JAYARAJ ANNAPACKIAM COLLEGE FOR WOMEN (AUTONOMOUS)

A Unit of the Sisters of St. Anne of Tiruchirappalli

Accredited with 'A' Grade (3rd Cycle) by NAAC

DST - FIST Supported College Since 2015

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PERIYAKULAM – 625 601, THENI DT.
TAMIL NADU.

M.SC. MATHEMATICS

2017 - 2020

DEPARTMENT OF MATHEMATICS

PROGRAMME OUTCOME - P.G.

PO. NO	UPON COMPLETION OF THIS PROGRAM THE STUDENTS WILL BE ABLE TO
1.	Endow with in-depth knowledge, analyze and apply the understanding of their discipline for the betterment of self and society.
2.	Synthesize ideas from various disciplines, enhance the interdisciplinary knowledge and extend it for research.
3.	Gain confidence and skills to communicate orally/ verbally in research platforms and state a clear research finding.
4.	Develop problem solving and computational skills and gain confidence to appear the competitive examination.
5.	Enhance knowledge regarding research by accumulating practical knowledge in specific areas of research.
6.	Achieve idealistic goals and enrich the values to tackle the societal challenges.

PROGRAMME SPECIFIC OUTCOMES - P.G.

PSO. NO.	UPON COMPLETION OF THE PROGRAM THE STUDENTS WILL BE ABLE TO	PO MAPPED
PSO-1	Solve complex mathematical problems using the knowledge of pure and applied mathematics	PO-1
PSO-2	Involve in research by incorporating the mathematical tools in science and technology	PO-5
PSO-3	Analyze and apply logical arguments to understand and apply mathematical concepts and techniques	PO-3
PSO-4	Model and solve real life problems using mathematical techniques and to develop scientific outlook in other disciplines	PO-4 PO-2
PSO-5	Interpret creatively the mathematical facts and figures to inculcate the individual scholarly research and to crack competitive examinations and procure their professional career	PO-1 PO-5 PO-6

P.G. COURSE PATTERN (2017 - 2020)

Sem.	Sub. Code	Subject Title	Hours	Credits
I	17PMA1C01	Algebra - I	6	5
	17PMA1C02	Analysis - I	6	5
	17PMA1C03	Advanced Calculus	6	5
	17PMA1C04	Classical Mechanics	6	5
	17PMA1E1A/ 17PMA1E1B	Numerical Analysis/ Optimization Theory	6	4
	Total		**30**	**24**
II	17PMA2C05	Algebra - II	6	5
	17PMA2C06	Analysis - II	6	5
	17PMA2C07	Mathematical Statistics	6	4
	17PMA2E2A/ 17PMA2E2B	Differential Geometry/ Graph Theory	6	4
	17PMA2I01	IDC - Mathematical Modelling	4	3
	17PGS2S01	Soft Skills	2	1
	Total		**30**	**22**
III	17PMA3C08	Field Theory and Lattices	6	5
	17PMA3C09	Topology	6	5
	17PMA3C10	Complex Analysis	6	5
	17PMA3C11	Stochastic Process	6	4
	17PMA3E3A/ 17PMA3E3B	Number Theory/ Calculus of Variations	6	4
	Total		**30**	**23**
IV	17PMA4C12	Functional Analysis	6	5
	17PMA4C13	Differential Equations	6	5
	17PMA4C14	Operations Research	6	5
	17PMA4R01	Project	12	6
	17PMA4A01	Comprehensive Examination	-	2*
Total			**30**	**21**
Total for all semesters			**120**	**90+2***

* Extra Credit

No External Exam for Soft Skills

M.Sc. MATHEMATICS QUESTION PATTERN (EXTERNAL)

MAXIMUM: 60 MARKS **TIME: 3 HOURS**

PART A	5 Questions to be answered One Question from each unit	Each carries One mark	5 × 1 = 5
PART B	5 Question to be answered Either or type One Question from each unit	Each carries Five marks	5 × 5 = 25
PART C	3 Question to be answered out of 5 Questions One Question from each unit	Each carries Ten marks	3 × 10 = 30

QUESTION PATTERN FOR IDC (EXTERNAL)

MAXIMUM: 60 MARKS **TIME: 3 HOURS**

PART A	10 Questions to be answered. Two Questions from each unit.	Each carries One mark	10 × 1 = 10
PART B	6 Question to be answered out of 10. Two Questions from each unit.	Each carries Five marks	6 ×5 = 30
PART C	2 Question to be answered out of 5 Questions. One Question from each unit.	Each carries Ten marks	2 × 10 = 20

TESTING AND EVALUATION (PG)

Evaluation of students is based on both Continuous Internal Assessment (CIA) and the Semester Examination (SE) held at the end of each Semester. The distribution of marks is indicated below

Course	Continuous Internal Assessment	Semester Examination
Theory	40%	60%
Project	50%	50%

CONTINUOUS INTERNAL ASSESSMENT (THEORY)

Components	Marks
Test - I	30
Test - II	30
Seminar	10
Term Paper	05
Attendance	05
Total	**80**

The total internal marks obtained for 80 will be converted to 40.

PROJECT WORK

The ratio of marks for Internal and External Examination is 50:50. The Internal Components of Project Work is

Components	Marks
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
Total	**50**

EXTERNAL VALUATION OF PROJECT WORK

Components	Marks
External Viva Voce	
Internal Examiner	25
External Examiner	25
Total	**50**

ALGEBRA-I

Semester: I **Hours: 6**

Code : 17PMA1C01 **Credit: 5**

COURSE OUTCOMES:

- Understand the concept of counting principles.
- Apply class equation and Sylows theorem to solve different problems.
- Construct ideal rings from the fundamental concepts.
- Utilize the results of Euclidian Ring to Gaussian integer.
- Identify the reducible and irreducible polynomials.

UNIT I

Another Counting Principle - Cauchy theorem - Sylow's theorem-Second part of - Sylow's theorem-Third part of Sylow's theorem. **(18 Hours)**

UNIT II

Direct Products - External direct Product - Internal direct Product - Finite Abelian Groups - Every finite Abelian group is the direct product of cyclic groups.

(18 Hours)

UNIT III

Ideals and Quotient rings - More Ideals and Quotient rings - The Field of Quotients of an integral Domain. **(18 Hours)**

UNIT IV

Euclidean Rings - Definition-Principal Ideal Ring - Unique Factorization theorem - A Particular Euclidean Ring j[i] - Fermat theorem . **(18 Hours)**

UNIT V

Polynomial Rings - Division Algorithm - Polynomial Rings over the Rational Field - Gauss' Lemma - The Eisenstein Criterion - Polynomial Rings over Commutative Rings. **(18 Hours)**

COURSE BOOK:

I. N. Herstein, Topics in Algebra (2nd Edition) Replika Press Pvt. Ltd.2002

Unit I : Chapter 2 : sections 2.11, 2.12
(Theorem 2.12.1, Lemma 2.12.1 & 2.12.2 are omitted)

Unit II : Chapter 2 : sections 2.13, 2. 14

Unit III : Chapter 3 : sections 3.4, 3.5, 3.6

Unit IV : Chapter 3 : sections 3.7, 3.8

Unit V : Chapter 3 : sections 3.9 , 3.10 , 3.11

ANALYSIS - I

Semester: I **Hours: 6**

Code : 17PMA1C02 **Credit: 5**

COURSE OUTCOMES:

- Acquire basic knowledge of metric spaces and Euclidean spaces.
- Build a foundation for Topology.
- Understand the concepts of limits of sequences, series and functions.
- Determine the continuity of functions.
- Operate the extended real number system in terms of neighborhoods.

UNIT I

Finite, countable and uncountable sets - Metric spaces - compact sets - Perfest sets - Connected sets. **(18 Hours)**

UNIT II

Numerical sequences and series - Convergent sequences - subsequences - Cauchy sequences - Upper and lower limits - Some special sequences - Series - Series of nonnegative terms. **(18 Hours)**

UNIT III

The number e - The root and ratio tests -Power series - Summation by parts - Absolute convergence - addition and multiplication of series - Rearrangements. **(18 Hours)**

UNIT IV

Continuity - Limits of functions - Continuous functions - Continuity and compactness - Continuity and connectedness - Discontinuities - Monotonic functions - Infinite limits and limits at infinity. **(18 Hours)**

UNIT V

Differentiation - The derivatives of a real function - Mean value theorems - The continuity of derivatives - L' hospital's rule - Derivatives of higher order - Taylor's theorem - Differentiation of vector valued functions. **(18 Hours)**

COURSE BOOK:

Walter Rudin, Principles of Mathematical analysis(Third Edition), Mc Graw - Hill International Book Company, International Student Edition), 1984.

Unit I : chapter 2

Unit II : chapter 3 section 3.1 to 3.29

Unit III : chapter 3 section 3.30 to 3.55

Unit IV : chapter 4

Unit V : chapter 5

ADVANCED CALCULUS

Semester: I **Hours: 6**

Code : 17PMA1C03 **Credits: 5**

COURSE OUTCOMES:

- Develop analytic and numerical techniques for solving problems using fundamental theorem of integral calculus.
- Analyze the concepts of implicit functions theorems.
- Evaluate integrals over curves and surfaces.
- Explain the concept of differential forms
- Deduce Poisson's equation from inhomogeneous wave equation.

UNIT I

Integration -The definite integral -The lower and upper integral of f over R- Sets of zero area-Basic Existence theorem for definite integral-Evaluation of definite integrals-Fundamental theorem of integral calculus. **(18 Hours)**

UNIT II

Differentials of transformations - Local approximations - Differentiable at a point and on an open set - Mean value theorem-Inverses of transformations -Jacobian of T- The implicit functions theorems- Functional dependence. **(18 Hours)**

UNIT III

Transformations of multiple integrals - Curves and arc length - Direction cosines for the line - Rectifiable curve - Smoothly equivalent curves - Surfaces and surface area -Smooth surface - Normal to smooth surface - Area of smooth surface - Smoothly equivalent surfaces - Orientable manifold -Integrals over curves and surfaces. **(18 Hours)**

UNIT IV

Differential forms -Curve functional - Surface functional - Region functional - Line integrals 1-form& 2-form in the XY plane-3-form in the XYZ space - Addition and multiplication of forms-Differentiation for forms - Vector analysis -Inner product - The theorems of Green, Gauss and Stokes. **(18 Hours)**

UNIT V

Exact forms and closed forms - Simply connected set - Applications - Inhomogeneous wave equations-Poisson's equation - Laplace equation - Harmonic functions- Green's first and second identities. **(18 Hours)**

COURSE BOOK:

R. Creighton Buck, Advanced calculus (THIRD EDITION), McGraw Hill Kogakusha (International Student Edition), 1978.

Unit I : Chapter 4 - Sections 4.2 & 4.3

Unit II : Chapter 7 - Sections 7.4 , 7.5 , 7.6 & 7.7

Unit III : Chapter 8 - Sections 8.3, 8.4, 8.5 & 8.6

Unit IV : Chapter 9 - Sections 9.2 , 9.3 & 9.4

Unit V : Chapter 9 - Sections 9.5 & 9.6

CLASSICAL MECHANICS

Semester: I **Hours: 6**

Code : 17PMA1C04 **Credits: 5**

COURSE OUTCOMES:

- Understand the elementary principles and Formulate the Lagrangian.
- Derive Lagrangian equations from Hamilton's principle.
- Extend Hamilton's principle to nonholonomic system.
- Reduce two body problem to one body problem.
- Describe planar and spatial motion of rigid body.

UNIT I

Survey of the elementary principles - Mechanics of a particle, mechanics of a system of particles - Constraints - D' Alembert's Principle and Lagrange's Equations - Velocity - dependent potentials and the dissipation function - Simple applications of the Lagrangian formulation. **(18 Hours)**

UNIT II

Variational principles and Lagrange's Equation - Hamilton's principle - Some techniques of the calculus of variations - Derivation of Lagrangian's equations from Hamilton's Principle. **(18 Hours)**

UNIT III

Extension of Hamilton's principle to non holonomic systems - Advantages of variational priniciple formulation - Conservation theorems and symmetry properties. **(18 Hours)**

UNIT IV

The two body central force problem - Reduction to the equivalent one body problem- The equations of motion and first integrals - The equivalent one dimensional problem and classification of orbits- The virial theorem - The differential equation for the orbit and integrable power-law potentials - Conditions for closed orbits (Bertrand's theorem). **(18 Hours)**

UNIT V

The Kelper problem - Inverse square law of force - The motion in time in the Kepler problem - The Laplace - Runge - Lenz vector. **(18 Hours)**

COURSE BOOK:

Herbert Goldstein, Classical Mechanics (Second Edition), Narosa Publishing House, 2001.

Unit I : Chapter 1
Unit II : Chapter 2 Sections 2.1-2.3
Unit III : Chapter 2 : Sections 2.4-2.6
Unit IV : Chapter 3 : Sections 3.1-3.6.
Unit V : Chapter 3 : Sections 3.7 -3.9

NUMERICAL ANALYSIS

Semester: I **Hours: 6**

Code : 17PMA1E1A **Credits: 4**

COURSE OUTCOMES:

- Perform an error analysis for various numerical methods.
- Apply numerical methods to obtain approximate solutions to nonlinear equations.
- Determine the intermediate values in tabulated data using interpolation.
- Develop appropriate numerical methods to solve differential equations.
- Evaluate differentials and integrals using different formulae.

UNIT I

Transcendental and polynomial equations - Introduction -Bisection method - Iteration methods based on first degree equation - methods based on second degree equation- Rate of Convergence - Iteration Methods - Methods for Complex roots - Polynomial Equations. **(18 Hours)**

UNIT II

Interpolation and Approximation - Introduction - Lagrange and Newton Interpolations - Finite difference operators - Interpolating polynomials using Finite Differences - Hermite Interpolations . **(18 Hours)**

UNIT III

Numerical Differentiation - Introduction - Numerical Differentiation - Extrapolation methods - partial differentiation. **(18 Hours)**

UNIT IV

Numerical Integration - Methods Based on Interpolation - Composite Integration Methods - Romberg Integration - Double Integration. **(18 Hours)**

UNIT V

Ordinary Differential Equations - Introduction - Numerical Methods - Single step Methods. **(18 Hours)**

COURSE BOOK:

M.K. Jain, S.R.K. Iyengar & R.K. Jain, Numerical Methods for Scientific and Engineering Computation,New Age International Pvt. Ltd., Publishers,Third Edition,1996.

Unit I	:	Chapter 2 Sections 2.1 to 2.8
Unit II	:	Chapter 4 Sections 4.1 to 4.5
Unit III	:	Chapter 5 Sections 5.1 to 5.5
Unit IV	:	Chapter 5 Sections 5.6, 5.7, 5.9, 5.10, 5.11
Unit V	:	Chapter 6 Sections 6.1 to 6.3

OPTIMIZATION THEORY

Semester: I **Hours: 6**

Code : 17PMA1E1B **Credit: 4**

COURSE OUTCOMES:

- Acquire knowledge of Fibonacci method for optimization.
- Understand constrained optimization techniques through linear and nonlinear programming.
- Describe the algorithms and solution analysis.
- Solve optimization problems.
- Compare the abstract properties of various optimization techniques.

UNIT I

One Dimensional Optimization : Introduction - Function Comparision Methods - Polynomial Interpolation Methods - Iterative Methods - Function Comparison Methods : Two Point Equal Interval Search - Method of Bisection - Fibonacci Method - Golden Section Search - Polynomial Interpolation - Quadratic Interpolation - Cubic Interpolation -Iterative Methods: Newton's Method-Secant Method. **(18 Hours)**

UNIT II

Unconstrained Gradient Based Optimization Methods : Introduction - Gradient and Conjugate Gradient Type Algorithms - Method of Steepest Descent - Conjucate Gradient Method - Newton Type Methods : Newton's Method - Marquardts's Method - Quasi Newton Methods : Quasi-Newton Algorithms.

(18 Hours)

UNIT III

Linear Programming : Introduction - Simplex Method -Case study Equipment Bags - Movement from one extreme point to another - Simplex Algorithm - Case Study Revisited- Revised Simplex Method. **(18 Hours)**

UNIT IV

Finding Initial Solution - Two Phase Simplex Method - Duality- Duality Theory - Dual Simplex Method. **(18 Hours)**

UNIT V

Constrained Optimization Methods: Introduction - Lagrange Multipliers - Kuhn-Tucker Conditions - Convex Optimization - Transformation Methods: Penalty Function Techniques - Method of Multipliers. - Linearization Methods: Linearly Constrained Problems - Cutting Plane Method. **(18 Hours)**

COURSE BOOK:

Mohan C Joshi & Kannan M Moudgalya, Optimization Theory and Practice, Narosa Publishing House, Chennai, 2004.

Unit I : Chapter 2 : Sections 2.1.1- 2.1.3, 2.2.2 - 2.2.5 & 2.3.2-2.3.3.

Unit II : Chapter 3 : Sections 3.1,3.2.2 - 3.2.3, 3.3.2 - 3.3.3 & 3.4.2

Unit III : Chapter 4 : Sections 4.1 & 4.2.1 - 4.2.5

Unit IV : Chapter 4 : Sections 4.3.2 & 4.4.2 - 4.4.3.

Unit V : Chapter 5 : Sections 5.1 & 5.1.1 - 5.1.3, 5.2.2 - 5.2.3, & 5.3.2 - 5.3.3.

ALGEBRA - II

Semester: II **Hours: 6**

Code : 17PMA2C05 **Credits: 5**

COURSE OUTCOMES:

- Understand Module as a generalization of Vector Space.
- Construct the abelian groups generated by finite number of elements.
- Differentiate between linearly independent vectors and linearly dependent vectors.
- Find the matrices corresponding to linear transforms.
- Reduce the matrix to rational triangular form and canonical form.

UNIT I

Vector spaces - Elementary Basic Concepts - Subspaces -Homomorphism - Isomorphism - Internal direct Sum - Linear Independence - Linear Span - Finite Dimensional vector space - linearly independent vectors - Basis of V - Dual spaces. **(18 Hours)**

UNIT II

Inner Product Spaces -Norm of a vector-Orthogonal vectors-Orthogonal complement -Orthonormal Set-Modules-Cyclic modules and Finitely Generated modules. **(18 Hours)**

UNIT III

Linear transformations -The Algebra of Linear Transformations - Algebra over a field F-Invertible or Regular Transformation - Singular Transformation - Characteristic Roots - Matrices-Algebra of Matrices-Canonical Forms : Triangular Form. **(18 Hours)**

UNIT IV

Canonical Forms : Nilpotent Transformations - A decomposition of V : Jordan Form - Jordan Canonical Form - Rational Canonical Form - Trace and Transpose. **(18 Hours)**

UNIT V

Determinants - The formal Properties in the theory of Determinants - Cramer's Rule for solving the system of linear Equations - Hermitian, Unitary, and Normal Transformations - Real Quadratic Forms. **(18 Hours)**

COURSE BOOK:

I. N. Herstein, Topics in Algebra (Second Edition), Replica Press Pvt. Ltd, 2002

Unit I	:	Chapter 4: Sections 4.1 - 4.3
Unit II	:	Chapter 4 : Section 4.4 - 4.5 .
Unit III	:	Chapter 6 : Sections 6.1 - 6.4.
Unit IV	:	Chapter 6 : Sections 6.5 - 6.8.
Unit V	:	Chapter 6 : Sections 6.9 - 6.11.

ANALYSIS - II

Semester: II **Hours: 6**

Code : 17PMA2C06 **Credits: 5**

COURSE OUTCOMES:

- Compare the convergence and uniform convergence of sequence of functions
- Extend the structure of the real line to complex and vector valued functions on intervals
- Derive the properties of analytic functions
- Discuss integration of real valued functions on intervals
- Develop the Lebesque integral in several distinct ways

UNIT I

The Riemmann -Stieltjes integral - Definition and existence of the integral - properties of the integral - integration and differentiation. **(18 Hours)**

UNIT II

Seqences of series of functions - Discussion of Main Problem - uniform convergence - uniform convergence and continuity - uniform convergence and integration-uniform convergence and differentiation. **(18 Hours)**

UNIT III

Equicontinuous families of functions - The Stone Wierstrass theorem -Some Special Functions- power series - the exponential and logarithmic functions - The trigonometric functions. **(18 Hours)**

UNIT IV

The algebraic completeness of the complex field - Fourier series-The Gamma function - some consequences - Stirling's formula. **(18 Hours)**

UNIT V

The Lebesgue theory- set functions - construction of the Lebesgue Measure - measure spaces - measurable functions - simple functions - integration-comparison with the Riemann integral - integration of complex functions-functions of class L^2 . **(18 Hours)**

COURSE BOOK:

Walter Rudin, Principles of Mathematical Analysis(Third edition) , McGraw-Hill International Company (International Student Edition),1976

Unit I	:	Chapter 6 - 6.1 to 6.22
Unit II	:	Chapter 7 - 7.1 to 7.18
Unit III	:	Chapter 7 - 7.19 to 7.33 & Chapter 8 - 8.1 to 8.7
Unit IV	:	Chapter 8 - 8.8 to 8.22
Unit V	:	Chapter 11

MATHEMATICAL STATISTICS

Semester: II **Hours: 6**

Code : 17PMA2C07 **Credits: 4**

COURSE OUTCOMES:

- Explore the essentials of Distribution theory
- Construct the theory of probability to make inferences
- Promote knowledge of special distributions
- Build effective methods of finding the distribution of a function of several random variables
- Provide ways of approximation to determine complicated probability density functions

UNIT I

Distributions of Random Variables - the probability set function - random variables - the probability density function - the distribution function - certain probability models - mathematical expectation - some special mathematical expectations -Chebyshev's inequality. **(18 Hours)**

UNIT II

Conditional Probability and Stochastic Independence - Conditional Probability - Marginal and conditional distributions - the correlation coefficient - Stochastic independence. **(18 Hours)**

UNIT III

Some Special Distributions-The Binomial, Trinomial and multinomial Distributions-The Poisson distribution - The Gamma and Chi-square Distributions - The Normal Distribution - The Bivariate Normal Distribution. **(18 Hours)**

UNIT IV

Sampling Theory - Transformations of variables of the discrete type - Transformations of variables of the continuous type - The t and F distributions - Extensions of the change of variable technique - Distributions of order statistics - The moment generating function technique - The distributions of $\bar{X}$ and nS^2/σ^2 - Expectations of functions of random variables. **(18 Hours)**

UNIT V

Limiting distributions - Stochastic convergence - Limiting Moment generating functions - The Central Limit Theorem - Some theorems on Limiting distributions. **(18 Hours)**

COURSE BOOK:

Robert V. Hogg & Allen T. Craig, Introduction to Mathematical Statistics, IV Edition, Macmillan Publishing Co., Inc. NEW YORK, Collier Macmillan Publishers, 1978.

Unit I	:	Chapter 1 : Sections 1.4 to 1.11
Unit II	:	Chapter 2 : Sections 2.1 to 2.4
Unit III	:	Chapter 3 : Sections 3.1 to 3.5
Unit IV	:	Chapter 4 : Sections 4.1 to 4.9
Unit V	:	Chapter 5 : Sections 5.1 to 5.5

DIFFERENTIAL GEOMETRY

Semester: I **Hours: 6**

Code : 17PMA2E2A **Credits: 4**

COURSE OUTCOMES:

- Understand the basic principles of space curves and surfaces.
- Familiarize with the concept of osculating circles and spheres and their properties.
- Derive differential equations of Geodesics using normal property.
- Discuss the principal curvature and lines of curvature.
- Describe the local intrinsic property of a surface.

UNIT I

Theory of space curves - Representation of space curves - Unique parametric representation of a space curve - Arc length - Tangent and osculating plane - principal normal and binormal - curvature and torsion - Behaviour of a curve near one of its points - The curvature and torsion of a curve as the intersection of two surfaces - contact between curves and surfaces. **(18 Hours)**

UNIT II

Osculating circle and osculating sphere - Locus of centres of spherical curvature - Tangent surfaces , involutes and evolutes - Bertrand curves - Spherical indicatrix - Intrinsic equations of space curves -Fundamental Existence theorem for space curves - Helices. **(18 Hours)**

UNIT III

The first fundamental form and local intrinsic properties of a surface - Definition of a surface- Nature of points on a surface - Representation of a surface - curves on a surface -Tangent plane and surface normal -The general surface of revolution - Helicoids - metric on a surface -The first fundamental form - Direction coefficients on a surface - Families of curve -Orthogonal trajectories - Double family of curves. **(18 Hours)**

UNIT IV

Geodesics on a surface - Geodesics and their differential equations - Canonical geodesic equations - Geodesics on surfaces of revolution - Normal property of Geodesics -Differential equations of geodesics using normal property - Existence theorems - geodesics parallels - geodesics polar co-ordinates - geodesics curvature. **(18 Hours)**

UNIT V

The Second fundamental form and local non intrinsic properties of a surface - Second fundamental form - Classification of points on a surface - principal curvature-lines of curvature - Dupin indicatrix. **(18 Hours)**

COURSE BOOK:

D. SomaSundaram , Differential Geometry A First Course, Narosa Publishing House, 2008

Unit I : Chapter 1 : Sections 1.1 - 1.10.

Unit II : Chapter 1 : Sections 1.11 -1.20

Unit III : Chapter 2 : Sections 2.1 - 2.13

Unit IV : Chapter 3 : Sections 3.1 - 3.10

Unit V : Chapter 4 : Sections 4.1 - 4.6

GRAPH THEORY

Semester: II **Hours: 6**

Code : 17PMA2E2B **Credits: 4**

COURSE OUTCOMES:

- Understand the techniques in Graph Theory.
- Represent real life problems in a graph.
- Develop the skill of constructing models using graphs.
- Discover solutions to problems using algorithmic approach.
- Inculcate the spirit of research in network problems.

UNIT I

Trees and Connectivity - Definitions and simple properties - bridges - Spanning trees - Connector problems - Shortest path problems - Cut vertices and connectivity. **(18 Hours)**

UNIT II

Euler Tours and Hamiltonian Cycles - Euler Tours - The Chinese postman Problem - Hamiltonian Graphs -The Travelling Salesman Problem. **(18 Hours)**

UNIT III

Matchings - Matchings and Augmenting paths - The Marriage Problem - The Personnel Assignment Problem. **(18 Hours)**

UNIT IV

Planar Graphs - Plane and Planar Graphs - Euler's Formula - The Platonic Bodies - Kuratowski's theorem - Non-Hamiltonian Plane Graphs - The Dual of a plane Graph. **(18 Hours)**

UNIT V

Colouring - Vertex Colouring - Vertex Colouring Algorithms - Critical Graphs - Cliques - Edge colouring - Map colouring. **(18 Hours)**

COURSE BOOK:

John Clark & Derek Allan Holton, A First Look At Graph Theory, Allied Publishers Ltd., 1995

Unit I	:	Chapter 2
Unit II	:	Chapter 3
Unit III	:	Chapter 4 - Sections 4.1 to 4.3
Unit IV	:	Chapter 5
Unit V	:	Chapter 6

MATHEMATICAL MODELLING

Semester: II **Hours: 4**

Code : 17PMA2I01 **Credits: 3**

COURSE OUTCOMES:

- Acquaint with more mathematical techniques.
- Design the learning gained from special case studies to other situations.
- Apply mathematical modeling through graphs.
- Create models through differential equations to solve real life problems.
- Formulate Bio medical problems.

UNIT I

Mathematical Modelling: Need , Techniques , Classifications and simple illustrations - Simple situations requiring Mathematical modeling - The techniques of Mathematical modelling - Classification of a Mathematical model - Simple Illustrations - Limitations of Mathematical modelling. **(12 Hours)**

UNIT II

Mathematical Modelling through Graphs - Situations that can be modeled through graphs - The seven bridge problem - Senior- subordinate relationship - Food Webs - Decanting Problem - Seating arrangement Problem. **(12 Hours)**

UNIT III

Mathematical Modelling through Graphs (continued) -Shortest Path problem - The instant Insanity problem - uses of Graphs in Markov processes - Transition Graph. **(12 Hours)**

UNIT IV

Mathematical Modelling through Programming - Mathematical representation of a linear programming problem - Diet problem - Relocation of Emergency unit - Equipment Bags problem - Making money with matrices. **(12 Hours)**

UNIT V

Mathematical Models in Biology and medicine - Scope of Mathematical Bio Sciences - Role of mathematics in Bio Sciences - Genetic Matrices - Medical Diagnosis problem - The Hospital Diet problem -Optimization Model for Blood testing & patient care (Dorfman Procedure). **(12 Hours)**

COURSE BOOK:

Course Material prepared by the Department.

SOFT SKILLS

Semester: II **Hours: 2**

Code : 17PGS2S01 **Credit: 1**

COURSE OUTCOMES:

- Develop their social, interpersonal, cognitive, ethical, professional, reading and communication skills.
- Increase their self-esteem and confidence.
- Achieve their short and long term goals.
- Prepare and formulate their resumes wisely.
- Face the mock group discussions and interviews with a challenge and choose their right career.

UNIT I: SOFT SKILLS

Introduction - Soft skills - Importance of soft skills - Selling your soft skills - Attributes regarded as soft skills - Soft skills - Social - Soft skills - Thinking - Soft skills - Negotiating - Exhibiting your soft skills - Identifying your soft skills - Improving your soft skills - will formal training enhance your soft skills - Soft Skills training - Train yourself - Top 60 soft skills - Practicing soft skills - Measuring attitude. **(6 Hours)**

UNIT II: CAREER PLANNING

Benefits of career planning - Guidelines for choosing a career - Myths about choosing a career - Tips for successful career planning - Developing career goals - Final thoughts on career planning - Things one should know while starting career and during his/her career. **(6 Hours)**

UNIT III: ART OF LISTENING AND SPEAKING

Two ears, one mouth - Active listening - Kinds of Listening, Common - poor listening habits - Advantages of listening - Listening Tips. Special features of Communication - Process - Channels of Communication - Net Work - Barriers - Tips for effective communication and Powerful presentation - Art of public speaking - Public Speaking tips - Over coming fear of public speaking. **(6 Hours)**

UNIT IV: ART OF READING AND WRITING

Good readers - Benefits - Types - Tips - The SQ3R Technique - Different stages of reading - Rates of Reading - Determining a student's reading rate - Increasing reading rate - Problems with reading - Effective reader - Importance of writing - Creative writing - Writing tips - Drawbacks of written communication. **(6 Hours)**

UNIT V: PREPARING CV / RESUME

Meaning - Difference among Bio-data, CV and Resume - The terms - The purpose of CV writing - Types of resumes - Interesting facts about resume - CV writing tips - CV/Resume preparation - the dos - CV/Resume preparation - the don'ts - Resume check up - Design of a CV - Entry level resume - The content of the resume - Electronic resume tips - References - Power words - Common resume blunders - Key skills that can be mentioned in the resume - Cover letters - Cover letter tips. **(6 Hours)**

COURSE BOOK:

Dr. K. Alex, Soft Skills, Chand & Company Pvt. Ltd., New Delhi.

REFERENCE BOOK:

1. Dr. T. Jeya Sudha & Mr. M.R. Wajida Begum : Soft Skills/Communication Skills, New Century Book House (P) Ltd., Chennai.
2. S. Hariharen, N. Sundararajan & S.P. Shanmuga Priya : Soft Skills, MJP Publishers, Chennai.

SOFT SKILLS

Semester: II **Hours: 2**

Code : 17PGS2S01 **Credit: 1**

QUESTION PATTERN

Part - A	3 Questions to be answered out of 5	Each Carries 4 marks	12 Marks
Part - B	2 Questions to be answered out of 4	Each Carries 9 marks	18 Marks

The Components of Internal Assessment for Soft Skill are as follows

Components	**Marks**
Test - I	30
Test - II	30
Mock Interview	30
Communication Skill	10
Total	**100**

FIELD THEORY AND LATTICES

Semester: III **Hours: 6**

Code : 17PMA3C08 **Credits: 5**

COURSE OUTCOMES:

- Familiarize with the concept of field extensions.
- Elucidate the normal extensions and identify the fixed fields of Galois groups.
- Analyse the concept of finite fields.
- Explain clearly about Lattices and types of lattices.
- Acquaint with the properties of lattices and Boolean Algebra.

UNIT I

Extension Fields - finite extensions - algebraic extensions - algebraic and transcendental elements - the transcendence of e - roots of polynomials.

(18 Hours)

UNIT II

More about roots - the elements of Galois theory - normal extensions - fixed fields - Galois groups. **(18 Hours)**

UNIT III

Solvability by radicals - finite fields. **(18 Hours)**

UNIT IV

Lattices - partially ordered sets - lattices - modular lattices- Schreier's theorem.

(18 Hours)

UNIT V

Decomposition theory for lattices with ascending chain condition - independence - complemented lattices - Boolean algebras. **(18 Hours)**

COURSE BOOKS:

1. **I.N. Herstein, Topics in Algebra**, **John Wiley & Sons**, Second Edition, 2002.
2. **Nathan Jacobson, Lectures in Abstract Algebra**, Affiliated East-West Press Pvt. Ltd., 1971.

   Unit I : Chapter - 5: Sections 5.1, 5.2 & 5.3 (Book 1)

   Unit II : Chapter - 5: Sections 5.5 & 5.6 (Book 1)

   Unit III : Chapter - 5: Section 5.7 & Chapter - 7: Section 7.1(Book 1)

   Unit IV : Chapter - 7: Sections 7.1 to 7.4 (Book 2)

   Unit V : Chapter - 7: Sections 7.5 to 7.8 (Book 2)

TOPOLOGY

Semester: III **Hours: 6**

Code : 17PMA3C09 **Credits: 5**

COURSE OUTCOMES:

- Understand the basic topological concepts.
- Extend the notion of continuous functions in topological spaces.
- Explain compactness and connectedness of topological spaces.
- Familiarize with the separation axioms.
- Use the properties of normal and regular spaces in proving theorems.

UNIT I

Topological spaces - basis for a topology - order topology - product topology on X ×Y - subspace topology - closed sets and limit points. **(18 Hours)**

UNIT II

Continuous functions - product topology - metric topology - the metric topology continued. **(18 Hours)**

UNIT III

Connected spaces - connected subspaces of the real line - components and local connectedness. **(18 Hours)**

UNIT IV

Compact spaces - compact subspaces of the real line - limit point compactness. **(18 Hours)**

UNIT V

The countability axioms - separation axioms - normal spaces - Urysohn lemma - Urysohn Metrization theorem - Tietze Extension theorem -Tychonoff theorem. **(18 Hours)**

COURSE BOOK:

James. R. Munkres, Topology, PHI Learning Private Ltd., New Delhi, Second Edition, 2014.

Unit I : Chapter - 2: Sections 12 to 17

Unit II : Chapter - 2: Sections 18 to 21
(omitting section 22 - The Quotient Topology)

Unit III: Chapter - 3: Sections 23 to 25

Unit IV: Chapter - 3: Sections 26 to 28
(omitting section 29 - Local Compactness)

Unit V: Chapter - 4: Sections 30 to 35
(omitting section 36 - Imbedding of Manifolds) &
Chapter - 5: Section 37

COMPLEX ANALYSIS

Semester: III **Hours: 6**

Code : 17PMA3C10 **Credits: 5**

COURSE OUTCOMES:

- Represent complex numbers algebraically and geometrically.
- Determine the differentiability of complex functions.
- Identify the removable and essential singularities of a function.
- Express analytic functions in terms of power series.
- Evaluate complex line integrals and some infinite real integrals.

UNIT I

The spherical representation - limits and continuity - analytic functions - polynomials - rational functions - sequences - series - uniform convergence - power series - Abel's limit theorem. **(18 Hours)**

UNIT II

Arcs and closed curves - analytic functions in region - conformal mapping - length and area - linear group - cross ratio - symmetry. **(18 Hours)**

UNIT III

Line integrals - rectifiable arcs - line integrals as functions of arcs - Cauchy's theorem for a rectangle - Cauchy's theorem in disk - Cauchy's integral formula - The index of a point with respect to a closed curve - the integral formula - higher derivatives. **(18 Hours)**

UNIT IV

Removable singularities - Taylor's theorem - zeros and poles - the local mapping - The maximum principle - The residue theorem - The argument principle - evaluation of definite integrals. **(18 Hours)**

UNIT V

Harmonic functions - definition and basic properties - the mean value property - Poisson's formula - Schwarz's theorem - Weierstrass's theorem - The Taylor's series - The Laurent's series. **(18 Hours)**

COURSE BOOK:

Lars V. Ahlfors, Complex Analysis, Mc Graw Hill Student Edition, Third Edition, 1979.

Unit I : Chapter - 1 : Section 2.4 & Chapter - 2 : Sections 1.1 to 2.5

Unit II : Chapter - 3 : Sections 2.1 to 2.4 & 3.1 to 3.3

Unit III: Chapter - 4 : Sections 1.1 to 1.5 & 2.1 to 2.3

Unit IV: Chapter - 4 : Sections 3.1 to 3.4 & 5.1 to 5.3

Unit V : Chapter - 4 : Sections 6.1 to 6.4 & Chapter - 5 : Sections 1.1 to 1.3

STOCHASTIC PROCESS

Semester: III **Hours: 6**

Code : 17PMA3C11 **Credits: 4**

COURSE OUTCOMES:

- Provide Mathematical models for random experiments
- Familiar with important tools of Applied Probability theory
- Develop ideas on the application of Markov chains and Markov process
- Benefit with more details on Renewal Process
- Solve various mathematical problems using limiting behavior

UNIT I

Random Variables and Stochastic Processes - Introduction - Probability Generating Function - Stochastic Process: An introduction - Markov chain - Definition and examples - Higher transition probabilities. **(18 Hours)**

UNIT II

Generalisation of independent Bernoulli trails: Sequence of chain - Dependent trails - Classification of states and chains - Determination of higher transition probabilities - Stability of a Markov system - Graph theoretic approach.

(18 Hours)

UNIT III

Poisson Process - Poisson process and Related Distributions - Generalisations of Poisson process - Birth and Death Process - Markov process with discrete state space. **(18 Hours)**

UNIT IV

Renewal Process - Renewal process in Discrete time - Renewal process in continuous time - Renewal equation. **(18 Hours)**

UNIT V

Stopping time: Wald's equation - Elementary Renewal theorems - Renewal theorems - Delayed and equilibrium renewal process. **(18 Hours)**

COURSE BOOK:

J. Medhi, Stochastic Process, New Age International Publishers, Third Edition, 2009.

UNIT I : Chapter - 1 & Chapter - 2 : Sections 1.1.1, 1.1.2, 1.5, 2.1, 2.2

UNIT II : Chapter - 2: Sections 2.3 to 2.7

UNIT III: Chapter - 3: Sections 3.1 to 3.5

UNIT IV: Chapter - 6 : Sections 6.1 to 6.3

UNIT V : Chapter - 6 : Sections 6.4 to 6.6

NUMBER THEORY

Semester: III **Hours: 6**

Code : 17PMA3E3A **Credits: 4**

COURSE OUTCOMES:

- Explain the concepts of arthimetic functions and Dirichlet multiplication.
- Determine multiplicative inverse, modulo n to solve linear congruences.
- Produce rigorous arguments of number theory and promote in writing proofs of theorems.
- Evaluate the law of quadratic reciprocity and quadratic residues.
- Assess with partition functions.

UNIT I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION

The Mobius function - Euler totient function - a relation connecting ϕ and μ - a product formula for $\phi(n)$ - the Dirichlet product of arithmetic functions - Dirichlet inverses and the Mobius inversion formula - the Mangoldt function - Multiplicative function - multiplicative functions and Dirichlet Multiplication - The inverse of a completely multiplicative function - Liouville's function - The divisor functions - Generalised convolutions - Formal Power series - The Bell series of an arithmetical function - Bell Series and Dirichlet multiplication - derivatives of arithmetical functions - The Selberg identity. **(18 Hours)**

UNIT II: AVERAGES OF ARITHMETICAL FUNCTIONS

The big oh notation - asymptotic equality of functions - Euler's summation formula- Some elementary asymptotic formulas - average order of d(n) - average order of the divisor functions $\sigma_\alpha(n)$ - average order of $\phi(n)$ - an application to the distribution of lattice points visible from the origin - average order of $\mu(n)$ and of $\Delta(n)$ - the partial sums of a Dirichlet product - applications to $\mu(n)$ and $\Lambda(n)$ - another identity for the partial sums of a Dirichlet product. **(18 Hours)**

UNIT III: CONGRUENCES

Definition and basic properties of Congruences - Residue classes and complete residue system - Linear congruences - reduced residue systems and the Euler - Fermat theorem - polynomial congruences modulo p - Langrange's theorem - applications of Lagrange's theorem - Simultaneous Linear Congruences: The Chinese remainder theorem - applications of the Chinese remainder theorem - Polynomial congruences with prime power moduli - the principle of cross classification - a decomposition property of reduced residue systems. **(18 Hours)**

UNIT IV: QUADRATIC RESIDUES AND QUADRATIC RECIPROCITY LAW

Quadratic residues - Legendre's symbol and its properties - evaluation of (-1/p) and (2/p) - Gauss' Lemma - the quadratic reciprocity Law - applications of the reciprocity law - the Jacobi symbol - Applications to Diophantine equations.

(18 Hours)

UNIT V: PARTITION FUNCTION

Partitions - graphs - Formal power series and Euler's identity - Euler's formula, Jacobi's formula - a divisibility property. **(18 Hours)**

COURSE BOOKS:

1. **Tom M. Apostol, Introduction to Analytic Number Theory,** Springer International Student Edition, 1998.
2. **Niven Herbert S. Zuckerman, Introduction to the Theory of Numbers**, Wiley Eastern University Edition, 1984.

Unit I	:	Chapter 2 Section 2.2 - 2.19 (Book 1)
Unit II	:	Chapter 3 Section 3.2 - 3.12 (Book 1)
Unit III	:	Chapter 5 Section 5.1 - 5.11 (Book 1)
Unit IV	:	Chapter 9 Section 9.1- 9. 8 (Book 1)
Unit V	:	Chapter 10 Section 10.1-10.6 (Book 2)

CALCULUS OF VARIATIONS

Semester: III **Hours: 6**

Code : 17PMA3E3B **Credits: 4**

COURSE OUTCOMES:

- Apply the concept of variation to solve problems on Mechanics.
- Analyze movable boundary for a functional dependent on two functions.
- Describe special kinds of Kernals and Fredholm alternatives.
- Familiar with successive approximation.
- Synthesize initial value problem and boundary value problem.

UNIT I

The concept of Variation and its properties - Euler's equation - Variational properties for functional - Functionals dependent on higher order derivatives - Functions of several independent variables - Some applications to problems of mechanics. **(18 Hours)**

UNIT II

Movable boundary for a functional dependent on two functions - One sided variations - Reflection and Refraction of extremals - Diffraction of light rays.

(18 Hours)

UNIT III

Introduction - Definition - Regularity conditions - Special kinds of Kernals - Eigen values and eigen functions - Convolution integral - Reduction to a system of algebraic equations - Examples - Fredholm alternative - Examples - An approximation method. **(18 Hours)**

UNIT IV

Method od successive approximations - Iterative scheme - Examples - Volterra integral equations - Examples - Some results about the resolvent kernel - The method of solution of Fredholm equation - Fredholm first theorem - Examples.

(18 Hours)

UNIT V

Initial value problems - Boundary value problem - Examples - Singular integral equations - The Abel integral equations - Examples. **(18 hours)**

COURSE BOOK:

1. **A. S. Gupta, Calculus of Variations with Applications**, PHI, New Delhi, 2005. (units I & II)
2. **Ram P. Kanwal, Linear Integral Equations**, Theory and Techniques, Academic Press, New York, 1971. (units III, IV & V)

Unit I : Chapter - 1 : Sections 1.1 - 1.7

Unit II : Chapter - 2 : Sections 2.1 - 2.5

Unit III : Chapter - 1 : Sections 1.1 - 1.5

Chapter - 2 : Sections 2.1 - 2.5

Unit IV : Chapter - 3 : Sections 3.1 - 3.5

Chapter - 4 : Sections 4.1 - 4.3

Unit V : Chapter - 5 : Sections 5.1 - 5.3

Chapter - 8 : Sections 8.1 - 8.2

FUNCTIONAL ANALYSIS

Semester: IV **Hours: 6**

Code : 17PMA4C12 **Credits: 5**

COURSE OUTCOMES:

- Illustrate the elementary concepts of Functional analysis.
- Convert a linearly independent set into an orthonormal set.
- Apply the ideas from the theory of Hilbert spaces to Fourier series.
- Describe the various kinds of operators.
- Apply the spectral theory to the resolution of integral equations

UNIT I

Banach spaces - definition and some examples - continuous linear transformation - The Hahn- Banach theorem - the natural imbedding on N in N** - the open mapping theorem - the conjugate of an operator. **(18 Hours)**

UNIT II

Hilbert spaces - definition and some simple properties - orthogonal complements - orthonormal sets - the conjugate space H^*. **(18 Hours)**

UNIT III

The adjoint of an operator - self-adjoint operators - normal and unitary operators - projections. **(18 Hours)**

UNIT IV

Matrices - determinants and the spectrum of an operator - the spectral theorem - a survey of the situation. **(18 Hours)**

UNIT V

General preliminaries on Banach algebras - definition and examples - regular and singular elements - topological divisors of zero - the spectrum - the formula for the spectral radius - the radical and semi simplicity. **(18 Hours)**

COURSE BOOK:

George. F. Simmons, Introduction to Topology and Modern Analysis, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, Edition 2004.

UNIT I : Chapter - 9: Sections 46 - 51

UNIT II : Chapter - 10: Sections 52 - 55

UNIT III : Chapter - 10: Sections 56 - 59

UNIT IV : Chapter - 11: Sections 60 - 63

UNIT V : Chapter - 12: Sections 64 - 69

DIFFERENTIAL EQUATIONS

Semester: IV **Hours: 6**

Code : 17PMA4C13 **Credits: 5**

COURSE OUTCOMES:

- Get acquaint with the ordinary and partial differential equations.
- Acquire the knowledge of finding the approximate solutions of the differential equations.
- Understand the existence and uniqueness property of solutions of first and higher order differential equations.
- Solve the partial differential equations using different methods.
- Infer the initial and boundary value problems and the methods to solve them.

UNIT I

Solutions in power series - introduction - second order linear equations with ordinary points - Legendre equation and Legendre polynomial. Hermite polynomial - second order equations with regular singular points - Bessel equation. **(18 Hours)**

UNIT II

Existence and uniqueness of solutions - introduction - preliminaries - successive approximations - Picard's theorem - non uniqueness of solutions - continuation and dependence on initial conditions - existence of solutions in the large - existence and uniqueness of solutions of systems. **(18 Hours)**

UNIT III

Boundary value problems - Sturm-Liouville problem - Green's functions - non existence of solutions - Picard's theorem. **(18 Hours)**

UNIT IV

Cauchy's method of characteristics - compatible systems of first order equations - Charpit's method. **(18 Hours)**

UNIT V

Linear partial differential equations with constant coefficients - equations with variable coefficients. **(18 Hours)**

COURSE BOOKS:

1. **S. G. Deo and V. Raghavendra, Ordinary Differential Equations and Stability Theory**, Tata McGraw-Hill Publishing Company Ltd., 1987.
2. **Ian Sneddon, Elements of Partial Differential Equations**, McGraw-Hill International Student Edition, 1982.

Unit I : Chapter - 3: Sections 3.1 - 3.5 (Book 1)
Unit II : Chapter - 5: Sections 5.1 - 5.8 (Book 1)
Unit III : Chapter - 7: Sections 7.1 - 7.5 (Book 1)
Unit IV : Chapter - 2: Sections 8 - 10(Book 2)
Unit V : Chapter - 3: Sections 4 - 5 (Book 2)

OPERATIONS RESEARCH

Semester: IV **Hours: 6**

Code : 17PMA4C14 **Credits: 5**

COURSE OUTCOMES:

- Formulate network models and solve using algorithms.
- Convert and solve the practical situation into non linear programming problems.
- Compute critical path in network problems.
- Apply and extend queuing models to analyze real life problems.
- Solve nonlinear programming problems.

UNIT I

Network models - scope of network applications - network definitions - minimal spanning tree algorithm - shortest route problem - short route algorithms - maximal flow model - maximal flow algorithm. **(18 Hours)**

UNIT II

Network models (continued) - minimum cost capacitated flow problem - linear programming formulation - capacitated network simplex algorithm - CPM and PERT - network representation - critical path computations - construction of the time schedule - determination of the floats. **(18 Hours)**

UNIT III

Queuing systems - why study queues? - elements of queueing model - role of exponential distribution - derivation of exponential distribution - pure birth and death models - generalised Poisson queueing model - specialized Poisson queues steady-state measures of performance - single server models (M/M/1) : (GD/∞/∞) - waiting time distribution for (M/M/1):(FCFS/∞ /∞) - (M/M/1): (GD/N/∞) - multiple server models - (M/M/c) : (GD/∞/∞), (M/M/c) : (GD/N/∞) - self service model (M/M/∞):(GD/∞/∞) - self service model - machine serving model (M/M/R) : (GD/K/K) (R<K). **(18 Hours)**

UNIT IV

Classical optimization theory - introduction - unconstrained problems - necessary and sufficient conditions - Newton - Raphson method - constrained problems - equality constraints - Jacobian method - Lagrangean method - inequality constraints - extension of the Lagrangian method - the Kuhn-Tucker conditions. **(18 Hours)**

UNIT V

Non linear programming algorithms - unconstrained algorithms - direct search method - gradient method - constrained algorithms - separable programming - quardratic programming - geometric programming - stochastic programming - linear combination method. **(18 Hours)**

COURSE BOOK:

Hamdy. A. Taha, Operations Research - An Introduction, Prentice Hall of India Private Ltd., New Delhi, (VI Edition) (2000).

Unit I	:	Chapter - 6 : Sections 6.1 - 6.5
Unit II	:	Chapter - 6 : Sections 6.6 - 6.7
Unit III	:	Chapter - 17: Sections 17.1 - 17.6 (up to 17.6.4 only)
Unit IV	:	Chapter - 20: Sections 20.1- 20.3
Unit V	:	Chapter - 21: Sections 21.1 - 21.2 (up to 21.2.5 only)

PROJECT

Semester: IV **Hours: 12**

Code : 17PMA4R01 **Credits: 6**

COURSE OUTCOMES:

- Cultivate abstract thinking.
- Acquire knowledge in their area of interest.
- Develop confidence in self learning.
- Gain experience in deductive reasoning.
- Promote techniques of research.

COMPREHENSIVE EXAMINATION

Semester: IV **Credits: 2**

Code : 17PMA4A01

COURSE OUTCOMES:

- Promote competency in Mathematics.
- Contemplate with important tools to solve problems in Pure and Applied Mathematics.
- Improve self learning.
- Have an understanding on the use of mathematical concepts.
- Equip themselves to appear for NET/SET Exams.