

M.E. Chemical Engineering - First Year - First Semester Examination-2025

M.E. Bio-Process Engineering - First Year - First Semester Examination-2025

Sub : Optimisation Techniques for Engineering Design ;

Full Marks : 100

time : 3 hrs

Answer any five questions (20 X5 = 100)

1. a) Compare **local optima** and **global optima**.
- b) How optimization techniques are important in design ?
- c) Develop the N.L.P of any design optimization problem.

5 + 5 + 10

2. a) find out the value of x at which the following function is minimum, maximum or point of inflection.

$$F(x) = x^4 - 6x^3 - 5x^2 + 6x$$

- b) Show two iterations of **Bi- Section** method to find out the minimum value of the following objective function.

$$f(x) = X^2 + 3x + 7.$$

- c) Describe Lagrange's optimality criteria for equality constraints.

5+10+5

3. a) Explain the **Box's Evolutionary algorithm** for multivariable optimisation.
- b) Explain Cauchy's Steepest Descent method for multivariable optimization
- c) Why Marquard method is more efficient ?

5+10+5

4. a) How penalty function method works for constrained optimization.
- b) Compare interior and exterior method.
- c) Explain the significance of Lagrange's multiplier in interior and exterior method.

6+8+6

[ Turn over

5. a) Why crossing over is necessary in Genetic Algorithm used for optimisation.  
b) How precision can be controlled in GA ?  
c) Describe the selection process in GA with reference to Roulette wheel principle.

6 + 6 + 8

6. Explain the working principle of the optimization techniques ( any two)

- a) **Particle Swarm Optimization** technique .  
b) **Simulated Annealing** .  
c) **Ant colony** optimization algorithm.

10+10

7. a) Explain "Pareto optimal solution".

- b) Explain weighted metrics method for multivariable optimization.  
c) Explain any technique for finding "non dominated solution".  
d) Discuss the  $\epsilon$  – constraint method for multi-objective optimization.

5+5+5+5

8. a) Explain the working principle of **Artificial Neural Network with 2 inputs , one hidden layer and one output**. Assume activation function suitably.

- b) Explain the role of optimization in **backpropagation algorithm**.

14 +6