THOMAS ADEWUMI UNIVERSITY, OKO-IRESE	
Faculty	Computing and Applied Sciences
Department	Mathematical and Computing Science
Program	Computer Science
Course Code	CSC 419
Course Title	**OPTIMIZATION TECHNIQUES**
Study Year	4
Credit Hours	3
Contact Hours	45
Pre-requisite	
Status	Elective
Semester	First
Mode of Assessment	Lecture, Assessment and Practical
Mode of Delivery	• Classroom Lectures • Laboratory Practical Sessions
Assignment **practical** **Test** **Examination** **Total**	10% 20% 70% 100%
Course Lecturer and Instructor	
Course Description	Optimization Techniques" is a course designed to equip students with the knowledge and skills to solve a wide range of real-world problems by finding optimal solutions. It covers mathematical modeling, algorithmic approaches, and practical applications of optimization in various fields, including engineering, economics, logistics, and computer science.
Course Objectives	To teach the students: • Develop a clear understanding of optimization fundamentals, including decision variables, objective functions, constraints, and feasible regions. • Learn to formulate and solve linear programming problems using techniques like the simplex method. • Apply linear programming to real-world problems such as resource allocation and production planning.
Learning Outcome	At the end of this course, students will be able to: • Understands the concepts of optimization • Learn to formulate and solve linear programming • Apply linear programming to solve real-world problems

Detailed course contents	Introduction to optimization techniques, unconstrained non-linear optimization problems, constrained nonlinear optimization problems, multi objective optimization problems, evolutionary optimization algorithms, adaptive genetic algorithm, Bayesian statistics as optimization technique, optimization methods for inverse problems, solving optimization problems using MATLAB.	
Course Contents Sequencing		
Weeks	**Detailed Course Outline**	**Allocated Time**
WEEK 1	**Introduction to Optimization:** • Understanding the basic concepts of optimization, objectives, constraints, and decision variables. • Differentiating between linear, nonlinear, and integer optimization problems..	3 Hours
WEEK 2	**Linear Programming (LP):** • Formulating and solving linear optimization problems using techniques like the simplex method. • Applications in resource allocation, production planning, and transportation.	3 Hours
WEEK 3	**Nonlinear Programming (NLP):** • Techniques for solving nonlinear optimization problems, including gradient-based methods. • Applications in engineering design and economics.	3 Hours
WEEK 4,5	**Integer Programming (IP) and Mixed-Integer Programming (MIP):** • Solving problems with discrete decision variables. • Branch-and-bound, branch-and-cut, and cutting-plane methods. C.A Test	6 Hours
WEEK 6, 7	**Dynamic Programming:** • Principles of dynamic programming for solving problems with sequential decision-making. • Applications in finance, project scheduling, and resource management.	6 Hours

WEEK 8,9	**Metaheuristic Algorithms:** • Introduction to optimization algorithms that do not guarantee an optimal solution but are efficient in finding near-optimal solutions. • Genetic algorithms, simulated annealing, and particle swarm optimization.. C.A Test	6 Hours
WEEK 10	**Constraint Programming:** • Techniques for solving combinatorial optimization problems with constraints. • Applications in scheduling, resource allocation, and configuration.	3 Hours
WEEK 11	**Multi-Objective Optimization:** • Methods for handling problems with multiple conflicting objectives. • Pareto optimization and trade-off analysis	3 Hours
WEEK 12	**Global Optimization:** • Strategies for finding global optima in nonlinear optimization problems. • Interval analysis and stochastic search methods. **Optimization Software Tools:** • Practical use of optimization software such as MATLAB, Gurobi, CPLEX, and open-source libraries.	3 Hours
WEEK 13	REVISION	

READING LIST:

1. Introduction to Operations Research by Frederick S. Hillier and Gerald J. Lieberman:

2. Convex Optimization by Stephen Boyd and Lieven Vandenberghe:

3. Nonlinear Programming: Theory and Algorithms by Mokhtar S. Bazaraa, Hanif D. Sherali, and C. M. Shetty:

4. Integer and Combinatorial Optimization by George L. Nemhauser and Laurence A. Wolsey:

5. Optimization Methods in Finance by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei:

6. Practical Optimization by Philip E. Gill, Walter Murray, and Margaret H. Wright:

7. Optimization by Vector Space Methods by David G. Luenberger:

8. Numerical Optimization by Jorge Nocedal and Stephen J. Wright:

9. Applied Optimization with MATLAB Programming by P. Venkataraman:

10. Optimization Methods and Applications by U. Dinesh KumarW. Creswell and J. David Creswell