LINEAR PROGRAMMING PROBLEM

Sub. Code: BMAT1-618 **L T P C** **Contact Hrs.: 75**
4 1 0 5

Course Objectives: To introduce the basic concepts of linear programming among the students for its applications in solving optimization problems.

Course Outcomes: Formulate a linear programming problem from a real word problem and solve them graphically and using some computational procedure while employing some convex analysis. Introducing concept of duality in linear programming. Explain game theory concepts for scientific study of strategic decision making.

UNIT-I(18 hrs.)

System of Linear Equations, Linear independence and dependence of vectors, Concept of basis, Basic feasible solution, Convex sets. Extreme points, Hyperplanes, Introduction and formulation of linear programming problem (LPP), Solution of LPP using graphical method: Unbounded solution, infeasible solutions.

UNIT-II(19 hrs.)

Standard form of LPP, Slack, surplus and artificial variables, Optimal solution of LPP using Simplex, Big-M and two phase computational procedure, Exceptional cases in LPP i.e., Infeasible, unbounded, alternate and degenerate solutions.

UNIT-III(20 hrs.)

Duality in Linear Programming: General Primal- Dual pair, Formulating a dual problem from primal problem, Duality theorems, Complementary slackness theorem, Duality and simplex method, Dual simplex method.

UNIT-IV(18 hrs.)

Game Theory: Two person zero sum games, pure strategies (minimax and maximin principles), Game with saddle point, Mixed strategies: Game without saddle point, Rule of Dominance, Solution methods for games without saddle point: Graphical method, Linear programming method.

Recommended Text Books/ Reference Books:

1. G. Hadley: Linear Programming. Narosa, Reprint, 2002.
2. Kanti Swarup, P.K. Gupta and Man Mohan, ‘Operations Research’, 9th Edn., Sultan Chand & Sons, 2002.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
4. Martin Osborne, An Introduction to Game Theory, Oxford University Press, 2003.
5. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.
6. S. D. Sharma, Himanshu Sharma, Operations Research: Theory, Methods and ApplicationsKedar Nath Ram Nath, 2010

RING THEORY

Sub. Code: BMAT1-619 **L T P C** **Contact Hrs.: 75**
4 1 0 5

Course Objectives: This course is an integral part of any courses on Modern algebra the others being Group theory.

Course Outcomes: After completing this course, this will help students to continue more courses in advanced Ring theory modules, Galois groups.

UNIT-I (19 hours)

Definition and examples of rings, Properties of rings, Subrings, Necessary and Sufficient condition for a nonempty subset of a ring to be a subring, Integral domains, Skew field and Fields, Subfield, Necessary and Sufficient condition for a nonempty subset of a field to be a subfield, Characteristic of a ring.

UNIT-II (18 hours)

Ideals, Ideal generated by a subset of a ring, Operations on Ideals, Prime and Maximal ideals, Factor rings, Ring homomorphism, Properties of ring homomorphism, Isomorphism theorems I, II and III, Embedding of rings, Field of quotients of an integral domain.

UNIT-III (20 hours)

Factorization domain, Prime element, Irreducible element, Principal ideal ring, Principal ideal domain, Greatest common divisor (gcd), Least common multiple (lcm), Unique factorization domain, Relation between principal ideal domain & unique factorization domain, Euclidean domain, Relation between Euclidean domain & principal ideal domain.

UNIT-IV (18 hours)

Polynomial rings over commutative rings, Division algorithm and consequences, factorization of polynomials, Gauss lemma, Gauss theorem, irreducibility of polynomials, Eisenstein criterion, Unique factorization in Z[x], Noetherian rings.

Recommended Text Books/ Reference Books:

[1] John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

[2] M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
[3] Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
[4] Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
[5] D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998. [6] D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra.

MATHEMATICAL MODELLING

Sub. Code: BMAT1-620 **L T P C** **Contact Hrs.: 75**
4 1 0 5

Course Objectives: To introduce the basic concepts of mathematical modelling and some basic models among the students for its applications in dealing with mathematical problems.

Course Outcomes: This course is introduced mathematical modelling, that is, the construction and analysis of mathematical models inspired by real life problems. The course will present several modelling techniques and the means to analyze the resulting systems.

UNIT-I(18 hours)

Simple situations requiring Mathematical Modelling, The techniques of Mathematical modelling, Classifications and some characteristics of Mathematical Modelling, Limitations of Mathematical Modelling. Thomus Malthus Population Model, and Ecology models, Classical equations: Chebyshev Polynomials and their properties. Laplace, Heat, Wave equations, The Vibrating string.

UNIT-II(19 hours)

Bessel's and Legendre's equations, orthogonal properties & recurrences relation, Generating Function. Laplace transform and inverse transform application to initial value problem up to second order.

UNIT-III(18 hours)

Monte Carlo Simulation Modelling: simulating deterministic behaviour (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence.

UNIT-IV(20 hours)

Queuing Models: harbor system, morning rush hour, Overview of optimization modelling, Linear Programming Model: geometric solution algebraic solution, simplex method.

Recommended Text Books/ Reference Books:

1. Mathematical Modeling, J. N. Kapur, New Age International (P) Ltd., Publishers Reprint 2003.
2. TynMyint-U and Lokenath Debnath, Linear Partial Differential Equation for Scientists and Engineers, Springer, Indian reprint, 2006.
3. Mathematical Modeling, J.G. Andrews and R. R. Mclone (1976). Butterwerths London.
4. Frank R. Giordano, Maurice D. Weir and William P. Fox, A First Course in Mathematical Modelling, Thomson Learning, London and New York, 2003.
5. Partial Differential equations of Mathematical Physics: TynMyint-U.
6. Mathematical Modelling Techniques, R. Aris (1978) , Pitman.

DISCRETE MATHEMATICS

Sub. Code: BMAT1-621 **L T P C** **Contact Hrs.: 75**
4 1 0 5

Course Objectives: The objective of this course is to make the students familiar with the basic concepts in Discrete Mathematics and Graph Theory.

Course Outcomes: Students will have knowledge of significant concepts of partial order relations, Recurrence relations, Boolean Algebra , Lattices and Graph Theory.

UNIT-I (18 Hrs.)

Partial order relations, Chains and anti-chains, Pigeon hole principle, Principle of inclusion and exclusion, Analysis of algorithms-Time complexity. Complexity of problems, Discrete numeric functions and Generating functions..

UNIT-II (19 Hrs.)

Recurrence relations and Recursive algorithms, Linear recurrence relations with constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of Generating functions.

UNIT-III (20 Hrs.)

Boolean AIgebras-Lattices as ordered sets and as Algebraic structures. Duality. Distributive and Modular lattices. Boolean lattices and Boolean algebras. Boolean functions and expressions. Prepositional calculus. Design and implementation of digital networks. Switching circuits.

UNIT-IV (18 Hrs.)

Graph Theory: Graphs and Planar graphs-Basic concept. Biparite multigraphs. Weighted graphs. Paths and circuits, Shortest paths. Eulerian and Hamiltonian trails and cycles. Travelling salesman problem. Planar graphs. Trees.

Recommended Text Books/ Reference Books:

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Edition, McGraw Hill, International Edition, Computer Science Series, **1986**.
2. Dr.Babu Ram, Discrete Mathematics, Pearson Education India; First edition **2010.**
3. B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, **1990**.
4. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2nd Edition , Pearson Education (Singapore) P.Ltd., Indian Reprint **2003**.

FINANCIAL MATHEMATICS

Sub. Code: BMAT1-622 **L T P C** **Contact Hrs.: 75**

4 1 0 5

Course Objectives : The course explores fundamentals of mathematical finances through basic concepts and some important theories

Course Outcomes: The financial mathematics course helps the students to learn the basic theories of economics and Finance.

Unit I (18 hrs.)

Accumulation and discounting: Term factor in quantitative analysis of financial transactions, Interest and interest rates, Accumulation with simple interest, Compound interest, Nominal and effective interest rates, Determining the loan duration and interest rates, The notion of discounting

Unit II (20 hrs.)

Payment annuity streams: Basic definitions, The accumulated sum of the annual annuity, Accumulated sum of annual annuity, Accumulated sum of annual annuity with interest calculation m times a year, Accumulated sum of p-due annuity, Accumulated sum of p-due annuity with p not equal to m and m not equal to 1, The present value of the ordinary annuity and also with interest calculation m times a year, Relation between accumulated and present value of annuity

Unit III(19 hrs.)

Financial transaction yield: Absolute and average annual transaction yield, Tax and inflation accounting, Payment stream and its yield, Instant profit, Basic credit calculations.

Unit IV(18 hrs.)

Analysis of real Investments: Introduction, Net present value, Internal rate of return, Payback period, profitability index, Model of human capital investment.

Recommended Text Books/ Reference Books:

1. A. A. Mitsel "Basics of Financial Mathematics" Department of Higher Mathematics and Mathematical Physics,2012.
2. Mark S.Joshi, "The Concepts and practice of Mathematical finance", 2nd edition, 2014.
3. A Fahim, "Introduction of Financial Mathematics",2018.
4. Giuseppe Campolieti and Roman N. Makarov "Financial Mathematics-A Comprehensive Treatment" CRC press,2014.