SRI RAMAKRISHNA MISSION VIDYALAYA
COLLEGE OF ARTS AND SCIENCE
(Autonomous)
COIMBATORE – 641 020

DEPARTMENT OF MATHEMATICS

Under Choice Based Credit System (CBCS)
2018 – 2019 Onwards

M.Sc. MATHEMATICS

SCHEME OF EXAMINATIONS

SEMESTER – I								
S. No	**Course code**	**Title of the paper**	**Hrs**	**Credits**	**Exam Hours**	**Maximum Marks**		
						Int	**Ext**	**Total**
01	17PMA1C01	Algebra	6	5	3	25	75	100
02	13PMA1C02	Real Analysis	6	5	3	25	75	100
03	17PMA1C03	Ordinary Differential Equations	6	5	3	25	75	100
04	17PMA1C04	Mathematical Statistics	4	3	3	25	75	100
05	13PMA1EL1	Elective 1: Numerical Analysis	5	4	3	25	75	100
06	16PMA2CP1	Core Practical: Computer Programming with SPSS and C++	3	-	-	-	-	-
TOTAL – I			30	22				500

SEMESTER II								
S. No	**Course code**	**Title of the paper**	**Hrs**	**Credits**	**Exam Hours**	**Maximum Marks**		
						Int	**Ext**	**Total**
01	13PMA2C05	Complex Analysis	6	5	3	25	75	100
02	13PMA2C06	Partial Differential Equations	6	4	3	25	75	100
03	17PMA2C07	Mechanics	6	4	3	25	75	100
04	13PMA2C08	Mathematical Software II : (Programming in C++)	4	3	3	25	75	100
05	17PMA2EL2	Elective 2: Graph Theory	5	4	3	25	75	100
06	16PMA2CP1	Core Practical: Computer Programming with SPSS and C++	3	3	3	40	60	100
TOTAL - II			30	23				600

SEMESTER III								
S. No	**Course code**	**Title of the paper**	**Hrs**	**Credits**	**Exam Hours**	**Maximum marks**		
						Int	**Ext**	**Total**
01	13PMA3C09	Topology	6	5	3	25	75	100
02	13PMA3C10	Nonlinear Differential Equations	6	4	3	25	75	100
03	16PMA3C11	Combinatorics	6	4	3	25	75	100
04	17PMA3C12	Mathematical Software III(MATLAB)	5	4	3	25	75	100
05	13PMA3EL3	Elective 3(IDE): Relativity and Wave Mechanics	5	4	3	25	75	100
06	13PMA4CP2	Core Practical: MATLAB	2	-	-	-	-	-
TOTAL – III			30	21				400

SEMESTER IV								
S. No	**Course code**	**Title of the paper**	**Hrs**	**Credits**	**Exam Hours**	**Maximum Marks**		
						Int	**Ext**	**Total**
01	13PMA4C13	Functional Analysis	6	5	3	25	75	100
02	13PMA4C14	Mathematical Methods	6	4	3	25	75	100
03	13PMA4C15	Differential Geometry	5	4	3	25	75	100
04	13PMA4EL4	Elective 4: Fluid Dynamics	6	4	3	25	75	100
05	13PMA4EL5	Elective 5: Control Theory	5	4	3	25	75	100
06	13PMA4CP2	Core Practical: MATLAB	2	3	3	40	60	100
TOTAL – IV			30	24				700

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE – 641 020.

For candidates admitted from academic year 2017-2018 onwards

Under New CBCS

Programme	**: M.Sc. Mathematics**		
Course Title	**: CORE 1: ALGEBRA**	**Subject Code: 17PMA1C01**	
Year	**: First Year**	**Semester**	**: I**
Hours/Week	**: 6**	**Credits**	**: 5**

Unit I:

Group Theory: Another counting principle - Sylows Theorem.

Chapter 2: Sections 2.11 and 2.12

Unit II:

Ring Theory: Euclidean Rings- Particular Euclidean Ring - Polynomial Rings - Polynomials over the Rational Field.

Chapter 3: Sections 3.7 to 3.10

Unit III:

Fields: Extension field – Roots of polynomials.

Chapter 5: Sections 5.1 and 5.3

Unit IV:

Fields: More about roots - Elements of Galois Theory.

Chapter 5: Sections 5.5 and 5.6

Unit V:

Linear Transformations: Canonical Forms: Triangular form, Trace and Transpose – Hermitian, Unitary and Normal Transformations.

Chapter 6: Sections 6.4, 6.8 and 6.10

Treatment as in:

Topics in Algebra by I.N. Herstein, John Wiley & Sons, Second Edition, 2006.

References:

1. **Algebra by M. Martin**, Prentice Hall of India, New Delhi, 1991.
2. **A First Course in Abstract Algebra by J. B. Fraleigh**, V Ed., Addison-Wesley Longman, Inc., Reading Massachusetts, 1999.

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For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 2: REAL ANALYSIS **Subject Code : 13PMA1C02**
Year : First Year **Semester : I**
Hours/Week : 6 **Credits : 5**

Riemann Stieltjes Integral

Unit I:

Riemann Stieltjes Integral: Definition and existence of the integral – Properties of the integral – Integration and Differentiation – Integration of vector valued function – Rectifiable curves.

Chapter : 6

Unit II:

Uniform convergence and continuity - Uniform convergence and integration - Uniform convergence and differentiation – equicontinuous families of functions – The Stone – Weirstrass theorem.

Chapter : 7

Function of Several Variables:

Unit III:

Linear Transformation – The Contraction principle – The Inverse Function Theorem – Implicit Function Theorem – Determinants – Derivatives of Higher order – Differentiation of integrals.

Chapter: 9

Lebesgue Measure:

Unit IV:

Lebesque Measure: Outer measure – Measurable sets and Lebesque measure – Measurable functions.

Chapter 3: Sections 3.2 - 3.4

Unit V:

Lebesque Integral: The Lebesque integral of a bounded functions over a set of finite measure – integrals of a non-negative functions – General Lebesque integral.

Chapter 4: Sections: 4.2 - 4.4

Treatment as in:

1. Principles of Mathematical Analysis, Walter Rudin, Third Edition, 1976. (**Units I, II and III**)
2. **Real Analysis by H.L. Royden**, 3nd edition, Macmillan, New york, 1988. (**Units IV and V**).

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For candidates admitted from academic year 2017-2018 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 3: ORDINARY DIFFERENTIAL EQUATIONS
Subject Code:17PMA1C03
Year : First Year **Semester : I**
Hours/Week : 6 **Credits : 4**

Unit I:

System of Linear Differential Equations: Introduction - System of first order equations – Existence and Uniqueness theorem – Fundamental Matrix.
Chapter 4: Section 4.1 - 4.5

Unit II:

System of Linear Differential Equations: Non – Homogeneous linear systems: Linear systems with constant co-efficient - Linear systems with periodic co-efficient.
Chapter 4: Section 4.6 - 4.7

Unit III:

Existence and Uniqueness of Solutions: Introduction - Preliminaries-Successive Approximation - Picard's theorem - Non-uniqueness of solutions- Continuation and dependence on initial conditions - Existence of solutions in the large - Existence and Uniqueness of solution of systems.
Chapter 5: Section 5.1 - 5.8

Unit IV:

Boundary Value Problems: Introduction - Sturm Liouville problem – Green's Functions – Non Existence of Solutions.
Chapter 7: Section 7.1 - 7.4

Unit V:

Oscillations of Second Order Equations: Fundamental results - Sturm's Comparision theorem - Elementary linear Oscillations - Comparision theorem of Hille – Wintner Oscillations of X'' + a(t) X=0, Elementary nonlinear oscillations.
Chapter 8: Section 8.1 - 8.6

Treatment as in:

Text book of Ordinary Differential Equations by S.G. Deo,
V. Lakshmikanthan and V. Ragavendra, Tata McGraw-Hill Publishing Company Limited, 2010.

Reference Book:

Ordinary Differential Equations A First Course by D. Somasundaram, Narosa Publishing House, Fourth Edition, New Delhi, 2010.

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For candidates admitted from academic year 2017-2018 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 4: MATHEMATICAL STATISTICS **Subject Code : 17PMA1C04**
Year : First Year **Semester : I**
Hours/Week : 5 **Credits : 4**

Unit I:

Parameters of the Distribution of a Random Variable: Expected values – Moments –The Chebyshev inequality – Absolute moments- order of parameters- Moments of random vectors.

Chapter 3: Sections 3.1 -3.6

Unit II:

Characteristic Functions: Properties of Characteristic functions and moments – Semi invariants – The Characteristic function of the sum of independent random variables – Determination of distribution functions by the characteristic functions- Probability generating functions.

Chapter: 4: Sections 4.1 -4.5, 4.7.

Unit III:

Some Probability Distribution: One point and two point Distributions –The Binomial distribution – The Poisson distribution – Normal Distribution – Uniform Distribution – Gamma Distribution – Beta Distribution.

Chapter: 5 Sections 5.1, 5.2, 5.5 - 5.9.

Unit IV:

Limit Theorems: Stochastic Convergence – Bernoulli's Law of large numbers – Levy Cramer theorem – De Moivre- Laplace theorem – The Lindeberg-Levy theorem.

Chapter: 6 Sections 6.2, 6.3, 6.6, 6.7, 6.8.

Unit V:

The Notion of a Sample: The notion of a statistic – The distribution of the arithmetic mean of independent normally distributed random variables – The Chi- square distribution- Distribution of the statistic ($\overline{X}, S$)- Student's t-distributions.

Chapter: 9 Sections 9.1 - 9.6

Treatment as in:

1. **Probability Theory and Mathematical Statistics, Marek Fisz,** John Wiley, Third Edition, New York, 1963.

Reference Book:

1. **An Introduction to Probability Theory and its Applications, W. Feller,** Vol. I, John Wiley, Third Edition, 1968.

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For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : Elective 1: NUMERICAL ANALYSIS **Subject Code : 13PMA1EL1**
Year : First Year **Semester : I**
Hours/Week : 5 **Credits : 4**

Unit I:

Solution of Non-Linear Equations: Method of halving the interval – Method of linear interpolation – Newton's method – Use of X = G(X) form - convergence of Newton's method – Bairstow's method for Quadratic factors – Quotient-difference algorithm.

Chapter 1: Sections 1.2 -1.4, 1.6 – 1.9

Unit II:

Solution of System of Equations: Elimination method – Gauss and Gauss Jordan methods – LU Decomposition method - Methods of iteration – Relaxation method – Set of Non-linear equations.

Chapter 2: Sections 2.3, 2.4, 2.5, 2.10, 2.11, 2.12

Unit III:

Solution of Ordinary Differential Equations: Taylor series method – Euler and Euler Modified methods – Runge-Kutta Methods – Multistep Methods – Milne's method – Adams Moulton method.

Chapter 5: Sections 6.2 – 6.7

Unit IV:

Boundary Value Problems and Characteristic Value Problems:

The shooting method – solution through a set of equations – Derivative of Boundary conditions – Characteristic value problems – Eigen values of a matrix by Iteration.

Chapter 6: Sections 7.2 – 7.5

Unit V:

Types of Partial Differential Equations:

The Heat equation and the Wave equation- Solution Techniques for the Heat equation in One Dimensional – Solving the Vibrating String Problem – Parabolic Equations in Two or Three Dimensions – The Wave Equation in Two Dimensions.

Chapter 8: Sections 8.1 – 8.6

Treatment as in: Applied Numerical Analysis by C.F. Gerald and P.O.Wheatley, Pearson Education, 6th Edition, 2003.

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Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 5: COMPLEX ANALYSIS **Subject Code : 13PMA2C05**
Year : First Year **Semester : II**
Hours/Week : 6 **Credits : 5**

Unit I:

Complex Integration: Cauchy's integral formula – local properties of analytic functions – the calculus of residues.
Chapter 4: Sections 2.1 - 2.3, 3.1, 3.2, 3.4, 5.1 - 5.2

Unit II:

Harmonic Functions: Series and product development: power series expansions.
Chapter 4: Sections 6.1- 6.3; Chapter V: Sections 1.1 - 1.3

Unit III:

Partial Fractions and Factorizations – Entire functions.
Chapter 5: Sections 2.1, 2.4, 3.1 - 3.2.

Unit IV:

Conformal Mapping, Dirichlet Problem: Conformal mapping of polygons, A closer look at harmonic functions, The Dirichlet problem
Chapter 6: Sections 2.1, 2.2, 3.1, 3.2, 4.1 and 4.2.

Unit V:

Elliptic Functions: Simply periodic functions, Doubly periodic functions.
Chapter 7: Sections 1.1 - 1.3, 2.1 - 2.4.

Treatment as in:

Complex Analysis by Lars. V. Ahlfors, McGraw Hill, International Edition (Third Edition) 1979.

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For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics. **Subject Code: 13PMA2C06**
Course Title : CORE 6 : PARTIAL DIFFERENTIAL EQUATIONS
Year : First Year **Semester : II**
Hours/Week : 6 **Credits : 5**

Unit I:

Partial Differential Equations- nonlinear PDE of first order compatible system of first order equations- Charpit's method-special type of first order equation- Jacobi method.
Chapter 2: Sections 1, 7, 9, 10, 11 and 13.

Unit II:

Partial Differential Equations of the second order : Linear partial differential equation with constant coefficients - Equations with variable co efficients
Chapter 3: Sections 4 and 5.

Unit III:

Laplace's Equation: Occurrence of Laplace equation in physics –Elementary solution of Laplace equation – Boundary value problem separation of variables-Problems with axial symmetry –Kelvin's theorem –Theory of Green's functions-Relations of Dirichlet problem to calculus of variables –Two dimensional Laplace Equation –Green function for two dimensional equation.
Chapter 4: Sections 1, 2, 4, 5, 6, 7, 8, 9, 11 and 13.

Unit IV:

The Wave Equation: Occurrence of wave function in Physics –Elementary solution one dimensional wave equation vibrating membranes-Application of calculus of variation-Three dimensional problem-General solution of wave equation-Green's function for wave equation-Non homogeneous wave equation.
Chapter 5: Sections 1, 2, 4, 5, 6, 7 and 8.

Unit V:

The Diffusion Equation: Occurrence of Diffusion equation in Physics –Resolution of boundary value problem for diffusion equation-Elementary solution of diffusion equation –Separation of variables-Use of Green's functions.
Chapter 6: Sections 1, 2, 3, 4 and 6.

Treatment as in:

Elements of Partial Differential Equations by I.N. Sneddon, McGraw Hill, 1988.

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For candidates admitted from academic year 2017-2018 onwards
Under New CBCS

Programme	**: M.Sc. Mathematics.**		
Course Title	**: CORE 7: MECHANICS**	**Subject Code**	**:17PMA2C07**
Year	**: First Year**	**Semester**	**: II**
Hours/Week	**: 6**	**Credits**	**: 4**

Unit I:

Introductory Concepts: The Mechanical System - Geometrical co-ordinates – Constraints Virtual Work - Energy.

Chapter 1: Sections 1.1 – 1.5

Unit II:

Lagrange's Equations: Derivation of Lagrange's Equations – Integral of the motion-

Natural system and Liouvilles systems & Examples

Chapter 2: Sections 2.1 - 2.3

Unit III:

Hamilton's Equations:

Hamilton's Principle – Hamilton's Equations – Modified Hamilton's Principle – Principle of least action and examples

Chapter 4: Sections 4.1 - 4.3

Unit IV:

Hamilton-Jacobi Theory:

Hamilton's Principle function – The Hamilton – Jacobi Equation.

Chapter 5: Sections 5.1 - 5.2.

Unit V:

Canonical Transformations:

Differential forms and generating functions – Lagrange and Poisson brackets.

Chapter 6: Sections 6.1 - 6.3

Treatment as in:

Classical Dynamics by D. T. Greenwood, Prentice Hall (1985).

Reference Book: Classical Mechanics by Herbert Golstein, Charles poole, John safko, Addson Wesley, Third edition, 2000.

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For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics. **Subject Code:13PMA2C08**
Course Title : Core 8 - Mathematical Software II : (Programming in C++)
Year : First Year **Semester : II**
Hours/Week : 4 **Credits : 3**

Unit I:

Principle of Object Oriented Programming: Object oriented programming paradigm. Basic concepts of object oriented programming structure of C++ program. Tokens – keywords – identities – Basic Data types – User-Defined Data types – Derived Data types – symbolic constants – Type compatibility – Declaration of variables – Dynamic Initialization of variables – reference variables.

Section: 1.4 & 1.5, 3.2 – 3.12

Unit II:

Operators in C++ - Scope Resolution operator – Member Dereferencing operators – Memory Management operators – Type cast operator – Expressions and Implicit conversions – Operator overloading – Operator Precedence. Functions in C++ - Introduction – The main function – Function Prototyping –Call by Reference – Return by Reference – Inline functions – Default Arguments – Constant Arguments.

Section: 3.13 – 3.16, 3.18 – 3.21, 4.1 – 4.8

Unit III:

Classes and Objects: Introduction – Specifying a class – Defining Members Functions – Making an outside function inline – Nesting of Member Functions – Private Member Functions – Arrays within a class – Memory Allocation for Objects – Static Data Members – Static Member Functions – Friendly functions – Returning objects – Const Member Functions. **Constructors and Destructors:** Introduction – Parameterized Constructors - Multiple Constructors in a class – Constructors with Default Arguments.

Section: 5.1, 5.3, 5.4, 5.6 – 5.12, 5.16 – 5.17, 6.1- 6.5.

Unit IV:

Operator Overloading and Type Conversions: Introduction – Defining operators overloading – Overloading Unary operators – Overloading Binary operators using friends – Manipulation of strings using operators. Rules for overloading operators – Type conversion. **Inheritance: Extending Classes:** Introduction – Defining Derived classes – Single Inheritance - Making a private Member inheritable – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance.

Sections: 7.1 -7.8, 8.1 – 8.8.

Unit V:

Pointers, Virtual Functions and Polymorphism: Introduction – Pointers to objects – 'This' pointer – pointer to Derived classes – Virtual Functions – Pure Virtual Functions. **Managing Console I / O Operations:** Introduction – C++ Streams – C++ stream classes – Unformatted I / O operations – Formatted console I / O operations – Managing output with Manipulators.

Sections: 9.1 – 9.6, 10.1 – 10.6.

Treatment as in:

Object – Oriented Programming with C ++ by E. Balagurusamy, Tata McGraw – Hill, New Delhi, 1998.

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For candidates admitted from academic year 2017-2018 onwards
Under New CBCS

Course Title: Elective 2: GRAPH THEORY **Course Code :17PMA2EL2**

Year : First Year **Semester : II**

Hours/Week : 5 **Credits : 4**

Unit-I

Graphs and Sub graphs: Graphs and simple graphs –Graph isomorphism – The incidence and adjacency matrix – sub graphs – vertex degree – path, **connection and cycles*.**
Tree: Trees – cut edges and bonds – cut vertices and Cayley's formula.
Chapter I- Section: 1.1-1.7, Chapter II- Section: 2.1-2.4

Unit -II

Connectivity and Blocks, Euler tours and Hamilton cycles: Euler tours and Hamilton cycles.
Chapter III- Section: 3.1-3.2, Chapter IV- Section: 4.1-4.2

Unit -III

Matchings: Matchings*, Matchings and coverings in bipartite graphs and perfect matchings.
Independent sets and Cliques: Independent sets.
Chapter V- Section: 5.1-5.3, Chapter VII- Section: 7.1

Unit -IV

Edge Colourings: Edge Chromatic number and Viging's theorem.
Vertex Colourings: Chromatic number, Brook's theorem, Hajo's Conjecture, Dirac's Theorem, **Chromatic polynomials*,** Girth and Chromatic number.
Chapter VI- Section: 6.1-6.2, Chapter VIII- Section: 8.1-8.5.

Unit -V

Planar graphs: Plane and planer graphs, dual graph, Euler's formula, Kuratowski's Theorem.
Directed graphs: Directed graphs, directed paths and **directed cycles*.**
Chapter IX- Section: 9.1-9.3 and 9.5, Chapter X- Section: 10.1-10.3.

*** denotes self study (Questions may be asked from these portions also)**

Book for study:

J. A. Bondy and U. S. R. Murty, *Graph Theory with applications*, Macmillan Company, 1976.

Books for Reference:

1. R. Balahrishnan and K. Ranganathan, *A text book on Graph Theory*, Springer Verlog, Newyork 2000.
2. R. Gould, *Graph Theory*, The Benjamin/Cummings publications company Califonia, 1988.
3. N. Harlsfield and G. Ringd, *Pearls in Graph Theory*, Academic press, 1990.

Course Title :CORE PRACTICAL: COMPUTER PROGRAMMING WITH SPSS & C + +
Course Code : 16PMA2CP1
Year : First Year **Semester : II**
Hours/Week/ : 3 for two Semesters **Credits : 2**

LIST OF EXPERIMENTS

SPSS PRACTICALS:

1. Mean, Median, Mode, Standard Deviation for individual data and discrete data.
2. Skewness and Kurtosis for individual data and discrete data.
3. Test of significance based on t- test (independent sample t-test).
4. Chi- square test for goodness of fit.
5. ANOVA table.

C + + PRACTICAL:

1. Expressing a given number as a product of primes
2. To convert the given 2 set of times calculated as day, hour, minutes and seconds.
3. Binary search.
4. Various types of Correlation.
5. Regression Analyss.
6. Standard and Mean Deviation.
7. Bisection Method.
8. Newton Raphson Method.
9. R-K method of fourth order.

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Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 9: TOPOLOGY **Subject Code : 13PMA3C09**
Year : Second Year **Semester : III**
Hours/Week : 6 **Credits : 5**

Unit I:

Topological Spaces and Continuous Functions: Topological spaces – Basis for a Topology – The Order topology – The Product topology on X x Y – The Subspace topology – Closed sets and limit points.
Chapter 2: Sections 12 - 17

Unit II:

Topological Spaces and Continuous Functions: Continuous functions – The Product topology – The Metric topology.
Chapter 2: Sections 18 - 20

Unit III:

Connectedness and Compactness: Connected spaces – Connected Subspaces of the real line – Components and Local Connectedness.
Chapter 3: Sections 23 - 25

Unit IV:

Connectedness and Compactness: Compact spaces, Compact Subspaces of the real line – Limit point compactness.
Chapter 3: Sections 26 - 28

Unit V:

Countability and Separation Axioms: The Countability Axioms – The Separation Axioms – The Urysohn Lemma – The UrysohnMetrization theorem.
Chapter 4: Sections 30, 31, 33, 34

Treatment as in:

Topology by James R. Munkres, Prentice Hall of India, New Delhi, 2007.

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Programme : M.Sc. Mathematics. **Subject Code :13PMA3C10**
Course Title : CORE 10: Nonlinear Differential Equations
Year : Second Year **Semester : IV**
Hours/Week : 6 **Credits : 5**

Unit I:

First order systems in two variables and linearization: The general phase plane – some population models – linear approximation at equilibrium points – The general solution of a linear system.

Chapter 2: Sections 2.1 - 2.4

Unit II:

Averaging Methods: An energy balance method for limit cycles – Amplitude and frequency estimates – Slowly varying amplitudes: Nearly periodic solutions – Periodic solutions: Harmonic balance – Equivalent linear equation by harmonic.

Chapter 4: Sections 4.1 - 4.5

Unit III:

Perturbation Methods: Outline of the direct method – Forced Oscillations far from resonance – Forced oscillations near resonance with weak excitation – Amplitude equation for undamped pendulum– Lindstedt's method – The perturbation method and Fourier series.

Chapter 5: Sections 5.1 - 5.4, 5.8, 5.10.

Unit IV:

Stability: Poincare stability – Solutions, paths and norms – Liapunov stability. Stability of linear systems- Stability and boundedness for linear systems- Stability of system with constant coefficients.

Chapter 8: Sections 8.1 – 8.4, 8.6-8.7.

Unit V:

The Existence of Periodic solutions: The Poincare-Bendixson theorem- Atheorem on the existence of a centre-A theorem on the existence of a limit cycle- Van der Pol's equation with large parameter.

Chapter 11: Sections 11.1 – 11.4

Treatment as in:

Nonlinear Ordinary Differential Equations by D.W. Jordan and P. Smith, Clarendon Press, Oxford, Second Edition, 1987.

References:

1. **Differential Equations by G.F. Simmons**, Tata McGraw-Hill, New Delhi, 1979.
2. **Ordinary Differential Equations and Stability Theory by D.A. Sanchez,** Dover, New York, 1968.

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For candidates admitted from academic year 2016-2017 onwards
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Programme : M.Sc. Mathematics.
Course Title : CORE 11: COMBINATORICS **Subject Code : 16PMA3C11**
Year : Second Year **Semester : I**
Hours/Week : 6 **Credits : 4**

Unit I:

Selection and Binomial coefficients: Permutations - Ordered selections - Unordered selections - Further remarks on the Binomial theorem - Miscellaneous problems.
Chapter:2 Sections 2.1-2.5.

Unit II:

Paring problems: Pairing within a set - Pairing between sets - An optimal assignment problem - Gale's optimal assignment problem - Further reading .
Chapter: 3 Sections 3.1 -3.5.

Unit III:

Recurrence : Some miscellaneous problems-Fibonacci - type relations - using generating functions - Miscellaneous methods - Counting simple electrical networks.
Chapter: 4 Sections 4.1-4.5.

Unit IV:

The Inclusion –Exclusion principle: The principle - Rook polynomials.
Steiner systems and sphere packing's : Introductory remarks – Steiner system - S(5,8,24).
Chapter: 5 Sections 5.1 , 5.2
Chapter: 7 Sections 7.1 – 7.3

Unit V:

Block design and Error –Correcting codes: Block designs- Square block design- Hadamard configurations- Error- Correcting codes.
Chapter: 6 Sections 6.1 - 6.4

Treatment as in:

A First Course in Combinatorial Mathematics by IAN ANDERSON,
Clorendon press, Oxford,1974 .

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For candidates admitted from academic year 2017-2018 onwards
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Programme : M.Sc. Mathematics. **Subject Code :17PMA3C12**
Course Title : CORE 12: Mathematical Software – III (MATLAB)
Year : Second Year **Semester : III**
Hours/Week : 5 **Credits : 4**

Unit I:

Introduction: What is MATLAB? - Does MATLAB do symbolic calculations? -Will MATLAB run on my computer? - Where do I get MATLAB? - How do I use this book?-Basic of MATLAB, Input – Output - File types – Platform dependence – General commands.
Chapter I: Section 1.1-1.6

Unit II:

Interactive Computation: Matrices and vectors – Matrix and Array Operations – Creating and Using Inline functions – Using Built-in Functions and On-line Help – Saving and loading data – Plotting simple graphs.
Chapter III: Sections 3.1 – 3.6.

Unit III:

Programming in MATLAB: Scripts and Functions – Script files – Function files – Language specific features – Advanced data objects.
Chapter IV: Sections 4.1 – 4.4.

Unit IV:

Applications: Linear Algebra – Curve fitting and Interpolation – Data analysis and Statistics – Numerical Integration – Ordinary differential equations – Nonlinear Algebraic Equations.
Chapter V: Sections 5.1 – 5.6.

Unit V:

Graphics: Basic 2-D plots – Using subplot to layout multiple graphs – 3-D Plots – Handle Graphics – Saving and Printing Graphs – Errors.
Chapter VI & VII: Sections 6.1 – 6.5.

Treatment as in:

Getting started with MATLAB – A Quick Introduction for Scientists and Engineers by Rudra Pratap, Oxford University Press, 2003.

Course Title : Core Practical: MATLAB
Course Code : 13PMA4CP2
Year : Second Year **Semester : IV**
Hours/Week : 3 for Two Semesters **Credits : 2**

Mat Lab Practical:

1. Equation of Straight line
2. Multiply, divide and exponentiate vectors
3. Points on a circle
4. Geometric series
5. Matrices and vectors
6. Simple sine plot
7. Exponentially decaying sine plot
8. Log scale plots
9. Overlay plots
10. Temperature conversion
11. Factorial calculation
12. Solution of a system of linear equations
13. Eigen value and Eigen vectors
14. Curve fitting and interpolation
15. Mean, Median and Standard Deviation
16. Numerical Integration
17. Double integration
18. Ordinary Differential Equation
19. RungeKutta method
20. Newton Rapson method

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE – 641 020.

For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 13: FUNCTIONAL ANALYSIS **Subject Code : 13PMA4C13**
Year : Second Year **Semester : IV**
Hours/Week : 6 **Credits : 5**

Unit I:

Banach Spaces: The definition and some examples – Continuous Linear Transformation – The Hahn – Banach theorem.
Chapter 9: Sections 46 – 48

Unit II:

The natural imbedding of N in N** - The Open Mapping Theorem – The conjugate of an operator. **Hilbert spaces**: The Definition and some examples - properties.
Chapter 9: Sections 49 -51 and **Chapter 10: Section 52**

Unit III:

Orthogonal complements – Orthogonal sets – The conjugate space H* - The Adjoint of an Operator.
Chapter 10: Sections 53 – 56

Unit IV:

Self – Adjoint operators – Normal and Unitary operators – Projections
Chapter 10: Sections 57 -59

Unit V:

Finite – dimensional Spectral Theory: Matrices – The Spectral theorem
General Preliminaries on Banach Algebras: The Definition and some examples – Regular and singular elements.
Chapter 11: Sections 60 – 62 and **Chapter 11: Sections 64, 65**

Treatment as in:

Introduction to Topology and Modern Analysis by G. F. Simmons, McGraw Hill publication Company, 1963.

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE – 641 020.
For candidates admitted from academic year 2017-2018 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : CORE 14: MATHEMATICAL METHODS Subject Code :13PMA4C14
Year : Second Year Semester : IV
Hours/Week : 6 Credits : 4

Unit I:

Fourier Transforms, Finite Fourier Transforms, Applications of Fourier Transforms in Initial and Boundary value problems.

Chapter 6: Sections 6.1, 6.4 -6.12, Examples 1 – 5, 13 - 19
Chapter 7: Sections 7.1 - 7.4, Examples 1 - 9
Chapter 8: (Omit miscellaneous exercises.)

Unit II:

Henkel Transforms and finite Hankel Transforms, Applications of Hankel Transforms in Initial and Boundary value problems.

Chapters: 9, 10, 11

Unit III:

Introduction: Definition – Regularity Conditions – Special kinds of Kernels – Eigenvalues and Eigenfunctions – Convolution Integral – The inner or scaler product of two functions. **Integral Equations with Separable Kernels:** Reduction to a system of Algebraic equations – Examples – Fredholm Alternative – Examples – An Approximate Method. **Method of Successive Approximations**: Iterative Scheme – Examples – Volterra Integral Equation – Examples.

Chapter I: Sections 1.1 – 1.6, Chapter II: Sections 2.1 – 2.5 and Chapters III: Sections 3.1 – 3.4

Unit IV:

Application Integral Equation to Ordinary Differential Equation Initial value problems, Boundary value problems – Examples **Singular Integral Equation** Abel integral equation - Examples.

Chapter 5: Sections 5.1 – 5.3 and **Chapter 8: Sections 8.1 – 8.2**

Unit V:

Calculus of Variations: Variation and its properties – Euler's equation – functionals of the form functional dependent on higher order derivatives- functional dependent on the functions of several independent variables variational problem in parametric form.

Chapter 6: Sections 6.1 - 6. 7.

Treatment as in:

1. **Integral transforms by Vasistha and Gupta, Krishna PrakasamMandir** Meerut, 1993-94. For Units I & II.
2. **Linear Integral Equations by Ram P.Kanwal,** Academic Press, New York, 1971. For Units III & IV.
3. **Differential Equations and Calculus of Variations by L.Elsgolts**, Mir Publishers, 1970. For Unit V.

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE – 641 020.

For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title :Core 15: DIFFERENTIAL GEOMETRY **Subject Code : 13PMA4C15**
Year : Second Year **Semester : IV**
Hours/Week : 5 **Credits : 4**

Unit I:

Curves: Analytic representation, Arc Length, Tangent, Osculating plane, Curvature Torsion, Formulas of Frenet.
Chapter I: Sections 1.1 - 1.6

Unit II:

Contact, Natural equations, Helices, General solutions of the Natural equations, Evolutes and Involutes.
Chapter I: Sections 1.7 -1.11

Unit III:

Elementary Theory of surfaces: Analytic Representation, First Fundamental form, Normal tangent plane, Developable surfaces.
Chapter II: Sections 2.1 - 2.4

Unit IV:

Second fundamental form, Meusnier's theorem, Euler's theorem. Dupin's indicatrix, some surfaces. The fundamental equations; the equations of Gauss – Weingarten.
Chapter II: Sections 2.5 - 2.8 and **Chapter III: Sections 3.1 - 3.2**

Unit V:

The theorem of Gauss and the equations of Codazzi, Some applications of the Gauss and Codazzi equations. The fundamental theorem of surface theory – Geodesic curvature, Geodesics.
Chapter III: Sections 3.3, 3.5, 3.6 and **Chapter IV: Sections 4.1 to 4.2**

Treatment as in:

Lectures on Classical Differential Geometry by Dirk,J.Struik, Addison Wesley Publishing Company, 1961.

Reference Book:

1. **Differential Geometry: First Course by D. Somasunduram**, Narosa Publishing House, 2010.
2. **Differential Geometry : An Integrated Approach by Nirmala Prakash**, Tata McGraw-Hill Publishing Company Ltd. Fourth Reprint, 1992.

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE – 641 020.
For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : Elective:4 FLUID DYNAMICS **Subject Code :13PMA4EL4**
Year : Second Year **Semester : IV**
Hours/Week : 6 **Credits : 4**

Unit I:

Introductory notions – Velocity – Stream lines, and Path of the particle - Stream tubes and Filaments – Fluid body – Density - Pressure, Differentiation with respect to time – Equation of continuity - Boundary conditions(Kinematical and Physical) - Rate of change of linear momentum – Equation of motion of an inviscid Fluid.

Chapter I: Sections 1.0 – 1.3, Chapter III: Sections 3.10, 3.20, 3.30, 3.31, 3.40, 3.41

Unit II:

Euler's Momentum theorem - Conservative forces – Steady motion (Bernoulli's equation) – The Energy equation – Rate of Change of Circulation (Kelvin's theorem) – Vortex motion - Permanence of Verticity (Helmholtz Equation).

Chapter IIII: Sections 3.42, 3.43, 3.45, 3.50, 3.51, 3.52, 3.53

Unit III:

Two dimensional motions – Two dimensional functions – complex potential basic singularities – source vertex – doublet circle theorem – flow past a circular cylinder with circulation – conformal transformation – Blasius theorem – Lift force.

Chapter 3: Sections 3.1 – 3.7.5 (omit 3.4 , 3.5 , 3.5.3 and 3.6)

Unit IV:

Viscous flows – Navier stokes equations – Vorticity and Circulation in a viscous fluid – steady flow through an arbitrary cylinder under pressure – steady couette flow between cylinders in relative motion – steady flow between parallel planes.

Chapter 5: Sections 5.2 – 5.3.3

Unit V:

Laminar boundary layer in incompressible flow boundary layer concept – Boundary layer equations – Displacement thickness – Momentum thickness – Kinetic energy thickness – Integral equation of boundary layer – Flow parallel to semi infinite flat plate - Blasius equation and it's solution.

Chapter 6: Sections 6.2.1, 6.2.3, 6.2.4, 6.3.1

Treatment as in:

1. **Theoretical Hydrodynamics by L.M. Milne Thomson**, Macmillan Company, 5th Edition, 1968. For Units I and II.
2. **Modern Fluid Dynamics – Vol I by N. Curle and H.J. Davies**, D Van Nostrand Company Ltd; London, 1968. For Units III, IV and V

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For candidates admitted from academic year 2013-2014 onwards
Under New CBCS

Programme : M.Sc. Mathematics.
Course Title : ELECTIVE 5:CONTROL THEORY Subject Code : 13PMA4EL5
Year : Second Year Semester : IV
Hours/Week : 5 Credits : 4

Unit I:

Observability: Linear systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear systems.
Chapter 2: Sections 2.1- 2.2

Unit II:

Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – Steering function – Nonlinear systems.
Chapter 3: Sections 3.1- 3.2

Unit III:

Stability: Stability – Uniform Stability – Asymptotic Stability of Linear systems – Linear time varying systems – Perturbed linear systems – Nonlinear systems.
Chapter 4: Sections 4.1- 4.3

Unit IV:

Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback.
Chapter 5: Sections 5.1- 5.3

Unit V:

Optimal Control: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Non linear systems.
Chapter 6: Sections 6.1- 6.3

Treatment as in:

Elements of Control Theory by K. Balachandran and J.P.Dauer, Narosa, 2nd Editio, New Delhi.

SRI RAMAKRISHNA MISSION VIDYALAYA COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS) COIMBATORE - 641 020

For candidates admitted from academic year 2014 - 15 onwards

Under New CBCS

Programme : M.Sc Physics **Subject Code: 14PPH3EL3**

Course Title : Elective : IDE: NUMERICAL ANALYSIS **Year : II**

Semester : III Hours/Week : 5 **Credits : 4**

Unit - I:

The solution of numerical algebraic and transcendental equation: Introduction - Bisection method - Method of successive Approximation or the iteration method - Method of false position (Regula Falsi method) - Newton's Iteration method or Newton-Raphson method.

Simultaneous Linear Algebraic equations: Introduction - Gauss elimination method - Computation of the inverse of a matrix using Gauss's elimination method - Method of triangularisation (or method of factorization) - Crout's method - Iterative methods - Comparison of Gauss Elimination and Gauss Seidal Iteration methods - Relaxation methods - examples.

Unit II:

Finite Differences: First differences - Higher differences - Backward differences Central difference notation - Properties of the operator Δ - Differences of a polynomial - Factorial polynomials - Relation between the operators E and Δ - Relation between the operators (D) and Δ - other difference operators - Relationship between the operators - Examples. Interpolation: Central difference tables - Central difference - Interpolation formulae - Gauss's Forward Interpolation formula and Backward Interpolation formulae- Examples.

Unit III:

Numerical Differentiation and Integration: Newton's Forward and Backward Difference Formula to compute the Derivatives - Derivatives using Striling's formula- Trapezoidal rule - Truncation error in the Trapezoidal Formula - Romberg's method - Simpson's rule - Practical Applications of the Simpson's rule - Examples.

Unit IV:

Numerical Solution of Ordinary Differential Equations: Solutions by Taylor's series - Euler's method - Improved Euler's method - Modified Euler's method - RungeKutta method - Second order RungeKutta method - Higher order RungeKutta method - Examples.

Unit V:

Numerical Solution of Partial Differential Equations: Solution of boundary value and Initial value problems of partial differential equations - Solution of elliptic, parabolic and hyperbolic partial differential equations.

Text book: Numerical Methods in Science and Engineering by Dr M.K. Venkataraman, The National Publishing Company, 5th Edition, 1999.

UNIT 1 Chapter III Sections 1- 6 and Chapter IV Sections 1- 8

2 Chapter V Sections 1- 18.and Chapter VII Sections 1- 4.

3 Chapter IX Sections 1- 4 & 8- 12.

4 Chapter XI Sections 6- 8 & 10- 18.

5 Chapter XII Sections 1- 9.