

M.Prod.E 1st Year 1st Semester Examination 2025

Ref. No. PG/PRD/PE/T/114B/2025

Subject: Advanced Quantitative Methods

Time:3 Hours

Marks:100

Answer any **five** questions

1a) What is the optimal alternative in the following situation? (Use Yager's method)

Alternatives: $X = \{x_1, x_2, x_3\}$

Goals:

$G_1(x_i) = \{(x_1, 0.7), (x_2, 0.5), (x_3, 0.4)\}$

$G_2(x_i) = \{(x_1, 0.3), (x_2, 0.8), (x_3, 0.6)\}$

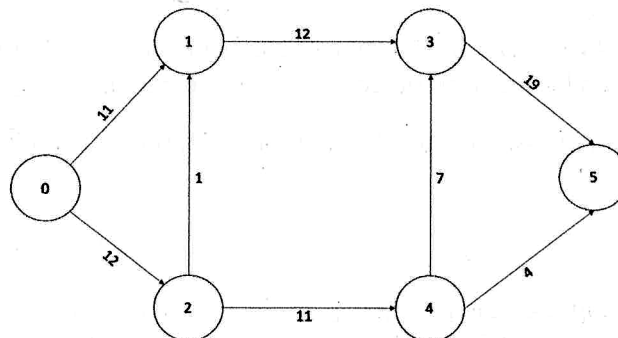
$G_3(x_i) = \{(x_1, 0.2), (x_2, 0.3), (x_3, 0.8)\}$

$G_4(x_i) = \{(x_1, 0.5), (x_2, 0.1), (x_3, 0.2)\}$

b) Outline the required procedural steps.

(12+8=20)

2. Determine the maximum flow for the given network as shown below using Ford Fulkerson's Algorithm.



Explanation is required at each level.

(12+8=20)

3. Expound ELECTRE Method with an example known to you.

(20)

4. Elucidate the steps needed for Robot selection in connection with an assembly shop by integrating AHP with QFD.

(20)

5. An organization decided to purchase a fleet of jet fighters from a company. The officials offered the characteristics information of four model's which may be sold to that organization. The analyst team of that organization agreed that four characteristics (attributes) should be considered.

They are maximin speed (X_1), ferry range (X_2), maximum payload (X_3); purchasing cost (X_4),

The values of the four attributes for each model (alternative) are given in the following. The decision matrix for the aircraft solution problem is:

[Turn over

$$D = \begin{matrix} & \begin{matrix} X_1 & X_2 & X_3 & X_4 \end{matrix} \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{bmatrix} 2.0 & 1500 & 20000 & 5.5 \\ 2.5 & 2700 & 18000 & 6.5 \\ 1.8 & 2000 & 21000 & 4.5 \\ 2.2 & 1800 & 20000 & 5.0 \end{bmatrix} \end{matrix}$$

Make an eclectic decision.

(20)

6. Consider the following LP product mix model with three products and three types of resources.

Maximize: $Z = 25x_1 + 10x_2 + 18x_3$

Subject to: $2x_1 + 1.5x_2 + 1.2x_3 \leq 400$ (Resource 1)

$x_1 + 1.5x_2 + 2x_3 \leq 520$ (Resource 2)

$x_1 + x_2 + x_3 \leq 300$ (Resource 3)

$x_1, x_2, x_3 \geq 0$

a) Suppose the prices of the resources are

$P_1 = \text{Rs } 20$; $P_2 = \text{Rs } 10$ and $P_3 = \text{Rs } 40$, reformulate the problem using De Novo Formulation with the same amount of money used for purchasing of resources in both Formulations.

b) Solve the problem Formulated in a) assuming the demand for each product is limited to 250

(10+10=20)

7. Discuss intuitionistic FUZZY TOPSIS with a suitable example known to you.

(20)

8. Write short notes on any two:

a) Transportation problem.

b) Game theory

c) Rough AHP

d) Boolean Programming

e) KRAUSKAL's algorithm

f) Theory of Constraints (TOC)

(10+10=20)