ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI
Master of Science (Mathematics)
Course Structure (w.e.f. June 2017-18)

Semester – I

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max .Marks		
					CIA	ESE	Total
Core I	17PMAC11	Algebra I	6	5	40	60	100
Core II	17PMAC12	Real Analysis I	6	5	40	60	100
Core III	17PMAC13	Ordinary Differential Equations	6	5	40	60	100
Core IV	17PMAC14	Mathematical Statistics	6	4	40	60	100
Elective I	17PMAE11	Operations Research / Optimization Techniques	6	4	40	60	100
			30	23	200	300	500

Semester – II

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core V	17PMAC21	Algebra II	6	5	40	60	100
Core VI	17PMAC22	Real Analysis II	6	5	40	60	100
Core VII	17PMAC23	Mechanics	6	5	40	60	100
Core VIII	17PMAC24	Partial Differential Equations	6	4	40	60	100
Elective II	17PMAE21	Numerical Methods	6	3	40	60	100
Self -Study Course (Compulsory)	17PMASS1	Discrete Mathematics		2		100	100
			30	24	200	400	600

Semester – III

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core IX	17PCCC31	Transforms with MATLAB	4	3	40	60	100
Core X	17PMAC31	Topology	6	5	40	60	100
Core XI	17PMAC32	Measure Theory	6	5	40	60	100
Core XII	17PMAC33	Graph Theory	6	5	40	60	100
Elective III	17PMAE31	Combinatorics / Calculus Of Variations and Integral Equations	6	3	40	60	100
Practical	17PCCCR1	Practical I - Transforms with MATLAB	2	1	40	60	100
Self- Study Course (Optional)	17PMASS2	History of Mathematics		2		(100)	(100)
			30	22 + 2	240	360	600

Semester – IV

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core XIII	17PMAC41	Complex Analysis	6	5	40	60	100
Core XIV	17PMAC42	Functional Analysis	6	5	40	60	100
Core XV	17PMAC43	Number Theory	6	4	40	60	100
Elective IV	17PMAE41	Differential Geometry/ Projective Geometry	6	4	40	60	100
Project	17PMAP41	Dissertation	6	5	40	60	100
			30	23	200	300	500

Semester I			
Core 1 - Algebra – I			
Code: 17PMAC11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To acquire a thorough knowledge about algebraic concepts like Groups, Rings , Vector Spaces and Dual spaces.

Unit I

Cayley's Theorem - Permutation Groups - Another Counting Principle.

(Chapter 2: Sections 2.9, 2.10, 2.11)

Unit II

Sylow's Theorem.

(Chapter 2: Sections 2.12)

Unit III

Direct Products - Internal direct product- Finite Abelian Groups-Invariants - Solvable.

(Chapter 2: Sections 2.13, 2.14)

Unit IV

Ring Theory– Homomorphisms- Ideals and Quotient Rings – More Ideals and Quotient Rings - The Fields of Quotients of an Integral Domain.

(Chapter 3: Sections 3.3, 3.4, 3.5, 3.6)

Unit V

Euclidean Rings - A Particular Euclidean Ring - Polynomial Rings -Polynomial over the Rational Field.

(Chapter 3: Sections 3.7, 3.8, 3.9, 3.10)

Text Book:

I.N.Herstein : Topics in Algebra, Second Edition ,Wiley Eastern Ltd, New Delhi 2013.

Reference Book:

Gavvett Birkhoff and Thomas C.Bartee : Modern Applied Algebra, CSS Publishers and Distributors,Delhi 1987.

Semester I			
Core II - Real Analysis – I			
Code: 17PMAC12	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To make the students learn about main concepts of analysis.

Unit I

Metric Spaces- Compact sets- Perfect sets- Connected sets.

(Chapter 2)

Unit II

Convergent Sequences – Subsequences - Cauchy Sequences - Upper and Lower Limits - Some Special Sequences- Series of nonnegative terms - The Number e.

(Chapter 3)

Unit III

The Root and Ratio Tests - Power Series - Summation by parts - Absolute Convergence - Addition and Multiplication of series - Rearrangements.

(Chapter 3)

Unit IV

Limits of functions - Continuous functions - Continuity and Compactness - Continuity and Connectedness - Discontinuities - Monotone functions - Infinite limits and limits at infinity.

(Chapter 4)

Unit V

The Derivative of a real function - Mean value Theorems - The continuity of derivatives - L'Hospital's Rule - Derivatives of Higher order - Taylor's Theorem.

(Chapter 5)

Text Book:

Walter Rudin: Principles of Mathematical Analysis , Third Edition , McGraw-Hill International Editions,1953.

Reference Books:

1. Apostol : Mathematical Analysis ,Addition Wesley Publishing company, London ,1971.

2. Goldberg: Methods of Real Analysis, Oxford & IBH Publishing company, 1970.

3. Tom M. Apostol: Mathematical Analysis , Second Edition, Narosa Publishing company, 1988.

Semester I			
Core III – Ordinary Differential Equations			
Code: 17PMAC13	**Hrs/Week:6**	**Hrs/Sem: 90**	**Credits : 5**

Objectives

- To understand the various concepts in differential equations.
- To make the students to solve the problems.

Unit I

Second order linear equations – The general solution of a homogeneous equation – The use of a known solution to find another – The method of variation of parameters.

(Chapter 3: Sections 14,15,16,19)

Unit II

Power series solution – A review of power series solution – series solution of first order equations – Second order linear equations.

(Chapter 5: Sections 25, 26, 27)

Unit III

Ordinary points – Regular singular points – Frobenius series– Hermite polynomials.

(Chapter 5: Sections 28,29, Appendix B)

Unit IV

Legendre polynomial – Bessel functions and Gamma functions.

(Chapter 6: Sections 32,33,34,35)

Unit V

Linear systems – Homogeneous linear systems with constant coefficients – The methods successive approximation – Piccard's theorem.

(Chapter 7: Sections 37, 38)
(Chapter 11 : Sections 55, 56)

Text Book:

G.F.Simmons: Differential equations with application and historical notes,Tata McGraw Hill, 1997.

Reference Books:

1. Richard Bronson: Differential Equations, Second Edition,Schaum's Outlines,Tata McGraw Hill, 1989.
2. ShepleyL.Ross : Differential Equations,Third Edition ,John Wiley & sons publications, 1980.

Semester I			
Core IV –Mathematical Statistics			
Code: 17PMAC14	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 4**

Objectives

- To know about the various discrete and continuous distributions.
- To make the students to think and analyze problems of real life situations.

Unit I

Some special Distributions: The Binomial and Related Distributions – The Poisson Distribution – The Gamma and Chi-square Distributions – The Normal Distribution – The Bivariate Normal Distribution.

(Chapter3: Sections 3.1, 3.2, 3.3, 3.4, 3.5)

Unit II

Distributions of functions of Random variables: Sampling theory – Transformations of variables of the discrete type – Transformations of variables of the continuous type – The Beta, t, and F Distributions.

(Chapter 4: Sections 4.1, 4.2, 4.3, 4.4)

Unit III

Extensions of the Change of variable technique – Distributions of Order statistics – The Moment generating function Technique – The Distributions of X and nS^2/σ^2 – Expectations of functions of random variables.

(Chapter 4: Sections 4.5, 4.6, 4.7, 4.8, 4.9)

Unit IV

Limiting Distributions : Convergence in Distribution – Convergence in Probability – Limiting Moment Generating function – The central limit theorem – Some theorems on Limiting Distributions.

(Chapter 5: Sections 5.1, 5.2, 5.3, 5.4, 5.5)

Unit V

Theory of statistical tests: Certain best tests - Uniformly most powerful tests-Likelihood ratio test.

Chapter 8(Section 8.1 only) and 9(Sections 9.1 to 9.3).

Text Book:

Robert V.Hogg and allenT.Craig : Introduction to mathematical statistics, fifth edition, Pearson Education Asia,2004.

Reference Book:

J.N.kapur , H.C. Saxena: Mathematical Statistics, S.Chand& co, 2013.

Semester – I			
Elective I - Operations Research			
Code: 17PMAE11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 4**

Objectives

- To acquire a thorough knowledge of algorithms such as Branch and Bound algorithm, cutting plane algorithm etc.,
- To solve problems using O.R techniques.

Unit I

Integer Programming: Some Applications of Integer Programming Solution Algorithms- Methods of Integer Programming- Cutting Plane Algorithm- Branch and Bound Algorithm.

(Chapter 8: Sections 8.1, 8.2, 8.3, 8.4)

Unit II

Dynamic Programming: Elements of DP Model – The Capital Budgeting Example – Cargo-Loading Problem- Reliability Problem - Work Force Size Problem - Forward and Backward Recursive equations.

(Chapter 9: Sections 9.1, 9.2,9.3)

Unit III

Deterministic Inventory Models – Probabilistic Models: Continuous Review Model, Single Period Models: Instantaneous Demand, No Setup Cost and s-S Policy

(Chapter 13: Sections 13.1, 13.2, 13.3, 13.4(13.4.1, 13.4.2))

Unit IV

Decision Theory and Games: Decisions under Risk – Decision Trees – Decision under uncertainity- Game Theory.

(Chapter 11: Sections 11.1, 11.2, 11.3, 11.4)

Unit V

Queueing Theory: Elements of Queueing model – Roles of the Poisson and Exponential Distributions- Arrivals Process- Departures Process- Queues with combined arrivals and departures.

(Chapter 15: Sections 15.1, 15.2, 15.3)

Text Book

Hamdy A.Taha : Operations Research an Introduction ,Fourth Edition, Macmillan Publishing Company, NewYork,1987

Reference Books

1. J.K.Sharma : Operations Research, Macmillan, Publishers, India Ltd, 2007.
2. Kanti Swarup , P.K.Kupta and Man Mahan : Operations Research, Sultan Chand & Sons Publications, 2013.

Semester - I			
Elective I Optimization Techniques			
Code: 17PMAE11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 4**

Objectives

- To acquire thorough knowledge about optimization techniques
- To solve problems using optimization methods

Unit I

Classical Optimization Techniques : Single Variable Optimization –Multi Variable Optimization with no constraints - Multi Variable Optimization with Equality constraints - Multi Variable Optimization with inequality constraints.

(Chapter 2: Sections :2.1,2.2,2.3)

Unit II

Classical Optimization Techniques : Multi Variable Optimization with Equality constraints - Multi Variable Optimization with inequality constraints.

(Chapter 2: Sections :2.4,2.5)

Unit III

Linear Programming : Simplex Method –Standard form of a Linear Programming problem-Geometry of Linear Programming problem-Definitions and Theorems-Solution of a system of Linear simultaneous equations.

(Chapter 3: Sections :3.1,3.2,3.3,3.4,3.5)

Unit IV

Integer Programming: Integer Linear Programming- Graphical Representation – Gomory's Method for All- Integer Programming Problems –Gomory's Method for Mixed Integer Programming Problems- Balas Algorithm for Zero –One Programming Problems.

(Chapter 10: Sections: 10.1,10.2,10.3,10.4)

Unit V

Integer Non Linear Programming: Integer Polynomial Programming- Integer Non Linear Programming ,Stochastic Programming: Basic Concepts of Probability Theory.

(Chapters 10&11:Sections:10.5,10.6,11.1,11.2)

Text Book:

S.S. Rao : Optimization theory and Applications, second edition, Wiley Eastern Limited.1984.

Reference Books:

Kanti Swarup , P.K.Kupta and Man Mahan : Operations Research, Sultan Chand & Sons Publications, 2013.

Semester II			
Core V - Algebra – II			
Code: 17PMAC21	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To acquire a detailed knowledge about algebraic concepts.

Unit I

Dual Spaces – Inner product Spaces – Orthogonal Complement – Norm – Gram Schmidth Process – Schwartz Inequality – Modules – R-Module – Unital R-Module - Module Homomorphisms – Finitely Generated Module.

(Chapter 4: Sections 4.3, 4.4,4.5)

Unit II

Extension fields – Algebric Extension – Finite Extension – Roots of polynomials – Remainder theorem – Factor theorem – Splitting field – More about Roots – Irreducible – Simple extension.

(Chapter 5: Sections 5.1, 5.3, 5.5)

Unit III

Galois Group – Fixed Field – Automorphism – Normal Extension– Elements of Galois Theory – Fundamental Theorem – Solvability by Radicals – Commutators – Solvable – Abel's Theorem.

(Chapter 5: Sections 5.6, 5.7)

Unit IV

The Algebra of linear Transformations – Minimal Polynomial – Invertible – Singular – Regular – Rank – Characteristics Roots – Characteristics Vector – Matrix of linear Transformation.

(Chapter 6: Sections 6.1, 6.2, 6.3)

Unit V

Canonical forms – Triangular form - Nilpotent Transformations – Jordan Form.

(Chapter 6: Sections 6.4, 6.5, 6.6)

Text Book:

I.N.Herstein : Topics in Algebra , Second Edition, Wiley Eastern Ltd. New Delhi 2013.

Reference Book:

Gavvett Birkhoff and Thomas C.Bartee : Modern Applied Algebra , CSS Publishers and Distributors ,Delhi 1987.

Semester II			
Core VI – Real Analysis - II			
Code: 17PMAC22	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To make the students learn about main concepts of analysis such as differentiation, integration and some special functions.

Unit I

Riemann - stieltjesintegral: Definition and Existence of Riemann- Stieltjes Integral - Properties of the integral

(Chapter 6)

Unit II

Integration and Differentiation - Rectifiable curves. Sequences and series of functions: Discussion of Main problem - Uniform Convergence - Uniform Convergence and Continuity

(Chapter 6&7)

Unit III

Uniform Convergence and Integration - Uniform Convergence and Differentiation- Equicontinuos families of Functions - Stone Weierstrass Theorem.

(Chapter 7)

Unit IV

Some special functions: Power series - The Exponential and Logarithmic Functions - The Trigonometric Functions - The Algebraic Completeness of the Complex field

(Chapter 8)

Unit V

Fourier series - The Gamma function.

(Chapter 8)

Text Book

Walter Rudin : Principles of Mathematical Analysis , Third Edition , McGraw Hill International Editions, 1953.

Reference Books

1. Apostol : Mathematical Analysis ,Addition Wesley Publishing company, London ,1971.
2. Goldberg : Methods of Real Analysis, Oxford & IBH Publishing company, 1970.
3. Tom M. Apostol : Mathematical Analysis , Second Edition ,Narosa Publishing company,1988.

Semester II			
Core – VII - Mechanics			
Code: 17PMAC23	**Hrs/Week:6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To learn about the generalized coordinates, Lagrange's equations, different Variational Principles, Canonical transformations and its applications in Classical Mechanics.

Unit I

Some Definitions-Lagrange's Equations for a Holonomic System- Lagrange's Equations of Motion for Conservative, Non- Holonomic system – Physical Significance of λ_l .

(Chapter 1: Sections 1.1, 1.2,1.3,1.4)

Unit II

Variational Principle – Calculus of Variations- Hamilton's Principle – Derivation of Hamilton's Principle from Lagrange's Equations- Derivation of Lagrange's Equations from Hamilton's Principle-Extension of Hamilton's Principle- Cyclic or Ignorable Coordinates-Conservation Theorems.

(Chapter 2: Sections 2.1, 2.2,2.3,2.4,2.5,2.6,2.7,2.8)

Unit III

Equations of Motion of a Rigid Body- Generalised Coordinates of a Rigid body- Eulerian Angles – Components of Angular Velocity along the Body Set of Axes- Rate of Change of a Vector-Coriolis force-Euler's Equations of motion for a rigid body-Motion of a Heavy Symmetrical Top.

(Chapter 3: Sections 3.1, 3.2,3.3,3.4,3.5,3.6,3.7,3.8)

Unit IV

Derivations of Hamilton's Equations of Motion – Routh's procedure – Equations of motion – Derivation of Hamilton's equations from Hamilton's principle – Principle of least action.

(Chapter 4: Sections 4.1, 4.2,4.3,4.4)

Unit V

Canonical coordinates and canonical transformations – Hamilton's Equations of Motion in poisson's Bracket – Infinitesimal contact Transformation - Relation between Infintesimal contact Transformation and Poisson's Bracket – Hamilton – Jacobi theory.

(Chapter 5: Sections 5.1, 5.2, 5.3, 5.4 ,5.5)

Text Book:

C.R.Mondal: Classical Mechanics, Prentice Hall of India,2007.

Reference Books:

1. K. SankaraRao: Classical Mechanics, Prentice Hall of India,2005.
2. Herbert Goldstein: Classical Mechanics, Second Edition ,Narosa, 1994.

Semester – II			
Core – VIII Partial Differential Equations			
Code: 17PMAC24	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 4**

Objectives

- To acquire a detail knowledge about partial differential equations and its various concepts.

Unit I

Partial differential equations of the first order: Partial differential equations -Origins of first order partial differential equations-Linear equations of the first order-Surface orthogonal to a given system of surfaces-Nonlinear PDE of the first order-Cauchy's method of characteristics.

(Chapter:2, Sec:1,2,4,6,7,8)

Unit II

Compatible systems of first order equations - Charpit's Method-Special types of first order equations-Solutions satisfying given conditions.

(Chapter:2, Sec:9,10,11)

Unit III

Partial differential equations of second order: The origin of second order equations-higher order equations in physics-Linear PDE with constant coefficients-Equations with variable coefficients. **(Chapter:3, Sec:1,3,4,5)**

Unit IV

Characteristic curves of second order equations-Characteristics of equations in three variables-The solution of linear hyperbolic equations-Separation of variables in a PDE.

(Chapter:3, Sec:6,7,8,9)

Unit V

Laplace's equation, elementary solutions of Laplace's equations; families of equipotential surfaces. (**Chapter:4, Sec:1,2,3)**

Text Book:

I. N. Sneddon:Elements of Partial Differential Equation , Third edition, McGraw Hill Book Company, 1998.

Reference Book:

E. T. Copson: Partial Differential Equations Second edition, Cambridge University, 1975.

Semester II			
Elective II - Numerical Methods			
Code: 17PMAE21	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 3**

Objectives

- To enable students develop their calculation skills.
- To apply various techniques in solving numerical problems.

Unit I

Simultaneous Equations: Simultaneous equations - Back substitutions - Guass Elimination method - Gauss Jordan method - Calculation of inverse of a matrix - Guass Jacobi Iteration method - Gauss - Seidel iteration method.

(Chapter 4 : Sections: 4.1 , 4.2 , 4.3 , 4.4 , 4.5 , 4.7 , 4.8)

Unit II

Finite Differences: Difference operators - Other difference operators - Newton's interpolation formula - Central difference interpolation formula - Lagrange's interpolation formula - Divided difference- Divided difference formula - Inverse interpolation.

(Chapter 6 : Sections: 6.1 , 6.2
Chapter 7 : Sections: 7.1 , 7.2 , 7.3 ,7.4 ,7.5, 7.6)

Unit III

Numerical differentiation : Derivatives using Newton's forward difference formula - Derivatives using Newton's backward difference formula - Derivatives using Newton's central difference formula - Maxima and Minima of the interpolating polynomial.

(Chapter 8 : Sections: 8.1 ,8.2 , 8.3 ,8.4)

Unit IV

Numerical Integration: Numerical Integration - Newton's Cote's Quadrature formula - Trapezoidal rule-Simpson's one third rule - Simpson's three eighth rule - Wedley's rule.

(Chapter 8 : Section : 8.5)

Unit V

Numerical solutions of ordinary differential equations: Taylor's series method - Picard's method-Euler's Method - Runge - Kutta Methods - Predictor - Corrector Methods.

(Chapter 10 : Sections: 10.1 ,10.2 ,10.3 ,10.4 ,10.5)

Text Book:

S.Arumugam , A.Thangapandi Issac & A.Soma Sundaram : Numerical Methods , Scitech Publications (INDIA) Pvt.Ltd, Chennai, 2002.

Reference Book:

S.Arumugam and Issac: Numerical Analysis , New Gamma Publishing House , Palayamkottai, 2013.

Semester II			
Self - Study Course(Compulsory) – Discrete Mathematics			
Code: 17PMASS1			**Credits: 2**

Objectives:

- To acquire the detailed knowledge about various discrete Structures of mathematics.

Unit I

The Foundation : Logic, Sets and Functions- Logic, Propositions, Translating English Sentences, Propositional Equivalences, Logic Equivalence.

(Chapter 1: Section 1.1,1.2)

Unit II

Predicates and Quantifiers, Translating Sentences into Logical Expressions, Examples from Lewis Carroll.

(Chapter 1: Section 1.3)

Unit III

Counting :Basic Counting Principles, The Inclusion-Exclusion Principle, Tree Diagrams, The Pigeonhole Principle, The Generalized Pigeonhole Principle, Some Elegant Applications of The Pigeonhole Principle.

(Chapter 4: Section 4.1,4.2)

Unit IV

Permutations and combinations – Binomial coefficients – Pascal's Identity Vandermonde's Identity , The Binomial Theorem , Generalized Permutations and Combinations, Permutations with Repetition ,Combinations with Repetitions.

(Chapter 4: Section 4.3,4.6)

Unit V

Advanced Counting Techniques : Recurrence Relations , Modeling with Recurrence Relations, Solving recurrence Relations , Solving Linear homogeneous Recurrence Relation With Constant coefficients.

(Chapter 5: Section 5.1,5.2)

Text Book:

Discrete Mathematics and its Applications, fourth edition, Kenneth H. Rosen, WCB/McGraw Hill publications, 2007.

Reference Books:

1. P. K. Mittal, Discrete Structures, Paragon International Publishers, New Delhi, 2007.
2. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, Thomson Brooks/Cole Publications.

Semester III			
Core IX - Transforms with MATLAB			
Code: 17PCCC31	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits : 3**

Objectives

1. To enable students develop their calculation skills using MATLAB.
2. To apply various techniques in solving problems.

Unit I

Fourier Transforms:Introduction - Fourier Integral theorem - Fourier Transforms - Alternative form of Fourier complex integral formula - Relationship between Fourier Transforms and Laplace Transforms.

(Text Book 1 - Chapter 2 : Sections 2.1 , 2.2 , 2.3 , 2.4 , 2.5)

Unit II

Properties of Fourier Transforms - Finite Fourier Transforms .

(Text Book 1 - Chapter 2 : Sections 2.6 , 2.7)

Unit III

Z - Transforms: Introduction - Properties of Z- Transforms - Z-Transforms of some basic functions - Inverse Z- Transforms - Use of Z-Transforms to solve finite differential equations.

(Text Book 1 - Chapter 5 : Section 5.1 , 5.2 , 5.3 , 5.4 , 5.5)

(Exercise Problems are not included)

Unit IV

MATLAB Introduction: MATLAB Environment - Types of files - Search - Constants , Variables and Expressions - Vectors and Matrices - Polynomials - Input / Output statements.

(Text Book 2 - Chapter 1, 2, 3, 4, 5)

Unit V

Control Structures - Writing Programmes and functions - Ordinary Differential Equations and Symbolic Mathematics - MATLAB Applications : Z-Transforms and Fourier Transforms.

(Text Book 2 - Chapter 7, 8, 9, 15 (Sections: 15.1, 15.6, 15.7,15.8)

Text Books:

1. T.Veerarajan : Transforms and Partial Differential Equations (Updated Edition), 2012 .
2. Rajkumar Bansal , Ashok Kumar Goel , Manoj Kumar Sharma : MATLAB and its Applications in Engineering, Pearsons Publications, 2012.

Semester III			
Core IX - Practical - Transforms with MATLAB			
Code: 17PCCCR1	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits : 1**

Using MATLAB:

1. Find the Fourier sine transforms of f(x) defined as f(x) = $\begin{cases} sinx\,, when\ 0 < x < a \\ 0\,, when\ \ x > a \end{cases}$

2. Find the Fourier cosine transform of f(x) defined as f(x) = $\begin{cases} x \quad for\ 0 < x < 1 \\ 2 - x \ \ for\ 1 < x < 2 \\ 0 \quad for\ x > 2 \end{cases}$

3. Find the Fourier transform of f(x) if f(x) = $\begin{cases} 1 - |x| for\ \ |x| < 1 \\ 0 \quad for\ |x|\ > 1 \end{cases}$. Hence prove that $\int_0^\infty \frac{sin^4\, x\, dx}{x^4} = \frac{\pi}{3}$

4. Solve the equation ($D^2 - 4D + 3$) y = cos 3x , x > 0 given that y(0) =0 and y'(0) = 0.

5. Find the finite Fourier sine transform of cos ax and finite Fourier cosine transform of sin ax in (0 , π).

6. Find the finite Fourier sine transform and cosine transform of e^{ax} in (0 , *l*).

7. Find the Z-Transforms of f(n) = $\frac{1}{n(n-1)}$

8. Use convolution theorem to find the inverse Z-Transforms of $\frac{z^2}{(z+a)^2}$

9. Find $Z^{-1}\{\ \frac{1}{1+4Z^{-2}}\ \}$by the long division method.

10. Find $Z^{-1}\{\frac{2z^2+4z}{(z-2)^3}\}$ by using Residue theorem.

Semester III			
Core X – Topology			
Code: 17PMAC31	**Hrs/ Week: 6**	**Hrs/Sem: 90**	**Credits: 5**

Objective

- To acquire a complete and thorough knowledge about topological spaces and its characterizations.

Unit I

Topological spaces and Continuous functions : Topological spaces - Basis for a topology - Order Topology - The Product topology on X x Y - The Subspace Topology - Closed sets and Limit points.

(Chapter 2, Sections: 12,13,14,15,16,17)

Unit II

Continuous Functions - The Product Topology –The Metric Topology.

(Chapter 2, Sections: 18, 19, 20, 21)

Unit III

Connectedness and Compactness: Connected Spaces – Connected subspaces of the real line – Compact spaces – Compact subspaces of the real line –Limit point compactness.

(Chapter 3, Sections: 23, 24, 26,27,28)

Unit IV

Countablity and Separation Axioms : The Countablity Axioms – The separation axioms – Normal spaces – The Urysohn lemma.

(Chapter 4, Sections: 30, 31, 32, 33)

Unit V

The Urysohn Metrization theorem – The Tietze extension theorem – The Tychonoff theorem.

(Chapter 4, Sections: 34, 35,
Chapter 5, Section: 37)

Text Book:

J.R Munkres: Topology, Second Edition, Pearson Education Agency , New Delhi, 2002.

Reference Books:

1. George McCarty: Topology, Tata McGraw Hill Publications, New Delhi, 1967.
2. G.F.Simmons: Topology and Modern Analysis ,McGraw – Hill International Editions, 1963.

Semester III			
Core XI - Measure Theory			
Code: 17PMAC32	**Hrs/Week :6**	**Hrs/Sem: 90**	**Credits : 5**

Objective

- To acquire the knowledge of integration and differentiation on R together with the fundamentals of abstract measure and integration.

Unit I

Lebesgue Measure : Outer measure - Measurable sets and Lebesgue measure - Measurable functions - Littlewood's three principles.

(Chapter 3 : Sections 1,2, 3,5,6)

Unit II

The Lebesgue Integral : The Riemann Integral - The Lebesgue integral of a bounded function over a set of finite measure - The integral of a non-negative function – The general Lebesgue Integral .

(Chapter 4 : Sections 1, 2, 3, 4)

Unit III

Classical Banach Spaces: L^p space – Holder and Minkowski inequalities- Convergence and completeness- Bounded linear functionals on the L^p spaces. **(Chapter 6)**

Unit IV

General Measure and Integration : Measure spaces- Measurable functions - Integration - Signed Measures -The Radon Nikodym Theorem.

(Chapter 11: Sections 1, 2, 3, 5, 6)

Unit V

Measure and Outer measure: Outer measure and Measurability- The Extension theorem –The Lebesgue - stieltjes Integral - Product Measures.

(Chapter 12: Sections 1, 2, 3, 4)

Text Book:

H.L.Royden : Real Analysis , Second Edition , Collier , Macmillan Co., New York, 2004.

Reference Book:

Munroe,M.E : Introduction to Measure and Integration , Addition–Wesley Publishing Company ,U.S.A 1959.

Semester - III			
Core XII - Graph Theory			
Code: 17PMAC33	**Hrs/Week: 6**	**Hrs/Sem:90**	**Credits : 5**

Objectives

- To acquire a detail knowledge about graph theory and its various concepts.
- To solve problems in communication network, railway network etc.,

Unit I

Graphs–Sub graphs- Graphs & Simple graphs- Graph Isomorphism- Vertex degrees –Path and connection – Trees-Cut edges and Bonds-Cut vertices - Gayley's formula.

(Chapter 1, Chapter 2, Sections: 1.1,1.2,1.3,1.4,1.5,1.6,1.7 & 2.1,2.2,2.3,2.4)

Unit II

Connectivity – Blocks – Euler tour – Hamilton cycle - Chavatal theorems.

(Chapter 3, Chapter 4, Sections: 3.1,3.2 & 4.1, 4.2)

Unit III

Matchings - Matchings and Coverings in Bipartite Graphs – Marriage Theorem - Perfect Matching.

(Chapter 5, Sections: 5.1,5.2,5.3)

Unit IV

Colourings - Edge Colouring- Edge Chromatic number - Vizing's theorem-Vertex Colouring-Chromatic number - Brook's Theorem-Hajo's Conjecture-Chromatic Polynomials- Grith and Chromatic Number.

(Chapter 6 and Chapter 8, Sections: 6.1, 6.2 & 8.1,8.2,8.3,8.4,8.5)

Unit V

Independent sets – Cliques: Independents sets-Ramsey's Theorem – Erdo's Theorem-Turan's Theorem.

(Chapter 7, Sections: 7.1,7.2,7.3)

[Last sections (applications) in each chapter not included]

Text Book:

H.J.A.Bondy and U.S.R.Murty: Graph Theory with Applications ,North Holland, New York, Amsterdam, Oxford, 2008.

Reference Books:

1. R.BalaKrishnan and K.Ranganathan : Text Book of Graph Theory, Springer Publications.
2. M.Murugan : Applications of Graph Theory , Muthali Publishing House.

Semester III			
Elective III – Combinatorics			
Code:17PMAE31	**Hrs/week: 6**	**Hrs/Sem:90**	**Credits: 3**

Objective:

To introduce combinatorial techniques for solving enumeration problems**.**

Unit I

Permutations and Combinations :

Introduction, rules of sum and product, Permutations and Combinations, Distributions of distinct objects, distributions of non distinct objects.

(Chapter 1: Sections : 1.1 -1.6)

Unit II

Generating Functions:

Generating functions for combinations, enumerators for permutations, Distributions of distinct objects into non distinct cells, partitions of integers.

(Chapter 2: Sections : 2.1 -2.7)

Unit III

Recurrence Relations :

Linear Recurrence relations with constant coefficients, Solution by the technique of generating functions, A Special class of nonlinear difference equations, Recurrence relation with two indices.

(Chapter 3: Sections : 3.1 -3.5)

Unit IV

The Principle of Inclusion and exclusion :

The principle of Inclusion and Exclusion, the general formula, Derangements, Permutations with restrictions on relative positions.

(Chapter 4: Sections : 4.1 -4.5)

Unit V

Polya's Theory of Counting :

Equivalence classes under a permutation group, Equivalence classes of functions, Weights and inventories of functions, Polya's fundamental theorem.

(Chapter 5: Sections : 5.3 -5.6)

Text Book:

Introduction to Combinatorial Mathematics, C. L. Liu, McGraw Hill, 1968.

Books for Reference:

1. Normal L. Biggs, Discrete Mathematics, Oxford University Press, Oxford, 2002.
2. J.Hein, Discrete Structures, Logic and Computability, Jones and Barlett, 2002.
3. C.L.Liu, Elements of Discrete Mathematics, McGraw Hill, 1986.

Semester III			
Elective III – Calculus of Variations and Integral Equations			
Code: 17PMAE31	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits : 3**

Objectives:

- To solve differential equations using variational methods.
- To introduce Fredhlom & Volterra Integral equations and to study the methods of solving the above equations.

Unit I:

The Calculus of Variations - Functionals - Euler's equations - Geodesics - Variational problems involving several unknown functions.

(Chapter 9: Sections 1 - 11)

Unit II:

Functionals dependent on higher order derivatives - Variational problems involving several independent variables - Constraints and Lagrange multipliers.

(Chapter 9: Sections 12 - 14)

Unit III:

Isoperimetric problems - The general variation of a functional - Variational problems with moving boundaries - Hamilton's principle, Sturm - Liouville's problems and variational methods - Rayleigh's principle - Ritz method.

(Chapter 9: Sections 15 - 21)

Unit IV:

Integral Equations - Introduction - Relation between differential and integral equations - Relationship between Linear differential equations and Volterra integral equations.

(Chapter 10: Sections 1 - 3)

Unit V:

The Green's function and its use in reducing boundary value problems to integral equations - Fredholm equations with separable kernels - Fredholm equations with symmetric kernels: Hilbert Schmidt theory - Iterative methods for the solution of integral equations of the second kind - The Neumann series - orthogonal kernels.

(Chapter 10: Sections 5 - 11)

Text Book:

Dr.M.K.Venkataraman, Higher Mathematics for Engineering and Sciences, The National Publishing Company, 2001.

Book for Reference:

Francis B. Hildebrand, Methods of Applied Mathematics, second edition, Prentice-Hall of India private limited, 1968.

Semester III			
Self - Study Course (Optional) – History of Mathematics			
Code: 17PMASS2			**Credits: 2**

Objective:

- To make the students to understand the History of Mathematics.

Unit I

The beginnings – The Ancient and Medieval Period - Mesopotamia – Egypt, Greece – The Atherian school.

(Chapter2: page 55 – 66)

Unit II

Hellenistic Mathematics – Alexandria Euclid ,Archimedes and Apollonius -Pappus and Diophantus – The Middle Ages

(Chapter2: page 66 – 74)

Unit III

History of Indian Mathematics -Vedic period – VedangaJotisha - Sulba Sutras – Arithmetic

(**Chapter3:page 97 – 104)**

Unit IV

Algebra –Geometry – Trigonometry

(**Chapter3: page 104– 111)**

Unit V

History of Algebra – History of Geometry – History Calculus

(**Chapter4: page 112– 126)**

Text Book:

A History of Mathematics, - K.S. Narayanan and K. Narasimhan, Taj printers, First Edition Reprint 1985

Reference Book:

The History of Ancient Indian Mathematics - C.N. SrinivasaIyengar, World Press Pvt. Ltd., Calcutta, 1967 .

Semester IV			
Core XIII – Complex Analysis			
Code: 17PMAC41	**Hrs/week : 6**	**Hrs/Sem : 90**	**Credits : 5**

Objective:

- To know about the complex variables and its functions which extends calculus to the complex variables.

Unit I

Analytic functions as mappings: Conformality: arcs and closed curves – analytic functions in regions – conformal mapping – length and area. **Linear transformations:** linear group – the cross ratio – symmetry – oriented circles – family of circles. **Elementary conformal mappings:** the use of level curves – a survey of elementary mappings – elementary Riemann surfaces.

(Chapter 3 :Sections 2, 3 and 4)

Unit II

Complex Integration Fundamental theorem: line integrals – rectifiable arcs –line integrals as functions of arcs – Cauchy's theorem for a rectangle – Cauchy's theorem in a disk. **Cauchy's integral formula:** the index of a point with respect to a closed curve –the integral formula – higher derivatives.

(Chapter 4 : Sections 1 and 2)

Unit III

Local properties of analytical functions: removable singularities – Taylor's theorem – zeros and poles –the local mapping – the maximum principle. **The general form of Cauchy's theorem**: chains and cycles – simple connectivity – homology – general statement of Cauchy's theorem –proof of Cauchy's theorem – locally exact differentials–multiply connected regions.

(Chapter 4 : Sections 3 and 4)

Unit IV

Calculus of Residues: the residue theorem – the argument principle – evaluation of definite integrals. Harmonic functions: definition and basic properties – the mean value property -Poisson's formula – Schwartz theorem – the reflection principle.

(Chapter 4 : Sections 5 and 6)

Unit V

Power series Expansions – Partial Fractions – Infinite Products – Canonical Products.

(Chapter 5: Sections 1 and 2.1, 2.2, 2.3)

Text Book:

Lars V.Ahlfors : Complex Analysis .Third Edition , McGrawHill International Edition, 1979.

Reference Books:

1. Karunakaran .V: Complex Analysis, Narosa Publications (2002).
2. S.Ponnusamy: Foundation of Complex Analysis, Narosa Publishing House,2005.

Semester IV			
Core XIV – Functional Analysis			
Code: 17PMAC42	**Hrs/week:6**	**Hrs/Sem:90**	**Credits : 5**

Objective:

- To acquire a detail knowledge about Banachspaces, Hilbert spaces, Banach Algebras and Functionals defined on a set of functions.

Unit I

Banach spaces: Definition and Examples – Continuous linear transformation – The Hahn Banach theorem - The natural imbedding of N in N**

(Chapter 9: Sections 46,47,48,49)

Unit II

The open mapping theorem – The conjugate of an operator - Hilbert spaces : The Definition and some simple properties – Orthogonal complements – orthonormal sets.

(Chapter 9: Sec 50,51, Chapter 10: Sec 52, 53, 54)

Unit III

Conjugate space H* - The adjoint of an operator – Self adjoint operators – Normal and unitary operators.

(Chapter 10: Sec 55, 56, 57, 58)

Unit IV

Finite Dimensional spectral theory: Determinants and the spectrum of an operator – The spectral theorem.General Preliminaries : The Definition and some Examples – Regular and Singular points - Topological Divisors of Zero.

(Chapter 11: Sections 61,62 Chapter 12: Sections 64, 65, 66)

Unit V

The Spectrum – The formula for the Spectral Radius – The Radical and Semi-simplicity.

(Chapter 12: Sections 67, 68, 69)

Text Book:

G.F.Simmons : Topology and Modern Analysis ,McGraw – Hill International Editions.

Reference Books:

1. M.Thamban Nair : Functional Analysis A first course ,Prentice Hall of India.
2. S. Ponnusamy –Functional Analysis –Narosa Publishing.

Semester IV			
Core XV – Number Theory			
Code:17PMAC43	**Hrs/week: 6**	**Hrs/Sem:90**	**Credits: 4**

Objective

- To make the students to understand the various analytical concepts in numbers.

Unit I

Divisibility –primes- Congruences - Solutions of Congruences - Congruences of degree one.

(Chapter 1 and chapter 2)
(Section:1.1,1.2,1.3,2.1,2.2,2.3,)

Unit II

The function f(n) – congruences of higher degree – prime power moduli-prime modulus-congruences of degree two, prime modulus-power residues.

(Chapter 2 Sec:2.4,2.5,2.7,2.8,2.9)

Unit III

Quadratic residues - quadratic reciprocity – The Jacobi symbol.

(Chapter 3, Sec:3.1,3.2,3.3)

Unit IV

Greatest integer Function –Arithmetic functions- The Moebius inversion formula-Multiplication of Arithmetic functions

(Chapter 4 Sec:4.1,4.2,4.3,4.4)

Unit V

The equation $x^2+ y^2=z^2$, The equation $x^4+y^4=z^2$, sum of four and five squares – Waring's problem: Sum of fourth powers-sum of two squares.

(Chapter 5, Sec:5.5,5.6,5.7,5.8,5.9,5.10)

(Each unit without Exercise problems)

Text Book:

Ivan Niven and Herbert S. Zuckerman, An introduction to the theory of numbers – Third Edition, Wiley Eastern ltd (1976).

Reference Book:

Harriet Griffin: Elementary Theory of Numbers, McGraw-Hall Book company, INC 1954.

Semester IV			
Elective IV– Differential Geometry			
Code: 17PMAE41	**Hrs/Week :6**	**Hrs/Sem: 90**	**Credits : 4**

Objective:

- To acquire the essential ideas and methods of differential Geometry.
- To learn about the classical theory of curves, surfaces and vector methods.

Unit I

The Theory of Space Curves: Introductory Remarks about Space Curves – Definitions - Arc Length – Tangent, Normal and Binormal– Curvature and Torsion of a curve given as the intersection of two Surfaces.

(Chapter 1: Sections 1,2,3,4,5)

Unit II

Contact between Curves and surfaces - Tangent Surface ,Involutes and Evolutes. Intrinsic Equations, Fundamental Existence Theorem for Space Curves – Helices.

(Chapter 1: Sections 6,7,8,9)

Unit III

The Metric : Local Intrinsic Properties of a Surface : Definition of a Surface – Curves on a Surface - Surfaces of Revolution – Helicoids – Metric - Direction Coefficients.

(Chapter 2: Sections 1,2,3,4,5,6)

Unit IV

Families of Curves – Geodesics – Canonical Geodesic Equations – Normal Property of Geodesics.

(Chapter 2: Sections 7, 10, 11,12)

Unit V

The Second and Fundamental form : The Second and Fundamental form – Principal curvatures – Lines of Curvature-Geodesic Parallers - Geodesic curvature.

(Chapter 2: Sections 14,15 & Chapter 3 : Sections 1,2,3)

Text Book :

T.J.Wilmore : An Introduction to Differential Geometry ,Oxford University Press, 2007.

Reference Books :

1. Dirk J.Struik : Lectures on Classical Differential Geometry ,Second Edition , Addision Wesley Publishing House.
2. William C.Graustein : Differential Geometry, Dover Publications , New York, 1962.

Semester IV			
Elective IV– Projective Geometry			
Code: 17PMAE41	**Hrs/Week :6**	**Hrs/Sem: 90**	**Credits : 4**

Objectives

- To acquire the essential ideas and methods of differential Geometry.
- To learn about the classical theory of curves, surfaces and vector methods.

UNIT-I

Projective Geometry as an extension of high school geometry: Two approaches to projective geometry-An initial question-Projective invariants-Vanishing points – Vanishing lines-Some projective noninvariants – Betweenness -Division of a segment in a ratio-Desargues' Theorem-Perspectivity; projectivity-Harmonic tetrads; fourth harmonic-Further theorems on harmonic tetrads. **(Chapter 1 : Sections 1-12)**

UNIT-II

Projective Geometry as an extension of high school geometry: The cross-ratio-Fundamental Theorem of Projective Geometry-Further remarks on the cross- ratio-Construction of the projective plane- Previous results in the constructed plane- Analytic construction of the projective plane. **(Chapter 1 : Sections 13-18)**

UNIT-III

The axiomatic foundation: Unproved propositions and undefined terms-Requirements on the axioms and undefined terms-Undefined terms and axioms for a projective plane-Initial development of the system; the Principle of Duality-Consistency of the axioms-Other models-Independence of the axioms-Isomorphism-Further axioms-Consequences of Desargues' Theorem-Free planes. **(Chapter 2 : Sections 1-11)**

UNIT-IV

Establishing coordinates in a plane : Definitions of a field-Consistency of the field axioms-The analytic model –Geometric description of the operations plus and times- Setting up coordinates in the projective plane-The non commutative case. **(Chapter 3 : Sections 1-6)**

UNIT-V

Relations between the basic theorems & Axiomatic introduction of Higher – dimensional space: Higher –dimensional , especially 3-dimensional projective space-Desarguesian planes and higher – dimensional space. **(Chapter 4 & 5 : Sections 1-2)**

TEXT BOOK:

A.Seidenberg, Lectures In Projective Geometry,Van Nostrand reinhold Company, New York, 1965.

REFERENCE:

Herbert Busemann and Paul J. Kelly, Projective Geometry and Projective Matrics, Academic Press INC., Publishers, New York 1953.

Semester IV			
Project - Dissertation			
Code:17PMAP41	**Hrs/week: 6**	**Hrs/Sem:90**	**Credits: 5**

Objective

- To help the students to enhance their knowledge on a specific area of study.

Suggested Topics:

1. Methods and Modeling , Sequence Spaces , Finite Automata , Lie Groups , Fuzzy Sets, Distribution Theory ,Dominations , Fixed points , Wavelets , Neural Networks , Labelings.
2. Digital topology.
3. Hyper Ideals.
4. Fuzzy near rings, Gamma near rings in algebra.
5. Labellings and pebbling.
6. Generalised topology.
7. Any other topics of interest.
8. Research Articles from standard Journals / Proceedings / Technical Reports in Mathematical Sciences.

Suggested Books

1. Sequences & Series in Banach Spaces –Joseph Diestel- Springer-Vierlag

2. Micheal W. Frazier: An Introduction to Wavelets through Linear Algebra , Springer.

3. Yu.A.Shashkin : Fixed Points ,University Press.

4. Mark V. Lawson, Chapman and Hall : Finite Automata , CRC.

5. Kevin Gurney : An Introduction to Neural Networks , CRC Press.

6. R.S.Pathak : A Course in Distribution Theory and Applications.

7. Howison : Practical Applied Mathematics Modeling ,Analysis , Approximations ,Cambridge University Press.
8. M.V.Atlaisky : Wavelets Theory and Applications Implements.

9. S.C.Bagchietal : A First course on Representation Theory, Universities Press

10. Martin Antony and Norman Biggs : Mathematics for Economics and Finance , Cambridge University Press.