DEPARTMENT OF MATHEMATICS, JADAVPUR UNIVERSITY

COURSE STRUCTURE for B. Sc. HONOURS in MATHEMATICS

(as per UGC guideline for CBCS)

Syllabus of B.Sc.
Mathematics (Honours)
Department of Mathematics
Jadavpur University

(Core – 14, DSE – 04, SEC – 01, GE – 02+02)

(AECC – 02 & SEC – 01 offered by Sc. Faculty)

DEPARTMENT OF MATHEMATICS, JADAVPUR UNIVERSITY

COURSE STRUCTURE for B. Sc. HONOURS in MATHEMATICS

(as per UGC guideline for CBCS)

SEMESTER	CORE COURSE (14)	ABILITY ENHANCEMENT COMPULSARY COURSE – AECC (2)	SKILL ENHANCEMENT COURSE – SEC (2)	DISCIPLINE SPRCIFIC ELECTIVE - DSE (4)	GENERIC ELECTIVE COURSE – GE (4)
Semester - I	CORE - 1	AECC - 1			GE - 1
	CORE - 2				
Semester - II	CORE – 3	AECC - 2			GE - 2
	CORE - 4				
Semester - III	CORE – 5		SEC - 1		GE - 3
	CORE – 6				
	CORE - 7				
Semester - IV	CORE - 8		SEC - 2		GE - 4
	CORE - 9				
	CORE - 10				
Semester - V	CORE - 11			DSE – 1	
	CORE - 12			DSE – 2	
Semester - VI	CORE – 13			DSE – 3	
	CORE - 14			DSE – 4	

DEPARTMENT OF MATHEMATICS, JADAVPUR UNIVERSITY
DETAILS OF COURSE UNDER B. Sc. HONOURS in MATHEMATICS

SEMESTER	CORE COURSE (14)	ABILITY ENHANCEMENT COMPULSARY COURSE –AECC (2)	SKILL ENHANCEMENT COURSE – SEC (2)	DISCIPLINE SPRCIFIC ELECTIVE - DSE (4)	GENERIC ELECTIVE COURSE – GE (4)
Semester - I	ALGEBRA, GEOMETRY & CALCULUS	AECC – 1 ENG (Faculty)			PHY/CHEM/GEOL/GEOG/STAT
	GROUP THEORY - I				
Semester - II	REAL ANALYSIS	AECC – 2 ENV. SCIENCE (Faculty)			MATH - 1 / COMP SC - 1
	DIFFERENTIAL EQUATIONS				
Semester - III	THEORY OF REAL FUNCTIONS		SEC – 1 COMPUTER (Faculty)		MATH - 2 / COMP SC - 2
	RING THEORY & LINEAR ALGEBRA - I				
	NUMERICAL METHODS THEORY + PRACTICAL				
Semester - IV	RIEMANN INTEGRATION & SERIES FUNCTIONS		SEC – 2 OS / SW (Math Dept)		PHY/CHEM/GEOL/GEOG/STAT
	MULTIVARIATE CALCULUS				
	RING THEORY & LINEAR ALGEBRA – II				
Semester - V	PARTIAL DIFFERENTIAL EQUATIONS			DSE – 1*	
	METRIC SPACE & COMPLEX ANALYSIS			DSE – 2*	
Semester - VI	GROUP THEORY - II			DSE – 3*	
	MECHANICS			DSE – 4*	

DEPARTMENT OF MATHEMATICS, JADAVPUR UNIVERSITY
DETAILS OF COURSE UNDER B. Sc. HONOURS in MATHEMATICS

SEMESTER	COURSE	SUBJECT	CREDIT	THEORY	TUTORIAL/ PRACTICAL	MARKS
Semester - I	CORE - 1	ALGEBRA, GEOMETRY & CALCULUS	6	5	1	50
	CORE – 2	GROUP THEORY - I	6	5	1	50
	AECC – 1	ENG (Faculty)	2	2	-	50
	GE – 1	STAT - I	6	5	1	50
Semester - II	CORE - 3	REAL ANALYSIS	6	5	1	50
	CORE – 4	DIFFERENTIAL EQUATIONS	6	5	1	50
	AECC – 2	ENV. SCIENCE (Faculty)	2	2	-	50
	GE – 2	MATH – I OR COMP. SC. - I	6	5	1	50
Semester - III	CORE - 5	THEORY OF REAL FUNCTIONS	6	5	1	50
	CORE - 6	RING THEORY & LINEAR ALGEBRA - I	6	5	1	50
	CORE -7	NUMERICAL METHODS THEORY + PRACTICAL	6	5	1	50
	SEC – 1	COMPUTER (Faculty)	2	2	-	50
	GE – 3	MATH – II OR COMP. SC. - II	6	5	1	50

Semester - IV	CORE -8	RIEMANN INTEGRATION & SERIES FUNCTIONS	6	5	1	50
	CORE -9	MULTIVARIATE CALCULUS	6	5	1	50
	CORE -10	RING THEORY & LINEAR ALGEBRA – II	6	5	1	50
	SEC – 2	OS / SW (Math Dept)	2	2	-	50
	GE – 4	STAT - II	6	5	1	50
Semester - V	CORE -11	PARTIAL DIFFERENTIAL EQUATIONS	6	5	1	50
	CORE -12	METRIC SPACE & COMPLEX ANALYSIS	6	5	1	50
	DSE – 1*	ELECTIVE - I	6	5	1	50
	DSE – 2*	ELECTIVE – II	6	5	1	50
Semester - VI	CORE -13	GROUP THEORY - II	6	5	1	50
	CORE -14	MECHANICS	6	5	1	50
	DSE – 3*	ELECTIVE – III	6	5	1	50
	DSE – 4*	ELECTIVE – IV	6	5	1	50

DEPARTMENT OF MATHEMATICS, JADAVPUR UNIVERSITY
DETAILS OF COURSE UNDER B. Sc. HONOURS in MATHEMATICS

SL NO.	COURSE	CREDIT	THEORY	TUTORIAL / PRACTICAL	MARKS
I	CORE COURSE	6 X 14	5 X13 +4 X 1	1 X 13 + 2 X 1	50 X 14 = 700
II	DSE	6 X 4	5 X 4	1 X 4	50 X 4 = 200
III	GE	6 X 4	5 X 4	1 X 4	50 X 4 = 200
IV	SEC (Dept)	2 X 1	2 X 1	--	50 X 1 = 50
V	SEC (Faculty)	2 X 1	2 X 1	--	50 X 1 = 50
VI	AECC (Faculty)	2 X 2	2 X 2	--	50 X 2 = 100
	TOTAL	140	117	23	1300

CHOICE FOR **DSE** PAPERS **:-**

DSE – 1* **: (a) LINEAR PROGRAMMING & GAME THEORY**

(b) INDUSTRIAL MATHEMATICS

DSE – 2* **: (a) PROBABILITY & STATISTICS**

(b) PORTFOLIO OPTIMIZATION

DSE – 3* **: (a) NUMBER THEORY**

(b) MATHEMATICAL MODELLING

(c) DIFFERENTIAL GEOMETRY

(d) BOOLEAN ALGEBRA & AUTOMATA THEORY

(e) HYDROSTATICS

DSE – 4* **: (a) COMBINATORICS & GRAPH THEORY**

(b) BIO MATHEMATICS

(c) MATHEMATICAL PHYSICS & RELATIVITY

(d) POINT SET TOPOLOGY

(e) DYNAMICAL SYSTEMS

CHOICE FOR **SEC - 2** **:- OPERATING SYSTEM (LINUX) / MATLAB**

CHOICE FOR **GE - 2 & 3** PAPERS **:-**

(a) MATHEMATICS – 1 / COMPUTER SCIENCE - 1

(b) MATHEMATICS – 2 / COMPUTER SCIENCE - 2

CORE 1 : ALGEBRA, GEOMETRY & CALCULUS
Subject code : UG/Sc/CORE/MATH/01
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1 (ALGEBRA)

Complex: Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Theory of equations: Relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation. Well-ordering property of positive integers, division algorithm, divisibility and Euclidean algorithm, prime number and Fundamental theorem of Arithmatic. Inequality: The inequality involving AM≥ GM≥ HM, Cauchy-Schwartz inequality. Properties of Determinant, linear independence, Systems of linear equations: row reduction and echelon forms, rank of a matrix, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems.

UNIT – 2 (GEOMETRY)

Pole and polars. Diameters and conjugate diameters. Systems of conics. Polar equation of a conic referred to a focus as pole. Equations of tangent, normal, chord of contact.

Sphere : General Equation. Great circle, Sphere through the intersection of two spheres. Radical Plane, Tangent, Normal. Cone : Right circular cone. General homogeneous second degree equation. Section of cone by a plane as a conic and as a pair of lines. Condition for three perpendicular generators. Reciprocal cone. Cylinder : Generators parallel to either of the axes, general form of equation. Right-circular cylinder. Ellipsoid, Hyperboloid, Paraboloid : Canonical equations only. Tangent planes, Normal, Enveloping cone. Generating lines of hyperboloid of one sheet and hyperbolic paraboloid.

UNIT – 3 (CALCULUS)

Hyperbolic functions, higher order derivatives, Leibnitz rule, concavity and inflection points, envelopes, asymptotes, curvature, curve tracing in cartesian coordinates. Reduction formulae, derivations and illustrations of reduction formulae, parametric equations, parameterizing a curve, arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution.

References:

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006.

2. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

3. H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons (Asia) Pvt. Ltd. 2002.

4. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.

5. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

6. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

7. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

8. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.

9. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer- Verlag, New York, Inc., 1989.

10. Bernard and Child, Higher Algebra

11. T. M. Apostol, Calculus, Volumes I and II

CORE 2 : GROUP THEORY – I
Subject code : UG/Sc/CORE/MATH/02
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.

UNIT – 2

Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.

UNIT - 3

Properties of cyclic groups, classification of subgroups of cyclic groups. 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 – 4

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

UNIT – 5

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

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 A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.

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

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

6. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra

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CORE – 3 REAL ANALYSIS
Subject code : UG/Sc/CORE/MATH/03
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Review of algebraic and order properties of R, ε-neighborhood of a point in R. Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. Construction of Reals from Rationals, Cantor's nested interval Theorem, Completeness property of R and its equivalent properties. The Archimedean property, density of rational (and irrational) numbers in R, intervals. Limit points of a set, isolated points, open set, closed set, derived set, Bolzano-Weierstrass theorem for sets, compact sets in R, Heine-Borel Theorem.

UNIT – 2

Sequences, bounded sequence, convergent sequence, limit of a sequence, lim inf, lim sup. Limit theorems. Monotone sequences, monotone convergence theorem. Subsequences, divergence criteria. Monotone subsequence theorem (statement only), Bolzano Weierstrass theorem for sequences. Cauchy sequence, Cauchy's convergence criterion.

UNIT - 3

Infinite series, convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, D'Alembert's test, Raabe's test, Cauchy's

nth root test, Gauss test, Logarithmic test, Integral test. Alternating series, Leibniz test. Absolute and conditional convergence, Rearrangement of series.

References:

1. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

2. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.

3. Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.

4. S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.

CORE – 4 : DIFFERENTIAL EQUATIONS
Subject code : UG/Sc/CORE/MATH/04
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

UNIT – 2

Lipschitz condition and Picard's Theorem (Statement only). General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, orthogonal trajectories.

UNIT – 3

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 – 4

Power series solution of a differential equation about an ordinary point and its application to Legendre differential equation, solution about a regular singular point.

References:

1. Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.

2. C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.

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

4. Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.

5. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.

CORE – 5 : THEORY OF REAL FUNCTION
Subject code : UG/Sc/CORE/MATH/05
CREDIT HOURS – 6 (50 MARKS)

UNIT -1

Limits of functions (ε - δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on closed and bounded interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Classification of discontinuity, discontinuity of monotonic functions. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem on compact sets.

UNIT – 2

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem. Mean value theorem: Lagrange's mean value theorem, Cauchy's mean value theorem, Darboux's theorem on derivatives. Applications of mean value theorem to inequalities and approximation of polynomials.

UNIT – 3

Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder and Young's form of remainder, application of Taylor's theorem to convex functions, Jensen's inequality, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, ln (1 + x), 1/(ax + b) and$(x+1)^n$. Application of Taylor's theorem to inequalities. L'Hospital's rule

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 – 6 : RING THEORY & LINEAR ALGEBRA – I
Subject code : UG/Sc/CORE/MATH/06
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

UNIT – 2

Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, field of quotients.

UNIT – 3

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces (with special emphesis on R^n over R).

UNIT - 4

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, Eigen values, Eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem. Algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

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. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.

4. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.

5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

7. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India,1999.

8. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.

9. D.A.R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.

CORE – 7 : NUMERICAL METHODS
Subject code : UG/Sc/CORE/MATH/TH/07
CREDIT HOURS – 4 (30 MARKS)

UNIT – 1

Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation.

UNIT – 2

Transcendental and polynomial equations: Bisection method, Newton's method, secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods.

UNIT – 3

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

UNIT – 4

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

Numerical differentiation: Methods based on interpolations, methods based on finite differences.

UNIT – 5

Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpsons 3/8th rule, Weddle's rule, Boole's Rule. midpoint rule, Composite trapezoidal rule, composite Simpson's $1/3^{rd}$ rule, Gauss quadrature formula.

UNIT – 6

Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.

CORE – 7 : NUMERICAL METHODS (PRACTICAL) WITH C / C++

Subject code : UG/Sc/CORE/MATH/PR/07
CREDIT HOURS – 2 (20 MARKS)

1. Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.
2. Enter 100 integers into an array and sort them in an ascending order.
3. Solution of transcendental and algebraic equations by
   i) Bisection method
   ii) Newton Raphson method.
   iii) Secant method.
   iv) Regula Falsi method.
4. Solution of system of linear equations
   i) Gaussian elimination method
   ii) Gauss-Jacobi method
   iii) Gauss-Seidel method
5. Interpolation
   i) Lagrange Interpolation
   ii) Newton Interpolation
6. Numerical Integration
   i) Trapezoidal Rule
   ii) Simpson's one third rule
   iii) Weddle's Rule
   iv) Gauss Quadrature

7. Solution of ordinary differential equations
   i) Euler method
   ii) Modified Euler method
   iii) Runge Kutta method

References:

1. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineerin Computation, 6th Ed., New age International Publisher, India, 2007.

3. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.

4. Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.

5. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.

CORE – 8 : RIEMANN INTEGRATION & SERIES OF FUNCTIONS
Subject code : UG/Sc/CORE/MATH/08
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Riemann integration: inequalities of upper and lower sums, Darboux integration, Darboux theorem, 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; Integrability of functions with infinitely many discontinuities having finitely many limit points, Definition and integrability of piecewise continuous and monotone functions.

Intermediate Value theorem for Integrals; Fundamental theorem of Integral Calculus.

UNIT – 2

Improper integrals. Convergence of Beta and Gamma functions.

UNIT – 3

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

UNIT – 4

Fourier series: Definition of Fourier coefficients and series, Reimann Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series.

UNIT – 5

Power series, radius of convergence, Cauchy Hadamard theorem. Differentiation and integration of power series, Abel's theorem, Dirichlet's Theorem.

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. Goldberg, Calculus and mathematical analysis.

5. T. M. Apostol, Calculus I, II.

CORE – 9 : MULTIVARIATE CALCULUS
Subject code : UG/Sc/CORE/MATH/09
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Functions of several variables, limit and continuity of functions of two or more variables.

Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems

UNIT – 2

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions.

Definition of vector field, divergence and curl. Line integrals, applications of line integrals: mass and work. Fundamental theorem for line integrals, conservative vector fields, independence of path.

UNIT – 3

Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals.

UNIT – 4

Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

References:

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.

3. E. Marsden, A.J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer (SIE), Indian reprint, 2005.

4. James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

5. M.R. Speigel, Schaum's outline of Vector Analysis.

CORE – 10 : RING THEORY & LINEAR ALGEBRA – II
Subject code : UG/Sc/CORE/MATH/10
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, Euclidean domains.

UNIT – 2

Factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, and unique factorization in Z [x]. Divisibility in integral domains, irreducible, primes, unique factorization domains.

UNIT – 3

Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms.

UNIT – 4

Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator. Least squares approximation, minimal solutions to systems of linear equations. Normal and self-adjoint operators. Orthogonal projections and Spectral theorem.

Application : Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant

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 A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.

4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.

5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

5. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.

6. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.

7. S.H. Friedberg, A.L. Insel and L.E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., 2004.

8. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra.

CORE – 11 : PARTIAL DIFFERENTIAL EQUATIONS
Subject code : UG/Sc/CORE/MATH/11
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Partial differential equations – Basic concepts and definitions. Formation of PDE, Mathematical problems. First order equations: classification, construction and geometrical interpretation, Lagrange's and Charpit's method for solving PDE. Method of characteristics for obtaining general solution of quasi linear equations. Canonical forms of first-order linear equations. Method of separation of variables for solving first order partial differential equations.

UNIT – 2

Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order linear equations to canonical forms.

UNIT – 3

The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial boundary value problems. Semi-infinite string with a fixed end, semi-infinite string with a free end. Equations with non-homogeneous boundary conditions. Non- homogeneous wave equation. Method of separation of variables, solving the vibrating string problem. Solving the heat conduction problem.

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.

3. Martha L Abell, James P Braselton, Differential equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.

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

5. Miller, F. H., Partial Differential Equations, John Wiley and Sons.

CORE – 12 : METRIC SPACE & COMPLEX ANALYSIS
Subject code : UG/Sc/CORE/MATH/12
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Metric spaces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces. Sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem.

UNIT – 2

Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness, connected subsets of R.

Compactness: Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property, and continuous functions on compact sets.

Homeomorphism. Contraction mappings. Banach fixed point theorem and its application to ordinary differential equation.

UNIT – 3

Limits, limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, Stereographic projections, functions of complex variable.

Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability, Harmonic functions.

Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of functions.

UNIT – 4

Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula.

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. Laurent series and its examples, absolute and uniform convergence of power series.

References:

1. Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.

2. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.

3. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.

4. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.

5. Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., NewYork, 1997.

CORE – 13 : GROUP THEORY – II
Subject code : UG/Sc/CORE/MATH/13
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.

UNIT – 2

Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental theorem of finite abelian groups.

UNIT – 3

Group actions, stabilizers and kernels, permutation representation associated with a given group action. Applications of group actions. Generalized Cayley's theorem. Index theorem.

UNIT – 4

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in Sn, p-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of An for n ≥ 5, non-simplicity tests.

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 A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, 1999.

4. David S. Dummit and Richard M. Foote, Abstract Algebra, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2004.

5. J.R. Durbin, Modern Algebra, John Wiley & Sons, New York Inc., 2000.

6. D. A. R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.

7. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of abstract algebra

CORE – 14 : MECHANICS

Subject code : UG/Sc/CORE/MATH/14
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve. Virtual work. Forces in three dimensions. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium.

UNIT – 2

Simple Harmonic Motion. Velocities and accelerations in Cartesian, polar, and intrinsic coordinates. Equations of motion referred to a set of rotating axes. Central forces. Stability of nearly circular orbits. Motion of a projectile in a resisting medium. Stability of nearly circular orbits. Motion under the inverse square law. Slightly disturbed orbits. Motion of artificial satellites. Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution.

UNIT – 3

Degrees of freedom. Moments and products of inertia. Momental Ellipsoid. Principal axes. D'Alembert's Principle. Motion about a fixed axis. Compound pendulum. Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy.

References:

1. F. Chorlton, Textbook of Dynamics.

2. S. L. Loney, An Elementary Treatise on the Dynamics of particle and of Rigid Bodies

3. S. L. Loney, Elements of Statics and Dynamics I and II.

4. I. H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4th Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.

5. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.

DSE 1 : A. LINEAR PROGRAMMING & GAME THEORY
Subject code : UG/Sc/DSE/MATH/01/A
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Theory of the simplex method, solution of a linear programming problem via simplex method, Charne's big-M technique. Two phase method, principle of duality in linear programming problem, fundamental theorem of duality, simple problems, the transportation and assignment problems.

UNIT - 2

Two – person zero sum games . Players and their strategies. Rectangular games . Pure and mixed strategies .Maximin and Minimax criteria. Optimal strategy and the value of the game. Solution of a game for mixed strategies. Geometric method for resolving 2 x n and m x 2 games. Fundamental theorem. Relationship between game theory and LPP.

References:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.

2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.

3. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.

4. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

5. Dutta, Prajit K. (1999), Strategies and games: theory and practice, MIT Press, ISBN 978-0-262-04169-0. Suitable for undergraduate and business students.

6. Fernandez, L F.; Bierman, H S. (1998), Game theory with economic applications, Addison-Wesley, ISBN 978-0-201-84758-1. Suitable for upper-level undergraduates.

7. Gibbons, Robert D. (1992), Game theory for applied economists, Princeton University Press, ISBN 978-0-691-00395-5. Suitable for advanced undergraduates.

DSE 1 : B. INDUSTRIAL MATHEMATICS

Subject code : UG/Sc/DSE/MATH/01/B
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Medical Imaging and Inverse Problems. The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, elementary differential equations, complex numbers and matrices.

UNIT - 2

Introduction to Inverse problems: Why should we teach Inverse Problems? Illustration of Inverse problems through problems taught in Pre-Calculus, Calculus, Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

UNIT - 3

X-ray: Introduction, X-ray behavior and Beers Law (The fundamental question of image construction) Lines in the place

Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom - Mathematical phantoms). Back Projection: Definition, properties and examples.

CT Scan: Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction. Algorithms of CT scan machine. Algebraic reconstruction techniques abbreviated as ART with application to CT scan.

References:

1. Timothy G. Feeman, The Mathematics of Medical Imaging, A Beginners Guide, Springer Under graduate Text in Mathematics and Technology, Springer, 2010.

2. C.W. Groetsch, Inverse Problems, Activities for Undergraduates, The Mathematical Association of America, 1999.

3. Andreas Kirsch, An Introduction to the Mathematical Theory of Inverse Problems, 2nd Ed., Springer, 2011.

DSE 2 : A. PROBABILITY & STATISTICS
Subject code : UG/Sc/DSE/MATH/02/A
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Random variables: Concept, cumulative distribution function, discrete and continuous random variables.

Discrete random variables: Bernoulli's trials, Binomial distribution, geometric distribution, Poisson distribution. Poisson process as an example of Stochastic process.

Continuous random variables: Uniform distribution, exponential distribution, Gamma distribution, Normal distribution, Chi-square distribution, t- & F-distribution.

Bivariate random variables: Joint distribution, joint and conditional distributions, the correlation coefficient. Bivariate normal distribution, Rectangular distribution

UNIT - 2

Expected value of random variables: expectation, Raw and central moments of random variables, mean, variance, moment generating function, characteristics function, Median, Mode, Symmetric distribution, Skewness and Kurtosis, covariance, correlation coefficient.

Convergence in Probability: Tchebycheff's inequality, properties of convergence, laws of large numbers, central limit theorem, approximation of distributions.

UNIT - 3

Population, Finite and Infinite Population, Fake random variable, distribution of fake random variable, Characteristics of fake random variable.

Theory of Sampling, parameter and statistic, estimator, good estimator, Consistent & Unbiased estimates of any Characteristic associated with distribution.

Estimatation of parameters: Maximum likelihood estimates, Confidence interval.

UNIT – 4

Testing of hypothesis: Problem, Different types of hypothesis, Formation of the problem – Probability of Type – I error, Probability of Type – II error, Best Critical region, Likelihood ratio testing, examples. Chi-square test of goodness of fit.

References:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007.

2. Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia, 2006.

3. Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007.

4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw- Hill, Reprint 2007

DSE 2 : B. PORTFOLIO OPTIMIZATION
Subject code : UG/Sc/DSE/MATH/02/B
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Financial markets. Investment objectives. Measures of return and risk. Types of risks. Risk free assets. Mutual funds. Portfolio of assets. Expected risk and return of portfolio. Diversification.

UNIT - 2

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-free assets and one fund theorem, efficient frontier. Portfolios with short sales. Capital market theory.

UNIT - 3

Capital assets pricing model- the capital market line, beta of an asset, beta of a portfolio, security market line. Index tracking optimization models. Portfolio performance evaluation measures.

References:

1. F. K. Reilly, Keith C. Brown, Investment Analysis and Portfolio Management, 10th Ed., South-Western Publishers, 2011.

2. H.M. Markowitz, Mean-Variance Analysis in Portfolio Choice and Capital Markets, Blackwell, New York, 1987.

3. M.J. Best, Portfolio Optimization, Chapman and Hall, CRC Press, 2010.

4. D.G. Luenberger, Investment Science, 2nd Ed., Oxford University Press, 2013.

DSE 3 : A. NUMBER THEORY
Subject code : UG/Sc/DSE/MATH/03/A
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

UNIT - 2

Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

UNIT - 3

Order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation x2 + y2= z2, Fermat's Last theorem

References:

1. David M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.

2. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007

DSE 3 : B. MATHEMATICAL MODELLING
Subject code : UG/Sc/DSE/MATH/03/B
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Perturbation methods: Introduction to modelling concepts, dimensional analysis, perturbation techniques, applications of techniques of nonlinear dynamics

UNIT - 2

Queuing Models**:** Birth and death model (Earlang model) M|M|1 (∞|FCFS), (N|FCFS), Harbor system, morning rush hour.

UNIT - 3

Modelling of Social Dynamics**:** Mathematical theories of war, Richardson's theory of conflict, Lancaster's combat models, modeling of terrorism, modeling of environmental related phenomena. Modeling of intoxicants.

UNIT - 4

Modelling of Electrical Circuits**:** Oscillations in RLC circuits, response of RLC circuits to sinusoidal square, pulse, ramp and burst.

UNIT - 5

Models for inventory controls**:** Inventor, Demand, Holding cost, shortage cost, Setup cost, Lead time, Deterioration, models for cost minimization and profit maximization.

UNIT - 6

Introduction to Stochastic Analysis**:** Brownian motion, hitting problems, stochastic differential equations.

UNIT - 7

Monte Carlo Simulation Modeling**:** Simulating deterministic behavior (area under a curve, volume under a surface), Generating Random Numbers: middle square method, linear congruence,

References:

1. W. Meyer, Concepts of Mathematical Modeling, McGraw Hill, New York, 1994.
2. Hinch, Perturbation methods, Cambridge Texts in Applied Mathematics.
3. Kevorkian & Cole, Perturbation methods in applied mathematics, Applied Mathematical Sciences, Springer.
4. Bender & Orszag, Advanced mathematical methods for scientists and engineers, Asymptotic Methods and Perturbation Theory: v.1, Springer.
5. I. Karatzas and S. Shreve, Brownian motion and Stochastic Calculus, Graduate texts in Mathematics, Springer.
6. G. Hadeley and T.M. Whitin, Analysis of Inventory Systems, Prentice Hall, 1963.

DSE 3: C. DIFFERENTIAL GEOMETRY
Subject code : UG/Sc/DSE/MATH/03/C
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Theory of Space Curves: Space curves, Parametrized Curves and Arc Length, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating plane , normal plane, rectifying plane and osculating circles and spheres. Fundamental Theorem of the Local Theory of Curves. Evolutes and involutes of curves, Helix and Bertrand curves.

UNIT - 2

Theory of Surfaces: Regular Surfaces and Inverse Image of Regular Values, Parametric curves on surfaces, Change of Parameters and Differential Functions on Surfaces, The Tangent Plane, The

Differential of a map, first Fundamental form,angle between two curves on a surface, area under parametric curves, second Fundamental form, Developablesurfaces, Minimal surfaces.

UNIT - 3

Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

References:

1. T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
2. B. O'Neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
3. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press 2003.
4. D.J. Struik, Lectures on Classical Differential Geometry, Dover Publications, 1988.
5. S. Lang, Fundamentals of Differential Geometry, Springer, 1999.
6. E.Kreyszig, Differential Geometry, Dover Publications, New York, 1991.
7. B. Spain, Tensor Calculus: A Concise Course, Dover Publications, 2003.

DSE 3 : D. BOOLEAN ALGEBRA & AUTOMATA THEORY
Subject code : UG/Sc/DSE/MATH/03/D
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms.

UNIT - 2

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal and maximal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, Logic gates, switching circuits and applications of switching circuits.

UNIT - 3

Introduction: Alphabets, strings, and languages. Finite automata and regular languages: deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages.

UNIT - 4

Context free grammars and pushdown automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

UNIT - 5

Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence.

UNIT - 6

Undecidability: Recursively enumerable and recursive languages, undecidable problems about Turing machines: halting problem. Post correspondence problem, and undecidability problems about CFGs.

References:

1. B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.

2. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory,(2nd Ed.), Pearson Education (Singapore) P.Ltd., Indian Reprint 2003.

3. Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

4. J. E. Hopcroft, R. Motwani and J. D. Ullman, Introduction to Automata Theory, Languages, and Computation, 2nd Ed., Addison-Wesley, 2001.

5. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation, 2nd Ed., Prentice-Hall, NJ, 1997.

6. J.A. Anderson, Automata Theory with Modern Applications, Cambridge University Press, 2006

DSE 3 : E. HYDROSTATICS
Subject code : UG/Sc/DSE/MATH/03/E
CREDIT HOURS – 6 (50 MARKS)

Unit -1 :

Perfect fluid. Pressure at a point.Pressure of heavy fluid. Pressure at any point of a fluid at rest is the same in every directions. Conditions of equilibrium for homogeneous, heterogeneous, and elastic fluid.

Unit -2 :

Lines of force. Surfaces of equal pressure and density. Pressure gradient, pressure function and equation of equilibrium. Homogeneous fluid at rest under gravity. Definition of centre of pressure. Formula for the depth of the centre of pressure of a plane area. Position of centre of pressure.

Unit -3 :

Thrusts on plane and curved surfaces. Rotating fluid. Pressure at any point and surfaces of equipressure when a mass of homogeneous fluid contained in a vessel revolves uniformly about a vertical axis. Floating bodies. Stability of equilibrium of floating bodies.

Unit -4 :

Meta-centre. Metacentric height. Curves of buoyancy. Surface of buoyancy. Plane and surface of floatation. Oscillation of floating bodies.

Unit -5 :

Gas laws, work done in compressing a gas. Pressure of gases. The atmosphere. Relation between pressure , density and temperature.

References:

1. Batchelor, George K. (1967). An Introduction to Fluid Dynamics. Cambridge University Press. ISBN 0-521-66396-2.

2. Falkovich, Gregory (2011). Fluid Mechanics (A short course for physicists). Cambridge University Press. ISBN 978-1-107-00575-4.

3. Kundu, Pijush K.; Cohen, Ira M. (2008). Fluid Mechanics (4th rev. ed.). Academic Press. ISBN 978-0-12-373735-9.

4. Currie, I. G. (1974). Fundamental Mechanics of Fluids. McGraw-Hill. ISBN 0-07-015000-1.

5. Massey, B.; Ward-Smith, J. (2005). Mechanics of Fluids (8th ed.). Taylor & Francis. ISBN 978-0-415-36206-1.

6. White, Frank M. (2003). Fluid Mechanics. McGraw–Hill. ISBN 0-07-240217-2.

7. F. Chorlton, Textbook of Fluid Dynamics.

DSE 4 : A. COMBINATORICS & GRAPH THEORY
Subject code : UG/Sc/DSE/MATH/04/A
CREDIT HOURS – 6 (50 MARKS)

Unit -1

Mathematical induction. Principle of inclusion and exclusion. Pigeon hole principle. Finite combinatorics. Generating functions. Partitions. Recurrence relations. Linear difference equations with constant coefficients.

Unit -2

Partial and linear orderings. Chains and antichains. Lattices. Distributive lattices. Complementation.

Unit -3

Graphs and Planar graphs. Paths and circuits. Hamiltonian paths. Shortest paths. Eulerian paths. Traveling salesman problem. Trees. Spanning trees.

Unit -4

Truth functional logic and prepositional connectives. Switching circuits. Boolean algebras. Duality. Boolean functions. Normal forms. Karnaugh maps.

References:

1. Biggs, N.; Lloyd, E.; Wilson, R. (1986), Graph Theory, 1736–1936, Oxford University Press.

2. Bondy, J.A.; Murty, U.S.R. (2008), Graph Theory, Springer, ISBN 978-1-84628-969-9.

3. Bollobás, Béla; Riordan, O.M (2003), Mathematical results on scale-free random graphs in "Handbook of Graphs and Networks" (S. Bornholdt and H.G. Schuster (eds)), Wiley VCH, Weinheim, 1st ed..

4. Chartrand, Gary (1985), Introductory Graph Theory, Dover, ISBN 0-486-24775-9.

5. Gibbons, Alan (1985), Algorithmic Graph Theory, Cambridge University Press.

6. Reuven Cohen, Shlomo Havlin (2010), Complex Networks: Structure, Robustness and Function, Cambridge University Press.

7. Golumbic, Martin (1980), Algorithmic Graph Theory and Perfect Graphs, Academic Press.

8. Harary, Frank (1969), Graph Theory, Reading, MA: Addison-Wesley.

9. Harary, Frank; Palmer, Edgar M. (1973), Graphical Enumeration, New York, NY: Academic Press.

10. Mahadev, N.V.R.; Peled, Uri N. (1995), Threshold Graphs and Related Topics, North-Holland.

11. Mark Newman (2010), Networks: An Introduction, Oxford University Press.

DSE 4: B. BIO MATHEMATICS
Subject code : UG/Sc/DSE/MATH/04/B
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Mathematical Biology and the modeling process: an overview.

UNIT - 2

Qualitative analysis of continuous models: Steady state solutions, stability and linearization, Routh- Hurwitz Criteria, Phase plane methods and qualitative solutions, Lyapunov second method for stability, bifurcations (saddle-node, transcritical, pitchfork and Hopf).

UNIT - 3

Continuous growth functions: Malthus growth, logistic growth, Gompertz growth, Holling type growth. One species models**:** Different growth models for single species, harvesting of species.

UNIT - 4

Predator-Prey models**:** Lotka-Volterra model, Gause model, Kolmogorov model, Two species competition model.

UNIT - 5

Epidemic Models**:** Deterministic model of simple epidemic, Infection through vertical and horizontal transmission, General epidemic- Karmac-Mackendric Threshold Theorem, SI, SIR, SIRS models.

UNIT - 6

Discrete system**:** Overview of difference equations, steady state solution and linear stability analysis, Introduction to Discrete Models, Linear Models, Growth models, Decay models, Discrete Prey-Predator model and Epidemic model.

UNIT - 7

Models for Population Genetics**:** **B**asic model for inheritance of genetic characteristic, Hardy-Wienberg law, models for genetic improvement.

References:

1. H. I. Freedman - Deterministic Mathematical Models in Population Ecology
2. Mark Kot (2001): Elements of Mathematical Ecology, Cambridge Univ. Press.
3. D. Alstod (2001): Basic Populas Models of Ecology, Prentice Hall, Inc., NJ.
4. J.D.Murray (2002): Mathematical Biology, Springer and Verlag.
5. Leach Edelstein-Keshet (1987): Mathematical Models in Biology, The Random House/ Birkhauser Mathematics Series.

DSE 4 : C. MATHEMATICAL PHYSICS & RELATIVITY
Subject code : UG/Sc/DSE/MATH/04/C
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Review of Newtonian mechanics – inertial frames. Galilean transformation. Michelson Morley experiment. Concepts of simultaneity. Postulates of Special Theory of Relativity. Lorentz transformation equations and its geometrical interpretation. Group properties of Lorentz transformations. Mathematical Properties of Lorentz Transformations.

UNIT - 2

Relativistic Kinematics - composition of parallel velocities. Length contraction. Time dilation.Transformation equations for components of velocity and acceleration of a particle. Variation of mass with velocity. Equivalence of mass and energy. Relativistic energy - momentum relation, longitudinal and transversal mass.

UNIT - 3

Geometrical representation of space-time - four dimensional Minkowskian space-time of special relativity. Time-like, light-like, and space-like intervals. Null cone, proper time. World line of a particle. Four-vectors and tensors in Minkowskian space-time. Relativistic mechanics - energy-momentum four-vector.

UNIT - 4

Photon in Relativity.Relativistic force and transformation equations for its components. Relativistic Lagrangian and Hamiltonian. Relativistic equation of motion of a particle.

UNIT - 5

Energy-momentum tensor of a continuous material distribution.Transformation equations for electric and magnetic field strengths under Lorentz transformation.Lorentz invariance of Maxwell's equations. Maxwell's equations in tensor form.

References:

1. G.A.G. Bennet (1974). Electricity and Modern Physics (2nd ed.). Edward Arnold (UK). ISBN 0-7131-2459-8.

2. Dibner, Bern (2012). Oersted and the discovery of electromagnetism. Literary Licensing, LLC. ISBN 978-1-258-33555-7.

3. Durney, Carl H.; Johnson, Curtis C. (1969). Introduction to modern electromagnetics. McGraw-Hill. ISBN 0-07-018388-0.

4. Feynman, Richard P. (1970). The Feynman Lectures on Physics Vol II. Addison Wesley Longman. ISBN 978-0-201-02115-8.

5. Fleisch, Daniel (2008). A Student's Guide to Maxwell's Equations. Cambridge, UK: Cambridge University Press. ISBN 978-0-521-70147-1.

6. I.S. Grant; W.R. Phillips; Manchester Physics (2008). Electromagnetism (2nd ed.). John Wiley & Sons. ISBN 978-0-471-92712-9.

7. Griffiths, David J. (1998). Introduction to Electrodynamics (3rd ed.). Prentice Hall. ISBN 0-13-805326-X.

8. Jackson, John D. (1998). Classical Electrodynamics (3rd ed.). Wiley. ISBN 0-471-30932-X.

DSE 4 : D. POINT SET TOPOLOGY
Subject code : UG/Sc/DSE/MATH/04/D
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Countable and Uncountable Sets, Schroeder-Bernstein Theorem, Cantor's Theorem. Cardinal numbers and cardinal arithmetic. Continuum Hypothesis, Zorns Lemma, Axiom of Choice. Well-ordered sets, Hausdorff's maximal principle. Ordinal numbers.

UNIT - 2

Topological spaces, basis and Subbasis for a topology, subspace topology, interior points, limit points, derived set, boundary of a set, closed sets, closure and interior of a set. Continuous functions, open maps, closed maps and homeomorphisms. Product topology, quotient topology, metric topology, Baire category theorem.

UNIT - 3

Connected and path connected spaces, connected sets in R, components and path components, local connectedness. Compact spaces, compact sets in R. Compactness in metric spaces. Totally bounded spaces, Ascoli-Arzela theorem, the Lebesgue number lemma. Local compactness.

References:

1. Munkres, J.R., Topology, A First Course, Prentice Hall of India Pvt.Ltd.,New Delhi, 2000.

2. Dugundji, J., Topology, Allyn and Bacon, 1966.

3. Simmons, G.F., Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

4. Kelley, J.L., General Topology, Van Nostrand Reinhold Co., New York,1995.

5. Hocking, J., Young, G., Topology, Addison-Wesley Reading, 1961.

6. Steen, L., Seebach, J., Counter Examples in Topology, Holt, Reinhart andWinston, New York, 1970.

7. Abhijit Dasgupta, Set Theory, Birkhäuser.

DSE 4: E. DYNAMICAL SYSTEMS
Subject code : UG/Sc/DSE/MATH/04/E
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

One dimensional Flow: Flow on the line: Introduction, A Geometric way of thinking, Fixed points and stability, Linear stability analysis, Existense and Uniqueness theorem.

UNIT - 2

Flow on the circle: Introduction, Examples and definitions, Uniform oscillator, non-uniform oscillator, over-damped pendulum, Josephson Junctions.

UNIT - 3

Bifurcations: Introductions, Saddle-Node Bifurcations, Transcritical Bifurcation, Pitchfork Bifurcation, Imperfect Bifurcations and Catastrophes.

UNIT - 4

Two-Dimensional Flows: Linear Systems - Introduction, Definition, Classification of linear systems, Phase plane: Phase portrait, Fixed points and Linearization, Index Theory
Limit Cycles: Introduction, Definition, Ruling out closed orbits, Poincare Bendixon theorem, Relaxation oscillators, weakly nonlinear oscillators

UNIT - 5

Nonlinear Systems: Method of Nullclines,
Bifurcations: Saddle-node Bifurcation, Transcritical Bifurcations, Pitchfork Bifurcations, Hopf Bifurcations, Hysteresis, coupled oscillators and quasiperiodicity.
Limit Sets: omega limit set, alpha limit set, limit cycles, Discreate Dynamical Systems

UNIT - 6

One dimensional Maps: Fixed points, stability, Cobwebs, Logistic Maps, Liapunov Exponents.

UNIT - 7

Fractals: Introduction, Cantor set, Dimension of self similar Fractals, Box dimension, Pointwise and correlation dimension.

Reference:

1. Nonlinear Dynamics and Chaos-Stevan H. Stogatz

2. Differential Equations, Dynamical Systems & An introduction to Chaos- Morris W. Hirch, Stephen Smale & Robert L. Devaney

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GE 1: STATISTICS - I
Subject code : UG/Sc/GE/STAT/01
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Concepts of a statistical population and sample from a population, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and by diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods).

UNIT - 2

Measures of location (or central tendency) and dispersion, moments, measures of skewness and kurtosis, cumulants. Bivariate data: Scatter diagram, principle of least-square and fitting of polynomials and exponential curves. Correlation and regression. Karl Pearson coefficient of correlation, Lines of regression, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).

UNIT - 3

Discrete and continuous random variables, p.m.f., p.d.f. and c.d.f. Expectation of random variable. Moments and cumulants, moment generating function, cumulants generating function and characteristic function. Bivariate probability distributions; independence of variates (only general idea to be given). Binomial, Poisson, Geometric, negative binomial, Hypergeometric, Normal, Uniform, Exponential, Beta and Gama distributions. Statement of Chebychev's inequality, WLLN and SLLN, Central limit theorem (CLT) for I.i.d. variates, and De Moivere's Laplace Theorem.

Reference:

1. J.E. Freund, Mathematical Statistics with Applications, 7th Ed., Pearson Education, 2009.

2. A.M. Goon, M.K. Gupta and B. Dasgupta, Fundamentals of Statistics, Vol. I, 8th Ed., World Press, Kolkatta, 2005.

3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.

4. R.V. Hogg, A.T. Craig and J.W. Mckean, Introduction to Mathematical Statistics, 6th Ed., Pearson Education, 2005.

5. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw Hill Publication, 2007.

GE 2: A. MATHEMATICS - I
Subject code : UG/Sc/GE/MATH/01
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

General equation of second degree, concept of poles and polars, diameters & conjugate diameters, system of circles, Polar equation of a conic. Sphere, equation of circle in three dimensions, conicoids.

UNIT – 2

Triple products of vectors – its properties and application to geometry and mechanics.
Vector functions: gradient, divergence, curl, line, surface, volume integral and allied theorems.

UNIT – 3

Successive differentiation and Leibnitz theorem. Rolle's theorem (statement only), Lagrange's mean value theorem, Taylor's theorem, Maclaurin's series and expansion of standard function, Indeterminate forms, Maxima and Minima, point of inflexion. Function of several variables – limit, continuity, partial derivatives. Euler's theorem.

Fundamental theorem of integral calculus, properties of definite integrals, Improper integrals, Beta and Gamma functions, application of definite integrals to geometric problems. Multiple integrals.

Reference:

1. S. L. Loney, The Elements of Coordinate Geometry, McMillan and Company, London.

2. M. R. Speigel, Schaum's outline of Vector Analysis

3. T. M. Apostol, Calculus, Volumes I and II

GE 2: B. COMPUTER SCIENCE - I
Subject code : UG/Sc/GE/COMP/TH/01
CREDIT HOURS – 4 (30 MARKS)

Problem solving through computers – Problem Analysis, Algorithm, Flow Chart and Program coding, Introduction to C, History, Basic Structure of C Program. Data types, Operators and Expression, type Conversion, Input – Output, Decision Control Structure, Loop Control Structure, Arrays, Functions, Pointers, Structures, Unions, Pre processor, Dynamic Memory Allocation.

Reference:

1. Ward, Terry A. (August 1983). Annotated C / A Bibliography of the C Language.

2. Prinz, Peter; Crawford, Tony (2005-12-16). C in a Nutshell

3. Kernighan, Brian W.; Ritchie, Dennis M. (February 1978). The C Programming Language (1st ed.). Englewood Cliffs, NJ: Prentice Hall. ISBN 0-13-110163-3.

GE 2: B. COMPUTER SCIENCE - I
Subject code : UG/Sc/GE/COMP/PR/01
CREDIT HOURS – 2 (20 MARKS)

Laboratory – C Programming.

GE 3: A. MATHEMATICS - II
Subject code : UG/Sc/GE/MATH/02
CREDIT HOURS – 6 (50 MARKS)

UNIT – 1

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation. Matrices – operation and its properties, rank of a matrix, system of linear equations, condition of consistency, eigenvalue and eigenvector.

UNIT – 2

General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations. Systems of linear differential equations, method for linear systems with constant coefficients. Basic theory of linear systems in normal form, homogeneous linear systems with constant coefficients.

Partial differential equation: formation and solution first order linear and higher order equations with constant coefficients. Method of separation of variables and its applications.

UNIT – 3

Numerical solution of algebraic and transcendental equations in one variable. Solution of simultaneous linear equations. Numerical integration: Trapezoidal and Simpson's rule.

Reference:

1. K.B. Dutta, Matrix and linear algebra.

2. W.S. Burnstine and A.W. Panton, Theory of equations

3. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.

4. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering

5. Bernard and Child, Higher Algebra

GE 3: B. COMPUTER SCIENCE - II
Subject code : UG/Sc/GE/COMP/TH/02
CREDIT HOURS – 4 (30 MARKS)

Data Structure: Arrays, Stacks, Queues. Link list – applications, trees. Recursion sorting and searching – linear and binary search, internal sorting methods.

Reference:

1. Peter Brass, Advanced Data Structures, Cambridge University Press, 2008.

2. Donald Knuth, The Art of Computer Programming, vol. 1. Addison-Wesley, 3rd edition, 1997.

3. Dinesh Mehta and Sartaj Sahni Handbook of Data Structures and Applications, Chapman and Hall/CRC Press, 2007.

4. Niklaus Wirth, Algorithms and Data Structures, Prentice Hall, 1985.

GE 2: B. COMPUTER SCIENCE - II
Subject code : UG/Sc/GE/COMP/PR/02
CREDIT HOURS – 2 (20 MARKS)

Laboratory – Implementation of different data structure using C.

GE 4: STATISTICS – II

Subject code : UG/Sc/GE/STAT/02
CREDIT HOURS – 6 (50 MARKS)

UNIT - 1

Index number. Time Series.

UNIT - 2

Estimation: Parameter space, sample space, point estimation, requirement of a good estimator, consistency, unbiasedness, efficiency, sufficiency, Minimum variance unbiased estimators. Cramer-Rao inequality (Statement only).

UNIT - 3

Methods of estimation: maximum likelihood, leasesquares and minimum variance, statement of Rao-Blackwell theorem and lehmann-Scheffe theorem. Properties of maximum likelihood estimators (illustration). Interval Estimation: confidence intervals for the parameters of normal distribution, confidence intervals for difference of mean and for ratio of variances.

UNIT - 4

Testing of Hypothesis: Statistical Hypothesis, simple and composite hypotheses. Test of statistical hypothesis, null and alternative hypotheses. Critical region. Two kinds of errors, Level of significance and power of a test. Neyman-Pearson lemma (statement only). Likelihood ratio test, Critical regions for simple hypothesis for one parameter.

Reference:

1. A.M. Goon, M.K. Gupta and B. Dasgupta, An outline of Statistical Theory (Vol. I), 4th Ed., World Press, Kolkata, 2003.

2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Ed., Sultan Chand and Sons, 2007.

3. R.V. Hogg, A.T. Craig, and J.W. Mckean, Introduction to Mathematical Statistics, 6th Ed. Pearson Education, 2005.

4. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw Hill Publication, 2007.

5. V.K. Rohtagi and A.K. Md. E. Saleh, An Introduction to Probablity and Statistics, 2nd Edition, John Wiley and Sons, 2009.

6. S.A. Ross, Introduction to Probability Models, 9th Ed., Academic Press, 2007.

7. G. Casella and R.L. Berger, Statistical Inference, 2nd Ed., Thomson Duxbury, 2002.

8. E.J. Dudewicz and S.N. Mishra, Modern Mathematical Statistics, John Wiley and Sons, 1988.

9. J.D. Gibbons and S. Chakraborty, Non Parametric Statistical Inference, 4th Ed., Marcel Dekkar, CRC, 2003.

10. M.G. Kendall and A. Stuart, The Advanced Theory of Statistics (Vol. III), Macmillan Publishing Co., Inc., 1977.

SEC 2: A. OPERATING SYSTEM (LINUX)
Subject code : UG/Sc/SEC/OS/01
CREDIT HOURS – 2 (50 MARKS)

UNIT - 1

Linux overview: Multi-user, multi-tasking OS, login, Security and privacy, Kernell and shell, File systems, Philosophy of team working-owner,group and others, Permission for read, write and execute. Online help – apropos, whatis, info, man.

UNIT - 2

Linux internal commands : creating and deleting of directories, moving around directories and renaming of directories. Creating, deleting and renaming of files, links to file- hard link and symbolic link. Listing of files- use of wild card for selective listing. Finding files. cp, mv, pwd, chmod, chgrp, chown commands. File managers.

UNIT - 3

Process, job scheduling and system monitoring : Commands ps, top, kill, cron
Text editor : use vi, vim and gedit to create, save and edit program or simple text files.
Stream text editor : grep, sed and awk for automated text editing.

UNIT - 4

Compression utility: zip, gzip, bzip, rar, lz and xz and archiving utilities tar and cpio
compiling and running of program: compiler collection in gcc, g++ and gfortran, Environment variables and exporting them.

UNIT - 5

Basics of shell script : operations in batch mode, shell variable and their manipulation, control structure, shell function, command line parameters.

Reference:

1. Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., PearsonEducation, 2008.

2. Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.

3. R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.

4. Sumitabha Das, UNIX Concepts and Applications, 4th Ed., TMH, 2009.

5. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, Linux in a Nutshell, 6th Ed.,O'Reilly Media, 2009.

6. Neil Matthew, Richard Stones, Alan Cox, Beginning Linux Programming, 3rd Ed., 2004.

SEC 2: B. MATLAB
Subject code : UG/Sc/SEC/SW/01
CREDIT HOURS – 2 (50 MARKS)

UNIT - 1

Introduction to MATLAB: Command Window, Editor Window, Figure Window, Help Window, etc. Data Types in MATLAB: Scalars, vectors, Arrays, Strings, etc.

UNIT - 2

Different inbuilt functions of MATLAB. Common System Commands, Syntax and Operators. Programming in MATLAB through M-file Editor. User defined functions in MATLAB. Programming in MATLAB through M-file Function. Algorithm. Simple problems.

UNIT - 3

Examples: (1) Sum of any finite number of terms (2) Product of any finite number of terms(3) Computation of Factorial (4) Computation of e^x, sinh(x), cosh(x), cos(x), sin(x) etc. (5) LCM and GCD of finite number of positive integers. (6) Sorting of numbers in ascending or descending order. (7) Plotting of different curves along with styles, width etc. (8) Plotting of different surfaces along with styles, width etc.

Reference:

1. Gilat, Amos (2004). MATLAB: An Introduction with Applications 2nd Edition. John Wiley & Sons. ISBN 978-0-471-69420-5.

2. Quarteroni, Alfio; Saleri, Fausto (2006). Scientific Computing with MATLAB and Octave. Springer. ISBN 978-3-540-32612-0.

3. Ferreira, A.J.M. (2009). MATLAB Codes for Finite Element Analysis. Springer. ISBN 978-1-4020-9199-5.

4. Lynch, Stephen (2004). Dynamical Systems with Applications using MATLAB. Birkhäuser. ISBN 978-0-8176-4321-8.