MTE 8104 Operations Research

AIM:

This is an introductory course on operations research that will give students the essential tools of operations research to enable them model and make scientifically based decisions in production environments

Course Description:

The course focuses on Modeling in operations research, linear programming (Simplex method, duality, sensitivity analysis), network models (shortest path, PERT/CPM, maximum flow, minimum spanning tree, transportation and assignment), Poisson processes, and queuing models

Detailed Course Content:

- Introduction to operations research, Operations research techniques, simulation models
- Linear programming formulation and graphic solution: Models of mathematical operations research, art of modeling, construction of the LP model, graphical LP solution
- The Simplex method: Standard LP form, basic solution, The Simplex method, the M-method, the two-phase method, degeneracy, alternative optimal solution, unbounded solution, infeasible solution
- Sensitivity analysis and dual problem: Definition of the dual problem, the relationship between the optimal primal and dual solution, economic interpretation of duality, the dual Simplex method, primal-dual computations, sensitivity analysis
- Transportation, assignment, and transshipment models: Definition of the transportation model, determination of a starting solution, the transportation algorithm, definition of the assignment problem, the Hungarian method, the transshipment model
- Network models: Network definition, minimal spanning tree algorithm, shortest route problem, shortest route algorithm, maximal flow model, enumeration of cuts, maximal flow algorithm, CPM, PERT
- Queuing systems: Elements of a queuing model, role of exponential distribution, birth and death models, steady state measures of performance, single server models, multiple-server models, machine servicing model, Pollaczek-Khintchine formula, queuing decision models

Learning Outcomes

- Formulate LP problems and describe the logic underlining the steps in the Simplex method and solve LP problems by Simplex method.
- Formulate the dual problem and describe its economic interpretation and interpret the LP solution.
- Use the Dual Simplex method to find the optimal solution of an LP.
- Use primal-dual computational formulas to find a solution of an LP.
- Conduct sensitivity analysis.
- Formulate and solve the transportation and assignment problems.
- Describe and solve the minimal spanning tree, the shortest path problem and the maximal flow problems.
- Use CPM and PERT to find the critical path and time schedule of a project.
- Describe the elements of a queuing model and the role of the exponential distribution in queuing models.
- Represent a queuing system by a transition-rate diagram.
- Define the stead state measures of performance of a queuing system.
- Establish the transition-rate diagram, the transition probabilities and the measures of performance for selected queuing models

Teaching and Learning Pattern

The teaching of students will be conducted through lectures, tutorials, short classroom exercises, case studies, group discussions among the students and projects aimed at solving real life problems. The lecture material will be availed to the students in advance to enable them have prior reading. Solving real life problems in each theme or a number of topics will enhance the students' understanding of the problem based learning techniques.

Assessment method

Assessment will be done through coursework which will include assignments, class room and take home tests, project work and presentations and a written examination. Course work will carry a total of 40% and written examination carries 60%. Coursework marks will be divided into; Assignments 5%, Tests 10% and Practical/project Work 25%.

References:

[1] H. Taha, Operations Research: an introduction
[2] Hilier and Liebermann, Introduction to Operations Research, McGraw-Hill
[3] Wayne Winston, Operations Research: Applications and Algorithms, Duxbury Press
[4] Wayne L. Winston, S. Christian Albright, Mark Broadie, Chris Albright. "Practical Management Science: Spreadsheet Modeling and Applications", 2nd Ed. Duxbury Press. September, 1997. ISBN 0534217745.
[5] Ronald. L. Rardin, "Optimization in Operation Research", Person Education, Asia, 2002.
[6] JIT.S Chandran, Mahendran P. Kawatra Ki Ho Kim, "Essential of Linear Programming", Vikas Publishing House Pvt.Ltd., New Delhi, 1994.
[7] R.Panneer Selvam, "Operations Research", Prentice Hall of India, 2002.
[8] P.C. Tulsin, "Quantitative Technique : Theory and Problem", Pearson Education, 2002.
[9] Ravindran, Phillips, Solberg, "Operation Research Principles and Practice", Second Edition, John wiley, 1987.