COURSE NAME: B. Tech   SEMESTER: 3rd

BRANCH NAME: EE (A and B), and EEE
Optimization & Soft Computing

FULLMARKS:30   TIME:90 Minutes

Answer **All** Questions.
The figures in the right-hand margin indicate Marks. *Symbols carry usual meaning.*

Q1.   Answer all Questions.   [2 × 3]

   a) Define optimization problem. What is duality principle?   -CO1
   b) What do you mean by soft computing? How is it different from Hard computing?   -CO2
   c) Distinguish between fuzzy set and crisp set.   -CO3

Q2.   [8]

a) Consider the well-known graph k-colouring problem. Here we are given a set of points   -CO1
(vertices) and a list of connections between them (edges). The task is to assign one of k
colours to each vertex, so that no two vertices which are connected by an edge share
the same colour.

   i)   Formalise this problem as a free optimisation problem.

   ii) Formalise this problem as a constraint satisfaction problem.

   iii) Formalise this problem as a constrained optimisation problem.

OR

b) How are objective functions classified in the context of optimization? Explain using   -CO1
suitable examples.

Q3.   [8]

a) Explain the trapezoidal membership function with the help of mathematical expression   -CO2
and relevant graph.

b) Consider the following two fuzzy sets A and B defined over a universe of discourse $[0,
3]$ of real numbers with their membership functions, $\mu_A(x) = \frac{x+5}{x+8}$ and $\mu_B(x) = 2^{-x}$.
Determine the membership functions of the following:
   i) $A^c \cdot B^c$
   ii) $A \cup B$
   iii) $A \cap B$
   iv) $(A \cup B)^c$

OR

a) Consider $X = \{a, b, c, d\}$, and $Y = \{1, 2, 3, 4\}$ be the universe of discourses. Let, A =   -CO2
$\{(a, 0.0), (b, 0.8), (c, 0.6), (d, 1)\}$, B = $\{(1, 0.2), (2, 1), (3, 0.8), (4, 0.2)\}$ and C = $\{(1, 0),
(2, 0.6), (3, 0.8), (4, 0.6)\}$ are three fuzzy sets. Determine the implication relation "*If x is
A Then y is B Else y is C*".

b) Describe all the properties of Fuzzy sets.

Q4.

a) Distinguish between Mamdani and Sugeno fuzzy inference system. -CO3

b) Explain various De-fuzzification techniques with suitable examples.

OR

a) What is a fuzzy implication? How does it differ from classical logical implication? -CO3

b) Consider a fuzzy set A defined on the interval $X = [0, 10]$ of integers by the membership function $\mu_A(x) = \frac{x}{x+2}$. Find α cut corresponding to $\alpha = 0.5$.