Operations Research

1.1 Course Number: CS391
1.2 Contact Hours: [3-0-0] Credits: 9
1.3 Semester Offered: 6th
1.4 Prerequisite: Knowledge of mathematics at high school level; Knowledge of probability distributions and statistics, and preferably basic calculus, for learning Simulation

2. OBJECTIVE

· To exposes students to some of the most fundamental concepts and algorithms in the field of Linear and Discrete Optimization, and Simulation
· To develop skill in effective LP model formulation and application and sensitivity analysis
· To develop an understanding about algorithmic complexity

3**. COURSE CONTENT** (Unit wise distribution of content and number of lectures)

Unit	Topics	Sub Topic	Lectures
1	**Introduction**	Models as abstraction of real world, model building; course vs. fine grain building of models	**2**
2	**Applications**	Applications to computing, economic, electronic, environmental, industrial, organizational, service and telecommunication areas.	**4**
3	**Algorithms**	Elements of algorithms and complexity, performance criteria, heuristics	**3**
4	**Optimization**	Linear Optimization: Linear algebra and convexity concepts, simplex and interior point algorithms, duality concepts sensitivity analysis.	**5**
5	**Integer Programs**	Integer Programs: MILP formulations, Branch & Bound and Cutting Planes, Application of MILP in complex problems—Energy, Infrastructure	**5**
6	**Graphs**	Graphs and Flows: Shortest paths, spanning trees, minimal cost flows, probabilistic networks, CPM/PERT, integrality of solutions.	**6**
7	**Queuing models**	Queueing models and applications, Markovian queues, semi-markovian models, little"s formula, bulk queues, modelling in computing systems. Reliability concepts	**4**
		Total	**29**

4. READINGS

4.1 TEXTBOOKS:

1. Operations Research: An Introduction, 10/E, By Taha, Pearson Education, 2019
2. Operations Research: Principles and Practice, Prentice, A.Ravindran, D.T.Phillips, and J.Solberg

4.2 REFERENCE BOOKS:

1. Introduction to Operations Research, Hillier & Lieberman, Tata McGrawHill
2. Data, Models, and Decisions : The Fundamentals of Management Science, Dimitris Bertsimas and Robert M Freund, Dynamic Ideas, 2004
3. Operations Research: Applications and Algorithms, 4/E, Wayne L Winston, Cengage Learning 2003
4. Network Flows: Theory, Algorithms, and Applications by Ravindra K. Ahuja, Thomas L. Magnanti, James B. Orlin, Pearson, 1993
6. Quantitative Analysis for Management, 10/E, Render Barry et al.; Pearson Education, 2009

5. OUTCOME OF THE COURSE

· Understand the foundations of linear and of integer linear optimization
· Ability to model a business problem in terms of linear/integer linear constraints and objective function and drive managerial insights from sensitivity analysis
· Able to model network problems such as shortest paths, maxi-flows, spanning tree optimization problems, and solve them with the algorithms discussed in the course
· Model more complex business problems, and solve those using commercial solvers