M.Sc. MATHEMATICS (2017 - 2018)

S. No.	Semester	Category	Paper Code	Title of the Paper	Maximum Marks			Minimum Marks for Pass			Hours/ Week	Credits
					CIA	EE	Total	CIA	EE	Total		
1	I	Core	17P1MAC1	Linear Algebra	25	75	100	10	30	50	6	5
2		Core	17P1MAC2	Real Analysis – I	25	75	100	10	30	50	6	5
3		Core	17P1MAC3	Ordinary Differential Equations	25	75	100	10	30	50	6	5
4		Core	17P1MAC4	Stochastic Processes	25	75	100	10	30	50	6	4
5		Major Elective-I	17P1MAEL1A 17P1MAEL1B	Classical Dynamics (or) Fluid Dynamics	25	75	100	10	30	50	6	4
6	II	Core	17P2MAC5	Algebra	25	75	100	10	30	50	5	5
7		Core	17P2MAC6	Complex Analysis	25	75	100	10	30	50	5	4
8		Core	17P2MAC7	Partial Differential Equations	25	75	100	10	30	50	5	4
9		Core	17P2MAC8	Mathematical methods	25	75	100	10	30	50	5	4
10		Core	17P3MAC9	Optimization Techniques	25	75	100	10	30	50	5	5
11		Major Elective-II	17P2MAEL2A 17P2MAEL2B	Mathematical Probability (or) Mathematical Modeling	25	75	100	10	30	50	5	4
12	III	Core	17P3MAC10	General Topology	25	75	100	10	30	50	5	4
13		Core	17P3MAC11	Differential Geometry	25	75	100	10	30	50	5	3
14		Core	17P3MAC12	Real Analysis – II	25	75	100	10	30	50	5	4
15		Core	17P3MAC13	Programming in C++	25	75	100	10	30	50	5	3
16		Core-Practical	17P3MACPL	Programming in C++ Practical	40	60	100	10	30	50	5	2
17		EDC	17P3MAEDC	Extra disciplinary course - Applicable Mathematical Techniques	25	75	100	16	24	50	4	-
		Communicative Skill & Personality Development			-	-	-	-	-	-	1	-
18	IV	Core	17P4MAC14	Functional Analysis	25	75	100	10	30	50	6	5
19		Core	17P4MAC15	Graph Theory and its application	25	75	100	10	30	50	6	5
20		Core	17P4MAC16	Cryptography	25	75	100	10	30	50	6	5
21		Major Elective-III	17P4MAEL3A 17P4MAEL3B	Advanced Numerical Analysis (or) Design and Analysis of Algorithms	25	75	100	10	30	50	6	4
22		CN	17P4MACN	Comprehension	-	100	100	-	50	50	5	2
23		Project	17P4MAPR	Project	40	60	100	16	24	50	-	4
		Communicative Skill & Personality Development			-	-	-	-	-	-	1	-
		Total					**2300**				**120**	**90**

M.Sc. MATHEMATICS (2017 – 2018)

Paper Code	Total No. Of Papers	Total Marks	Total Credits	Classification
Core	17	1700	72	✓
Elective	3	300	12	✓
E.D.C	1	100	---	✓
Project	1	100	4	x
Comprehension	1	100	2	✓
Soft skill using Language lab	--	--	---	X
Total	**23**	**2300**	**90**	

A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE (AUTONOMOUS),
POONDI, THANJAVUR DIST.

Question Pattern for UG and PG Programmes for students to be admitted during 2017 – 2018 and afterwards

Total Marks: 75

QUESTION PATTERN

SECTION – A
(Question 1 to 10)

10 x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

SECTION – B
(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C
(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1MAC1**	**LINEAR ALGEBRA**	**6**	**5**

Unit I: **18 Hrs**

Systems of Linear Equations, Vector Spaces: A motivating Example – Systems of Linear Equations – Vector Spaces – Definition and Examples – Vector Subspaces - Basis and Dimension of a vector space.

Unit II: **18 Hrs**

Lines and Quotient Spaces, Linear Transformations: Definition of a line – Affine Spaces – Quotient Space – Linear Transformation – Representation of Linear Maps by Matrices – Kernel and image of a Linear Transformation – Linear Isomorphism – Geometric Ideas and Some Loose Ends – Some special Linear Transformations.

Unit III: **18 Hrs**

Inner Product Spaces: Inner Product Spaces – Orthogonality – Some Geometric Applications – Orthogonal Projection onto a Line – Orthonormal Basis – Orthogonal complements and Projections – Linear Functionals and Hyperplanes – Orthogonal Transformations – Reflections and Orthogonal Maps of the Plane.

Unit IV: **18 Hrs**

Determinants: 2×2 Determinant as Area of a Parallelogram – Determinant and its Properties – Computation of Determinants – Basic results on Determinants – Orientation and Vector Product.

Unit V: **18 Hrs**

Diagonalization, Classification of Quadrics: Rotation of Axes of Conics – Eigen Values and Eigen Vectors – Diagonalization of Symmetric Matrices – Conics and Quadrics – Computational Examples.

Text Book:

Linear Algebra – A Geometric Approach, S.Kumaresan**,** PHI Learning Pvt. Ltd., 2000.

Unit I : Chapter 1, 2.
Unit II : Chapter 3, 4.
Unit III: Chapter 5.
Unit IV : Chapter 6.
Unit V : Chapter 7, 8.

References:

1 K. Hoffman and R. Kunze, Linear Algebra, Second Edition, PHI, New Delhi, 1975.

2. Jin Ho Kwak, Linear Algebra, Second Edition, Birkhäuser, 2004.

3. R.A. Beezer, A First Course in Linear Algebra, Congruent Press, Washington, 2004.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
I	**17P1MAC2**	**REAL ANALYSIS – I**	**6**	**5**

Unit I **18 Hrs**

Preliminaries, The Real Numbers: Sets and functions – Mathematical Induction – Finite and infinite sets – The algebraic and order properties of R – Absolute value and Real line – The Completeness Property of R.

Unit II **18 Hrs**

Sequences and Series: Sequences and their limits – Limit theorems – Monotone Sequences – Subsequences and the Bolzono-Weierstrass Theorem – The Cauchy criterion – Property of divergent sequences – Introduction to Series.

Unit III **18 Hrs**

Limits,Continuous Functions: Limits of Functions – Limit theorems - Continuous functions – Combinations of continuous functions – Continuous functions on Intervals – Uniform continuity.

Unit IV **18 Hrs**

Differentiation: The Derivative – The Mean Value Theorem – L'Hospital Rule – Taylors Theorem.

Unit V **18 Hrs**

The Riemann Integral: The Riemann Integral – Riemann Integrable Functions – The Fundamental Theorem – Approximate Integration.

Text Book:

Introduction to Real Analysis, Third Edition, R. G. Bartle and D. R. Sherbert, Wiley India Pvt. Ltd, 2012.

Unit I : Chapter I, II (1.1-1.3, 2.1-2.3)
Unit II : Chapter III (3.1-3.7)
Unit III: Chapter IV, V (4.1-4.2, 5.1-5.4)
Unit IV: Chapter VI (6.1-6.4)
Unit V : Chapter VII (7.1-7.4)

References:

1. Tom M. Apostol, Mathematical Analysis 2 edn, Narosa, New Delhi, 1985
2. Walter Rudin, Principles of Mathematical Analysis, Third Edition, Mcgraw Hill, 1976

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
I	**17P1MAC3**	**ORDINARY DIFFERENTIAL EQUATIONS**	**6**	**5**

Objectives:

- Teaching the theory and applications to students preparing for advanced training in applied sciences and social sciences.
- Presenting in easy and lucid language the results of oscillations, boundary valued Problems (BVP) and elements of control theory.
- Justifying the inclusion of qualitative theory to students who think that it is out of place.
- Emphasizing the importance of the study of Boundary value problems, both in Mathematics and in the applied sciences.
- Studying about the stability of stationary solutions

Unit I **18 Hrs**

Systems of linear Differential equations: Systems of first order equations – Existence and uniqueness theorem-Fundamental matrix-Non –homogeneous linear systems-linear systems with constant coefficients-linear systems with periodic coefficients.

Unit II **18 Hrs**

Existence and Uniqueness of solutions: 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.

Unit III **18 Hrs**

Oscillations of second order equations: Fundamental results - Strurm's comparison theorem – Elementary linear oscillations - comparison theorem of Hille-Winter –Oscillation of $x''+ a(t)x=0$ - Elementary nonlinear oscillations.

Unit IV **18 Hrs**

Boundary Value Problems: Introduction - Sturm-Liouville Problem - Green's functions - Non-existence of solutions - Picard's theorem.

Unit V **18 Hrs**

Behaviour of solution of Linear differential equation: n^{th} order equations – Elementary critical points - Critical points of nonlinear systems-linear systems with constant coefficients - linear systems with variable coefficients – second order linear differential equations.

Text Book:

Ordinary Differential equations and stability theory – S.G.Deo & V.Ragavendra

Unit I : Chapter 4
Unit II : Chapter 5
Unit III : Chapter 6
Unit IV : Chapter 7
Unit V : Chapter 8

General References:

1. Differential equations with applications and historical notes –George F Simmons Tata McGraw Hill Ltd New Delhi 1972.
2. Theory of ordinary differential equations EA coddington, N .Levinson-tata McGraw Hill New Delhi 1982.

Semester	Subject Code	Title of the paper	Hours of Teaching /Week	No. of Credits
I	**17P1MAC4**	**STOCHASTIC PROCESSES**	**6**	**4**

Objectives

- To introduce the basic concepts of Stochastic models.
- To learn the real life models such as Birth- Death processes.

Unit-I **18 Hrs**

Stochastic Processes- An introduction-Specification of Stochastic Processes- Definition and Examples – Transition Matrix (or Marix of Transition Probabilities) – Order of a Markov Chain – Markov Chains as Graphs.

Unit – II **18 Hrs**

Higher Transition Probabilities – Generalisation of Independent Bernoulli Trials: Sequence of chain – Dependent Trials – Markov – Bernoulli Cain – Correlated Random Walk – Classification of States and Chains – Communication relations – Class Property – Classification of States : Transient and Persistent(Current) States

Unit –III **18 Hrs**

Determination of Higher Transition Probabilities – Aperiodic Chain : Limiting Behaviour – Stability of A Markov System – Computation of the Equilibrium Probabilities – Graphic theoretic Approach – Markov Chain with Denumerable Number of States(or countable state space)

Unit – IV **18 Hrs**

Poisson Process – Introduction – Postulates for Poisson Process - Properties of Poisson Process – Poisson Process and Related Distributions – Interarrival Time – Further Interesting Properties of Poisson Process.

Unit – V **18 Hrs**

Generalisations of Poisson Process – Poisson Process in Higher Dimensions – Poisson Cluster Process (Compound or Cumulative Poisson Process) – Pure Birth Process : Yule – Furry Process – Birth – Immigration Process – Time – dependent Poisson Processes(Non – homogeneous Poisson Process)- random Variation of the Parameter λ - Renewal Process – Birth and Death Process – Particular Cases.

Text Book :

STOCHASTIC PROCESSES – J. MEDHI -New Age International Publishers (2015)

Unit I : Chapters 1.5 to 2.1
Unit II : Chapters 2.2 to 2.4
Unit III : Chapters 2.5 to 2.8
Unit IV : Chapters 3.1 to 3.2
Unit V : Chapters 3.3 to 3.4

General References:

1. First course in Stochastic process by Samuel karlin.
2. Stochastic process by Srinivasan and Menta.

Semester	Subject Code	Title of the paper	Hours of Teaching/ Week	No.of Credits
I	**17P1MAEL1A**	**Major Elective – I** **CLASSICAL DYNAMICS**	**6**	**4**

Objectives:

- Classical mechanics afford the student an opportunity to master many of mathematics techniques.
- It is certainly true that classical mechanics today is far from being a closed subject.
- Alternate means exist in the curriculum for acquiring the mathematics needed in other branches.

Unit I **18 Hrs**

INTRODUCTORY CONCEPTS: The mechanical systems - Generalized Coordinates-Constraints –Virtual work – Principle of virtual work – D'Alemberts principle – Examples – Generalized force - Example

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Unit II **18 Hrs**

LAGRANGE'S EQUATIONS: Derivation of Lagrange's Equations – Examples – Integral of the motion – Ignorable coordinates – the Routhian function – example – Lioville's system – examples.

Unit III **18 Hrs**

SPECIAL APPLICATIONS OF LAGRANGE'S EQUATIONS: RAYLEIGH'S Dissipation Function - impulsive motion - Gyroscopic systems – small motions – Gyroscopic stability – examples.

Unit IV **18 Hrs**

HAMILTON'S EQUATIONS: Hamilton's principle – Hamilton's equations - other variational principles – Principle of least action – example.

Unit V **18 Hrs**

Hamilton's Principal function – the canonical integral – Pfaffian forms - The Hamilton-Jacobi Equation - Jacobi's theorem - example.

Text Book

"CLASSCIAL DYNAMICS" *– DONALD T.GREENWOOD, Prentice Hall of India Private Ltd New Delhi - 110001(1979)*

Unit I : Chapter 1-sec 1.1, 1.2, 1.3, 1.4, 1.5
Unit II : Chapter 2-sec 2.1, 2.2, 2.3,
Unit III : Chapter 3 –sec 3.1, 3.2, 3.3,
Unit IV : Chapter 4 –sec 4.1, 4.2, 4.3,
Unit V : Chapter 5-sec 5.1, 5.2

General References:

Herbert Goldstein" Classical Mechanics" Second Edition Narosa Publishing House-New Delhi.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
I	**17P1MAEL1B**	**Major Elective – I FLUID DYNAMICS**	**6**	**4**

Objectives:
- To introduce the behavior of fluid in motion.
- To study the application of complex analysis in the analysis of flow of fluids.

Unit I **18 Hrs**

Real fluids and ideals fluid –velocity of a fluids at a point-Streamlines and path lines: steady and unsteady flows-the velocity potential-The velocity vector-local and particle rates of change -The Equations of continuity –Worked examples –Accelerations of a fluids –Pressure at a point in a fluid at rest-Pressure at a point in moving fluids-Conditions at a Boundary of two invisid immiscible fluids –Euler's equations of motions-Bernoulli's equation-worked examples.

Unit II **18 Hrs**

Some flows involving axial symmetry –some special two-Dimensional Flows-impulsive Motion. Some three-dimensional flows: Introductions –sources, sinks and doublets –images in a rigid infinite plane- Axi-symmetric Flows: stokes stream functions.

Unit III **18 Hrs**

Some two-Dimensional Flows: meaning of a two-Dimensional flow-Use of cylindrical polar coordinates –The steam function –The complex potential for two Dimensional, irrotational, incompressible flow –complex velocity potentials for standard two-dimensional flows-some worked examples –The Milne-Thomson circle theorem and applications –The theorem of Blasius.

Unit IV **18 Hrs**

The use of conformal transformation and Hydro dynamical Aspects –stress components in real fluids –relations between Cartesian components of stress-Transnational motion of fluid element –The rate of strains Quadric and principal stresses-Some further properties of the rate of strains quadric-stress Analysis in fluid motion-Relations between stress and rate of strain-The coefficient of viscosity and laminar flow – the Navier-stokes equation of motion.

Unit V **18 Hrs**

Some solvable problems in viscous flow-steady viscous flow in tubes of uniform cross section –Diffusion of vorticity –Energy. Dissipation due to viscosity –steady flow past a fixed sphere –Dimensional Analysis; Reynolds Number-prandtl's Boundary layer.

Text Book:

Fluids dynamics *by F.Chorlton (CBS publisher & Distributors, Delhi-110032) 1985.*

Unit I : Chapter 2.sec 2.1 to 2.9 and chapter 3.sec 3.1 to 3.6
Unit II : Chapter 3.sec 3.9 to 3.11 and chapter 4.sec 4.1, 4.2,4.3,4.5
Unit III : Chapter 5 sec 5.1 to 5.9 except 5.7
Unit IV : Chapter 5 sec 5.10 and chapter 8:Sec 8.1 to 8.9
Unit V : Chapter 8 sec 8.10 to 8.16

General References:

Fluids Dynamics *–shanti swarup, Krishna prakasan mandir Meerut 1984*

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No.of Credits
II	**17P2MAC5**	**ALGEBRA**	**5**	**5**

Objectives:

- Group Theory is the fundamental building blocks for the Abstract algebra.
- To study the algebraic aspects of Real and complex numbers.
- Module is a third algebraic Model –Applicable to geometry and physics.

Unit I **19 Hrs**

Group Theory: Sylow's theorem –Direct products-Finite Abelian groups.

Unit II **19 Hrs**

Ring theory: Polynomial Rings-polynomials over the Rational Fields-polynomial Rings over Commutative Rings-Modules.

Unit III **19 Hrs**

Fields: Extension fields-Roots of polynomials-More about roots.

Unit IV **18 Hrs**

Fields: The Elements of Galois theory - Finite fields

Unit V

Linear transformations: The Algebra of Linear transformations - Characteristic roots - Hermition, Unitary and normal transformations.

Text Book:

Topics in Algebra. *I.N. Herstein 2nd Edition-Wiley Eastern Limited-1975.*

Unit I : Chapter 2 (2.12 to 2.14) Pages: 91 – 115

Unit II : Chapter 3 (3.9 to 3.11), Chapter 4(4.5) Pages: 153 – 166, 201 – 205

Unit III : Chapter 5 (5.1, 5.3, 5.5) Pages: 207 – 214, 219 – 226, 232 - *236*

Unit IV : Chapter 5 (5.6), Chapter 7(7.1) Pages: 237 – 249, 355 - 360

Unit V : Chapter 6 (6.1, 6.2, 6.10) Pages: 269 – 272, 336 – 348

General References:

1. *Algebra: Serge Lang*
2. *Modern Algebra: Vander worden vol.1& vol.2.Objective.*

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
II	**17P2MAC6**	**COMPLEX ANALYSIS**	**5**	**4**

Objectives:

- To introduce the students to the fascinating world of complex analysis which is different from analysis of real variable.
- To introduce the concepts of harmonic functions and elliptic functions

Unit I **19 Hrs**

Harmonic functions: Definition and Basic properties –Mean-value property - Poisson's formula-Schwartz's theorem-the Reflection principle. **Power series Expansion**: Weiertrass's theorem-Taylor series –Laurent's series:

Unit II **19 Hrs**

Partial fractional and Factorization: partial fractions–infinite products. Canonical products –Gamma function – Stirling's formula. **Entire Functions:** Jensen's formula –Hadamard's theorem.

Unit III **19 Hrs**

Normal Families: Equicontinuity - Normality and compactness – Arzela's theorem – Families of analytic functions - classical Definition. **The Reimann mapping theorem**: statement and proof - Boundary behavior - Use of the Reflection principle - Analytic arcs.

Unit IV **18 Hrs**

A Closer look at Harmonic functions: Functions with the mean value property – Harnack's principle. **The Dirichlet problem**: Sub harmonic Functions - solution of Dirichlet's problem.

Unit V

Simply Periodic Functions: Representation by exponentials – Fourier Development – Functions of finite order. **Doubly Periodic functions:** period module – Unimodular transformations– canonical Basis - General properties of Elliptic Functions. **The Weisertrass theory**: weierstrass p-function - Functions ζ(z) and σ(z) – differential Equation.

Text Book:

"complex Analysis –An Introduction to the theory of Analytic Functions of one complex variables"-third Edition, *Lars V.AHLFORS, (1979), McGraw-Hill book company-New Delhi.*

Unit I : Chapter 4 – sec:6.1 to 6.5(page 162 – 173),
Chapter 5 - Sec :1.1 to 1.3 (Page 175 – 186)
Unit II : Chapter 5 – sec:2.1 to 2.5, 3.1 to 3.2(Page 187 – 212)
Unit III: Chapter 5 – sec: 5.1 to 5.5,
Chapter6 – sec:1.1 to 1.4 (Page 219 - 235)
Unit IV : Chapter 6 – Sec: 3.1 to 3.2, 4.1 to 4.2 (Page 241 – 251)
Unit V : Chapter 7 – Sec: 1.1 to 1.3, sec: 2.1 to 2.4, sec: 3.1 to 3.3(Page 263– 276)

General References:

1. *John B.Conway (1980)"Functional of one complex variable"-Narosa Publishing House; New Delhi.*
2. *Thomas m. Macrobert (1966),"Functional of a complex variable"-Macmillan and Co.,Let.,New York.*

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
II	**17P2MAC7**	**PARTIAL DIFFERENTIAL EQUATION**	**5**	**4**

Objectives:
- To introduce notion of partial differentiated equations.
- To give an awareness about methods of integral transforms.
- To study boundary value problems

Unit I **19 Hrs**

Partial Differential Equations of first order: Partial Differential Equations – Cauchy's problem for First order Equations-linear Equations of the first Order-Integral surfaces passing through a given curve-surfaces orthogonal to a given system of surfaces-compatible systems of First-order Equations.

Unit II **19 Hrs**

Charpit's Method-Jacobi's method - **Partial Differential Equations of second order:** Linear Partial Differential Equations with constant coefficients-Equations with Variable coefficients - Separation of Variables –The method of Integral Transforms.

Unit III **19 Hrs**

Laplace's Equation: Elementary Solutions of Laplace's Equation-Families of Equipotential Surfaces – Boundary Value Problems-Separation of Variables - The theory of Green's Function for Laplace's Equations.

Unit IV **18 Hrs**

The Wave equation: The occurrence of the wave equation in Physics-Elementary solutions of the one dimensional wave equation-The Riemann –Volterra solution of the one dimensional wave equation-vibrating membranes: Application of the calculus of variations-General solutions of the wave equation.

Unit V

The Diffusion Equation: The resolution of Boundary value problems for the Diffusion Equation-Elementary solutions of the Diffusion Equation-Separation of Variables –The use of Integral transforms –The use of Green's functions.

Text Book:-

Elements of Partial Differential equations, Ian Sneddon, International Student edition

Unit I : Chapter 2 : sec. 2.1,2.3 to 2.6,2.9
Unit II : Chapter 3 : sec. 2.10, 2.11, 3.4,3.5,3.9,3.10
Unit III : Chapter 4 : sec. 4.2, to 4.5, 4.8
Unit IV : Chapter 5 : sec. 5 1 to 5.4,5.6
Unit V : Chapter 6 : sec. 6.2 to 6.6

General References :

1. *Partial Differential Equation* 3rd Edition, John F., Narosa 1979.
2. Introduction to partial Differential Equation second Edition, K.Sankara Rao, Prentice-Hall of India 2005.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
II	**17P2MAC8**	**MATHEMATICAL METHODS**	**5**	**4**

Objectives:

- To introduce the notion of Fourier Transform and to study its properties
- To discuss the calculus of variations.
- To discuss linear integral equation and its application.
- To discuss some of the applications of ordinary differential equations.

Unit I **19 Hrs**

Fourier transform – integral formula – complex transform – cosine – sine – transform property – linearity change of scale, shifting – modulation theorem – Finite Fourier Transforms – Finite Fourier sine and cosine transform – Inversion formula for sine and cosine transform.

Unit II **19 Hrs**

Calculus of Variations – Euler's equation – Euler'sequation for more general case – variational problems in Parametric form – Some Applications - Elementary problem with moving boundaries and special functional.

Unit III **19 Hrs**

Linear integral equations – Definition Regularity conditions – special kinds of kernels – Eigenvalues and Eigen functions – convolution integral – The inner or scalar product of two functions – Notation – reduction to a system of Algebraic Equations – Examples – Fredholm Alternative – Examples.

Unit IV **18 Hrs**

Method of successive approximations – Iterative scheme – Examples – Volterra integral Equation – Examples – some results about the Resolvent Kernel. Classical Fredholm Theory – The method of solution of Fredholm – Fredhom's first theorem.

Unit V

Application to ordinary differential equations – Initial value problems - boundary value problems – examples – singular integral equations – The Abel integral equations – Examples.

Textbook:

1. *For unit I,* ***Integral transforms*** *– A.R. Vasistha and R.K. Gupta, Krishna Prakashan media (P) Ltd, Meerut (2002)*
2. *For unit II,* ***Differential Equations and Calculus of variations*** *– L. Elsgolts, Mir Publications, Moscow.(1980)*
3. *For unit III, IV, V,* ***Linear Integral Equations Theory and Techniques*** *– Ram Kanwal, Academic Press (1971).*

Unit I : Chapter 6 (sections 6.3 to 6.15), Chapter 7 (sections 7.1 to 7.4)
Unit II : Chapter 6, 7(sections 7.1 and 7.2 only)
Unit III : Chapter 1 and 2 (Sections 2.1 to 2.4 only)
Unit IV : Chapter 3 and 4 (sections 4.1, 4.2, 4.3 only)
Unit V : Chapter 5 (sections 5.1, 5.2, 5.3) Chapter 8 (sections 8.1 , 8.2).

General References:

Mathematical methods, M.C.Potter and J.Goldberg, Prentice Hall of India, New Delhi. 1988.

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No. of Credits
II	**17P2MAC9**	**OPTIMIZATION TECHNIQUES**	**5**	**5**

Unit I **19 Hrs**

Integer programming problem: Gomory's All - IPP method – Gomory's mixed integer method – Branch and Bound method.

Unit II **19 Hrs**

Dynamic programming: The recursive equation approach – characteristics of Dynamic programming – Dynamic programming algorithms – The solution of L.P.P. by Dynamic programming.

Unit III **19 Hrs**

Non Linear Programming Problem: General Non-LPP – Problems of Constrained maxima and minima – graphical solution – Kuhn Tucker Condition (non negative constraints) – Quadratic Programming – Wolfe's modified simplex method.

Unit IV **18 Hrs**

Queuing Theory: Queuing system – characteristic of queuing system – symbols and notations – Poisson process of exponential distribution – classification of queues – definition of transient and steady states – Poisson queues – non-Poisson queuing systems – the M/G/1 Queuing system

Unit V

Inventory Control: Reasons for Carrying Inventory – Types of Inventory – The Inventory Decisions – Economic Order Quantity – Deterministic Inventory Problem – EOQ Problem with Price-Breaks – Multi-item – Deterministic Problem

Text Book:

Problem in operations Research, *PK Gupta & ManMohan (Relevant portions only)*

Unit - I : Chapter 12 (pages 219 – 242)

Unit - II : Chapter 18 (pages 379 – 399)

Unit - III : Chapter 25, 26 (pages 609 – 623, 627 - 636)

Unit - IV : Chapter 22 (pages 495 - 519)

Unit - V : Chapter 23 (pages 529 – 556)

Reference:

Operations Research: Kantiswarup, PK. Gupta and Man Mohan.

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No.of Credits
II	**17P2MAEL2A**	**Major Elective – II** **MATHEMATICAL PROBABILITY**	**5**	**4**

Objectives:

- A property constructed course in probability should indeed make substantial use of these and other allied disciplines.
- Probability is still distinct from its tools and it's applications not only in the final results achieved but also in the manner of proceeding.
- A basic course in probability should offer a broad perspective of study and research.
- Students acquire knowledge of ideas and practice in methods and dwell with them long and deeply enough to reap the benefits.

UNIT I **19 Hrs**

Measure theory-Classes of sets – Monotone class theorem - Probability measures and their distribution functions.

UNIT II **19 Hrs**

Random Variables –Expectation-Independence-General Definitions-Properties of mathematical expectation-Independence.

UNIT III **19 Hrs**

Convergence concept-Various modes of convergence –Almost sure convergence – Borel-Cantelli lemma-Vague convergence-continuation –Uniform integrability – convergence of moments.

UNIT IV **18 Hrs**

Law of large numbers and random series-simple limits theorem's –weak law of large numbers-convergence of series –strong law of large numbers.

UNIT V

Characteristic function-General properties-convolutions-Uniquess and inversion-convergence theorems.

Text Book

A course in Probability Theory-Second Edition by Kai Lai Chung, Academic Press, New York *(1974)*

Unit I : Chapter 2
Unit II : Chapter 3
Unit III : Chapter 4
Unit IV : Chapter 5 (sec 5.1 to 5.4 only)
Unit V : Chapter 6 (sec 6.1 to 6.3 only)

General Reference:

Modern Probability theory –BR.Bhat, Willy Eastern Limited (1989).

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
II	**17P2MAEL2B**	**Major Elective – II MATHEMATICAL MODELLING**	**5**	**4**

Objectives:
- To discuss population Models.
- To. Study mathematical models for epidemic diseases.
- To discuss mathematical models for genetics behavior.
- To discuss mathematical models in Pharmacokineties.

Unit I **19 Hrs**

Microbial population models, single-species, non –age-structured population models.

Unit II **19 Hrs**

Age-structured population models.

Unit III **19 Hrs**

Epidemic models.

Unit IV **18 Hrs**

Models in genetics.

Unit V

Mathematical models in Pharmacokinetics

Text Book:

Mathematical models in Biology and Medicine By J.N Kapur, Affiliated East – West Press Pvt. Ltd., New Delhi.

Unit I : Chapter 2, 3
Unit II : Chapter 4
Unit III : Chapter 8
Unit IV : Chapter 9
Unit V : Chapter 10

General References:

1. Mathematical Modelling J.N Kapur Wiley Eastern Ltd New Delhi.
2. Theory of Ordinary Differential Equations with Equations with applications in biology and Engineering Ahmad & Mohana Rao Affiliated East-West Pvt Ltd New Delhi, (1999).

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No.of Credits
III	**17P3MAC10**	**GENERAL TOPOLOGY**	**5**	**4**

Objectives:

- The subject of topology is of interest in its our right and it also serves to lay the foundations for future study in analysis, in Geometry and in Algebraic Topology.
- To develop the students abilities through hard thinking.
- To train the students to develop analytical thinking.

Unit I **18 Hrs**

Topological spaces –Basis for a Topology –order Topology –Product topology on XxY –subspace Topology-closed sets and limits points.

Unit II **18 Hrs**

Continuous functions -Product topology- Metric Topology-Metric Topology (continued).

Unit III **18 Hrs**

Connected Spaces – Connected sets in the Real line-Components and Path Components-Local Connectedness – Compact Spaces.

Unit IV **18 Hrs**

Compact sets n the Real line – Limit point Compactness – Local Compactness – Accountability Axioms.

Unit V **18 Hrs**

The Separation Axioms - Urysohn Lemma - Urysohn Metrization theorem.

Text Book:

"Topology-A First Course - James R. Munkres Prentice-Hall of India Private limited New Delhi (1975)

Unit I : Chapter 2 (Section 2.1 to 2.6)
Unit II : Chapter 2 (Sections 2.7 to 2.10)
Unit III : Chapter 3 (Sections 3.1 to 3.5)
Unit IV : Chapter 3 (sections 3.6 to 3.8)
Unit V : Chapter 4 (Section 4.2 to 4.4)

General References:

Introduction to general topology S.T.Hu Tata Mcgraw hill Company New Delhi 1979.

Semester	Subject code	Title of the paper	Hours of Teaching /Week	No.of Credits
III	**17P3MAC11**	**DIFFERENTIAL GEOMETRY**	**5**	**3**

Objectives:
- Presenting the fundamental conceptions of the theory of curves and surfaces
- Stressing the properties of a surface in relation to the surrounding space.
- Real praising the general theory of surfaces.
- Studying the intrinsic properties of the surfaces.

Unit I **19 Hrs**

Analytic representation –Arc length, tangent –Osculating plane-Curvature – Torsion-Formulas of Frenet-contact-Natural Equations –Helices.

Unit II **19 Hrs**

General Solution of the natural equations-Evolutes and involutes –Analytical representation –First fundamental Form-Normal, tangent plane.

Unit III **19 Hrs**

Developable surfaces-second fundamental form, Meusnier's theorem-Euler's theorem –Dupin's indicatrix-Some surfaces –A Geometrical interpretation of asymptotic and curvature lines.

Unit IV **18 Hrs**

The equations of Gauss Wiengarten –The theorem of Gauss and the equations of Codazzi-curvilinear coordinates in space-Some applications of the Gauss and the codazzi equations-The fundamental theorems of surface theory. (Proof of the theorem is omitted)

Unit V

Geodesic (tangential) curvatures – Geodesics - Geodesic coordinates.

Text Book:

Lectures on Classical Differential Geometry *– D.J. Struik, Addition – Wesley Publishing company*

Unit I: Chapter 1 (Section 1.1 to 1.9), Pages : 1 – 35
Unit II : Chapter 1 (Section1.10.1.11, 2.1 to 2.3) Pages : 36 – 46, 55 – 65
Unit III : Chapter 2 (Sections 2.4 to 2.10) Pages : 66 – 96
Unit IV : Chapter 3 (Sections 3.1 to 3.6) Pages : 105 – 126
Unit V : Chapter 4 (Section: 4.1-4.3) Pages : 127 – 140

General References:

1. *An introduction to differential geometry T.J.willmore Oxford University press Bombay 1989.*
2. *Three dimensional differential geometry PP.Gupta & G.S. Malik, pragti prakasan. Meerut 1981.*

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
III	**17P3MAC12**	**REAL ANALYSIS – II**	**5**	**4**

Unit I **15 Hrs**

Riemann –Stieltjes. Integral: Introduction –Notation-The definition of the Riemann-Stieltjes integral-Linear properties-Integration by parts-Change of variable in a Riemann –integral –step functions as integrators –Reduction of a Riemann–Stieltjes integral to a finite sum-Euler's summation formula-monotonically increasing integrators. Upper and lower integrals –Additive and linearity properties of upper and lower integrals-Riemann's condition-Comparison theorems –Integrators of bounded variation.

Unit II **15 Hrs**

Riemann –Stieltjes. Integral: Sufficient conditions for existence of Riemann –Stieltjes integrals-Necessary conditions for existence of Riemann –Stieltjes integral-Mean value Theorems for Riemann-Stieltjes integrals-the integrals as a functions of the interval-Second fundamental theorem of integrals calculus-Change of variable Riemann integral-Second Mean value Theorem for Riemann integrals-Riemann –Stieltjes integrals depending on a parameter-Differentiation under the integral sign-interchanging the order of integration.

Unit III **15 Hrs**

Infinite Series and Infinite Products: Introduction –Convergent and divergent sequences of complex numbers-Limit superior and limit inferior of a real-valued sequence-monotonic sequences of real numbers-Infinite series-inserting and removing parantheses-Alternating series-Absolute and conditional convergence-Real and imaginary parts of a complex series-Tests for convergence of series with positive terms. The geometric series- The integral test –The big oh and little oh notation –The ratio test and the root test-Dirichlet's test and Abel's test.

Unit IV **15 Hrs**

Sequences of Functions: -Point wise convergence of sequences of functions –examples of sequences of real –valued functions-Definition of uniforms convergence-Uniform convergence and continuity –The cauchy condition for uniform convergence–Uniform convergence of infinite series of functions-Uniform convergence and Riemann–Stieltjes intergration-uniformly convergent sequences that can be integrated term by term-Uniform convergence and differentiation-sufficient conditions for uniform convergence of a series.

Unit V **15 Hrs**

The Lebesgue integral: Introduction- The integral of a step function – Monotonic sequences of step functions – Upper functions and their integrals - Riemann integrable functions as examples of upper functions - The class of Lebesgue integrable functions on a general interval – Basic properties of Lebesgue integral – Lebesgue integration and sets of measure zero – The Levi monotone convergence theorem – The Lebesgue dominated convergence theorem.

Text Book:

Tom M. Apostol, Mathematical Analysis 2 edn, Narosa, New Delhi, 1985

Unit I : Chapter 7 (7.1-7.15)

Unit II : Chapter 7(7.16-7.25)

Unit III: Chapter8(8.1-8.15)

Unit IV : Chapter 9 (9.1-9.6,9.8-9.11)

Unit V : Chapter 10 (10.1-10.10)

General References:

1. *I.I.HIRSCHMAN "infinite series". Holt.Rinehart and Winston, Newyork 1962.*
2. *K.Knopp,"Theory and applications of infinite series", Hafner, newyork, 1948.*
3. *Woll.J.W"functions of several variables Harcourt brace and world, Newyork 966.*
4. *Keotelman.H."Modern Theories of Integration "Oxford university press 1937*

Semester	Subject code	Title of the paper	Hours of Teaching /Week	No. of Credits
III	**17P3MAC13**	**PROGRAMMING IN C++**	**5**	**3**

Objectives:

- C++ is an extension of C language that is widely used on many machines.
- It is a powerful modern language that combines the power, elegance and flexibility of C and the features of object oriented programming.
- With its object-oriented capabilities such as data abstraction, inheritance and Polymorphism, C++ offers significant software engineering benefits over C.

Unit I **18 Hrs**

Beginning with C++: Applications of C++ - Simple C++ program - Structure of C++ program – Creating the source file - compiling and linking - **Tokens, Expressions and controls structures**: Tokens - keywords – Identifiers - **Basic data types**: User defined data types -Derived data types – symbolic constant – type compatibility - declaration of variables – Initialization of variables - reference variables.

Unit II **18 Hrs**

Operators in C++: Scope resolution operator – member differencing operator – memory management operator – Manipulators - Type cast Operator – Expressions, special assignment expressions - implicit conversions - operator overloading - Operator precedence - control structures. **Functions in C++**: Introduction - main function - Functions prototyping call by reference – inline function, default arguments – constant arguments - return by reference-function overloading-Friend- and virtual functions.

Unit III **18 Hrs**

Class and object: Specifying a class – defining member functions - C structures revisited- A C++ program with class-Arrays with in a class- static member function-Arrays of objects- Returning objects- constant Member functions-pointers to members

Unit IV **18 Hrs**

Constructors and Destructors: Introduction - constructors - parameterized constructors - Multiple constructors in a class – Copy constructors-dynamic constructor – constructing Two-dimensional arrays-Destructors-Defining operator over loading-manipulation strings using operations - type conversions.

Unit V **18 Hrs**

Inheritance: Extending classes-Introduction-Defining derived classes-Single inheritance-making a private member inheritance-Multiple, multilevel, hierarichal, hybrid inheritance- virtual base classes - Abstract classes – constructors in derived classes - Member classes: nesting of classes.

Text Book:

Object Oriented Programming with C++ *by E.Balagurusamy, Tata Mcgraw Hill Publishing Company Ltd., New Delhi (1995).*

Unit I : Chapter 2 (2.1-2.3, 2.6 – 2.8) and Chapter 3 (3.1-3.12)
Unit II : Chapter 3 (3.13-3.21) and Chapter 4 (4.1-4.10)
Unit III : Chapter 5 (5.1-5.5, 5.9, 5.12, 5.13 – 5.18)
Unit IV : Chapter 6 (6.1-6.4,6.7–6.9, 6.11), Chapter 7 (7.2, 7.6, 7.8)
Unit V : Chapter 8 (8.1-8.12)

General References:

The C language trainers with C graphics and C++ J.Jayasri-willey eastern Ltd Madras 1993.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**17P3MACPL**	**Programming in C++ Practical**	**5**	**2**

1. Write a function in C++ to generate a Fibonnaci Series of n Number**. - 75 Hrs**

2. Develop a program in C++ to find the largest of any three numbers Using Marco Definition.

3. Create a class called time that separate in member data for hours, minutes and seconds .one constructors should initialize data to 0,and another should initialize it to fixed values. A member function should display in 11:59:59 format. The final member function should add two objects of type passed as arguments. A main() program should create two initialized time objects and one that is initialized. Then it should add the two initialized values together ,leaving the result in the third time variable. Finally it should display the value of this third variable.

4. Develop an object oriented program in C++ to create a database of the following items of the derived class.
   a. Ward number b. Name of the patient
   c. Sex d. Age
   e. Bed Number f. Nature of the illness
   g. Date of Admission.

   Design a base class consisting of the data members namely, name of the patients,sex and age. Another base class consists of ward numbers, bed number and nature of illness .The derived class consists of the data member date of Admission. Design a virtual class for the data member, namely, name of the patient, sex and age.

5. Create a generic base class called building that stores the number of floors of a building has the numbers of rooms, and its total square footage. Create a derived class called house that inherits building and also stores the number of bedrooms and the number of Bathrooms. Next, create a derived class called office that inherits building and also stores the number of fire extinguisher and the number of telephones.

6. Write a program in C++ using function overloading to read two matrices of different data such as integers and floating-point numbers. Find out the sum of the above two matrices separately and display the total sum of these arrays individually.

7. Create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operated on the objects of FLOAT.

8. Write an object-oriented program in C++ to read an integer number and find the sum of all digits until it reduces to a single digit using constructor, Destructor, Default Constructor and inline member functions.

9. Write a C++ program to add two complex numbers and display all the three number.

Semester	Subject Code	Title of the paper	Hours of Teaching /Week	No. of Credits
IV	**17P4MAC14**	**FUNCTIONAL ANALYSIS**	**6**	**5**

Objectives:

General knowledge- Banach spaces and Factor spaces – Hahn Banach theorem
To study about convergences, Hilbert spaces and Bessel's inequality.
To study about complete orthonormal sets.
To study about convergences in L(X,Y)–Uniform bounded ness and closed graph Theorem and Banish Algebra.

Unit-I **18 Hrs**

Banach spaces, equivalent norms, and Factors spaces: The Holdr's and Minkowski inequalities-Banach spaces and Examples-The completion of Normed Linear spaces-Generated Subspaces and Closed Subspaces- Equivalent norms and Reisz theorem- Factors spaces.

Unit II **18 Hrs**

Commutative Convergence, Hilbert spaces and Bessel's Inequality. Commutative convergence - Norms and inner products on Cartesian products of normed and Inner products spaces–Hilbert Spaces–A Non Separable Hilbert space–Bessel's inequality-some results from L2$(0, 2\pi)$ - Riesz –Fischer Theorem–Complete Orthonormal sets–Parseval's identity-A complete Orthonormal set for $L_2(0, 2\pi)$

Unit III **18 Hrs**

Complete orthonormal sets: Complete orthonormal sets and parseval's identity– the cardinality of complete orthonormal sets-A Note on the structure of Hilbert spaces–closed surfaces and projection theorem for Hilbert's spaces. **Hahn–Banach Theorem:** A Hahn–Banach Theorem - bounded linear functional – the conjucate space.

Unit IV **18 Hrs**

Convergence in L(x, y) and the principle of uniform Boundedness: Convergence of L(X,Y) - The Principle of Uniform Boundedness - some Consequences of the principle of uniform boundedness. **Closed transformation and the closed graph:** the graph of a mapping – closed linear transformation and the bounded inverse theorem

Unit V **18 Hrs**

Introduction to Banach Algebras–Analytic Vector Valued Functions–Normed and Banach Algebras–Banach Algebras with identity–An Analytic Function-The Resolvent operator–Spectral Radius and The Spectral Mapping Theorem for polynomials.

Text Book:

"Functional Analysis", George Bachman and Lawrence Narici Academic press, New York – 1966.

Unit I : Chapter 8 (8.1 to 8.6) Pages : 109 - 129
Unit II : Chapter 9(9.1 to 9.9) Pages : 136 - 157
Unit III : Chapter 10(10.1 to 10.4),Chapter 11(11.1 to 11.3) Pages:162–172,176-187
Unit IV : Chapter15(15.1 to 15.3), Chapter 16(16.1 to 16.2) Pages:245–256,259-271
Unit V : Chapter 19(19.1 to 19.5) Pages : 307 - 327

General References:

1. Bose,S.C. Introduction to functional Analysis, Macmillan India Limited, Delhi, 1992.
2. Walter Rudin: Functional Analysis. Tata McGraw Hill Publishing Co., News Delhi, 1995
3. Simmons G.F: Introduction to Topology & Modern Analysis, International Student Edition McGraw Hill Kogakusha Ltd., 1963.

Semester	Subject Code	Titles of the Paper	Hours of Teaching / Week	No. of Credits
IV	**17P4MAC15**	**GRAPH THEORY AND ITS APPLICATIONS**	**6**	**5**

Unit I **18 Hrs**

Graphs and subgraphs, Trees: Graphs and simple graphs – Graph isomorphism – The incidence and adjacency matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles – Trees – Cut edges and Bonds – Cut vertices – Cayley's Formula.

Unit II **18 Hrs**

Connectivity, Euler Tours and Hamilton Cycles: Connectivity – Blocks – Construction of Reliable Communication Networks – Euler Tours – Hamilton Cycles – The Chinese Postman Problem – The Travelling Salesman Problem.

Unit III **18 Hrs**

Matchings, Edge Colourings: Matchings – Matchings and Coverings in Bipartite Graphs – Perfect Matchings – The Personnel Assignment Problem – The Optimal Assignment Problem – Edge Chromatic Number – Vizing's Theorem – The Timetabling Problem.

Unit IV **18 Hrs**

Independent Sets and Cliques, Vertex Colouring: Independent Sets – Ramsey's Theorem – Turan's Theorem – Schur's Theorem – A Geometry Problem – Chromatic Number – Brook's Theorem – Hajos'Cnjecture – Chromatic Polynomials – Girth and Chromatic Number – A Storage Problem.

Unit V **18 Hrs**

Planar Graphs: Plane and Planar Graphs – Dual Graphs – Euler's Formula – Bridges – Kuratowski's Theorem – The Five-colour Thorem and the Four-Colour Conjecture – Nonhamiltonian Planar Graphs

Text Book:

Graph Theory with Applications, J.A.Bondy and U.S.R.Murty, Macmillan, London, 1976.

Unit I : Chapter I (1.1-1.7), Chapter II (2.1-2.4)
Unit II: Chapter III (3.1-3.3), Chapter IV (4.1-4.4)
Unit III: Chapter V (5.1-5.5), Chapter VI (6.1-6.3)
Unit IV: Chapter VII (7.1-7.5), Chapter VIII (8.1-8.6)
Unit V: Chapter IX (9.1-9.7)

References:

1. R. Balakrishnan and K.Ranganathan, **A Textbook of Graph Theory**, Springer Verlag, New York, 1999.
2. D.B.West**, Introduction to Graph Theory**, II Ed., PHI, New Delhi, 2007.

Semester	Subject code	Title of the paper	Hours of Teaching / Week	No.of Credits
IV	**17P4MAC16**	**CRYPTOGRAPHY**	**6**	**5**

Objectives:

- To provide Techniques for keeping information secret.
- To provide Techniques for determining that information has not been tampered With.
- To provide Techniques for determining who authored pieces of information.
- To provide various principles, techniques and algorithms of interest in cryptographic practice.
- To provide techniques for non- reputation in message transmission.

Unit I **18 Hrs**

Simple Cryptosystems-Enciphering Matrices

Unit II **18 Hrs**

Idea of Public Key Cryptograph-RSA-Discrete Log.

Unit III **18 Hrs**

Knap- sack Pseudoprimes- Rho method.

Unit IV **18 Hrs**

Fermat factorization and factor bases- Continued Fraction Method.

Unit V **18 Hrs**

Basic Facts- Elliptic curve Cryptosystems-Elliptic curve factorization.

Text Book:

N. Koblitz, " A Course in Number Theory and Cryptography", Springer-Verag, New York, 1987.

Unit I : Chapter III, Sec 1-2(Pages 53-79)
Unit II : Chapter IV, Sec 1-3(Pages81-106)
Unit III : Chapter IV-Sec 4 and Chapter V Sec 1 and 2(Pages 107-130)
Unit IV : Chapter V –Sec 3 and 4(Pages 131-149)
Unit V : Chapter VI Sec 1-3(Pages 150-179)

General References:

1. *D.R.Stinson, "Cryptography", CRC Press, New York, 1995.*
2. *A.J Meneze, P.R.Oorche and S.A Vans ton " hand book of applied Cryptography", Crc Press New York, 1995.*

Semester	Subject Code	Title of the Paper	Hours of Teaching /Week	No. of Credits
IV	**17P4MAEL3A**	**Major Elective – III ADVANCED NUMERICAL ANALYSIS**	**6**	**4**

Unit I **18 Hrs**

Transcendental and Polynomials equations: Iteration methods based on first and second degree equation: Secant method – Newton Raphson method – Muller method – Chebyshev method – Polynomials Equations: Birge - vieta method – Graeffe's root squaring method.

Unit II **18 Hrs**

System of linear algebraic equation and Eigen values problems: Jacobi iteration method, Gauss – Seidel iteration method - Successive over relaxation method - Eigen values and vectors: Jacobi method, Given's method and Householder transformation for symmetric matrices.

Unit III **18 Hrs**

Interpolation and approximation: Hermite Interpolation – Bivariate interpolation – Lagrange bivariate interpolation – Newton's bivariate Interpolation for equispaced points - Approximations – Least squares approximation – Gram-Schmidt orthogonalizing process – Legendre Polynomials - Chebyshev polynomials.

Unit IV **18 Hrs**

Numerical integration; methods based on interpolation – Newton-cotes methods – trapezoidal rule – Simpson's rule - methods based on undetermined coefficients – Gauss-Legendre integration methods – Labotto integration method – Radau integration method and Gauss - Chebyshev integration methods.

Unit V **18 Hrs**

Ordinary Differential equations: Numerical methods – Euler method – Backward Euler method – midpoint method – Taylor series method – Runge-kutta methods : Fourth order Runge-kutta method.

Text Book:

Numerical methods for Scientific and Engineering computation By M.K.Jain, S.R.K.Iyengar, R.K.Jain III – Edition.

nit I : Chapter – 2 : Section 2.3, 2.4, 2.8 (Pages : 25-33, 46-49, 52-58)
Unit II : Chapter– 3 : Section 3.4, 3.5 (Pages : 103-115,122-130)
Unit III : Chapter – 4 : Section 4.5, 4.7, 4.8, 4.9 (Pages : 177-179, 186-199)
Unit IV : Chapter - 5 : Section 5.6, 5.7, 5.8 (Pages : 249-262)
Unit V : Chapter – 6 : Section 6.2, 6.3 (Pages : 295-319)

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Semester	Subject Code	Title of the Paper	House of Teaching / Week	No.of Credits
IV	**17P4MAEL3B**	**Major Elective – III DESIGN AND ANALYSIS OF ALGORITHMS**	**6**	**4**

Objectives:

- To impart the students the knowledge of design analysis of algorithms which is the core of computer science.
- To make students thinks logically and organize sequentially these algorithms.

Unit I **18 Hrs**

Introduction: What is an algorithm?- Algorithm specification- Performance analysis- Randomized algorithms.

Unit II **18 Hrs**

Elementary data structures: Stacks and Queues- Trees- Dictionaries- Priority Queues- Graph representations.

Unit III **18 Hrs**

Design of algorithm methods: Divided- And- Conquer- General method- Binary search- finding the maximum and minimum in a set of items- Merge sort- Quick sort.

Unit IV **18 Hrs**

Design of algorithm methods continuation: The Greedy method- The general method- Tree vertex Splitting Problem- Tree traversal and search techniques- Techniques for Binary trees- Techniques for Graphs- Breadth first search and depth first search traversal-Connected components and spanning trees- Backtracking- General method- the 8-Queens Problem- Branch and Bound method- Travelling sales person algorithm.

Unit V **18 Hrs**

Algebraic problems: Algebraic problems- The general method- Evaluation and Interpolation- The Fast Fourier transform- Modular arithmetic- Even faster evaluation and interpolation.

Text Book:

Fundamentals of Computer Algorithm, *Eills Horowitz, Sartaj Shani and Sanguthevar Rajasekaran, Galgotia Publications Pvt Ltd, 2000.*

Unit I : Chapter 1 (sections; 1.1, 1.2, 1.3.1 to 1.3.4, 1.4.1 to 1.4.3)
Unit II : Chapter 2 (section: 2.1 to 2.4, 2.6)
Unit III : Chapter 3 (sections 3.1 to 3.5)
Unit IV : Chapter 4 (sections 4.1, 4.3) Chapter 6 (sections 6.1 to 6.3) Chapter 7 (sections 7.1, 7.2) Chapter 8 (sections 8.1, 8.3)
Unit V : Chapter 9 (sections 9.1 to 9.5)

Books for Reference:

1. *Aho A.V., Hopcroft, J.E. and Ullman, J.D.: The Design and Analysis of Computer Algorithms. Additor Wesley Reading Mass (1974)*
2. *Goodman, S.E and Hedetniemi, S.T.: Introduction to the design and analysis of algorithms (McGraw Hill international Edition 1987).*

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Option MEASURE & INTEGRATION**	**5**	**4**

Objectives:

- To treat the theory of functions of real variable from a classical point of view.
- To develop the student's abilities through hard thinking.
- To introduce the concept of measure of a point set.
- To introduce the motion of Lebesgue integral.
- To discuss the basic properties of measurable functions.

Unit I **19 Hrs**

Measurable sets measure of a bounded open set-measure of a bounded closed set-outer and inner measure of a bounded set – measureable sets-Measure as invariants under isometrics - Class of measurable sets - Vitali's theorem.

Unit II **19 Hrs**

Measure functions:-definition and properties of measurable functions-Sequences of measurable functions - Structure of measurable functions - Theorems of weierstrass.

Unit III **19 Hrs**

Lebesque integral of a bounded function: - Definition of Lebesque integral - Fundamental properties of the integral – passage to the limit under the integral sign - Comparison of Riemann and Lebeque integrals - Reconstruction of the primitive function.

Unit IV **18 Hrs**

Summable functions integral of a Non-negative Measurable function – Summable functions of arbitrary sign - Passage to the limit under the integral sign.

Unit V

Square Summable functions:- Inequalities – Norms-Mean Convergence -Orthogonal systems - The space l_2 – linearily independent systems - Spaces L_p and l_p.

Text Book:

"Theory of functions of a real variable", *I.P.natanson, Frederick Ungar Publishing Co., New York 1964.*

Unit I	:	Chapter 3- secs 1 to 6,8
Unit II	:	Chapter 4- secs 1 to 5
Unit III	:	Chapter 5- secs 1 to 5
Unit IV	:	Chapter 6 secs 1 to 3
Unit V	:	Chapter 7 sec 1 to 6

General References:

1. *P.R.Halmos"Measure theory", Springer –Verlac 1974.*
2. *T.Hawkins,"Lebseque Theory of integration-its Origin and development" Chelsea* Publishing Co New York 1975.
3. H.L.Royden "Real Analysis Prentice Hall India Ltd.New Delhi 1995.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Option - NUMBER THEORY**	**4**	**3**

Objectives:-To introduce the theoretical concepts of Number theory.
To enlighten the students with the famous theory on number theory.

Unit I **15 Hrs**

The Fundamental Theorem of Arithmetic: Introduction- Divisibility- Greatest Common divisor- Prime numbers- The fundamental theorem of arithmetic- The series of reciprocals of the primes- The Euclidean algorithm- The greatest Common divisor of more than two numbers.

Unit II **15 Hrs**

Arithmetical Functions and Dirichlet multiplication: - The motions function $\mu(n)$- The Euler totient function- A relation connecting φ and μ- A product formula for $\mu(n)$- the Dirichlet product of arithmetical functions- Dirichlet inverses and the Mobius inversion formula- the Mangold t function $\Lambda(n)$- multiplicative functions- Multiplicative function and Dirichlet multiplication- The inverse of a completely multiplicative function- Liovilles function A (n)- the divisor functions $\sigma_\alpha(n)$- Generalized convolutions- formal power series- the Bell series of an arithmetical function- Bell series and Dirichlet multiplication- Derivatives of arithmetical functions- the selberg identity. .

Unit III **15 Hrs**

Averages of Arithmetical Functions: - The big oh notation Asymptotic equality of functions- Eulers summation formula- some elementary asymptotic formulas- the average order of d (n)- the average order of the divisor functions $\sigma_\alpha(n)$- the average order of $\varphi(n)$- An application to the distribution of lattice points visible from the origin- the average order of $\mu(n)$ and $\Lambda(n)$- the partial sums of a Dirichlet product.

Unit IV **15 Hrs**

Congruences: Definition and basic properties of congruence's- Residue classes complete residue systems- Linear congruence's Reduced revised systems- Ruler Fermat's Theorem- Polynomial congruence's module Lagranges theorem- Applications of Lagranges Theorem- Chineses Remainder theorem.

Unit V

Quadratic Residues and the Quadratic laws: Quadratic residues- Legendre's symbol and its properties- Evaluation of (-1/p) and (2/p)- Gauss's Lemma - The quadratic reciprocity law- the Jocobi symbol- application to Diophantine equation- Gauss- sums and the quadratic law the reciprocity law for Gauss sums.

Text Book:

Analytic Number Theory by Tom. M.Apostal.

Unit I Chapter 1 (1.1- 1.8)
Unit II Chapter 2 (2.1- 2.19)
Unit III Chapter 3 (3.1- 3.10)
Unit IV Chapter 5 (5.1- 5.8)
Unit V Chapter 9 (9.1- 9.10)

General References:

1. Number Theory - George E.Andrews
2. Introduction to theory of Number - G.H.Hardy and E.M.Wright.
3. Basic Number Theory - S.B.Malilk
4. Elements of Number Theory - S.Kumaravelu and Susheela Kumaravelu.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No.of Credits
-	**-**	**Core Option - Combinatorial Mathematics**	**6**	**5**

Unit I **18 Hrs**

Basic combinatorial numbers.

Unit II **18 Hrs**

Generating functions and Recurrence relations symmetric functions.

Unit III **18 Hrs**

Multinomials- Inclusion and exclusion principles- permutations with forbidden positions.

Unit IV **18 Hrs**

Necklace problem and Burnsides' Lemma- Cycle Index of a permutations group.

Unit V **18 Hrs**

Polya's theorems and their immediate applications- Binary operations on permutations groups.

Text Book

Combinatorics theory and applications by V. Krishnamurthy.

Unit I : Chapter I (Pages 1-15)
Unit II : Chapter I (Pages 26- 61)
Unit III : Chapter I (Pages 66- 98)
Unit IV : Chapter II (Pages 99- 121)
Unit V : Chapter II (Pages 122-159)

General Reference:

Introductory Combinatorics- Kenneth P. Bogart- Pitman Publishing Inc, Mashfield, Massachusetts.

Semester	Subject Code	Title of the Paper	House of Teaching / Week	No.of Credits
-	-	**Core Option - Geometric Function Theory**	**6**	**5**

Unit I **18 Hrs**

Geometric function theory. Basic principles- Local mapping properties- Normal families- Extremal problems- The Riemann mapping theorem- Analytic continuation- Harmonic and sub harmonic functions- Green's function- positive Harmonic functions.

Unit II **18 Hrs**

Elementary theory of univalent functions. Introduction- the Area theorem- Growth and Distortion theorems- coefficient Estimates.

Unit III **18 Hrs**

Convex and star like function- close- to- convex functions- spiral like functions.

Unit IV **18 Hrs**

Typically Real functions- A Primitive variation Method- growth of Integral Means- odd univalent functions- Asymptotic Biber back conjecture.

Unit V **18 Hrs**

Sub ordination. Basic principles- coefficient Inequalities- sharpened forms of the Schwarz - Lemma- Majorization- Univalent subordinate functions.

Text Book:

Geometric Function Theory ***by Peter L. Duren.***

Unit I : Chapter-1 (1.1- 1.9)
Unit II : Chapter- 2 (2.1- 2.4)
Unit III : Chapter-2 (2.5- 2.7)
Unit IV : Chapter-2 (2.8- 2.12)
Unit V : Chapter- 6 (6.1- 6.5)