OPTIMISATION TECHNIQUES

Semester	4			
Course code	DSE-04			
Category	Discipline Specific Elective Courses			
Course title	Optimisation Techniques			
Scheme and Credits	L	T	P	Credits
	2	1	0	3
Theory Internal	25 marks			
Theory External	50 marks			
Total	75 Marks			
Duration of Exam	3 hours			

Note: *The examiner will set nine questions in total. Question one will have seven parts from all units and the marks of first question will be of 20% of total marks of Question Paper and the remaining eight questions to be set by taking two questions from each unit and the marks of each question from Question no.2 to 9 will be of 20% of total marks of Question paper. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.*

UNIT – I

Introduction to Optimization: Definition and scope of optimization techniques, Classification of optimization problems: linear vs. nonlinear, discrete vs. continuous, single-objective vs. multi-objective, Applications of optimization in various domains: engineering, economics, operations research, machine learning, etc.

Linear Programming: Formulation of linear programming (LP) problems: constraints, objective function, decision variables, Simplex method for solving LP problems: initialization, pivoting, optimality conditions, Duality in linear programming and economic interpretation.

Integer Programming and Combinatorial Optimization: Introduction to integer programming (IP) and mixed-integer programming (MIP) problems, Branch and bound method for solving IP problems, Applications of combinatorial optimization: traveling salesman problem (TSP), knapsack problem, scheduling problems.

UNIT – II

Nonlinear Optimization: Unconstrained Optimization: Optimization without constraints: gradient-based methods (gradient descent, Newton's method), Line search methods and convergence criteria, Applications in machine learning: parameter estimation, neural network training.

Constrained Optimization: Constrained optimization problems: equality and inequality constraints, Lagrange multipliers and KKT conditions for constrained optimization, Interior point methods and penalty methods for solving constrained optimization problems.

UNIT – III

Metaheuristic Optimization Techniques:

Evolutionary Algorithms: Introduction to evolutionary algorithms: genetic algorithms (GA), differential evolution (DE), Genetic operators: selection, crossover, mutation, Applications of evolutionary algorithms in optimization and search problems.

Swarm Intelligence: Basics of swarm intelligence: particle swarm optimization (PSO), ant colony optimization (ACO), Algorithmic principles, convergence properties, and parameter tuning, Real-world applications of swarm intelligence techniques.

UNIT – IV

Multi-objective Optimization: Pareto optimality and the concept of Pareto front, Multi-objective evolutionary algorithms (MOEA): NSGA-II, SPEA2, Decision-making in multi-objective optimization: weighted sum approach, epsilon-constraint method.

Applications of Optimization Techniques: Optimization techniques in data science: feature selection, model parameter tuning, Optimization in machine learning pipelines: hyperparameter optimization using grid search, random search, and Bayesian optimization

BOOKS:

1. Optimization for Machine Learning by Suvrit Sra, Sebastian Nowozin, and Stephen J. Wright
2. Introduction to Linear Optimization by Dimitris Bertsimas and John N. Tsitsiklis
3. Metaheuristics: From Design to Implementation by El-Ghazali Talbi

CLOUD COMPUTING & IOT

Semester	4			
Course code	DSE-04			
Category	Discipline Specific Elective Courses			
Course title	Cloud Computing & IoT			
Scheme and Credits	L	T	P	Credits
	2	1	0	3
Theory Internal	25 Marks			
Theory External	50 Marks			
Total	75 Marks			
Duration of Exam	3 hours			

Note: *The examiner will set nine questions in total. Question one will have seven parts from all units and the marks of first question will be of 20% of total marks of Question Paper and the remaining eight questions to be set by taking two questions from each unit and the marks of each question from Question no.2 to 9 will be of 20% of total marks of Question paper. The students have to attempt five questions in total, the first being compulsory and selecting one from each unit.*

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

CO1: Understand the concepts of Internet of Things

CO2: Analyze basic protocols network

CO3: Understand the concepts of Web of Things

CO4: Basic Understanding of Cloud Computing.

UNIT - I

INTRODUCTION TO CLOUD COMPUTING: Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

UNIT - II

CLOUD COMPUTING ARCHITECTURE: Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise .

UNIT – III

INTRODUCTION TO IOT: Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

NETWORK AND COMMUNICATION ASPECTS: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

UNIT – IV

WEB OF THINGS: Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory
and Practice"
3. Cuno Pfister, “Getting Started with the Internet of Things”, Shroff Publisher/Maker Media.
4. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, John Wiley and Sons