



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

OPTIMIZATION TECHNIQUES AND APPLICATIONS (Professional Elective – III)								
II Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2224019	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Basic programming concepts								

Course Overview:

This course introduces fundamental concepts and methods used to solve optimization problems in engineering and decision-making. It covers single and multi-variable non-linear optimization techniques, linear programming, and integer programming methods for optimal resource allocation. The course also includes stochastic programming and simulation for handling uncertainty in real-world systems. Advanced topics such as geometric programming and modern metaheuristic algorithms like genetic algorithms, simulated annealing, and particle swarm optimization are introduced. Overall, the course equips students with analytical and computational tools to model, analyze, and solve complex optimization problems in engineering and industrial applications.

Course Objectives:

- The objectives of this course are
1. To know Numerical Optimization techniques for single variable
 2. non-Linear optimization problems.
 3. To know Numerical optimization techniques for multi variable non- linear optimization problems.
 4. To understand Sensitivity analysis on LPP queuing
 5. To know integer programming and stochastic planning
 6. State of art nontraditional optimization technique, namely genetic algorithm simulated
 7. annealing & particle swarm optimization.

Course Outcomes: At the end of the course, the student is able to:

1. Apply appropriate optimization techniques and solve for single variable
2. Apply appropriate optimization techniques and solve for multivariable.
3. Make sensitivity analysis to study effect of changes in parameters of LPP on the optimal solution without reworking.
4. Apply chance constrained algorithm and solve stochastic linear programme.
5. Solve given optimization problem by genetic algorithm or simulated annealing or PSO.

UNIT- I: Single Variable Non-Linear Unconstrained Optimization: Elimination methods: Uni-Model function- its importance, Fibonacci method & Golden section method. Interpolation methods: Quadratic & Cubic interpolation methods.

UNIT- II: Multi variable non-linear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell’s, Hook -Jeeves, Rosenbrock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher- Reeves method & variable metric method.



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UNIT-III: Linear Programming: Formulation, Simplex method & Artificial variable optimization techniques: Big M & Two-phase methods. Sensitivity analysis: Changes in the objective coefficients, constants & coefficients of the constraints. Addition of variables, constraints. Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

UNIT-IV: Integer Programming: Introduction – formulation – Geometry cutting plane algorithm – Zero or one algorithm, branch and bound method Stochastic Programming: Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

UNIT-V: Geometric Programming: Posynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (\leq type only) Non-Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing-Working Principle- Simple Problems. Introduction to Particle Swarm Optimization (PSO) (very brief)

TEXT BOOKS:

1. Optimization theory & Applications by S.S.Rao, New Age International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

REFERENCE BOOKS:

1. Operations Research by S.D.Sharma
2. Operation Research by H.A.Taha, TMH
3. Optimization in operations research by R.L.Rardin
4. Optimization Techniques by Benugundu & Chandraputla, Pearson Asia.
5. Optimization Techniques theory and practice by M.C.Joshi, K.M.Moudgalya, Narosa Publications.

ELECTRONIC RESOURCES:

1. <https://web.stanford.edu/~boyd/cvxbook/>
2. <https://nptel.ac.in>
3. <https://people.brunel.ac.uk/~mastjib/jeb/or/lp.html>
4. <https://ocw.mit.edu/courses/15-053-optimization-methods-in-management-science-spring-2013/>
5. <https://stanford.edu/class/ee364a/>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II

9. Lecture notes

10.E-Learning Readiness Videos (ELRV)