Semester	**4**
Course	**Skill Enhancement Paper**
Paper Code	**S2MT230421T**
Paper Title	**Elementary Operations Research**
No. of Credits	**3**
Theory/ Practical/Composite	**Theory**
Minimum No. of preparatory hours per week a student has to devote	**3**
Number of Modules	**Nil**
Syllabus	**Elementary Operations Research** Recapitulation of Vector Space, Linearly dependent and independent set of vectors in E^n, Spanning set, Basis, Dimension, Replacement Theorem [No proof]. Elementary row and column operations on a matrix, Row rank and Column rank of a matrix and the relationship between them [statement only]. Full rank of a matrix, Rank of product of two matrices [statement only], Determination of rank of a matrix using elementary row/ column operations, Invertibility of matrices through rank . Introduction to n dimensional Euclidean space E^n.(3) General form of Linear Programming Problems: standard and canonical forms. Assumptions behind Linear Programming Problems. Graphical Solution of L.P.P and moving hyperplane method: Examples of Finite Optimal Solution; Alternative Optimal Solution; Unbounded Solution; Non-Existence of feasible solution (3). Solution of system of linear equations: Basis matrix and Basic solution: examples. Feasible solution. Degenerate solution. Reduction of a feasible solution to a basic feasible solution with proof (3). Simplex Method: Computational Simplex table. (6) Introduction to Artificial variable: Charne's Big M Method. Two-Phase Method .[5] Convex Combination of finite number of points in E^n. Convex sets and their properties Extreme points,Boundary points of a Convex set: Examples. . Hyperplanes. Half spaces:Closed and Open. Elementary results on Hyperplane and Half spaces are convex sets .[3] Duality Theory. Standard form of primal and dual l.p.p. dual of the dual LPP is the primal LPP (proof included). Weak duality Theorem, Fundamental Theorem on Duality. and their

	applications. Simultaneous solution of primal and dual Problem through examples.[3]. Transportation Problem: Mathematical formulation. Balanced and Unbalanced TP number of basic variables in TP Obtaining initial b.f.s.By North-west corner rule, Row Min ,Column Min ,Matrix Min and Vogel's approximation method Testing of optimality of a balanced transportation problem and Optimum Solution. Unbalanced and Degenarated transportation problem and its solution.[4] The Assignment Problem: Mathematical Formulation. Computational Procedure of solving Assignment problem.. Unbalanced assignment problem. Conversion of Maximization Assignment Problem. Travelling Salesman Problem. .[3] Introduction to Game Theory :Two Person zero sum game. Pay-off matrix. The Saddle point and the maximin-minimax principle. .Games without saddle point: Mixed strategy.Solution of 2x2 games. Graphical Method of solving nx2 and 2xn games . Dominance property: generalised dominance. Reduction of a game problem to a LPP. Fundamental Theorem of Rectangular Games . [6]. [Emphasis will be given on understanding and solving problems. Use of software will be encouraged. Understanding of theory through problems will be target].
Learning Outcomes	• On completion of the above course a student will be able to do the following: • Will be able to explain the role of OR in modelling diverse types of problems in planning, routing, scheduling, assignment, and design. • Understanding LPP as an application of linear algebra & how Operation Research can be used to solve some problem relevant to Industry. • Understanding how historically ideas from linear programming have inspired many of the central concepts of optimization theory, such as duality, decomposition, convexity and its generalizations. • Getting acquainted as how LPPs always occur in maximization minimization dual pairs and its application to Transportation Problem, Assignment

	problem and Game Theory which can be related philosophically to dialectics.
Reading/Reference Lists	• Linear Programming: D.J.Bhattacharya. • Linear Programming: P.M.Karak. • Linear Programming & Game Theory: Ghosh & Chakraborty. • Linear Programming: Saumitra Mukhopadhyay. • Linear Programming: G.Hadley. • Operations Research: An Introdution: Hamdy M Taha. • Linear Programming & Network Flows: Bajara & Jarvis.
Evaluation	CIA
Paper Structure for theory semester examination	