**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS**
**SECOND SEMESTER 2018-2019**
**COURSE HANDOUT (PART-II)** **Date: 07/01/2019**

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 nonlinear models | Lagrangian Dual Problem, Duality Theorems and saddle point optimality conditions, Properties of the Dual Function, Solution of dual and | Chapter 6 Section 6.1-6.5. |

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|---|---|---|---|
| | | 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. |
| 37-42 | 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 | 13/3<br>3.30 - 5.00 PM | CB |
| Assignments (5) | | 10 | 10 | Will be announced in the class | OB |
| Seminars (5) | | 10 | 10 | Will be announced in the class | OB |
| Comprehensive | 180 minutes | 45 | 45 | 07/05 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**