Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2023

Programme Name: **M Tech (DHE)**

Semester: **II**

Subject Code: **PG12E1205**

Subject Name: **Optimization Methods**

Date: 24.05.2023	Max Marks: 60
Duration: 03 Hrs	Pass Marks: 30

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. If a point x^* corresponds to the minimum value of function $f(x)$, the same point also corresponds to the maximum value of _____.
   a) $-f(x)$
   b) $f(-x)$
   c) $-f(1-x)$
   d) $f(1/x)$
2. At a maximum or minimum of a continuous function $f(x)$, its first derivative is equal to _____.
   a) -1
   b) 0
   c) 1
   d) Infinity
3. Minimum value of the function $f(x) = 2x^2 + 1$, occurs at _____.
   a) $x = 1$
   b) $x = -1$
   c) $x = 0$
   d) $x = 0.5$
4. In an optimization problem, constraints that represent physical limitations on design variables, such as availability, fabricability, transportability and so on are known as _____.
   a) Geometric constraints.
   b) Topology constraints
   c) Functional constraints
   d) Physical constraints

5. Identify the correct one from the following statements.
    a) Linear programming problems consist of linear objective function and linear or nonlinear constraints.
    b) All objective functions and constraints are nonlinear in a nonlinear programming problem.
    c) In linear programming problems all objective functions and constraints should be linear.
    d) Options 'b' and 'c' are correct.
6. Simplex method is an approach to solve _____.
    a) Linear programming problem
    b) Nonlinear programming problem
    c) Unconstrained optimization problem
    d) None of the options
7. In a linear programming problem with two decision variables, the feasible region that can be enclosed in a circle is called _____.
    a) Bounded feasible region
    b) Unbounded feasible region
    c) Extended feasible region
    d) Open feasible region
8. Steepest descent method is also called as _____.
    a) Cauchy method
    b) Newton' s method
    c) Newton-Raphson method
    d) Fletcher Reeves method
9. Which of the following is considered as a selection process in genetic algorithms.
    a) Tournament
    b) Roulette Wheel
    c) Stochastic Universal Sampling
    d) All options
10. _____ is based on the behaviour of colony of insects such as termites, ants, bees, a folk of birds or a school of fish.
    a) Linear programming
    b) Genetic Algorithm
    c) Simulated Annealing
    d) Particle Swam Optimization

Section B

Five Questions of 02 Marks each

11. Enlist any four engineering applications of optimization.
12. What is the use of slack variables in linear programming?
13. Define gradient of a function having n variables.
14. What is one point crossover in Genetic Algorithms.
15. What do you mean by linear combination of multiple objectives of a multi objective optimization problem.

Section C

Seven Questions of 8 Marks each of which any 05 questions to be answered.

16. Explain the terms Design variable, Objective function and Constraints in relation with an optimization problem.
17. Discuss pareto optimal solutions in the context of multi objective optimization.
18. How does conventional design procedure differ from optimization-based design.
19. Formulate a simple linear programming problem and solve it using simplex method.
20. Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ using steepest descent method. Minimum three iterations to be done. Starting point for iterations may be taken as $X_1 = \binom{0}{0}$
21. Discuss the significance of selection, crossover and mutation in Genetic Algorithms.
22. Express any dredging related problem as an optimization problem and discuss the solution method which may be adopted to solve the problem.