

IT-775 : Advanced Computational Methods for Optimizations (ACMO)

Credits 3

Course offered to: M,Sc./Ph.D. (Common for CS-Track & CB-Track)

Course Description; The development of fast, efficient and in computers has significantly increased the range of complex problems specially biological/complex networks that can be solved reliably. Computational techniques use computers to solve problems by step-wise, repetitive and iterative solution methods, which would otherwise be tedious or unsolvable by hand calculations. This course is designed to give an over of computational methods of interest to model biological network for optimal solution(). A part will be class room teaching and other part will be working exercise with project assigned to the students along with the demonstrations of some mathematical software(s) for problem solving (if the software is available).

Pre-requisites: Must complete the semester one and at least credited the course on Computational Biology and Bioinformatics. A part will be classroom teaching and other part will be working exercise (assignments/practicals) with project assigned to the students.

Course Outcomes) (CO): Upon finishing the course, the student is expected to be able to:

1. Knowledge of errors analysis in computation problems.
2. Knowledge of solving system of linear equations by various mathematical methods.
3. To find the optimal solutions of complex/wide networks problems.
4. This paper helps to understand various decision making optimization techniques such as game theory, AHP, etc.

Tentative plan:

Week number	Lecture topic	CO met
1-2	Introduction : Motivation and applications. Computation and Error Analysis: Accuracy and precision; Truncation and round-off errors; Binary Number System; Error propagation.	CO 1
3-5	Linear Systems and Equations: Matrix representation; Cramer's rule; Gauss Elimination; Matrix Inversion; LL: Decomposition; Iterative Methods; Relaxation Methods; Eigen Values.	CO 2
6-8	Optimization - Introduction, Formulation of LPP , Geometry of LPP and Graphical Solution of LPP, Solution of LPP : Simplex Method, Big-M Method, Two-Phase Method, Special Cases in Simple Applications	CO 3

9-10	Introduction to Duality Theory, Dual Simplex Method, Post Optimality Analysis	CO 4
11-12	Introduction to Transportation Problems & Assignment Problems Solving Various types of Transportation Problems and Assignment Problems	CO 5
12-14	Analytic Hierarchy Process, Multi Objective Decision Making, Game Theory (Introduction)	CO 6

Note: To encourage and motivate the students, topic related to further studies can be included/change in the syllabus to maintain the quality of research,

Some Text Books and References:

1. Gupta S. K. (1995) Numerical Methods for Engineers, New Age International.
2. Chandra S. C. and Canale RR (2006) Numerical Methods for Engineers, 5th Ed; McGraw Hill
3. I. A. Taha, Operations Research: An Introduction, 8th Edition, Prentice Hall, 2006,
4. Taha, A. Hadley, Linear Programming, Narosa. 1987 (2002 reprint available).
5. F.S. Hillier and G.J. Lieberman, An Introduction to Operations Research Concepts and Cases, 9th Edition, McGraw Hill. 2010,
6. R.E. Steuer, Multiple Criteria. Optimization; Theory, Computation and Application, John Wiley, New York, 1986.
7. Ravindran A., Phillips, D.T., Solberg J.J., - Operations Research: Principles and Practice, 2nd ed., 2001, John Wiley & Sons,
8. Related articles from journals
9. Hyperlinks: [en.wikipedia.org/wiki/Operations Research](http://en.wikipedia.org/wiki/Operations_Research)