
CORE COURSES

B.Sc. (Honours)-Mathematics

Semester-I

MATH.(Hons) -CC-1: Calculus-I

(Total Marks: 100)

Part-I (Marks: 75) Time – 3 hrs.

(Theory:Sem-60 Marks+Mid-Sem-15 Marks, Credit – 6 [4(Th.) + 2 (Pr.)])

Unit-I

Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of the type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, asymptotes.

Unit-II

Curve tracing in Cartesian coordinates, tracing in polar coordinate of standard curves, L'Hospital's rule, applications in business, economics and life sciences, Reduction formulae, Derivations and illustrations of reduction formulae of the type $\int \sin nx dx$, $\int \cos nx dx$, $\int \tan nx dx$, $\int \sec nx dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^n x dx$

Unit-III

Volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Unit-IV

Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics. Sphere, Cone, Cylinder, Central Conicoids.

Unit-V

Triple product, introduction to vector functions, operations with vector-valued functions, limits and Continuity of vector functions, differentiation and integration of vector functions, tangent and normal Components of acceleration.

Math. Part-II C – I (Practical, Marks:25)

List of Practicals (Using any software)

Practical/ Lab work to be performed on a Computer.

1. Plotting the graph of the function se^{ax+b} , $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).
4. Tracing of conics in cartesian coordinates/ polar coordinates.
5. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, hyperbolic paraboloid using Cartesian coordinates.
6. Matrix operation (addition, multiplication, inverse, transpose).

Books Recommended:

1. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007. Chapters: 4 (4.3, 4.4, 4.5 & 4.7), 9 (9.4), 10 (10.1-10.4).
2. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002. Chapters: 6, (6.2-6.5), 7 (7.8), 8 (8.2-8.3), Pages: 532-538, 11 (11.1), 13 (13.5)
3. Analytical Geometry of Quadratic Surfaces, B. P. Acharya and D. C. Sahu, Kalyani Publishers, New Delhi, Ludhiana.
4. Elements of vector calculus by Sarana & Prasad + 878

Books for Reference:

1. G. B. Thomas and R. L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
3. Text Book of Calculus, Part-II- Shantin Narayan, S. Chand & Co.,
4. Text Book of Calculus, Part-III- Shantin Narayan, S. Chand & Co.,
5. Shanti Narayan and P. K. Mittal- Analytical Solid Geometry, S. Chand & Company Pvt. Ltd., New Delhi.

CORE COURSES**MATHEMATICS- SEMESTER- 1****Math (Hons) C-1I : Algebra-I Time – 3 hrs.****Total Marks: 100****Theory: Sem.-80 Marks + Mid- Sem: 20 Marks Credit - 6****5 Lectures, 1 Tutorial (per week per student)****Unit-I**

Polar representation of complex numbers, n -th roots of unity, De Moivre's theorem and its applications.

Unit-II

Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm.

Unit-III

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $Ax=b$, solution sets of linear systems, applications of linear systems, linear independence.

Unit-IV

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices

Sub spaces of \mathbb{R}^n , dimension of sub spaces of \mathbb{R}^n

Unit-IV

Congruence relation between integers, Principles of Mathematical Induction, statement of

Fundamental theorem of Arithmetic Rank of a matrix, Eigenvalues, EigenVectors and Characteristic Equation of a matrix.

Books Recommended:

1. L. V. Ahlfors, Complex Analysis, McGraw-Hill (International Student Edn.)
2. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006. Chapter: 2
3. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005. Chapters: 2 (2.4), 3, 4 (4.1-4.1.6, 4.2-4.2.11, 4.4(4.1-4.4.8), 4.3-4.3.9, 5(5.1-5.1.4).
4. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint
5. V. Krishanmurthy, V. P. Mainra & J. B. Arara – An Introduction of Linear Algebra Chapters: 1(1.1-1.9), 2(2.1-2.3, 2.8, 2.9), 5(5.1, 5.2)

Semester-II

CORE COURSES

Math (Hons) CC-III : Real Analysis (Analysis-I)

Time – 3 hrs.

Total Marks: 100

Theory: Sem.-80 Marks + Mid-Sem: 20 Marks

Credit - 6

5 Lectures, 1 Tutorial (per week per student)

Unit-I

Review of Algebraic and Order Properties of \mathbb{R} , Neighborhood of a point in \mathbb{R} , Idea of countable sets, uncountable sets and uncountability of \mathbb{R} . Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima.

Unit-II

The Completeness Property of \mathbb{R} , The Archimedean Property, Density of Rational (and Irrational) numbers in \mathbb{R} , Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano – Weierstrass theorem for sets.

Unit-III

Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy Convergence Criterion.

Unit-IV

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n -th root test,

Integral test.

Unit-V

,Alternating series,Leibniz test, Absolute and Condition al convergence.

Books Recommended:

1.G.DasandS.Pattanayak,FundamentalsofMathematicsAnalysis,TMHPublishingCo.,Chapters:2(2.1to2.4,2.5to2.7),3(3.1-3.5),4(4.1to4.7,4.10,4.11,4.12,4.13).

Books for References:

1.R.G.BartleandD.R.Sherbert,IntroductiontoRealAnalysis,3rdEd.,JohnWileyandSons(Asia)Pvt.Ltd., Singapore, 2002.

2.GeraldG.Bilodeau , Paul R.Thie,G.E.Keough,AnIntroductiontoAnalysis,2ndEd.,Jones&Bartlett,2010.

3.BrianS.Thomson,Andrew.M.BrucknerandJudithB.Bruckner,ElementaryRealAnalysis,PrenticeHall,2001.

4.S.K.Berberian,AFirstCourseinRealAnalysis,SpringerVerlag,NewYork,1994.

5.S.C.MallikandS.Arora-MathematicalAnalysis,NewAgeInternationalPublications.

6.D.SmasundaramandB.Choudhury-AFirstCourseinMathematicalAnalysis,NarosaPublishingHouse.

7.S.L.GuptaandNishaRani-RealAnalysis,VikasPublishingHousePvt.Ltd.,NewDelhi.

8. R.B. Dash & D.D. Dalai – A Course on Mathematical analysis, Kalyani Publisher

CORE COURSES

Semester-II

Math (Hons) – CC -IV : DifferentialEquations

Time – 3 hrs. Full Marks:100 [60 (Sem.) + 15 (In.) + 25 (Pr.)]

Credit – 6 [4(Th.) + 2 (Pr.)]

Part-I (Marks:75)

Theory: 60 Marks + Mid-Sem:15 Marks

04 Lectures (per week per student)

Unit-I

Differential equations and mathematical models. First order and first degree ODE (variables separable, homogeneous, exact ,and linear). Equations of first order but of higher degree.

Applications of first order differential equations(Growth, Decay and Chemical Reactions, Heatflow, Oxygen debt, Economics).

Unit-II

Second order linear equations (homogeneous and non-homogeneous) with constant coefficients, second order equations with variable coefficients, variation of parameters, method of undetermined coefficients

Unit-III

Euler's equations reducible to linear equations with constant coefficients, Euler's equation. Applications of second order differential equations.

Unit-IV

Power series solutions of second order differential equations.

Unit-V

Laplace transforms and its applications to solutions of differential equations.

Part-II C – IV (Practical: Marks:25)

List of Practicals (Using any Software)

Practical /Lab work to be performed on a Computer.

1. Plotting of second order solution of family of differential equations.
2. Growth model (exponential case only).
3. Decay model (exponential case only).
4. Oxygen debt model.
5. Economic model.

Book Recommended:

1. J. Sinha Roy and S. Padhy, A Course of Ordinary and Partial Differential Equations, Kalyani Publishers, New Delhi. Chapters: 1, 2 (2.1 to 2.7), 3, 4 (4.1 to 4.7), 5, 7 (7.1-7.4), 9 (9.1, 9.2, 9.3, 9.4, 9.5, 9.10, 9.11, 9.13).

Books for References:

1. Martin Braun, Differential Equations and their Applications, Springer International.
2. M.D. Raisinghania - Advanced Differential Equations, S. Chand & Company Ltd., New Delhi.
3. G. Dennis Zill - A First Course in Differential Equations with Modelling Applications, Cengage Learning India Pvt. Ltd.
4. S.L. Ross, Differential Equations, John Wiley & Sons, India, 2004

MATHEMATICS- SEMESTER - 1 / III (Interdisciplinary):

GE-I: Calculus and Ordinary Differential Equations

Time – 3 hrs. F.M.–100 [80(End Sem) + 20(Mid Sem)] Credit

Unit-I

Curvature, Asymptotes, Tracing of Curves (Cartenary, Cycloid, Folium of Descartes, Astroid, Limacon, Cissoid & loops), Rectification, Quadrature, Volume and Surface area of solids of revolution.

Unit-II

Sphere, Cones and Cylinders, Conicoid.

Unit-III

Explicit and Implicit functions, Limit and Continuity of functions of several variables, Partial derivatives, Partial derivatives of higher orders, Homogeneous functions, Change of variables, Mean value theorem, Taylors theorem and Maclaurins theorem for functions of two variables. Maxima and Minima of functions of two and three variables, Implicit functions, Lagranges multipliers. Multiple integrals.

Unit-IV

Ordinary Differential Equations of 1st order and 1st degree (Variables separable, homogenous, exact and linear). Equations of 1st order but higher degree.

Unit-V

Second order linear equations with constant coefficients, homogeneous forms, Second order equations with variable coefficients, Variation of parameters. Laplace transforms and its applications to solutions of differential equations.

Books Recommended:

1. Advanced Higher Calculus (Vidyapuri Dr. Ghanasyam Sen & Others)
Ch- 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
2. B. P. Acharya and D. C. Sahu-Analytical Geometry of Quadratic Surfaces, Kalyani Publishers, New Delhi, Ludhiana. Ch. (2,3,4)
3. J. Sinharoy and S. Padhy-A Course of Ordinary and Partial Differential Equations, Kalyani Publishers. Chapters: 2(2.1 to 2.7), 3, 4(4.1 to 4.7), 5, 9(9.1, 9.2, 9.3, 9.4, 9.5, 9.10, 9.11, 9.13).

Books for References:

1. Shanti Narayan and P.K. Mittal-Analytical Solid Geometry, S. Chand & Company Pvt. Ltd., New Delhi.
2. David V. Weider-Advanced Calculus, Dover Publications.
3. Martin Braun-Differential Equations and their Applications-Martin Braun, Springer International.
4. M. D. Raisinghania- Advanced Differential Equations, S. Chand & Company Ltd., New Delhi
5. G. Dennis Zill-A First Course in Differential Equations with Modelling Applications, Cengage Learning India Pvt. Ltd.

MATH.-DSC-I, SEM-I IS SAME AS MATH.-CC-I,

SEM-I

MATHEMATICS- SEMESTER – II / IV (Interdisciplinary):

GE-II: : Linear Algebra and Advanced Algebra

Time – 3 hrs. F.M. – 100 [80 (Th.) + 20 (Pr.)] Credit - 6

Unit-I

Vector space, Subspace, Span of a set, Linear dependence and Independence, Dimensions and Basis. Linear transformations, Range, Kernel, Rank, Nullity, Inverse of a linear map, Rank-Nullity theorem.

Unit-II

Matrices and linear maps, Rank and Nullity of a matrix, Transpose of a matrix, Types of matrices. Elementary row operations, System of linear equations, Matrix inversion using row operations, Determinant and Rank of matrices, Eigenvalues, Eigenvectors, Quadratic forms.

Unit-III

Group Theory: Definition and examples, Subgroups, Normal subgroups, Cyclic groups, Cosets, Quotient groups, Permutation groups, Homomorphism.

Unit-IV

Ring Theory: Definition and examples, Some special classes of Rings, Ideals, Quotient rings, Ring homomorphism. Isomorphism theorems.

Unit-V

Zero divisors, Integral domain, Finite fields, Finite field $\mathbb{Z}/p\mathbb{Z}$, Field of quotients of an Integral domain, Polynomial ring, Division algorithm, Remainder theorem, Factorization of polynomials, irreducible and reducible polynomials, Primitive polynomials, Irreducibility tests, Eisenstein Criterion.

Books Recommended:

1. V. Krishnamurty, V. P. Mainra, J. L. Arora- An introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd., New Delhi, Chapters: 3, 4 (4.1 to 4.7), 5 (except 5.3), 6 (6.1, 6.2, 6.5, 6.6, 6.8), 7 (7.4 only).
2. I. N. Herstein, Topics in Algebra
Ch-1 (1.3 only), 2 (2.1 to 2.6; 2.7 excluding application, 2.10), 3 (3.1 to 3.6, 3.9, 3.10)

Books for References:

1. I. H. Sethi- Abstract Algebra, Prentice Hall of India Pvt. Ltd., New Delhi. Chapters: 13, 14, 15, 16, 17, 18, 19, 20.
2. Rao and Bhimasankaran- Linear Algebra, Hindustan Publishing House.

- 3.S.Singh-LinearAlgebra,VikasPublishingHousePvt.Ltd.,NewDelhi.
- 4.GilbertStrang-LinearAlgebra&itsApplications,CengageLearningIndiaPvt.Ltd.
- 5.Gallian-ContemporaryAbstractAlgebra,NarosapublishingHouse.
- 6.Artin-Algebra,PrenticeHallofIndia.
- 8.V.K.KhannaandS.K.Bhambri-A Course in Abstract Algebra, Vikas Publishing House Pvt.Ltd.,NewDelhi.

MATH.-DSC-II, SEM-II IS SAME AS MATH.-CC-IV, SEM-II

CHOICE BASED CREDIT SYSTEM SYLLABUS

Core Courses Semester-III MATHEMATICS (Hons)

CC-V-3.1:Theory of Real Functions (Analysis-II)

TotalMarks:100

Theory: 80Marks+Mid-Sem:20Marks

5Lectures, 1Tutorial (per week per student)

Unit-I

Limits of functions($\epsilon - \delta$ approach),sequential criterion for limits ,divergence criteria. Limit theorems, onesided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity.

Unit-II

Algebra of continuous functions. Continuous functions onan interval, intermediate value

theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.

Unit-III

Differentiability of a function at a point and in an interval, Caratheodorys theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorem, intermediate value property of derivatives.

Unit-IV

Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities.

Unit-V

Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1+x)$, $\frac{1}{1+x}$ and $(1+x)^n$.

Book Recommended:

1. G. Das and S. Pattanayak, Fundamentals of Mathematics Analysis, TMH Publishing Co., Chapters: 6(6.1-6.8), 7(7.1-7.7),
2. R. B. Dash & D. K. Dalai – A Course on Mathematical Analysis, Kalyani Publisher

Books for References:

1. R. Bartle and D. R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003.
2. K. A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
3. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
4. S. R. Ghorpade and B. V. Limaye, A Course in Calculus and Real Analysis, Springer, 2006.

Core Courses Semester-III MATHEMATICS (Hons)

CC-VI-3.2: Group Theory (Algebra-II)

Total Marks :100

Theory:80Marks+Mid-Sem:20Marks

5 Lectures, 1 Tutorial (per week per student)

Unit-I

Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups

Unit-II

Centralizer, normalizer, center of a group, product of two subgroups, Properties of cyclic groups, classification of subgroups of cyclic groups.

Unit-III

Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Unit-IV

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Unit-V

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Book Recommended:

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Edn.), Narosa Publishing House, New Delhi.

Books for References:

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.

3. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.

4. I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.

Ch 2 (2.1 to 2.7, 2.9, 2.10, 2.13)

Core Courses Semester-III MATHEMATICS (Hons)

CC-VII -3.3: Partial Differential Equations and Systems of Ordinary Differential Equations

(Total Marks: 100)

Part-I (Marks: 75)

Theory: 60 Marks + Mid-Sem: 15 Marks

04 Lectures (per week per student)

Unit-I

Systems of linear differential equations, types of linear systems, differential operators, an

operator method for linear systems with constant coefficients, Basic Theory of linear systems in normal form ,homogeneous linear systems with constant coefficients(Two Equations in two unknown functions).

Unit-II

Simultaneous linear first order equations in three variables, methods of solution, Pfaffian differential equations, methods of solutions of Pfaffian differential equations in three variables.

Unit-III

Formation of first order partial differential equations, Linear and non-linear partial differential equations of first order, special types of first-order equations, Solutions of partial differential equations of first order satisfying given conditions.

Unit-IV

Linear partial differential equations with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients, Partial differential equations with variable coefficients , Separation of variables, Non-linear equation of the second order.

Unit-IV

Laplace equation, Solution of Laplace equation by separation of variables, One dimensional wave equation, Solution of the wave equation (method of separation of variables), Diffusion equation, Solution of one-dimensional diffusion equation, method of separation of variables.

Part-II (Practical: Marks: 25)

List of Practicals (Using any Software)

Practical/Lab work to be performed on a Computer.

1. To find the general solution of the non-homogeneous system of the form:

$$\frac{dx}{dt} = a_1x + b_1y + f_1(t), \quad \frac{dy}{dt} = a_2x + b_2y + f_2(t)$$

with given conditions.

2. Plotting the integral surfaces of a given first order PDE with initial data.

3. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ for the following associated conditions:

(a) $u(x, 0) = \phi(x), u_t(x, 0) = \psi(x), x \in \mathbb{R}, t > 0$. (b) $u(x, 0) = \phi(x), u_t(x, 0) = \psi(x), u_x(0, t) = 0, x \in (0, \infty), t > 0$. (c) $u(x, 0) = \phi(x), u_t(x, 0) = \psi(x), u(0, t) = 0, x \in (0, \infty), t > 0$. (d) $u(x, 0) = \phi(x), u_t(x, 0) = \psi(x), u(0, t) = 0, u(1, t) = 0, 0 < x < 1, t > 0$.

4. Solution of wave equation $\frac{\partial u}{\partial t} = k^2 \frac{\partial^2 u}{\partial x^2}$ for the following associated conditions:

(a) $u(x, 0) = \phi(x), u(0, t) = a, u(l, t) = b, 0 < x < l, t > 0$.

(b) $u(x, 0) = \phi(x), x \in \mathbb{R}, 0 < t < T$.

(c) $u(x,0)=\varphi(x), u(0,t)=a, x \in (0, \infty), t \geq 0$.

Book Recommended:

1. J. Sinha Roy and S. Padhy, A Course on Ordinary and Partial Differential Equations, Kalyani Publishers, New Delhi, Ludhiana, 2012.

Chapters: 11, 12, 13 (13.1-13.7), 15 (15.1, 15.5), 16 (16.1, 16.1.1), 17 (17.1, 17.2, 17.3).
Ch. 8 (8.1 to 8.4)

Books for References:

1. Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.

2. S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Core Courses Semester-IV MATHEMATICS (Hons)

CC-VIII -4.1: Numerical Methods

(Total Marks: 100)

Part-I (Marks: 75)

Theory: 60 Marks + Mid-Sem: 15 Marks

04 Lectures (per week per student) (Using Scientific Calculator)

Unit-I

Algorithms, Convergence, Errors: Relative, Absolute, Roundoff, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit-II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit-III

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Unit-IV

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpson's 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.

Unit-V

Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.

Part-II (Practical: Marks: 25)

List of Practicals (Using any Software)

Practical/Lab work to be performed on a Computer.

1. Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 + \dots + 1/N$.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection Method.
5. Newton Raphson Method.
6. Secant Method.
7. Regula Falsi Method.
8. LU decomposition Method.
9. Gauss-Jacobi Method.
10. SOR Method or Gauss-Siedel Method.
11. Lagrange Interpolation or Newton Interpolation.
12. Simpson's rule.

Note: For any of the CAS (Computer aided software) Data types - simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Book Recommended:

1. B. P. Acharya and R. N. Das, A Course on Numerical Analysis, Kalyani Publishers, New Delhi, Ludhiana. Chapters: 1, 2(2.1 to 2.4, 2.6, 2.8, 2.9), 3(3.1 to 3.4, 3.6 to 3.8, 3.10), 4(4.1, 4.2), 5(5.1, 5.2, 5.3), 6(6.1, 6.2, 6.3, 6.10, 6.11), 7(7.1, 7.2, 7.3, 7.4 & 7.7).
2. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

Books for References:

1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International Publisher, India, 2007.
2. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
3. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
4. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.

Core Courses Semester-IV MATHEMATICS (Hons)

CC-IX -4.2:Riemann Integration and Series of Functions (Analysis-III)

TotalMarks:100

Theory:80Marks+Mid-Sem:20Marks

5Lectures,1Tutorial(perweekperstudent)

Unit-I

Riemannintegration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

Unit-II

Improper integrals; Convergence of Beta and Gamma functions.

Unit-III

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions.

Unit-IV

Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Unit-V

Limits superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abels Theorem; Weierstrass Approximation Theorem.

Book Recommended:

1. G. Das and S. Pattanayak-Fundamentals of Mathematics Analysis, TMH Publishing Co., Chapters: 8 (8.1 to 8.6), 9 (9.1 to 9.8)

Books for References:

1. K. A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R. G. Bartle D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.
4. S. C. Mallik and S. Arora-Mathematical Analysis, New Age International Ltd., New Delhi.
5. Shanti Narayan and M. D. Raisinghania-Elements of Real Analysis, S. Chand & Co. Pvt. Ltd.

Core Courses Semester-IV MATHEMATICS (Hons)

CC-X--4.3: Ring Theory and Linear Algebra-I (Analysis-III)

TotalMarks:100

Theory:80Marks+Mid-Sem:20Marks

5Lectures,1Tutorial(perweekperstudent)

Unit-I

Definitionandexamplesofrings,propertiesofrings,subrings,integraldomainsandfields,characteristic ofaring.Ideal,idealgeneratedbyasubsetofaring,factorrings,operationsonideals,primeandmaximalideals.

Unit-II

Ringhomomorphisms,propertiesofringhomomorphisms,IsomorphismtheoremsI,IIandIII,fieldofquotients.

Unit-III

Vectorspaces,subspaces,algebraofsubspaces,quotientspaces,linearcombinationofvectors,linearspan,linearindependence,basisanddimension,dimensionofsubspaces.

Unit-IV

Lineartransformations,nullspace,range,rankand nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

Unit-V

Isomorphisms, Isomorphism theorems,invertibility and isomorphisms, change of coordinate matrix.

BookRecommended:

- 1.JosephA.Gallian,ContemporaryAbstractAlgebra(4thEdn.),NarosaPublishingHouse,NewDelhi .Chapters:12,13,14,15.
- 2.StephenH.Friedberg,ArnoldJ.Insel,LawrenceE.Spence,LinearAlgebra,4thEd.,PrenticeHallofIndiaPvt.Ltd.,NewDelhi,2004.Chapters:1 (1.2-1.6), 2(2.1-2.5).

BooksforReferences:

- 1.JohnB.Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- 2.M.Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- 3.S.Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
- 4.Gilbert Strang, Linear Algebra and its Applications, Cengage Learning India Pvt.Ltd.
- 5.S.Kumaresan,LinearAlgebra-AGeometricApproach,PrenticeHallofIndia,1999.
- 6.KennethHoffman,RayAldenKunze,LinearAlgebra,2ndEd.,Prentice-HallofIndiaPvt.Ltd.,1971.
- 7.I.N.Herstein-Topics in Algebra, Wiley Eastern Pvt.Ltd.

Skills Enhancement Course (SEC)
SEC – II Semester-IV

Time - 2 hrs. F.M. - 50 [40 (Sem.) + 10 (Int.)] Credit - 2 Lectures - 30
-Logic and Sets

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contrapositive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers :Introduction, Quantifiers, Binding variables and Negations. Sets, subsets, Set operations and the laws of set theory and Venndiagrams. Examples of finite and infinite sets.Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of Congruence modulo relation, Partial ordering relations, naryrelations.

Books Recommended:

- 1.1.R.P.Grimaldi-DiscreteMathematicsandCombinatorialMathematics, PearsonEducation,1998.
- 2.P.R.Halmos-NaiveSetTheory, Springer,1974.
- 3.E.Kamke-TheoryofSets,DoverPublishers,1950

SEM-III Math DSC-III IS SAME AS CC-VII

SEM-IV Math DSC-IV IS SAME AS CC-VIII

