BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
INSTRUCTION DIVISION
SECOND SEMESTER 2015-2016
Course Handout Part II

Date: 09/01/2016

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. : ME F344/MF F344
Course Title : ENGINEERING OPTIMIZATION
Instructor-in-charge : RAJESH P MISHRA
Tutorial Instructors : Gajanand Gupta, Rohit Gunerkar, Nitesh Sihag

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 past several years, are encountered in physical sciences, engineering, economics, industry, planning, and many other areas of human activity. 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 description of optimization techniques, namely, Linear Programming and Nonlinear Programming, and their applications to various engineering and science disciplines including economics and finance. Multi-objective optimization which handles optimization aspects of more than one objective is also discussed. A brief and informative description of Nontraditional optimization techniques such as Genetic Algorithms, Differential Evolution, etc. is also provided.

2. Text Book:

T1 HA Taha, *Operations Research: An Introduction*, Pearson Education/PHI, 9/E, 2012.

Reference Books:

R1 SS Rao, *Engineering Optimization: Theory and Practice*, New Age International (P) Limited, Third Edition, 1996

R2 FS Hillier and GJ Lieberman, *Introduction to Operations Research*, TMH, 8/E, 2006.

R3 WL Winston, *Operations Research: Applications and Algorithms*, Thomson Learning, 4th Edition, 2004

R4 JC Pant, *Introduction to Optimization: Operations Research*, Jain Brothers, New , 6/E, 2004.

R5 A Ravindran, DT Philips and JJ Solberg, *Operations Research: Principles and Practice*, John Wiley & Sons, Singapore, Second Edition, 1987

R6 GC Onwubolu and BV Babu, *New Optimization Techniques in Engineering*, Springer-Verlag, Heidelberg, Germany, First Edition, 2004.

3. Course Plan:

Learning Objectives	Topics to be Covered	Lecture Nos.	Ref. To Text book
To understand the meaning of Optimization and Formulation of LPP models and NLPP models	Introduction to optimization	1-2	
Discussion on how to solve two variables LP models by the graphical solution procedure	Two variable LP model, Graphical LP solution, Selected LP applications, Convex Set	3-6	T1 (2.1, 2,2, 2.3, 7.1)
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, Artificial starting solution Special cases in the simplex method	7-8 9-10 11-13	T1 (3.1, 7.1.1 , 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, Economic Interpretation of Duality, Additional simplex algorithms (Dual Simplex Method, Generalized Simplex Algorithm), Post optimal Analysis	14-15 16-17 18-19	T1 (4.1, 7.4,4.2, 4.3, 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	T1 (5.1, 5.3, 5.4)
To understand multiples objectives optimization and how to solve multi objective optimization	Goal Programming Formulation, Goal Programming Algorithms: The Weights Method and The Preemptive Method	24 25	T1 (8.1, 8.2)

To understand Integer Programming problem and its efficacy	Formulation of IP problem Branch and Bound method for solving IPP Cutting Plane method	26-27	T1 (9.1, 9.2)
How to solve Nonlinear Programming problem	Unconstrained problems, Convex and concave functions, Elimination Methods: Fibonacci Method and Golden Section Method, Gradient of a Function, Descent Methods: Steepest Descent Method and Conjugate Gradient Method, Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming,	28 29-31 32-33 34 35	T1(18.1, Appendix D4) R1 (5.7), T1(19.1.1) T1(19.1.2) R1(6.11), T1(18.2.2) T1(19.2.2, Appendix D3)

4. Evaluation Scheme:

Component	Duration	Marks	Weightage (%)	Date & Time	Remarks
Mid Semester	1.5 hours	90	30	19/3 2:00 -3:30 PM	CB
Evaluative Tutorial	-	90	30		OB
Comprehensive	3 hours	120	40	11/5 FN	CB/OB

5. Make-Up Policy: Only genuine cases will be entertained (Prior permission will be needed for make up, usually make-up will be held within a week after the regular test)

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 by the respective Instructors.

8. Notice: Notices concerning this course will be displayed on FD II Notice Board.

INSTRUCTOR-IN-CHARGE
(ME F344/MF F344)