13-EC 536 **LINEAR & NONLINEAR OPTIMIZATION**

SYLLABUS

Mathematical Background: Sequences and Subsequences- Mapping and functions- Continuous functions- Infimum and Supremum of functions- Minima and maxima of functions- Differentiable functions. Vectors and vector spaces- Matrices- Linear transformation- Quadratic forms- Definite quadratic forms- Gradient and Hessian- Linear equations- Solution of a set of linear equations-Basic solution and degeneracy. Convex sets and Convex cones- Introduction and preliminary definition- Convex sets and properties- Convex Hulls- Extreme point- Separation and support of convex sets- Convex Polytopes and Polyhedra- Convex cones- Convex and concave functions- Basic properties- Differentiable convex functions- Generalization of convex functions. **Linear Programming:** Introduction - Optimization model, formulation and applications-Classical optimization techniques: Single and multi variable problems-Types of constraints. Linear optimization algorithms: The simplex method -Basic solution and extreme point Degeneracy-The primal simplex method -Dual linear programs - Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. **Post optimization problems:** Sensitivity analysis and parametric programming- **Nonlinear Programming**: Minimization and maximization of convex functions- Local & Global optimum- Convergence-Speed of convergence. **Unconstrained optimization:** One dimensional minimization - Elimination methods: Fibonacci & Golden section search - Gradient methods - Steepest descent method. **Constrained optimization:** Constrained optimization with equality and inequality constraints. Kelley's convex cutting plane algorithm - Gradient projection method - Penalty Function methods. Constrained optimization: Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions- Rate of convergence - Engineering applications Quadratic programming problems-Convex programming problems.

TEXT BOOKS

1. David G Luenberger, .Linear and Non Linear Programming., 2nd Ed, Addison-Wesley.
2. S.S.Rao, .Engineering Optimization.; Theory and Practice; Revised 3rd Edition, New Age International Publishers, New Delhi

REFERENCES

1. S.M. Sinha, Mathematical programming: Theory and Methods, Elsevier, 2006.
2. Hillier and Lieberman *Introduction to Operations Research*, McGraw-Hill, 8th edition, 2005.
3. Saul I Gass, Linear programming, McGraw-Hill, 5th edition, 2005.
4. Bazarra M.S., Sherali H.D. & Shetty C.M., Nonlinear Programming Theory and Algorithms, John Wiley, New York, 1979.
5. Kalyanmoy Deb, Optimization for Engineering: Design-Algorithms and Examples, Prentice Hall (India), 1998