BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Hyderabad Campus

SECOND SEMESTER 2022-2023
COURSE HANDOUT (PART-II) **Date: 09/01/2024**

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **MATH F471**
Course Title : NONLINEAR OPTIMIZATION
Instructor-in-charge : K. VENKATA RATNAM

1. **Scopes and Objective of the Course:**

The objective of this course is to provide a comprehensive and rigorous account of theory of nonlinear programming. In addition to the classical topics, other methods such as Lagrange multiplier theory, duality and interior point method are also discussed in this course. Convex analysis approach is used to explain the concept of optimization. Algorithms for Quadratic Programming, Separable Programming, Linear Fractional Programming are also explained.

2. Text Book:

1. M. S. Bazzara, H.D. sherali and C.M. Shetty, Nonlinear Programming: Theory and Algorithms, Wiley-Inter science; 3rd edition, 2006.

3. Reference:

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9th edition 2011.

2. Dimitri P. Bertsekas, Nonlinear Programming, Athena Scientific, Belmont, Massachusetts, 2nd edition, 1999.

3. O.L. Mangasarian, Nonlinear Programming, SIAM Publishing, 1994.

Lecture Nos.	Learning Objectives	Topics to be Covered	Chapter in the Text Book
1-2	Formulation of models and their interpretation for various applications	Problem Statement, Basic definition, guideline for model construction.	Chapter 1 Section 1.1, 1.3
3-8	To learn the basic concepts of optimization	Convex Sets, Convex Hulls, properties of convex sets, Convex Cones and polarity,	Chapter 2 Section 2.1-2.5
9-14	Design of Convex Functions which will give insights of maximization and minimization problems	Definition and properties, subgradients of Convex functions, Differentiable convex functions, Maxima and Minima, Generalization of convex functions	Chapter 3 Section 3.1-3.5
15- 20	To learn nonlinear optimization models using equality and inequality constraints	Kuhn Tucker optimality conditions for Unconstrained problems, Inequality and Equality Constrained problem	Chapter 4 Section 4.1-4.3.
21-24	Learn various types of constraints and its significance	Cone of tangents, other constraint qualifications	Chapter 5 Section 5.1-5.3.
25-30	Learn different types of	Lagrangian Dual Problem,	Chapter 6 Section 6.1-6.5.

	nonlinear models	Duality Theorems and saddle point optimality conditions, Properties of the Dual Function, Solution of dual and primal	
31-36	To introduce various methods in Unconstrained Optimization problems	Line search with and without using Derivatives, Multidimensional Search with and without using Derivatives	Chapter 8 Section 8.1-8.5.
37-40	To learn various methods in constrained Optimization problems	Quadratic Programming, Separable Programming, Linear Fractional Programming	Chapter 11 Section 11.1-11.4.

5. Evaluation Scheme:

Component	Duration	Marks	Weightage (%)	Date & Time	Nature of Component
Mid Semester	90 minutes	35	35	15/03 - 11.00 - 12.30PM	CB
Assignments (3)		15	15	Will be announced in the class	OB
Seminars (2)		10	10	Will be announced in the class	OB
Comprehensive	180 minutes	40	40	16/05 AN	CB

6.

Make-Up Policy: Only genuine cases will be entertained (Prior permission will be needed for makeup).

7. Chamber Consultation Hours: To be announced in the class.

8. Notice: Notices concerning this course will be displayed on CMS.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE