M.E Degree Examination, November/December 2016.

Second Semester

Manufacturing Engineering

MF 7201 — OPTIMIZATION TECHNIQUES IN MANUFACTURING

(Regulations 2013)

Time: Three hours

Maximum: 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the term 'Optimization'.
2. Mention any three engineering applications of optimization.
3. State the general linear programming problem in a "Matrix" form.
4. State correspondence rules for primal dual relations.
5. Enumerate any three differences between linear programming problems and non-linear programming problems.
6. Give any two applications of quadratic programming and stochastic programming.
7. Enumerate the 'Cutting Method' principle in integer programming.
8. State any three differences between dynamic programming and linear programming.
9. Name the different types of simulation and give two applications for each type.
10. Define 'Membership Function' in fuzzy systems.

PART B — (5 × 13 = 65 marks)

11. (a) Name the different types of models applied for optimization problems and explain their characteristics, advantages and limitations.

Or
(b) What are the essential characteristics of a good mathematical model to solve for optimization? Also discuss the different parameters that affect the optimal solution. Enumerate the precautions that are to be taken while solving optimization problem.

12. (a) Use dual simplex method to solve the LPP.
Max Z = -3x₁ - 2x₂
Subject to \( x₁ + x₂ \geq 1 \)
\( x₁ + x₂ \leq 7 \)
\( x₁ + 2x₂ \geq 10 \)
\( x₂ \leq 3 \)
\( x₁, x₂ \geq 0 \)

Or

(b) Use the revised simplex method to solve the following LPP
Max Z = 3x₁ + 5x₂
Subject to \( x₁ \leq 4 \)
\( x₁ \leq 6 \)
\( 3x₁ + 2x₂ \leq 18 \) and \( x₁, x₂ \geq 0 \)

13. (a) Max 60x₁ - 5x₁² + 80x² - 4x₂²
Subject to 60x₁ + 5x₂ \leq 60
10x₁ + 12x₂ \leq 150
\( x₁ \leq 8 \)
\( x₁ \geq 0, x₂ \geq 0 \)

Using the following break points, indicate a separable – programming approximation to this problem.

Or

(b) An orbital manned scientific lab is placed on an eccentric elliptical orbit described by \( x^2 + 5y^2 + x + 3y = 10 \) the reference system (x, y) being the centre of the Earth. All radio communications with the ground stations are going to be monitored via a satellite that will be fixed with respect to the reference system. The power required to communicate between the satellite and the lab is proportional to the square of the distance between the two.
Assuming that the satellite will be positioned in the plane of the ellipse, what should be the position of the satellite so that the maximum power required for transmissions between the lab and the satellite can be minimized? Formulate as a non-linear program.

14. (a) Solve the following LPP by dynamic programming

\[
\begin{align*}
\text{Max } Z &= 3x + 2y \\
\text{Subject to } x + y &\leq 300 \\
&\quad 2x + 3y \leq 800 \\
&\quad x, y \geq 0.
\end{align*}
\]

Or

(b) Use Branch and Bound method to solve the following problems.

\[
\begin{align*}
\text{Max } Z &= 3x_1 + 4x_2 \\
\text{Subject to } 7x_1 + 15x_2 &\leq 52 \\
&\quad 3x_1 - 2x_2 \leq 18 \\
&\quad x_1, x_2 \geq 0 \text{ and are integers.}
\end{align*}
\]

15. (a) With the help of an illustration, explain the concept of fuzzification and fuzzy rule based system. Also enumerate the different types of membership function of fuzzy in detail.

Or

(b) Describe the architecture of feed forward neural network in detail. Also discuss the variants of back propagation algorithm with an example.

PART C – (1 × 15 = 15 marks)

16. (a) A project schedule has the following characteristics

\[
\begin{array}{cccccccccccc}
\text{Activity} & 1-2 & 1-3 & 2-4 & 3-4 & 3-5 & 4-9 & 5-6 & 5-7 & 6-8 & 7-8 & 8-10 & 9-10 \\
\text{Time (days)} & 4 & 1 & 1 & 1 & 6 & 5 & 4 & 8 & 1 & 2 & 5 & 7 \\
\end{array}
\]

From the above information, you are required to

(i) Construct a network diagram

(ii) Compute the earliest event time and latest event time

(iii) Determine the critical path and total project duration

(iv) Compute total and free float for each activity.

Or
Consider the following project

<table>
<thead>
<tr>
<th>Activity</th>
<th>Time estimate in weeks</th>
<th>Predecessor</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3 6 9</td>
<td>None</td>
</tr>
<tr>
<td>B</td>
<td>2 5 8</td>
<td>None</td>
</tr>
<tr>
<td>C</td>
<td>2 4 6</td>
<td>A</td>
</tr>
<tr>
<td>D</td>
<td>2 3 10</td>
<td>B</td>
</tr>
<tr>
<td>E</td>
<td>1 3 11</td>
<td>B</td>
</tr>
<tr>
<td>F</td>
<td>4 6 8</td>
<td>C, D</td>
</tr>
<tr>
<td>G</td>
<td>1 5 15</td>
<td>E</td>
</tr>
</tbody>
</table>

Find the critical path and standard deviation. Also find the probability of completing the project by 18 weeks.