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**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI**  
**INSTRUCTION DIVISION**  
**FIRST SEMESTER 2018-19**  
**Course Handout Part II**

Date: 02/08/2018

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 F212  
**Course Title** : OPTIMIZATION  
**Instructor-in-charge** : SHIVI AGARWAL  
**Instructor** : C. B. Gupta, Chandra Shekhar

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

Engineers, scientists, analysts, and managers are often faced with the challenge of making trade-offs between different factors in order to achieve desirable outcomes. Optimization is the process of choosing these trade-offs in the best way. Optimization problems, having reached a degree of maturity over the years, are encountered in physical sciences, engineering, economics, industry, planning, and many other areas of human activity. The objective of the course is set to familiarize the students with standard methods of solving optimization problems.

This course deals with details of various aspects associated with optimization. These include a description of optimization techniques, namely, Linear Programming and Nonlinear Programming, and their applications to various engineering and science disciplines including economics and finance. A multi-objective optimization which handles optimization aspects of more than one objective is also discussed. A brief and informative description of Nontraditional optimization technique Genetic Algorithms is also provided.

**2. Text Book:**

HA Taha, *Operations Research: An Introduction*, Pearson Education, 9th Edition, 2012.

**Reference Books:**

- R1** CB Gupta, *Optimization in Operations Research*, 2nd Edition, IK International, New Delhi, 2012.  
**R2** JC Pant, *Introduction to Optimization: Operations Research*, Jain Brothers, New, 6th Edition, 2004.  
**R3** WL Winston, *Operations Research: Applications and Algorithms*, Cengage Learning India Pvt Ltd, 4th Edition, 2004.  
**R4** Kalyanmoy Deb, *Multi-objective Optimization Using Evolutionary Algorithms*, John Wiley & Sons Pte Ltd. Singapore, First Edition, 2001.

**3. Course Plan:**

Learning Objectives	Topics to be Covered	Lecture Nos.	Ref. To Text book
To understand the meaning of Optimization	Introduction to Optimization	1	(1.1-1.3,1.7)



Learning Objectives	Topics to be Covered	Lecture Nos.	Ref. To Text book
How to develop Linear Programming models and how to solve two variables LP models by the graphical solution procedure	Two variable LP model, Graphical LP solution, LP problems, Convex Set	2-6	(2.1, 2.2, 7.1, 7.1.1)
To obtain an understanding of why and how the simplex calculations are made and know how to recognize the special situations	LP model in equation form, Transition from graphical to algebraic solution, The Simplex Method, Generalized simplex tableau in matrix form, Revised Simplex method, Artificial starting solution, Special cases in the simplex method	7-13	(3.1, 3.2, 3.3, 7.1.2, 7.2, 3.4, 3.5)
To understand the concept of duality, how to read and interpret the solution of dual problem and relate the dual solution to the primal solution and to explain how post optimal analysis can be used by a decision maker	Definition of Dual Problem, Duality, Primal-Dual Relationships, Additional simplex algorithms (Dual Simplex Method, Generalized Simplex Algorithm), Post optimal Analysis	14-19	(4.1, 7.4, 4.2, 4.4, 4.5)
To formulate transportation and assignment problems as LPP and how to solve these problems	Definition of transportation problem, The transportation Algorithm, The Assignment Model	20-22 23-24	(5.1, 5.3, 5.4)
To understand multiples objectives optimization and how to solve multi objective optimization	Goal Programming Formulation, Algorithms: The Weights Method and The Preemptive Method	25-27	(8.1, 8.2)
To understand Integer Programming problem and its efficacy	Formulation of IP problem Branch and Bound method for solving IPP	28-30	(9.1, 9.2.1)
How to solve Nonlinear Programming problem	Unconstrained problems, Convex and concave functions, Elimination Methods: Direct search method Gradient of a Function, Descent Methods: Steepest Descent Method Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming	31-37	(20.1, 20.1.1, 21.1.1, 21.1.2) (20.2.2) (21.2.2)
To introduce Nontraditional Optimization Technique	Drawbacks of the Classical Techniques, Introduction to Nontraditional Optimization Technique (Genetic Algorithms)	38-40	R4 (4.4)



#### 4. Evaluation Scheme:

Components	Duration	Weightage (%)	Date & Time	Remarks
Mid Semester	90 Minutes	35	14/10 4:00 - 5:30 PM	CB
Announced 2 Tutorial Tests	15 Minutes each	20 (10% each)	TBA	CB
Comprehensive	180 Minutes	45	14/12 AN	Partially OB

- 5. Closed Book Exam:** Reference material of any kind will **not** be permitted inside the exam hall.  
**Open Book Exam:** Use of textbook and original class notes will be permitted inside the exam hall. Loose sheets of paper will **not** be permitted. Exchange of any material will **not** be allowed.
- 6. Make-Up Policy:** Only genuine cases will be entertained (Prior permission will be needed for makeup)
- 7. Problems:** Students are strongly advised to work out all the problems in the text-book and do similar problems from the reference books. It is also strongly recommended that the students should try out the algorithms on computers to get a better understanding of the subject.
- 8. Chamber Consultation Hours:** To be announced in the class.
- 9. Notice:** Notices concerning this course will be displayed on Mathematics Department notice board and NALANDA.

**INSTRUCTOR-IN-CHARGE  
(MATH F212)**



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