Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2020-2021

Course Handout Part II

Date: 16-01-2021

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
Course Title : Engineering Optimization
Instructor-in-Charge : **DHEERAJ AGARWAL**
other-instructors : AMIT KUMAR GUPTA
Deepak Nabapure, V Venkateswara Rao, V Muralidhar, K Lakshman Rao

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 with the standard methods of solving optimization problems. This course deals with details of various aspects associated with optimization, including Linear programming methods, simplex method, transportation model and its variants, PERT/CPM, inventory models, queuing systems, nonlinear optimization algorithms and evolutionary algorithms

Textbooks:

1. *Operations Research: An Introduction*, 10th Edition, by Taha, Hamdy A., Pearson Education, 2018.

Reference books

1. SS Rao, *Engineering Optimization: Theory and Practice*, New Age International (P) Limited, Third Edition, 1996
2. FS Hillier and GJ Lieberman, *Introduction to Operations Research*, TMH, 8/E, 2006.
3. WL Winston, *Operations Research: Applications and Algorithms*, Thomson Learning, 4th Ed., 2004.
4. A Ravindran, DT Philips and JJ Solberg, *Operations Research: Principles and Practice*, John Wiley & Sons, Singapore, Second Edition, 1987.
5. GC Onwubolu and BV Babu, *New Optimization Techniques in Engineering*, Springer-Verlag, Heidelberg, Germany, First Edition, 2004.

Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1	Introduction	Introduction to optimization	
2-3	Modeling with Linear Programming	Two variable LP model, Graphical LP solution (Problem solving: Selected LP applications)	T1 (2.1-3)

4-8	Simplex Method	LP model in equation form, Transition from graphical to algebraic solution; The Simplex Method, Generalized simplex tableau in matrix form, artificial starting solution (Problem solving: Simplex, Big-M, 2-phase, TORA)	T1 (3.1-2, 3.3-5)
9-11	Transportation Model and its Variants	Definition of transportation problem, The transportation Algorithm, The Assignment Model (Problem solving: transportation, assignment, TORA)	T1 (5.1, 5.3-4)
12-14	Network Models	Definition, Minimal Spanning Tree Algorithm, Shortest route Problem, CPM and PERT (Problem solving: Network, CPM, PERT, TORA)	T1 (6.1-3, 6.5)
15-17	Inventory Models	Deterministic Inventory Models (Problem solving: inventory)	T1 (11.1-3)
18	Review of Basic Probability	Random variables, Poisson, Exponential and Normal Distribution	T1 (12.2-4)
19-22	Queuing Systems	Definition, Birth and Death process, Role of Exponential Distribution, Generalized Poisson Queuing Models, Specialized Poisson Queues. (Problem solving: M/M/1 and M/M/c with infinite and finite system capacities, TORA)	T1 (15.1-6)
23-26	Nonlinear Programming Algorithms	Unconstrained problems, Unconstrained Algorithms Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming	T1 (18.1, 19.1, 18.2.2, 19.2.2)
27-28	Evolutionary Algorithms	Introduction to Nontraditional Optimization Techniques (Genetic Algorithms, Simulated Annealing, etc.)	

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Sem. Test	1.5 hours	30%	03/03 9.00 - 10.30AM	Open Book
Tutorial assignments		20%		Open Book
Surprise Quizzes		10%		Open Book
Comprehensive Exam	2 hours	40%	06/05 FN	Open Book

Chamber Consultation Hour: To be announced during the class.

Notices: Notices will be displayed on CMS**.**

Make-up Policy: Make-up will be granted only to genuine cases with prior permission from the IC. For cases related to illness, proper documentary evidence is essential. No makeup is allowed for assignments, etc.

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 (ME F344)