week on each machine is as follows :

<b>Machine</b>	<b>Chair</b>	<b>Table</b>	<b>Available Time (Hrs.)</b>
<b><math>M_1</math></b>	3	3	36
<b><math>M_2</math></b>	5	2	50
<b><math>M_3</math></b>	2	6	60

- (i) Give a mathematical formulation to this LPP.  
(ii) Use Simplex method to solve this problem.

2+8

**Unit—II***[Marks : 20]*

3. Answer any *two* of the following questions :

- (a) What do you mean by Buffer Stock or Safety Stock? 5
- (b) Distinguish between PERT and CPM. 5
- (c) A project has the following activities :

<i>Activity</i>	<i>Duration (Days)</i>
1-2	2
1-3	4
1-4	3
2-5	1
3-5	6
4-6	5
5-6	7

*Required :*

- (i) Draw the project network.
- (ii) Find the critical path and total project duration.
- (iii) Find earliest start time, latest start time, earliest finish time and latest finish time.

2+2+

- (d) The mean rate of arrival of planes at an airport during the peak period is 20 per hour and the actual number of arrivals in any hour follows a Poisson distribution. The airport can land 60 planes per hour on an average in good weather and 30 planes per hour in bad

weather, but the actual number landed in any hour follows a Poisson distribution with these respective averages. When there is congestion, the planes are forced to fly over the fields in the stack awaiting the landing of other planes that arrived earlier.

- (i) How many planes would be flying over the field in the stack on an average in good weather and the bad weather ?
- (ii) How long a plane would be in the stack and in the process of landing in good and in bad weather ?
- (iii) How long a plane would be in the process of landing in good and bad weather after stack awaiting ? 2+2+1

4. Answer any one of the following : 10×1

(a) The following table gives the activities and other relevant data for a project :

Activity	Normal time (days)	Crash Time (days)	Normal Cost (Rs.)	Crash Cost (Rs.)
1-2	4	3	600	800
1-3	2	2	400	400
1-4	5	4	750	900
2-3	7	5	400	600
2-5	7	6	800	1000
3-5	2	1	500	650
4-5	5	4	600	850

Indirect cost per day for the project is Rs. 200.

- (i) Draw the network of the project.
  - (ii) Find the normal duration and cost of the project.
  - (iii) Find the optimum duration and cost of the project. 2+4+4
- (b) (i) Find the optimum order quantity for a product for which the price breaks are as follows :

<i>Quantity</i>	<i>Purchasing cost</i>
$0 < Q_1 < 100$	Rs. 20 per unit
$100 \leq Q_2 < 200$	Rs. 18 per unit
$200 \leq Q_3$	Rs. 16 per unit

The monthly demand for the product is 400 units. The storage cost is 20 per cent of the unit cost of the product and the cost of ordering is Rs. 25 per month.

Also determine the total inventory cost. 5

- (ii) An oil engine manufacturer purchases lubricants at the rate of Rs. 42 per piece from a vendor, the requirement of these lubricants is 1800 per year. What should be the order quantity per order, if the cost per placement of an order is Rs. 16 and inventory carrying charges per rupee per year is only 20 paise ? 5

**[Internal Assessment : 10 Marks]**

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