Course Description:

Course Title and Code:	**AS1113& Optimization for Computer Science**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech IV Sem (CSE/CS+AI)
Evaluation	Theory – 70%, Lab – 30%

Course Objective: This course provides a comprehensive understanding of optimization techniques and their practical applications in the field of computer science. By systematically employing modeling and optimization approaches, real-world problems will be solved using methods such as non-linear optimization, convex optimization, and nature-inspired algorithms.

Course Outcomes:

On successful completion of this course, the students will be able to:

1. formulate and express diverse real-world problems as optimization problems.
2. develop problem-solving skills by solving complex, real-world nonlinear optimization problems.
3. formulate convex programming problems and explore their solutions.
4. apply genetic algorithms and related nature-inspired optimization techniques in various domains.

Sr. No.	Specifications	Marks
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	10
05	Theory Exam-I	20
06	Theory Exam-II	Nil
07	Theory Exam-III	40
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
	Total (100)	**100**

Syllabus

Introduction to Optimization

Overview of optimization problems and their types (continuous, discrete, constrained, unconstrained). Formulation of optimization problems (objective functions, decision variables, constraints). Local vs. global optimization.

Nonlinear programming
Convex sets and convex functions, their properties, convex programming problem, generalized convexity, Pseudo and Quasi convex functions, KKT conditions.

Search Techniques
Direct search and gradient methods, Unimodal functions, Fibonacci method, Golden Section method, Method of steepest descent, Newton-Raphson method, Conjugate gradient methods.

Dynamic Programming
Characteristics of Dynamic Programming Problems, Deterministic and Probabilistic Dynamic Programming.

Nature Inspired Algorithms
Genetic Algorithms, Binary and Real coded Genetic Algorithms, Coding and decoding of variables, Key steps in a GA, starting population, fitness evaluation, reproduction, crossover, mutation, evaluation.

Text and Reference Books:

1. S S Rao, Engineering Optimization: Theory and Practices, New Age International, 1996.
2. Hillier F.S. and Lieberman G.J., Introduction to Operations Research: Concepts and Cases, Tata McGraw Hill, 8th Ed., (Indian Adapted Edition), 2005.
3. Taha. H. A, Operations Research: An Introduction, Pearson Education, 7th ed., 2003.
4. Bazaaraa, Hanif D. Shirali and M.C.Shetty, Nonlinear Programming, Theory and Algorithms, John Wiley & Sons, New York (2004).
5. Boyd and L. Vandenberghe, Convex Optimization, The Cambridge University Press, 2003.
6. Kalyanmoy Deb, Optimization for Engineering Design: Algorithms and Examples, PHI.
7. Goldberg, D.E. Genetic Algorithms in Search, Optimization, and Machine Learning, Pearson Education, 2008.