B. Tech.

(SEM. VIII) EXAMINATION, 2006-07
OPERATIONS RESEARCH

Time : 3 Hours] [Total Marks : 100

Notes : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Assume suitable data, in case any missing.

1. Attempt any two parts
   (a) Define operations research explaining its main characteristics.
   (b) Solve the following L.P.P. by graphical method

   Maximize \( Z = 5X_1 + 7X_2 \)

   Subject to \( X_1 + X_2 \leq 4 \)
   \( 3X_1 + 8X_2 \leq 24 \)
   \( 10X_1 + 7X_2 \leq 35 \)
   \( X_1, X, \geq 0 \)
(c) Write the dual of the following L.P.P.

Maximize \( Z = 5X_1 + 7X_2 + 9X_3 \)

Subject to \( 2X_1 + 2X_2 + 5X_3 \leq 12 \)
\( 6X_1 - 2X_2 + 4X_3 \geq 15 \)

2. Attempt any two parts of the following:

(a) What different terms are often used in context of dynamic programming? Explain the meaning of such terms.

(b) A company has a team of four sales person and four districts where the company wants to start its business. After taking into account the capabilities of sales persons and nature of districts, the company estimates the profit per day in rupees for each sales person in each district is as below

<table>
<thead>
<tr>
<th>Districts</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Person A</td>
<td>16</td>
<td>10</td>
<td>14</td>
<td>11</td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>11</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>15</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>13</td>
<td>12</td>
<td>14</td>
<td>15</td>
</tr>
</tbody>
</table>

Find assignment of sales-persons to various districts which yield maximum profit.

(c) Explain the general structure of a transportation problem.
3. Attempt any two parts:
   (a) What is a competitive situation called game? Explain two person zero sum game, giving suitable example.
   (b) Consider the game 'G' with following pay offs:

   \[
   \begin{pmatrix}
   2 & 6 \\
   -2 & \lambda \\
   \end{pmatrix}
   \]

   (i) Show that game 'G' is strictly determinable whatever \( \lambda \) may be.
   (ii) Determine the value of game 'G'.
   (c) One fifth percent blades produced by a blade manufacturing factory turns out to be defective. The blades are supplied in a packet of 10. Use Poisson distribution to calculate approximate number of packet containing no defective, one defective in a consignment of 1,00,000 (1 lakh) packets.
   (given that \( e^{-0.02} = 0.9802 \))

4. Attempt any two parts:
   (a) What is ABC analysis? Why is it necessary? What are basic steps in implementing it?
   (b) What is EOQ (Economic order Quantity)? Drive Wilson's formula for EOQ?
(c) A particular item has a demand of 9000 units per year. The cost of one procurement is Rs. 100, holding cost per unit is Rs. 2.40 per year and the cost of shortage is Rs. 5 per unit per annum. Determine:
   (i) Economic lot size
   (ii) The number of orders per year
   (iii) The time between orders
   (iv) The total cost per years if cost of one units is Re 1.

5. Attempt any two parts:
   (a) What do you understand by a queue? Give some important applications of queuing theory.
   (b) Write short note on simulation.
   (c) Consider a situation where the mean arrival rate ($\lambda$) is one customer every 4 minutes and the mean service time $\left(\frac{1}{\mu}\right)$ is $2\frac{1}{2}$ minutes. Calculate the average number of customers in the system, average queue length, the average time a customer spends in the system and average time a customer waits before being served.