Paper code: ARI 212	L	T/P	Credits
Subject: Optimization Techniques	4	-	4

Marking Scheme:
Teachers Continuous Evaluation: As per university examination norms from time to time.
End Term Theory Examination: As per university examination norms from time to time.

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: As per University Norms

- There should be 9 questions in the end term examination question paper
- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required

Course Outcomes[Bloom's Knowledge Level (KL)]:

CO1	Ability of students to translate the problem given in descriptive form into a linear programming problem, apply simplex method to solve it. **[K1, K2, K3]**
CO2	Ability of students to understand and implement methods to solve transportation and assignment problems. convolution networks and adversarial networks. **[K1,K2,K3]**
CO3	Ability of students to understand and apply numerical techniques for unconstrained optimization. **[K1,K2,K3]**
CO4	Ability of students to understand and implement numerical techniques for constrained optimization. **[K1, K2, K3]**

CO/PO	**PO01**	**PO02**	**PO03**	**PO04**	**PO05**	**PO06**	**PO07**	**PO08**	**PO09**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	3	-	-	-	-	-	1	3
CO2	3	3	3	3	3	-	-	-	1	-	1	3
CO3	3	3	3	3	3	-	-	-	1	-	1	3
CO4	3	3	3	3	3	-	-	-	1	-	1	3

Course Content	**No of lectures**
Unit I **Linear Programming:** Convex sets and functions, Graphical method, Feasible region, Basic feasible solutions, Degenerate and and non-degenerate solutions, Simplex method as algebraic version of graphical method, Simplex memethod, Method of artificial variables: Two phase and Big-M Method, Alternate Optima, Duality in Linear Programming, Weak and Strong duality Theorems (without proof), Existence Theorems for duality (without proof)	[14]

Unit II **Applications of Linear Programming:** Modelling of Transportation problem, Methods for finding starting solution for transportation problems, Balanced transportation problem, Unbalanced transportation problem, Modelling of Assignment problem, Hungarian method for assignment problem	[6]
Unit III **Numerical Techniques for Unconstrained Optimization Problems:** Line search method for unimodal functions: Golden Section Rule and Fibonacci Search Method, Steepest descent method, Newton's method, Conjugate gradient method	[10]
Unit IV **Numerical Techniques for Constrained Optimization:** Penalty function method: exterior and interior point penalty, Barrier function method **Multi-Objective Optimization:** Efficient Frontier, Weighted Sum Approach	[10]

Text Books:

[T1] Chandra, Suresh, Jayadeva, and Mehra, Aparna. *Numerical optimization with applications*. Alpha Science International, 2009.

[T2] Bazaraa, Mokhtar S., Hanif D. Sherali, and Chitharanjan M. Shetty. *Nonlinear programming: theory and algorithms*. John Wiley & Sons, 2013.

Reference Books:

[R1] Nocedal, Jorge, and Stephen J. Wright, eds. *Numerical optimization*. New York, NY: Springer New York, 1999.

[R2] Taha, Hamdy A. *Operations research: an introduction*. Vol. 7. Upper Saddle River, NJ: Prentice hall, 2003.

[R3] Fletcher, Roger. *Practical methods of optimization*. John Wiley & Sons, 2013.