BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
FIRST SEMESTER 2017-18
Course Handout Part II

Date: 02/08/2017

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 : **CHANDRA SHEKHAR**
Instructor : **C. B. Gupta**

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, 2011.

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*, Thomson Learning, 4th Edition, 2004

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	

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 32-35 36 37-38	(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)	39-40	Class Notes

4. Evaluation Scheme:

Component	Duration	Marks	Weightage (%)	Date & Time	Remarks
Mid Semester	90 minutes	70	35	<TEST_1>	CB
Tutorial Test/Assignment	15 minutes each	40	20	Three surprise quizzes will be conducted of 20 marks each. Out of which best 2 will be considered.	CB
Comprehensive	180 minutes	90	45	<TEST_C>	Partially OB

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

6. 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.

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

8. Notice: Notices concerning this course will be displayed on Mathematics Department notice board and NALANDA.

INSTRUCTOR-IN-CHARGE
(MATH F212)