NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	M.Tech. in Electronics & Instrumentation Engineering (Robotics and Artificial Intelligence)
Semester:	I
Course Code:	6ME802CC25
Course Title:	Optimization Techniques
Course Type:	Core
Year of introduction:	2025-26

L	T	Practical component				C
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Course Learning Outcomes (CLOs):

After successful completion of the course, the students will be able to –

1. make use of fundamental knowledge of optimization (BL3)
2. analyze hard engineering interdisciplinary problems using unconventional optimization techniques (BL4)
3. decide the various methods of optimization based on linear, nonlinear and stochastic programming for problem-solving (BL5)
4. evaluate the optimization problems using software tools. (BL5)

Unit	Syllabus	Teaching Hours (Total 45)
Unit I	**Introduction and Classical Optimization Techniques:** Introduction: Introduction, Classification. Classical methods: Basic Concepts of Optimization-Convex and Concave Functions, Necessary and sufficient conditions for Stationary Points; Optimization of one-dimensional Functions; Unconstrained Multivariable Optimization, Multivariable optimization with equality and inequality constraint.	12
Unit II	**Linear Programming and Nonlinear Programming** Linear Programming – Introduction, Linear Programming and its Applications, Simplex method Duality in linear programming, Decomposition Principle, Quadratic Programming. Nonlinear Programming - Introduction, non-linear programming for single and multiple variables, Elimination methods — Unrestricted Search, Exhaustive Search, Dichotomous search, Fibonacci method, Golden Section Method, Interpolation methods, Direct and Indirect Search Methods	15

Unit III	**Stochastic Programming** Introduction, Concept of Probability theory, Stochastic linear, Stochastic nonlinear, geometric programming and dynamic programming, Introduction to optimization toolbox for problem solution	05
Unit IV	**Unconventional Optimization**: Introduction to non-conventional optimization techniques like Genetic Algorithms, Simulated Annealing, Neural Network- Based Optimization, Fuzzy Systems. Application of optimization toolbox for solution of complex problems. Development of computer programs using optimization toolbox for non-conventional optimization problems with and without constraints.	13

Self – Study: The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/References:

1. Rao S S, Engineering Optimization, New Age.
2. Beveridge G. S. and Schechter R. S., Optimization Theory and Practice, McGraw-Hill
3. Rekllaitis G.V., Ravindran A., Ragsdell K.M., Engineering Optimization-Methods and Applications, Wiley.
4. Deb Kalyanmoy, Optimization for Engineering Design: Algorithms and Examples, PHI.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. the academic year 2025 - 26 and onwards