DSE – 19
Optimization Techniques

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical / Practice		
Optimization Techniques	**4**	**3**	**0**	**1**	**Class XII pass with Mathematics**	DSC-01(Programming using Python) , Linear Algebra and Vector Calculus

Learning Objectives:

1. *To apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems.*
2. *To go in research by applying optimization techniques in problems of Engineering and Technology.*

Learning Outcomes:

1. Be able to model engineering minima/maxima problems as optimization problems.
2. Be able to use Matlab to implement optimization algorithms

UNIT-I **(5 Hours)**

Linear Programming Problems (LPP) in the standard form: Mathematical formulation, LPP in canonical form, conversion of LPP in standard form to LPP in canonical form.

UNIT-II **(10 Hours)**

Simplex: Prevention of cyclic computation in Simplex and Tableau, Big-M method, Dual Simplex and Revised Simplex. Complexity of Simplex algorithms, Exponential behavior of Simplex.

UNIT-III **(15 Hours)**

Ellipsoid method and Karmakar's method for solving LPP: Solving simple LPPs through these methods etc. Assignment and Transportation Problems: Simple algorithms like Hungarian Method etc. Shortest Path Problems: Dijkestra and Moore's method

UNIT-IV **(15 Hours)**

Network Flow Problem: Formulation Max Flow, Mincut theorem, Ford and Fulkerson's algorithm, Malhotra, Pramod Kumar Maheshwari (MPM) Polynomial algorithm for solving network flow problem.

Non Linear Programming: Kuhn Tucker Conditions, Convex Functions and Convex region.

References:

1. An introduction to Optimization by Edwin P K Chong, Stainslaw Zak
2. Nonlinear Programming by Dimitri Bertsekas

Practicals:

1. Hands-on practice with optimization algorithms and tools.
2. A small project to apply optimization techniques to various problems.
3. A comprehensive project to formulate and solve a complex optimization problem. 4. Reviewing and analyzing optimization problems in real-world scenarios.

DSE – 20
Soft Computing

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Soft Computing	**4**	**3**	**0**	**1**	**Class XII pass with Mathematics**	**NIL**

Learning Objectives:

1. *To teach students the fundamentals of soft computing and its applications.*
2. *To give students knowledge of neural networks, fuzzy systems and hybrid systems.*

Learning Outcomes:

1. To Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.
2. Soft Computing is a consortia of methodologies which collectively provide a body of concepts and techniques for designing intelligent systems.

UNIT-I **(5 Hours)**

Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

UNIT-II **(10 Hours)**

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.