DRAVIDIAN UNIVERSITY – KUPPAM
DEPARTMENT OF MATHEMATICS

Two-Year M.Sc. Mathematics Course (CBCS)

COURSE STRUCTURE

First semester:

S. No.	course code	Subject	Credits Hrs. (Per Week)	Exam. Duration Hrs	Max.Marks		
					Internal	External	Total
1.	MA101	Algebra	5	3	30	70	100
2.	MA102	Real Analysis	5	3	30	70	100
3.	MA103	Ordinary Differential Equations	5	3	30	70	100
4.	MA104	Discrete Mathematics	4	3	30	70	100
5.	MA105	Programming in C & OOPS	4	3	30	70	100
6.	MA106	LAB : Lab in C Programming & OOPS	2	3		50	50
		Total	**25**				**550**

Second semester:

S. No.	Course Code	Subject	Credits Hrs.(Per Week)	Exam. Duration Hrs	Max.Marks		
					Internal	External	Total
1.	MA201	Linear Algebra	5	3	30	70	100
2.	MA202	Partial Differential Equations	5	3	30	70	100
3.	MA203	Complex Analysis	5	3	30	70	100
4.	MA204	Topology	5	3	30	70	100
5.	MA205	MATLAB/ FOSS LAB	2	3	-	50	50
6.	MA206	External Elective: Basic Mathematical Modellling. Soft Skills	3	3	30	70	100
		Total	**25**				**550**

Third semester:

S. No.	Course Code	Subject	Credits Hrs. (Per Week)	Exam. Duration Hrs	Max.Marks		
					Internal	External	Total
1.	MA301	Functional Analysis	5	3	30	70	100
2.	MA302	Numarical Analysis	5	3	30	70	100
3.	MA303	Mathematical Methods	5	3	30	70	100
4	MA304	Classical Mechanices	5	3	30	70	100
5	MA305	LAB:Numarical Methods	2			50	50
6.	MA306	Mathematics for Social and Biological Sciences (External Elective) & Core-II	3	3	30	70	100
		Total	**25**				**550**

Forth semester:

S. No.	Course Code	Subject	Credits (Hrs.Per Week)	Exam. Duration Hrs	Max.Marks		
					Internal	External	Total
1.	MA401	Measure and Integration	5	3	30	70	100
2.	MA402	Fluid Dynamics	5	3	30	70	100
3.	MA403	Graph Theory	4	3	30	70	100
4.	MA404	Operations Research/Mathematical Modeling(IE)	4	3	30	70	100
5.	MA405	Differential Geometry/Number Theory(IE)	4	3	30	70	100
6.	MA406	Project Work	3	3	-	50	50
		Total	**25**				**550**

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs:52**

SEMESTER – I **Credits: 05**

MA101: ALGEBRA

UNIT I: **Structure Theory of Groups:** Conjugacy and G–sets , Direct Product, Finitely generated Abelian groups – Invariants of a Finite Abelian group-Slow theorems **-13 Hrs**

UNIT-II: **Ideals and Homomorphism**: Ideals-Homomorphisms-Sum and Direct sum of Ideals-Maximal and Prime Ideals- Nilpotent and Nil Ideals-Zorn's Lemma **-13 Hrs**

UNIT III: **Unique Factorization domains and Euclidean Domains:** Unique factorization domains–Principal ideal domains–Euclidean domains, Polynomial rings over UFD. **-13 Hrs**

UNIT IV: **Modules:** Definition and examples, sub modules and direct sums, R–homomorphisms and quotient modules, completely reducible modules, free modules. **-13 Hrs**

Text book:

"**Basic Abstract Algebra"** by P.B. Bhattacharya,
S. K. Jain and S. R. Nagpaul, Cambridge University press, Reprint 1997.

Reference Books:

(i) Topics in Algebra, by I.N. Hierstein.

(ii) Commutative algebra, by Zariski and Samuel Affiliated East – West Press.

(iii)Abstract Algebra-by Ronald Solomon.

(iv) A First Course in "**ABTRACT ALGEBRA**" 7th Edition by Jhon B.fraleigh,Pearson education.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs: 52**
Credits: 05

SEMESTER – I
MA102: REAL ANALYSIS

UNIT I: **Sequence and series of functions:** Discussions of main problem , uniform convergence, uniform convergence and continuity, Uniform convergence and integration , uniform convergence and Differentiation of Equicontinuous families of functions. The stone – Weirstrass theorem**.** **-15 Hrs**

UNIT II: **The Riemann – Stieltjes Integral:** Definition and Existence of the integral, properties of the integral, integration and Differentiation, Integration of vector valued function, Rectifiable curves. **-10 Hrs**

UNIT III: **Improper Integrals:** Introduction, Integration of unbounded functions with finite limits of integration, comparison tests for convergence at a of $\int_a^b f\,dx$, infinite Range of integration, integral as a product of functions.

Fourier Series: Trigonometrical series, some preliminary theorems, the Main theorem, intervals other than $[-\pi, \pi]$. **-14 Hrs**

UNIT IV: **Function of Several Variables:** Explicit and Implicit functions, Continuity partial derivatives, differentiability, partial derivatives of higher order, differentials of higher order, function of function**,** change of variables, Taylor's theorem, Extreme values, Maxima and Minima, functions of several variables. **-13 Hrs**

Text Book:

"Principles of Mathematical Analysis" by Walter Rudin, 3rd edition (1976), McGraw hill international student edition.

Reference Books:

(i) "Mathematical Analysis" by "S.C.Malik 1994" Wiley Estern limited.

(ii) Mathematical Analysis- A modern Approach to AdvancedCalculus Narosa Book Distributors Pvt LTD- New Delhi.

(iii) Real Analysis - Golden Math Series By N.P. Bali.
(iv) AcourseofMathematicalAnalysisbyShantiNarayan-.KMittalS-Chand&Com.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Hrs: 52**
SEMESTER – I **Credits:05**
MA103: ORDINARY DIFFERENTIAL EQUATIONS

UNIT -I: **Oscillation Theory and boundary value problems:** Qualitative properties of solutions – The Sturm comparison theorem – Eigen values, Eigen functions and the vibrating string. **-13 Hrs**

UNIT - II: **Power series solutions:** Series solutions of first order equations – Second order linear equations – Ordinary points – Regular singular points – Gauss's hyper geometric equation. **-13 Hrs**

UNIT III: **Some special functions of Mathematical Physics:** Legendre polynomials – properties of Legendre polynomials – Bessel functions – The gamma function – Properties of Bessel functions. **-13 Hrs**

UNIT IV: **The existence and uniqueness of solutions**: The method of successive approximations – Picard's theorem. The second order linear equations.**-13 Hrs**

Text Book:

"**Differential Equations with Applications and Historical Notes"**
by George F. Simmons, (1992) Tata McGraw Hill Publications.

Reference Books:

1. Advanced Differential Equations, M.D. Raisinghania , S. Chand Publications

2. " Differential Equations" Ross, Shepley L Wieley India Pvt LTD.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) Total Hrs:52
SEMESTER – I Credits:04
MA104- DISCRETE MATHEMATICS

UNIT-I : Connectives – Negation – Conjunction – Disjunction – Statement Formulas and Truth Tables – Conditional and Biconditional Statements – Well – formed Formulas – Tautolgies – Equivalence of Formulas – Duality Law – Tautological Implications – Formulas with Distinct Truth Tables - Functionality Complete sets of connectives. **-14 Hrs**

UNIT-II: Normal Forms – Disjunctive , Conjunctive Principal Disjunctive, Principal conjunctive Normal Forms – Ordering and Uniqueness of Normal Forms. The theory of Inference for the statement Calculus – Rules of inferences – Consistency of premises – Automatic Theorem Proving. **-13 Hrs**

UNIT-III: Lattices and Boolean Functions: Lattices as Partially Ordered sets – Lattices as Algebraic Systems – Boolean Algebra – Boolean Functions – Minimization. **-12 Hrs**

UNIT-IV: Recurrence Relations: Generating functions of Sequences- calculating coefficient of generating functions recurrence relations-Solving recurrence relation by substitution and generating functions- the method of characteristic roots- Solutions of Inhomogeneous Recurrence relations.

-13 Hrs

Text Book:

"Discrete Mathematical Structures with Applications to Computer Science" by Tremblay , J.P. and Manohar , R. , McGraw Hill Book Company , 2nd Printing, 1988.

Reference Books:

1. **"Discrete Mathematics for computer Scientists and Mathematicians"** by Joe.L.Mott, Abraham Kandea, Theodore, P.Baker**.**
2. Discrete Mathematics & Graph Theory by Bhavanari Satyanarana & KunchamSyam Prasad, PHI Publications.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs: 52**
Credits : 04

SEMESTER – I

MA105: PROGRAMMING IN "C" & OOPS

UNIT I :

Overview of C – Constants, Variables – Data types – Operators – expressions – managing Input / Output operators **-13 Hrs**

UNIT II:

Decision Making and Branching- Decision making and Looping - Arrays **-13 Hrs**

UNIT III:

Handling of Character strings – User defined Functions,Pointers- Structures and Unions –File management in C **-13 Hrs**

UNIT IV:

Object-Oriented Programming Concepts **-13 Hrs**

Text Book:

(i) "**C Programming and Data Structures**" by E.Balaguruswamy, 4th Edition by Tata McGraw Hill Book Co.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs: 52**
Credits : 02

SEMESTER – I

MA106: LAB IN "C" PROGRAMMING & OOPS

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs : 52**
SEMESTER – II **Credits: 05**

MA201: LINEAR ALGEBRA

UNIT I: Linear transformations

Linear transformations – Isomorphism of vector spaces – Representations of linear transformations by matrices–Linear functional **13 hrs**

UNIT II: Algebra of polynomials

The algebra of polynomials–Polynomial ideals - The prime factorization of a polynomial-Determinantfunctions. **10hrs**

UNIT III: Determinants

Permutations and the uniqueness of determinants – Classical adjoint of a (square) matrix – Inverse of an invertible matrix using determinants – Characteristic values – Annihilating polynomials. **- 13hrs**

UNIT IV: Diagonalization

Invariant subspaces – Simultaneous triangulations – Simultaneous diagonalization – Direct-sum decompositions – Invariant direct sums – Primary decomposition theorem. **The Rational and Jordan forms:** Cyclic subspaces – Cyclic decompositions theorem (Statement only) – Generalized Cayley – Hamilton theorem - Rational forms – Jordan forms. **-16 hrs**

TEXT BOOK:

Kenneth M Hoffman and **Ray Kunze**, Linear Algebra, 2nd Edition, Prentice-Hall of India Pvt. Ltd, New Delhi, 2013.

BOOKS FOR SUPPLEMENTARY READING AND REFERENCES:

1. **M. Artin**, *"Algebra"*, Prentice Hall of India Pvt. Ltd., 2005.

2. **S.H. Friedberg, A.J. Insel and L.E Spence**, *"Linear Algebra*", 4th Edition, Prentice-Hall of India Pvt. Ltd., 2009.

3. **I.N. Herstein**, "Topics in Algebra", 2nd Edition, Wiley Eastern Ltd, New Delhi, 2013.

4. **J.J. Rotman**, *"Advanced Modern Algebra*", 2nd Edition, Graduate Studies in Mathematics, Vol. 114, AMS, Providence, Rhode Island, 2010.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs: 52**
SEMESTER – II **Credits:05**
MA202- PARTIAL DIFFERENTIAL EQUATIONS

UNIT I: **Ordinary Differential Equations in more than two variables:** Methods of solution of dx/P = dy/Q = dz/R – Orthogonal trajectories of a system of curves on asurface – Pfaffian differential forms and equations- Solution of Pfaffian Differential equations in Three variables. **-13 Hrs**

UNIT II: **Partial Differential Equations of the First order:** Partial differential equations –Origins of first order partial differential equations – Linear equations of first order – Integral surfaces passing through a given curve – Surfaces orthogonal to a given system of surfaces – Charpit's method.

-13 Hrs

UNIT III: **Partial Differential Equations of the Second Order:** The origin of second order equations – Linear partial differential equations with constant coefficients – Equations with variable coefficients**.** **-13 Hrs**

Unit IV: **Laplace's Equation:** Elementary solution of Laplace's equation – Families of equipotential surfaces – Boundary value problems – Separation of variables- Laplace's wave and Heat conduction equation.

-13 Hrs

Text Book:

"**Elements of Partial Differential Equations** "by IAN Sneddon

Reference Books:

1. Ordinary and Partial Differential Equations by M.D. Raisinghania

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Hrs : 52**
SEMESTER – II **Credits : 05**
MA203: COMPLEX ANALYSIS

UNIT-I: **Differentiation: Analytic Functions:** Derivative Rules for Differentiating Complex Functions - The Cauchy-Riemann Equations – Analytic Functions-Conformal Mapping of the Extended Plane. -Mobius Transformations- The Group Property of Mobius Transformations – The Circle –Preserving Property of Mobius Transformations – Fixed points of a Mobius Transformation – Invariance of Cross Ratio – Mapping of a Circle onto a Circle – Symmetry Transformations. **-14 Hrs**

UNIT - II: **Complex Integrals:** Cauchy Integral Theorem: Rectifiable Curves – Complex Integrals – The Case of Smooth Curves – Cauchy's Integral Theorem – The key Lemma – Proof of Cauchy's Integral Theorem – Application to the Evaluation of Definite Integrals – Cauchy's Integral Theorem for a system of Contours. Cauchy's Integral Formula and its Implications: Indefinite Integrals Cauchy's Integral Formula–Morera'sTheorem–Cauchy's Inequalities. **-14 Hrs**

UNIT III

Power Series: The Cauchy–Hadamard Theorem–Taylor Series. The Uniqueness Theorem for Power series – Expansion of an Analytic Function in a Power S eries - Liouville's Theorem.Laurent Series-Laurent's Theorem-Poles and Essential Singular points-Behavior at an Essential Singular point. Picard's Theorem-Behavior at infinity. **-12 Hrs**

UNIT IV:

The Residue Theorem and its Applications: The Residue Theorem-Residues at infinity-Jordan's Lemma-Evaluation of Definite Integrals – The Argument principal-The Theorems of Rouche and Hurwitz-Local Behavior of Analytic Mappings-The Maximum Modulus principle and Schwarz's Lemma. **-12 Hrs**

Text Book

"**Introductory Complex Analysis**" by Richard A. Silverman, Dover Publication,Inc(1972).

Reference books:

(i) Complex Variables - . Schaum outline series, 2/E by Speigel
(ii) An Introductions to Complex Analysis, by C.L. Siegel :North Holland, (1989).
(iii) Foundations of Complex Analysis by S. Ponnusamy- Narosa Publications.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs : 52**
SEMESTER – II **Credits: 05**

MA204: TOPOLOGY

UNIT I:

Metric spaces: the definition and some examples- open sets-closed sets-convergence, completeness and Baire's theorem –Continuous mappings- spaces of continuous functions- Euclidean and Unitary Spaces. **-14 Hrs**

UNIT II:

Topological spaces: The definition & examples- Elementary concepts- open bases and open subbases- weak topologies- the function algebras e(X, R) and e(X, C). **-12 Hrs**

UNIT III:

Compactness: Compact spaces-products spaces-Tychonoff's theorem and locally compact spaces-compactness for metric spaces-Ascoli's theorem. **-12 Hrs**

UNIT IV:

Separation: T_1 Spaces and Hausdorff spaces- completely regular spaces and normal spaces –Urysohn's lemma and Tietze extension theorem –the Ursohn's imbedding theorem – stone-cech compactification.

Connected spaces- Components of a space. **-14 Hrs**

Text Book:

"INTRODUCTION TO TOPOLOGY AND MODREN ANALYSIS" by G.F. SIMMONS of MC Graw Hill book company, inc, international student edition.

Reference Books:

1. 'Topology' by K.Chandra Sekhara Rao, Narosa Publications

2. "Topology" by J.P. Chauhan, J.N. Sharma, Krishna Publications

3."General Topology" by M.G. Murdeshwar, new age International publications

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs:52**
SEMESTER – II **Credits:02**
MA205: Problem Solving with MAT LAB/FOSS

LIST OF PROBLEMS SOLVING WITH MAT LAB/FOSS

(1).PROGRAM TO FIND ROOT OF GIVEN EQUATION USING BISECTION METHOD

(2).PROGRAM TO GENERATE FIBONACCI SERIES OF NUMBER

(3).PROGRAM TO GENERATE FIBONACCI N^{th} TERM OF NUMBER

(4).PROGRAM TO GENERATE RANDOM NUMBERS BETWEEN M AND N

(5).PROGRAM TO GENERATE MATRIX OPERATIONS

(6).PROGRAM TO GENERATE TRIGNOMETRIC FUNCTIONS WAVEFORMS

(7).PROGRAM TO GENERATE QUANTIZATION

(8).PROGRAM TO EXPONENTIAL SEQUENCE

(9).PROGRAM TO CONSTRUCTING AN INTERPOLATING POLYNOMIAL

(10).PROGRAM TO GENERATE MATRIX DETERMINANT

(11).PROGRAM TO GENERATE RANDOM MOTION FOR DIFFUSION EQUATION

(12).PROGRAM TO COMPUTES CHARACTERISTIC POLYNOMIAL FOR MATRIX

(13).PROGRAM TO COMPUTES SQUARE ROOT OF A NUMBER

(14).PROGRAM TO COMPUTES ROOTS OF A POLYNOMIAL

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) Total Hrs: 52
SEMESTER – II Credits: 03
MA206: BASIC MATHEMATICAL MODELLING (External Elective)

UNIT-I

Foundations: Basics-sets and Operations of Sets-Relations and Functions-Some methods of Proof and Problem-solving Strategies-Fundamentals of Logic-Logical Inferences-Methods of Proof of an Implication-First Order Logic and Other Methods of Proof-Rules of Inference for Quantified Propositions-Mathematical Induction

UNIT-II

Elementary Combinatorics: Basics of Counting-Combinations and Permutations-Enumeration of Combinations and Permutations-Enumerating Combinations and Permutations with Repetitions-Enumerating Permutations with Constrained Repetitions

UNIT-III

Binomial Coefficients-The Binomial and Multinomial Theorems-The Principle of Inclusion-Exclusion

UNIT-IV

Graphs: Basic Concepts-Isomorphisms and Subgraphs-Trees and Their Properties-Spanning Trees-Directed Trees-Binary Trees-Planar Graphs-Euler's Formula-Multigraph and Euler Circuits-Hamiltonian Graphs-Chromatic Numbers-The Four Color Problem.

TEXT BOOKS:

1. Discrete Mathematics, R.K.Bisht, H.S.Dhami, Oxford University Press 1st Edition 2015.
2. Discrete Mathematics for Computer Scientists & Mathematicians- Joe.L. Mott, Abraham Kandel Theodore P.Baker.
3. Elements of DISCRETE MATHEMATICS-A Computer Oriented Approach – C L Liu, D P Mohapatra.Third Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition.TMH.
2. Discrete Mathematical structures Theory and application-Malik & Sen., Cengage.
3. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
4. Logic and Discrete Mathematics, Grass Man & Trembley, Pearson Education

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs:52**
SEMESTER – III **Credits:05**

MA301- FUNCTIONAL ANALYSIS

UNIT –I :

The definitions and some examples –continuous –linear transformations-the Hahn-Banach Theorem. **-14 Hrs**

UNIT – II:

Natural imbedding of N in N**-Open mapping theorem –Conjugate of an Operator. **-12 Hrs**

UNIT – III:

Definition and some Simple Properties –Orthogonal Complements-Orthonormal sets – Conjugate spaces-Adjoint of an Operator. **-14 Hrs**

UNIT-IV:

Self adjoint operators –Normal and Unitary Operators-Projection –Spectral theorem. **-12 Hrs**

Text Book:

" Introduction to Topological and Modern analysis by G.F. Simmons Mc Graw Hill Book Company.

Reference books:

(1). " Foundations of Functional Analysis" by S. Ponnyusamy-NarosaPublications.

(2). " Text book of Functional Analysis – A Problem oriented Approach"

by V.K. Krishnan-Prentice Halls of India Publishers.

(3). " Functional Analysis" by B.V. Limaye New age International Publishers.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs: 52**
SEMESTER – III **Credits:05**
MA302- NUMERICAL ANALYSIS

UNIT-I:

Interpolation with Cubic splines : Divided differences and their properties – Inverse interpolation – double interpolation- Least squares curve fitting procedures – Weighted Least squares Approximation - Approximation of functions. **-13 Hrs**

UNIT-II:

Numerical solutions of O.D.E: Predictor – Corrector methods- Adams MoultonMethod - Milne's methods – The Cubic spline method – Boundary value Problems- Finite difference method -The Shooting method and The Cubic Spline method. **-13 Hrs**

UNIT-III:

Numerical methods of P.D.E.: Finite difference approximations to derivatives- **L**aplace's equations- Jacobi's method- Gauss Seidel method- Successive over Relaxation method- ADI method – Parabolic equations – Itrative methods for the solution of equations – Hyperbolic equations. **-13 Hrs**

UNIT-IV:

The Finite Element Method: Functionals- Base Functions- The Rayleirh –Ritz Method- The Galerkin Method- Application to two dimensional problems- Finite element method for one dimensional problems- Applications to two dimensional problems. **-13 Hrs**

Text Book:

"Introductory methods of Numerical Analysis " by S.S.Sastry (Third Edition) 1998.

Reference Books:

1. Numerical Methods : Problems and solutions, M.K. Jain, R.K. Jain, SRK Iyengar- Newage International Publications.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) Total Hrs: 52
SEMESTER – III Credits :05
MA303: MATHEMATICAL METHODS

UNIT-I

Integral Transforms: General definition of Integral transforms, Kernels, etc. Development of Fourier integral, Fourier transforms – inversion, Illustration on the use of integral transforms, Laplace, Fourier, Hankel and Mellin transforms to solve ODEs and PDEs - typical examples. Discrete orthogonality and Discrete Fourier transform. Wavelets with examples, wavelet transforms. **12 Hrs.**

UNIT-II

Integral Equations: Definition, Volterra and Fredholm integral equations. Solution by separable kernel, Neumann's series resolvent kernel and transform methods, Convergence for Fredholm and Volterra types. Reduction of IVPs BVPs and eigenvalue problems to integral equations. Hilbert Schmidt theorem, Raleigh Ritz and Galerkin methods. **14 Hrs.**

UNIT-III

Asymptotic expansions : Asymptotic expansion of functions, power series as asymptotic series, Asymptotic forms for large and small variables. Uniqueness properties and Operations.
Asymptotic expansions of integrals; Method of integration by parts (include examples where the method fails), Laplaces method and Watson's lemma, method of stationary phase and steepest descent. **12 Hrs.**

UNIT-IV

Regular and singular perturbation methods: Parameter and co-ordinate perturbations. Regular perturbation solution of first and second order differential equations involving constant and variable coefficients. Include Duffings equation, Vanderpol oscillator, small Reynolds number flow. Singular perturbation problems, Matched asymptotic expansions, simple examples. Linear equation with variable coefficients and nonlinear BVP's. Problems involving Boundary layers. Poincare – Lindstedt method periodic solution. WKB method, turning points, zeroth order Bessel function for large arguments, solution about irregular singular points. **14 Hrs.**

TEXT BOOKS

1. I.N. Sneddon – The use of Integral Transforms, Tata Mc Graw Hill, Publishing Company Ltd, New Delhi, 1974.
2. R.P. Kanwal: Linear integral equations theory and techniques, Academic Press, New York, 1971.
3. C.M. Bender and S.A. Orszag – Advanced mathematical methods for scientists and engineers, Mc Graw Hill, New York, 1978.

REFERENCE BOOKS

1. H.T. Davis – Introduction to nonlinear differential and integral equations, Dover Publications, 1962.
2. A.H. Nayfeh – Perturbation Methods, John Wiley & sons New York, 1973.
3. Don Hong, J. Wang and R. Gardner. Real analysis with introduction to wavelets and applications, Academic Press Elsevier (2006).

4. R.V. Churchill: Operational Mathematics, Mc. Graw Hill, New York, 1958.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs:52**
SEMESTER – III **Credits:05**
MA304: CLASSICAL MECHANICS

Unit-I: D'Alembert's Principle and Lagrange's Equations: Some Definitions – Classification of Dynamical System – Some Examples of Constraints – Virtual Displacement – Principle of Virtual Work – Generalised Force in Holonomic System – Mathematical Expression for the principle of Virtual work – D'Alembert's principle – Lagrange's Equations for a Holonomic system – Velocity – dependent Potential – Lagrange's Equations of Motion for conservative , Non – holonomic system – Physical Significance of λ_1 - Harmonic Oscillator. **-13 Hrs**

Unit-II :Variational Principle and Lagrange's Equations: Variational Principle – Calculus of Variations – Hamilton Principle – Derivation of Hamilton's principle from Lagrange's Equations – Derivation of Lagrange's Equations from Hamilton's Principle – Extension of Hamilton's Principle – Hamilton's Principle for Non – conservative , Non – holonomic System – Generalised Force in Dynamic System – Hamilton's Principle for Conservative – Non holonomic system – Lagrange's Equations for Non – conservative – Holonomic System – Cyclic or Ignorable Coordinates – Conservation Theorem – Conservation of Linear Momentum in Lagrangian Formulation – Conservation of Angular Momentum in Lagrangian Formulation – Conservation of Angular Momentum – Conservation of Energy in Lagrangian Formulation **- 13 Hr**

Unit-III: Hamilton's Equations of Motion: Derivation of Hamilton's Equations of Motion(using Lagrange's Equations)–Routh's Procedure–Equations of Motion– Derivation of Hamilton's Equations from Hamilton's Principle–Principle of Least Action–Distinction between Hamilton Principle and Principle of Least Action-**13Hr**

Unit-IV: Canonical Transformations: Canonical Coordinates and Canonical Transformations – The necessary and Sufficient Condition for a Transformation to be Canonical – Examples of Canonical Transformations – Properties of Canonical Transformations – Infinitesimal Contact Transformation – Relation between Infinitesimal Contact Transformation and Poissson's Bracket – Hamilton – Jacob Theory – Hamilton – Jacobi equations for Hamilton's Principal Function. **-13Hrs**

Text Book:

"**Classical Mechanics** "by C.R. MONDAL Prentice Hall of India Private Limited, New Delhi 110001, 2001.

Reference books:

(1). Classical Mechanics by Goldstein Herbert, Charles P Poole, John safiko-Pearson, India.

(2). Introduction to Classical Mechanics by Takwale R. Puranik P, Mc.Graw Hill Education.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs: 52**
SEMESTER – III **Credits: 02**
MA305- LAB: NUMERICAL METHODS

Soft Core (Problems on Numerical Methods) LAB:

(1). Bisection Method Module

(2). Newton-Raphson Method Module

(3). Newton's Method for 2D Module

(4). Lagrange Interpolation Module

(5). Chebyshev Polynomials Module

(6). Newton Polynomials Module

(7). Hermite Polynomials Module

(8). Numerical Differentiation Module 1 Module 2

(9). Simpson's Quadrature Rule Module

(10).Simpson's 2D Quadrature Module

(11). Romberg Integration Module

(12). Gauss-Legendre Quadrature Module

(13). Euler Methods Module

(14). Taylor Method for ODE's Module

(15). Runge-Kutta Method Module

(16). Adams-Bashforth-Moulton Method Module

(17). Gauss-Jordan Method Module

(18). Conic Section Curves Module

(19). Matrix Inversion Module

(20). A = LU Factorization Module

(21). Polynomial Curve Fit Module 1 Module 2

(22). Nonlinear Curve Fit Module

(23). Logistic Curve Project Module

(24). FFT - Trig. Polys. Module 1 Module 2

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Two-Year M. Sc. Mathematics Course(CBCS) Total Hrs: 52
SEMESTER – III Credits:03
MA306-MATHEMATICS FOR SOCIAL AND BIOLOGICAL SCIENCES
(External Elective)

UNIT I:

Linear Algebra: Matrices –Rank of a matrix, Elementary transformations of matrix, inverse of a matrix, System of linear equations, linear transformations, Eigen value and Eigen vectors . Vector Analysis – Definition of a vector, manipulation-Scalar product, Vector product; orthogonal components of a vector, Differentiation of vectors. **-13 Hrs**

UNIT II

Differential Calculus: Limits and continuity, Differentiation of functions, Successive differentiation, Leibnitz's theorem for nth derivative, tylor's and maclaurin's series , applications to maxima and minima of functions, partial differentiation , Euler's theorem.

-13 Hrs

UNIT III

Integral calculus: Introduction, integration –by substitution, by parts, by partial fractions; Definite integrals, Applications to areas, lengths, and volumes. Differential Equations: Equations of 1^{st} order and 1^{st} degree. **-13 Hrs**

UNIT IV

Numerical Methods : Computer arithmetic , Representation of numbers, computer errors in representing numbers, finding roots of equations- Bisection, Newton, and Secant methods; Interpolation and Numerical differentiation –Polynomial interpolation, Newton-Gregory forwarded interpolation , Backward differences ; Numerical integration- Trapezoidal and Simpson's rules. **-13 Hrs**

Text Books:

1. Grewal B.S. Elementary Engineering Mathematics, 10^{th} edition, Khanna Publishers
2. Cheney W, and Kincaid D, Numerical Mathematics and computing, Vikas Publications, 2003

Reference Books

1. Lipschutz S, and Lipson M, Schaum's Outline Algebra Mc Graw –Hill, 2000
2. Ayres F, and Mendelson E, Schaum's Outline of Calculus, 4^{th} edition , Mc Graw – Hill,1999
3. Rajaraman V, Computer Oriented Numerical method, 3^{rd} edition , PHI,1993

DRAVIDIAN UNIVERSITY, KUPPAM – 517 425
DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs: 52**
SEMESTER – IV **Credits:05**
MA401-MEASURE AND INTEGRATION

UNIT –I :

Lebesgue Measure: Introduction, Outer measure, Measurable sets and Lebesgue measure, a non measurable set, Measurable functions, Little wood's three principles **-13 Hrs**

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 , convergence in measure. **-13 Hrs**

UNIT – III:

Differentiation and Integration: Differentiation of Monotone functions –Functions of bounded variations-Differentiation of an integral – Absolute continuity –Convex functions. **-13 Hrs**

UNIT-IV:

The Classical Banach Spaces: The L^P Spaces- The MinKowski and Holder Inequalities- Convergence and completeness- Approximation in L^P- Bounded linear functional on the L^P Spaces. **-13 Hrs**

Text Book:

" Real Analysis" by H.L. Royden, Prentice Hall of India private limited, New Delhi,2001-Third edition.

Reference Books:

1. Principles of Mathematical Analysis , Third Edition by Walter Rudin
2. Real Analysis – Golden Math Series by N.P. Bali.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course **Total Hrs:52**
SEMESTER – IV **Credits:05**
MA402: FLUID DYNAMICS

UNIT-I Kinematics of Fluids in Motion:

Real Fluids and Ideal Fluids. Velocity of a Fluid at a Point. Stream Lines and Path Lines. Steady and Unsteady Flows. The Velocity Potential. The Vorticity Vector. Local and Particle Rates of Change. The Equation of Continuity. Acceleration of a Fluid. Conditions at a Rigid Body.Equations of Motion of Fluid: Euler's equation of Motion. Bernoulli's equation.

-13 Hrs

UNIT-II Some Three- dimensional flows:

Introduction. Sources, Sinks and Doublets.Some Two- dimensional flows: Meaning of Two-Dimensional flow. The Stream Function. The Complex Potential for two-dimensional irrotational and incompressible flow. Complex Velocity Potentials for standard two-dimensional flows. Uniform stream. Line Sources, Line Sinks and Line Doublets. Line Vortices. **-13 Hrs**

UNIT-III The Milne-Thompson Circle Theorem. Some Applications of the Circle theorem. Extension of the Circle theorem. The theorem of Blasius. Viscous Flows: Stress analysis in Fluid motion. Relation between stress and rate of strain. The Coefficient of Viscosity and Laminar Flow. **-13 Hrs**

UNIT-IV The Navier-Stokes equation of motion of Viscous Fluids. Some solvable Problems. Steady motion between parallel planes through tube of uniform cross section and flow between concentric rotating cylinders.Steady Viscous Flow in a tube of uniform cross section: A Uniqueness Theorem. Tube having uniform elliptic cross section and equilateral cross section. Diffusion of Vorticity. Energy dissipation due viscosity. **-13 Hrs**

Text Book:

"Standard and Treatment as a Fluid Dynamics" by Frank Charlton- CBS Publications.

Reference Books:

1. Theoretical Hydrodynamics by L.M.Milne-Thompson, Macmillan.
2. Modern Fluid Dynamics by N.Curle and H.J.Davies, VanNostrand.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs:52**
SEMESTER – IV **Credits:04**
MA403: GRAPH THEORY

UNIT I: Graphs & Subgraphs : Graphs and simple Graphs – Isomorphism – Incidence and adjacency Matrices – Sub graphs – Vertex Degrees – Paths and connection – Cyles – Shortest path – Problem – Sperner's Lemma. **-13 Hrs**

UNIT II: Trees: Trees – Edges and Bonds – Cut vation Cyley's Formula – Application – Connected problem. **-13 Hrs**

UNIT III: Connectivity: Connectivity – Blocks – Application Construction of Reliable communication Networks. **-13 Hrs**

UNIT IV: Euler Tohn and Hamiltonian Cycles: Euler Tours – Hamilton cycles Application - Chinese Postman Problem – Travelling Salesman Problem. **-13 Hrs**

Text Book :

"**Graph Theory with application**" J.A.Bondy and U.S.R.Murthy, Mc.Millan Press.

Rererence Books:

(1). Graph Theory with applications to Engineering and Computer Science – Narsingh Deo

(2).First look at Graph Theory- John Clark Derek Allaw Holton.

(3).Introduction to Graph Theory- Robin. J. Wilson

(4). Introduction to Graph Theory- Douglas B. West

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) Total Hrs:52
SEMESTER – IV Credits:04
MA404 (A)-OPERETIONS RSEARCH (Internal Elective)

UNIT I:**Linear Programming:** Graphical Method-Simplex Method-Big M Method-Two Phase Method-Duality in LP,-Transportation problem **-11 Hrs**

UNIT II: Inventory Control: Models of Inventory-Operation of Inventory Systems –Quantity Decisions-Implementation of Purchase Inventory Model-Multiple Item Model with Shortage Limitation. **-12 Hrs**

UNIT III:Dynamic Programming: Introduction –Capital Budgeting Problem Reliability improvement problem-Stage coach problem-Optional subdividing Problem- Solution Linear Programming Problem through Dynamic Programming. **-14 Hrs**

UNIT IV:Game Theory: Introduction-Game with pure strategies- Game with Mixed Strategies-Dominance Property –Graphical Methods for 2xn and mx2 Games- Linear Programming approach to Game theory (Chapter 12) Project Management: Guidelines for Network construction- Critical path Method (CPM)-Program Evaluation and review technique (PERT). **-15 Hrs**

Text Book:

"OPERATIONS RESEARCH" BY Pannerselvam , R , Published by Prentice Hall Of India, New Delhi, 2002 Edition.

Reference books:

(1). Introduction to Management Science " Operation Research" by Manmohan . P, P.K. Gupta, Kantiswarup, Sultan Chand & Sons Publishing house.
(2). Operations Research –Theory and Applications by J.K. Sharma- Macmillan Publishers,India.
(3). Operations Research –by Gupta, Prem Kumar, Hira S. Chand Publishers.
(4).Operations Research- by S.D Sharma
(4).Operations Research- by Thaha.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) Total Hrs:52
SEMESTER – IV Credits:04

MA404 (B): MATHEMATICAL MODELING (Internal Elective)

UNIT-I

Meaning of first and second order ordinary derivatives – slope of a tangent and curvature. Connecting these concepts to practical observation. **-10 Hrs**

UNIT-II

Meaning of first and second order partial derivatives – slope of a tangent and curvature. Connecting these concepts to practical observation. **-10 Hrs**

UNIT-III

Basic concepts. Real world problems, (Physics, Chemistry, Biology, Economics, and others) Approximation of the problem, Steps involved in modeling. **-10 Hrs**

UNIT-IV

Mathematical models : Linear growth and decay model, Logistic model, model of Mass-spring-dashpot (present in shock absorbed, mechanical engineering problems), Chemical reaction, Drug absorption from blood stream. Motion of a projectile. Current flow in electrical circuits(LCR), Model for deduction of diabetes, Nonlinear system of equation-Combat models- predator- prey equations, spread of epidemics, Models leading to linear and nonlinear partial differential equations - Vibration of string, Vibration of drum, Heat equation and Laplace equation and Poisson equation, Burger's equation, Fisher's equation, Telegraph equations. **-32 Hrs.**

TEXT BOOKS

1.J. N. Kapur : Mathematical Moodelling, Wiley Eastern Ltd., 1998.
2.E. Kreyszig, Advanced Engineering Mathematics, Wileyeastem, 2002.

REFERENCE BOOKS

7. Neil Gerschenfeld : The nature of Mathematical modeling, Cambridge Univeristy Press, 1999.
8. A. C. Fowler : Mathematical Models in Applied Sciences, Cambridge Univeristy Press, 1997.

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DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course (CBCS) **Total Hrs:52**
SEMESTER – IV **Credits:04**

MA405 (A): DIFFERENTIAL GEOMENTRY (Internal Elective)

UNIT-I

Calculus on Euclidean Space: Euclidean space. Natural coordinate functions. Differentiable functions. Tangent vectors and tangent spaces. Vector fields. Directional derivatives and their properties. Curves in E^3. Velocity and speed of a curve. Reparametrization of a curve. 1-forms and Differential forms. Wedge product of forms. Mappings of Euclidean spaces. Derivative map.

13 Hrs.

UNIT-II

Frame Fields**:**Arc length parametrization of curves. Vector field along a curve. Tangent vector field, Normal vector field and Binormal vector field. Curvature and torsion of a curve. The Frenet formulas Frenet approximation of unit speed curve and Geometrical interpretation. Properties of plane curves and spherical curves. Arbitrary speed curves. Cylindrical helix Covariant derivatives and covariant differentials. Cylindrical and spherical frame fields. Connection forms. Attitude matrix. Structural
equations. Isometries of E^3 - Translation, Rotation and Orthogonal transformation.
The derivative map of an isometry. **13 Hrs.**

UNIT-III

Calculus on a Surface: Coordinate patch. Monge patch. Surface in E^3 . Special surfaces-sphere, cylinder and surface of revolution. Parameter curves, velocity vectors of parameter curves, Patch computation. Parametrization of surfaces- cylinder, surface of revolution and torus. Tangent vectors, vector fields and curves on a surface in E^3. Directional derivative of a function on a surface of E^3. Differential forms and exterior derivative of forms on surface of E^3. Pull back functions on surfaces of E^3.

13 Hrs.

UNIT-IV

Shape Operators: Definition of shape operator. Shape operators of sphere, plane, cylinder and saddle surface. Normal curvature, Normal section. Principal curvature and principal direction. Umbilic points of a surface in E^3. Euler's formula for normal curvature of a surface in E^3. Gaussian curvature, Mean curvature and Computational techniques for these curvatures. Minimal surfaces. Special curves in a surface of E^3 -
Principal curve, geodesic curve and asymptotic curves. Special surface - Surface of revolution. **13 Hrs.**

TEXT BOOKS

1. Barrett O' Neil : Elementary Differential Geometry. Academic Press, New York and London, 1966
2. T.J.Willmore : An introduction to Differential Geometry. Clarendon Press, Oxford 1959.

REFERENCE BOOKS

1. D.J.Struik : Lectures on Classical Differential Geometry, Addison Wesley, Reading, Massachusetts, 1961.
2. Nirmala Prakassh: Differential Geometry- an integrated approach. Tata McGraw-Hill, New Delhi, 1981.

DRAVIDIAN UNIVERSITY, KUPPAM – 517 425
DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **TotaHrs:52**
SEMESTER – III **Credits:04**

MA405 (B): NUMBER THEORY (Internal Elective)

UNIT –I :

Arithmetical Functions and Dirichlet Multiplication: Introduction-The Mobius function (n)-The Euler totient function (n) –A relation connection and -A product formula for (n) - The Dirichlet product of arithmetical functions –Dirichlet inverses and the Mobius inversion formula-The Mangoldt function Λ(n) – Multiplicative functions-Multiplicative functions and Dirichlet multiplication-The inverse of a completely multiplicative function-Liouville's Function λ(n)-the divisor functions (n) – Generalized convolutions –Formal power series –The Bell series of an arithmetical function –Bell series and Dirichlet multiplications –Derivatives of arithmetical functions-The Selberg identity . **-13 Hrs**

UNIT – II:

Averages of Arithmetical Functions : Introduction –The big oh notation Asymptotic equality of functions-Euler's summation formula –Some elementary asymptotic formulas-The average order of d(n)-The average order of the divisor functions (n)-The average order of (n) -An application to the distribution of lattice points visible from the origin-The average order of (n) and of Λ(n) -Another identity for the partial sums of a Dirichlet product. **-13 Hrs**

UNIT – III:

Congruences: Definition and basic properties of congruences-Residue classes and complete residue systems-Linear congruences –Reduced residue systems and the Euler-Fermat theorem- Polynomial congruences modulo p.Langranage's theorem-Applications of Lagarange's theorem-Simultaneous linear congruences – The Chinese remainder theorem –Applications of the Chinese remainder theorem –Polynomial congruences with prime power moduli- The Principle of cross-classification- A decompositionpropertyofreducedresiduesystems **-13Hrs**

UNIT-IV:

Quadratic Residues and the Quadratic Reciprocity Law: Quadratic residues-Lengendre's symbol and its properties –Evaluation of (-1|p) and (2|p) –Gauss' lemma-The quadratic reciprocity law –Applications of the reciprocity law –The Jacobi symbol.Primitive Roots: The exponent of a number mod m. Primitive roots – Primitive roots and reduced residue systems – The non existence of primitive roots mod 2^{α} for $\alpha \geq 3$. **-13 Hrs**

Text Book:

"Introduction to Analytical Number Theory" by Tom. M. Apostal, Springer International Student Edition .

Reference Books:

(1) "Disquisitiones Arithmeticae" by Carl Friedrich Gauss.

(2) "A Classical Introduction to Modern Number Theory" by Michael rosen,Kenneth Ireland.

DRAVIDIAN UNIVERSITY, KUPPAM – 517 425
DEPARTMENT OF MATHEMATICS
Two-Year M. Sc. Mathematics Course(CBCS) **Total Hrs:52**
SEMESTER – IV **Cridits:03**
MA406: Project Work