Ref. No.: Ex/ME(M2)/PE/B/T/316B/2024

# B.E. MECHANICAL ENGINEERING 3rd YEAR 1st SEMESTER EXAM 2024

Sub : Optimisation Techniques for Engineering Design (elective)

Full Marks : 100 time : 3 hrs

Answer any five questions ( 20 X 5 = 100)

1. a) explain role of optimization in design .
   b) Develop an N.L.P for design optimization based on any design problem.
   c) Classify optimization techniques.
   d) Compare direct search method and gradient based methods for optimization.

   4+7+5 +4

2. a) Discuss the basic principles of **Golden Section** methods used in optimization techniques.
   b) Explain the algorithm for **Interval halving** method of optimization.
   c) Apply **Bisection method** ( two iterations) to find out optimum solution for the following objective function ?

   $f(x) = x^2 + 5x + 3$

   6+6+8

3. a) Explain **Simplex method** for optimisation.
   b) Explain **Cauchy's Steepest Descent** method for multivariable optimization. Why Marquard method is more efficient ?
   c) Explain **evolutionary algorithm** for multi variable optimisation ?.

   6+8+6

4. a) Explain the exterior and interior methods in constraint optimisation".
   b) What is the role of penalty multiplier ? Describe optimality criteria for equality constraints.
   c) Explain the significance of Lagrange's multiplier in interior and exterior method.

   6+8+6

5. a) Explain **genetic algorithm** used for optimisation.
   b) Write down the working principles of **Ant Colony Optimisation**

   10 +10

6. a) Explain **Particle swarm optimization** technique .
   b) Explain the algorithm for **Simulated Annealing** .

   10+10

7. a) Explain "Pareto optimal solution".
   b) Explain weighted metrices method for multivariable optimization.
   c) explain any technique for finding "non dominated solution". 6+8+6

8. a) Explain the method of Artificial Neural Network for three inputs and two outputs with two hidden layer.
   b) Explain back-propagation algorithm with a suitable example.

   10 +10