VIJAYANAGARA
SRI KRISHNADEVARAYA UNIVERSITY, BELLARY

Scheme And Syllabus

For B.A/B.Sc MATHEMATICS COURSE
(Semester System)

2016-17 Batch only

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
BELLARY

The syllabus in Mathematics for Six Semesters B.A/B.Sc. Degree Course

1. Following table shows the number of teaching hours, problem solving hours, examination pattern and marks.

		Semesters I,II,III,&IV	Semesters V & VI
Number of papers in each Semester		2	3
Teaching Hours per paper per Week	Teaching	4 Hours	4 Hours
Examination pattern in each paper in each semester	Duration of Examination	3 Hours	3 Hours
i)Examination marks	a. Maximum b.Minimum for pass	50 20	70 28
ii) Internal Assessment marks	a. Maximum b.Minimum for pass	25 --	30 --
iii) Total Marks	a. Maximum b.Minimum for pass	75 30	100 40

2. Internal assessment marks in each paper shall be awarded by the concerned course, teacher based on the two class tests each of one-hour duration conducted during semester.
3. The internal assessment marks awarded shall be carried forward for the repeated examination.
4. The maximum strength of each section for teaching hours is restricted to sixty students.

B.A/B.Sc. DEGREE COURSE STRUCTURE FOR MATHEMATICS SUBJECT
[DURATION THREE YEARS SPREAD OVER SIX SEMESTER]

Semester	Paper No	Paper Title	Content Of Topics
I	Paper-I	Algebra-I	Mathematical Logic, Theory of Equations. Matrices.
	Paper-II	Calculus-I	Successive differentiation, Functions of two and three variables, Polar co-ordinates and Theory of Plane Curves.
II	Paper-III	Algebra-II	Abstract Algebra, Sequences, and Series of real numbers.
	Paper-IV	Advanced Calculus	Differentiability, Integral Calculus, Line and multiple integrals & Gamma and Beta functions.
III	Paper-V	Algebra-III	Linear Algebra, Rings, Integral domains and fields
	Paper-VI	Differential Equations	Differential equation and Total Differential Equations.
IV	Paper-VII	Real and Complex Analysis	Complex Analysis and Real Analysis.
	Paper-VIII	Special Functions and PDE-I	Special Functions and Partial Differential Equations-I.
V	Paper-IX	Integral Transforms	Laplace transforms, Fourier Series, Fourier transforms and Z –Transforms.
	Paper-X	Applied Mathematics	Vector Analysis, Calculus of Variation, and Partial differential equation-II (PDE).
	Paper-XI	Optional –I	----
VI	Paper-XII	Trigonometry , Topology & Fuzzy Sets	Trigonometry , Topology & Fuzzy Sets.
	Paper-XIII	Numerical Analysis	Errors, Solution of algebraic and transcendental equations, Finite differences, Interpolation, Numerical Differentiation and Numerical Integration and solution of initial value problems.
	Paper-XIV	Optional-II	----

Students have to select ONE of the optional papers listed below during V semester and corresponding paper during VI semester (Depending upon the teaching staff available and infrastructure available in the college).

OPTIONAL PAPERS FOR V SEMESTER:	**OPTIONAL PAPERS FOR VI SEMESTER:**
5.3(A) GRAPH THEORY-I	6.3(A) GRAPH THEORY-II
5.3 (B) DISCRETE MATHEMATICS-I	6.3 (B) DISCRETE MATHEMATICS-II
5.3(C) OPERATION RESEARCH-I	6.3(C) OPERATION RESEARCH-II
5.3 (D) MECHANICS-I	6.3 (D) MECHANICS-II
5.3 (E) MATHEMATICAL MODELLING-I	6.3 (E) MATHEMATICAL MODELLING-II

Paper I: Algebra I

I. Mathematical Logic.

Recapitulation of Mathematical Reasoning, Open sentences, compound open sentences, Quantifier, universal Quantifier, Existential quantifier and negation of a quantifier statement. Rule of inference and proofs, Methods of proof. **12 Hrs**

II. Theory of Equations.

Relation between the roots and coefficients of general polynomial equation in one variable, Transformations of equations. Descartes rule of signs. Solution of cubic equation by Cordon's methods. Biquadratic equation. **15 Hrs**

III. Matrices.

Recapitulation of matrix algebra (Basic concepts), rank of matrix, elementary operations, equivalent matrices, invariance of rank under elementary operations, inverse of a non- singular matrix by elementary operations. System of m-linear equations in n unknowns, matrices associated with linear equation, criterion for existence of non-trivial solution of homogeneous and non-homogeneous system, criterion for uniqueness of solutions. Eigen values and Eigen vectors of square matrix- Cayley-Hamilton theorem - Applications. **25 Hrs**

Note: Internal mark: 25

References:

1. F.J. Noronha et al: Introduction to mathematical logic (Bangalore University Publication).
2. Rudraiah et al: College Mathematics Vol-I (Sapna Book House, Bangalore)
3. Schaum's outline of theory and problems of matrices by Frank Ayres (Schaum's Outline Series).
4. TEXTBOOK OF MATRIX ALGEBRA BY SUDDHENDU BISWAS
   (PHI Learning Pvt. Ltd. Copyright.)
5. Uspenskey: Theory of equations.
6. C.C. Macduff's: Theory of equations (John Wiley).

Paper II: CALCULUS-I

I. Successive differentiation:

n^{th} derivatives of the functions: $(ax+b)^n$, log (ax+b), e^{ax}, sin(ax+b), cos(ax+b), $e^{ax}\sin(ax+b)$, $e^{ax}\cos(bx+c)$, Leibnetz's theorem and its applications **07Hrs**

II. Functions of two and three variables:

Partial derivatives, Euler's theorem for homogeneous functions (two variables) and its applications. Total differential, Total derivative and partial derivative of composite functions, Jacobians properties and functional relations. Jacobians of implicit functions. **10Hrs**

III. Polar co-ordinates:

Polar co-ordinates, angle between radius vector and a tangent. Angle of intersections of curves, perpendicular distance drawn from the pole to the tangent and pedal equations (polar and Cartesian) **15Hrs**

IV. Theory of Plane Curves:

Points of inflection, concavity and convexity of curves, derivative of an arc in polar, Cartesian and parametric forms. Radius of curvature of a plane curve in Cartesian, parametric and polar forms, Centre of curvature and Evolutes, Envelops. **20Hrs**

NOTE: INTERNAL MARK: 25

References:

1. D.C.Pavate: Modern College Calculus.(Macmillan and Company Limited)
2. Shanti Narayan. : Differential Calculus (S Chand & Company Limited).
3. L.Ben: Calculus Vol-I and II (IBM).
4. Murray.R. Spiegel: Advance Calculus (Schaum's Outline Series).
5. G.K. Ranganath: A text book of Mathematics. (S Chand & Company Limited)
6. Rudraiah et al: College Mathematics Vol-I (Sapna Book House, Bangalore).

Paper III: Algebra- II

I. Abstract Algebra:

Groups, subgroups, cyclic groups, Lagrange's theorem and its consequences. Homomorphism and Isomorphism. Normal subgroups, quotient groups. The fundamental theorem of homomorphism. Permutation groups. Coset, decomposition of group. **15hrs**

II. Sequences:

Definition of sequence. Bounded and unbounded sequences. Convergence and divergence of sequences, monotonic sequences, algebra of convergent sequences, Cauchy's criterion for convergence. **15hrs**

III. Series of real numbers:

Partial sums of a series, convergence, divergence and oscillation of series. Properties of convergent series. Properties of series of positive terms. Geometric series. Tests for convergence of series: P-series test, comparison test, D Alembert's ratio test, Raabe's test, De'Alembert's test for absolute convergence (without proof), alternating series, Leibnitz test. Absolute and conditional convergence. **22hrs**

Note: Internal mark: 25

References:

1. Hertein.I.N: Topic in Algebra (Wiley Student Edition)
2. Fraleigh J.B: A first course in abstract Algebra (PEARSON Education)
3. G.K.Ranganath: B.Sc Mathematics (S Chand & Company Limited)
4. O.E.Stanaitis: An Introduction to Sequences, Series and Improper integrals
   Holdan-dey Inc.

Paper IV: Advanced Calculus

I. Differentiability:

Rolle's Theorem, Lagrange's and Cauchy's mean value theorem. Taylor theorem with Lagrange's form of the remainder. Taylors and Maclaurins series problems on transcendental functions. Indeterminate forms, L'Hospital's rules. **15 Hrs**

II. Integral Calculus:

Reduction formulae for the function: $\sin^n x$, $\cos^n x$, $\tan^n x$, $\cot^n x$, $\sec^n x$, $\operatorname{cosec}^n x$, $\sin^m x \cos^m x$ Application of integration to find area bounded by the curve, surface area, length of an arc & volumes of solids of revolution for standard curves in Cartesian and polar forms. **12 Hrs**

III. Line and multiple integrals:

Definition of line integrals, basic properties. Examples on evaluation of the integrals. Definition of double integral: evaluation of double integrals (i) under given limits (ii) in regions bounded by given curve. Change of variables. Surface areas as double integrals, definition of a triple integral and evaluation of volume as triple integrals. **15 Hrs**

IV. Gamma and Beta functions:

Gamma and Beta functions, connection between two functions, application to evaluation of integrals. **10 Hrs**

Note: Internal Marks: 25

References:

1. D.C.Pavate: Modern College Calculus. (Macmillan and Company Limited).
2. Shanti Narayan: Integral calculus (S Chand & Company Limited).
3. Murry R.Spigel: Advanced calculus (Schaum's Outline Series).
4. Rudraiah et al: College Mathematics Vol-I (Sapna Book House, Bangalore).
5. Sokoilnikoff I S: Advanced Calculus (McGraw Hill).

Paper V: Algebra III

I. Rings, Integral domains, fields:

Rings, types of rings, Properties of rings, rings of integer modulo n-sub rings, Ideals-Principal and maximal ideals in a commutative ring-examples and standard properties. Homomorphism and Isomorphism, properties of homomorphism. Quotient rings, Integral domains- fields- properties following the definition- field is an integral domain- finite integral domain is a field. **27 Hrs**

II. Linear Algebra:

Vector spaces, examples including R^n and C^n. Properties of vector spaces: subspaces. Criteria for a subset to be a subspace. Linear combination concepts of linearly independent and dependent subsets. Basis and dimension of a vector space and standard results related to a basis. Examples illustrating concept and result (with emphasis on R3). Linear transformations: Properties of linear transformations, matrix of a linear transformation, change of basis, range and kernel of a linear transformation, rank-nullity theorem. **25 Hrs**

Note: Internal Marks-25

References:

1. Hertein.I.N: Topic in Algebra (Wiley Student Edition)
2. Fraleigh J.B: A first course in abstract Algebra (PEARSON Education)
3. Lipschiz S: Linear Algebra (Schaum's Outline Series)
4. Shepherd G.C: Vector spaces of finite Dimension (Oliver and Boyd)
5. N. Jacobson: Basic Algebra Vol I & II, (Dover publications.)

Paper VI: Differential Equations

I. Differential equation:

Recapitulation of differential equations, exact equations, equations reducible to exact form. Linear and Bernoulli's equations, simple equations of first order and higher degree equations: solvable for p,x,y. Clairauts equations and their singular solutions. Orthogonal trajectories in Cartesian and polar form.

Second and higher order ordinary linear differential equations with constant coefficients, complementary functions, particular integrals (Standard types), Cauchy- Euler differential equation of order two, simultaneous differential equations with constant coefficients, solutions of ordinary second order linear differential equation by the following methods:

i. When a part of complementary function is given.

ii. Changing the independent variable.

iii. Changing the dependent variable.

iv. When first integral is given (Exact equation). **42Hrs**

II. Total Differential Equations:

Necessary condition for the equation Pdx+Qdy+Rdz=0 to integral problems there on,

Solution of the equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ **10 Hrs**

NOTE: INTERNAL MARKS-25

References:

1. Simnens G.F: Differential equations (TMH)
2. Cholriton F: Ordinary Differential Equations & Difference equations (D Van Norstrand Co Ltd).
3. Daniel. A .Murray: Introductory course in differential equations (Orient Longman).
4. Ayres F: Differential equation (Schum's Outline series).
5. M.D Raisinghania: Advanced Differential equations (S.Chand & co).
6. B.S Grewal: Higher Engineering Mathematics (Khanna Publishers).
7. Rudraiah et al: College Mathematics, Vol. I & II, (Sapna Book House, Bangalore).

Paper VII: Real and Complex Analysis

IV. Real Analysis:

Reimann Integration: Recapitulation of real number system, postulates and their consequences, inequalities and absolute values, lower and upper bounds. The upper and lower sums, necessary and sufficient conditions for integrability. Algebra of integrable functions. Integrability of continous and monotonic functions. Fundamental theorem of calculus, change of variables. Integration by parts. The first and second mean value theorems of integral calculus. **17 Hrs**

II Complex Analysis:

Recapitulation of complex numbers and complex plane, conjugate and modulus of a complex number. The polar form, geometrical representation, Euler's formula $e^{i\theta}$=CiSθ. Function of complex variable: Limits, continuity and differentiability. Analytic functions, Cauchy-Reimann equations in Cartesian and polar forms. Sufficient conditions for analyticity (in Cartesian form). Real and imaginary parts of analytic functions which are harmonic. Construction of analytic function given real and imaginary parts. Some standard transformation: Conformal transformation, special conformal transformation. The complex line integral: examples and properties (definitions of the concepts like Neighborhood of a point, closed contour etc. at appropriate places should be mentioned.) Cauchy integral theorem (statement) and its consequences. The Cauchy's integral formulae for the function and its derivatives, applications to the evaluation of simple line integrals. **35Hrs**

Note: Internal Marks-25.

References:

1. S C Malik: Mathematical Analysis (New Age International Pvt Ltd).
2. Sharma and Vasistha: Real Analysis (Krishna Prakashan Mandir, Meerut).
3. Churchill R V : Introduction to complex variables and applications (Mcgraw Hill)
4. Murry R Spiegel : Complex Variables (Schaum's Outline series)
5. Choudhary B: The elements of complex analysis (New Age International Pvt Ltd).
6. L.V. Alhfors : **Complex Analysis:** An Introduction to The Theory of Analytic Functions of One Complex Variable (Mcgraw Hill)

Paper VIII: Special Functions and PDE-I

I. Special Functions:

Legendre's differential equation, Legendre polynomials $P_n(x)$ as a solution, Rodrigue's formula, generating polynomials theorem, orthogonal property and basic relation. Recurrence relations.

Bessel differential equation, Bessel function $J_n(x)$ as a solution – generation formulae, integral formula for $J_n(x)$, orthogonal property, recurrence relations, basic relation problems there on.

Laguerre's differential equations, Laguerre polynomials $L_n(x)$ as a solution, generating function, orthogonal property, recurrence relations, basic relation problems there on. Hermite's differential equations, Hermite polynomials $H_n(x)$ as a solution, generating function, orthogonal property, recurrence relations, basic relation problems there on. **32 Hrs**

II Partial Differential Equations (PDE-I):

Formation of Partial Differential Equations, Lagrange's linear equations Pp+Qq=R, Standard types of first order linear Partial Differential Equations and equations reducible to standard form, Charpit's method. Standard type of Non-linear PDE of first kind. **20 Hrs**

Note: Internal Marks-25

References:

1. Ayres F : Differential Equations (Schaum's Outline Series)
2. Stophenson.G: An introduction to Partial Differential Equations(ELBS)
3. B.S Grewal: Higher Engineering Mathematics (Khanna Publishers).
4. M.D Raisinghania: Advanced Differential equations (S.Chand & co)
5. Ian N. Sneddan: Elements of Partial Differential Equations, McGraw Hill.

Paper IX: Integral Transforms.

I. Laplace transforms:

Definition and basic properties. Laplace transforms of some common functions, Laplace transforms of the derivatives and the integral of the function, convolution theorem. Inverse Laplace transforms: Application to ordinary linear differential equation of first and second order with constant co-efficient, solving the system of first order simultaneous differential equations.

20 Hrs

II. Fourier Series:

Periodic function, Fourier series of function with period 2π and period 2L. Half range cosine and sine series, Complex form of Fourier series. **10 Hrs**

III. Fourier transforms:

Definition and basic properties. Fourier integrals, Fourier sine and cosine integral, Fourier sine and cosine transforms. Properties of F-Transforms. Convolution theorem foe F-Transforms, Parseval's Identity for Fourier Transforms. Relation between Laplace and Fourier Transforms. Fourier transforms of the derivatives of function **12 Hrs**

VI. Z -Transforms:

Definition and basic properties. Some standard Z- transforms. Linearity property, Damping Rule, Some Standard Results. Shifting U_n to the right to the left, Multiplication by n. Two basic theorems (Initial Value and Final Value Theorems). Some useful Z-Transforms and Inverse Z-Transforms. Evaluation of inverse Z-Transforms (Power series method). Application to Differential equations. **10 Hrs**

NOTE: INTERNAL MARKS 30.

References:

1. Churchill.R.V and Briwn JW: Fourier series and Boundary value problems(McGraw-Hill)
2. G.Bachman, L. Narili, E. Backenstein, Fourier and Wavelet Analysis, Springer, 2005.
3. Murry. R. Spiegel: Laplace transforms (schaum's Outline Series)
4. Laplace transforms by S K Anand (Sarup and Sons New Delhi)
5. Fourier Transforms by Ian.sneddon (Dover Publications)
6. Dr.B.S.Grewal: Higher Engineering Mathematics, Khanna Publishers.

Paper X: Applied Mathematics

I. Vector Analysis:

Scalar field, Quotient of a scalar field, geometrical meaning, Directional Derivatives, Vector field, Divergence and curl of a vector field. Solenoidal and irrigational fields. Expression for $\nabla\Phi$, div f and curl f (Cartesian co-ordinates), vector identities, Greens theorem in the plane with proof and its applications, Gauss divergence theorem (Statement only), Stoke's theorem (Statement only), examples based on them. **22Hrs**

II Calculus of Variation:

Introduction, Functionals, Euler's equations, solutions of Euler's equation. Geodesics. Isoperimetric problems, several dependent variables, functionals involving higher order derivatives. **15Hrs**

III Partial Differential Equation (PDE-II):

Solution of second order linear partial differential equations in two variables with constant Coefficients by finding complimentary function and particular integral, canonical forms for parabolic, elliptic and hyperbolic equations, solution by separation of variables. Solutions of one-dimensional heat and wave equations and two dimensional Laplace equation by the method of separation of variables. **15Hrs**

Note: Internal Marks-30

References:

1. Murry. R. Spiegel: Vector analysis (Schaum's Outline series).
2. Spain.B: Vector analysis.(D. Van Nostrand Company, London, 1967)
3. Stophenson.G: An Introduction to Partial Differential Equations (ELBS).
4. Ian N. Sneddan: Elements of Partial Differential Equations, McGraw Hill.
5. M.D Raisinghania: Advanced Differential Equations (S.Chand & Co).
6. B.S Grewal: Higher Engineering Mathematics (Khanna Publishers).
7. K.Shankar Rao: Introduction to Partial Differential Equations
   (PHI Pvt Ltd, New Delhi)

Paper XII: Trigonometry and Complex analysis

I. Trigonometry:

Expression of sine and cosines using De-Moiver's theorem. Series of sines and cosines. Hyperbolic functions. Logarithm of complex number (simple example), summation of trigonometric series (simple problems) **12 hrs**

II. Topological Spaces:

Definition of a topology and examples: Types of topologies: Discrete, indiscrete and co-finite topology (or finite complement topology). Open and closed sets. Simple examples, elementary concepts closure and closure properties, neighborhoods, limit points and derived sets, interior, exterior and boundary of a set. **Bases and sub bases:** Definition, base for a topology, properties of base for a topology. Characterization of a topological space in terms of base.

III. Relative topology:

Definition, Elementary properties and examples. Separation axioms, T_1-Spaces and T_2- Spaces (Definition and simple properties) **30 Hrs**

IV. Fuzzy Sets:

The vocabulary of Fuzzy logic- Boolean sets-operators-Fuzzy sets-Fuzzy Quantifiers-Fuzzy set operators-operations on Fuzzy sets-illustrations-Applications. **10 Hrs**

Note: Internal Marks-30

References:

1. Churchill R V : Introduction to complex variables and applications (Mcgraw Hill)
2. Murry R Spiegel : Complex Variables (Schaum's Outline series)
3. Choudhary B: The elements of complex analysis (New Age International Pvt Ltd).
4. L.V. Alhfors : **Complex Analysis:** An Introduction to The Theory of Analytic Functions of One Complex Variable (Mcgraw Hill)

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5. E. Sampath Kumar and K.S. Amur: Introduction to Modern Algebra and Topology.
6. General Topology by Seymour Lipschutz (Schum's Outline series).
7. Klir and Yaan: Introduction to fuzzy set theory (PHI Publication).

Paper XIII: Numerical Analysis

I .Errors:

Introduction, significant digits, rounding of numbers, errors, relative error and number of correct digits, general error formula. Applications of errors to the fundamental operations of arithmetic.

II. Solution of algebraic and transcendental equations:

Method of successive bisection, Method of false position, Newton-Raphson's iterative method, Aitkins Δ^2 method, Solution of system of equation: Gauss elimination method, Jacobi method, Gauss-Seidal method,

III. Finite differences:

Definition and properties of Δ, ∇ and E and relation between them, the n^{th} differences of a polynomial.

IV. Interpolation:

Newton-Gregory forward and backward interpolation formula for unequal intervals.

V. Numerical Differentiation:

Using forward and backward formulae and Newton's divided difference formula, computation of first and second derivatives.

VI. Numerical Integration:

General Quadrature formula, Trapezoidal role, Simpson's $1/3^{rd}$ and $3/8^{th}$ Rules, Weddle's rule, problems there on.

VII. Solution of initial value problems:

For ordinary first order and first degree differential equation by Picard's method, Taylor's, Eulers and Eulers modified method and fourth order Runge-Kutta methods.

52Hrs

Note: Internal Marks-30

References:

1. G.Shanker Rao: Numerical analysis (New Age International Publication)
2. Sastry S.S: Numerical Ananlysis (Prentice Hall of India)
3. Scheild P: Numerical Ananlysis (Schaum Series)
4. Balaguru swamy.E: Numerical Methods (Tata Mecrew hill)
5. M.K.Jain, I.R.K. Iyengar and R.K.Jain- Numerical Methods (New Age International Pvt Ltd).

OPTIONAL PAPERS FOR FIFTH SEMESTER

Paper XI (A) Title: GRAPH THEORY- I

Introduction:

Graphs, finite and null graphs. Connectedness and component, degree of vertex, minimum and maximum degree, $\sum \deg v_i = 2q$. The number of vertices of odd degree is even. Isomorphism, complete graph, line graph, total graph. Sub graphs, spanning and induced sub graphs, walk, trial, path, cycle, the shortest path problems, bipartite graph characterization of bipartite graph in terms of its cycles. **22Hrs**

Eulerian and Hamiltonian graphs:

Introduction the Kenigsberg bridge (New name as kalingrad) problem and travelling salesman problem, Characterization of Eulerian graphs and properties of Hamiltonian graphs some applications graphs in electronic network., Cut vertex, bridge, block, tree, spanning tree, rooted and binary trees, forest. Some properties of trees. **15Hrs**

Connectivity:

Vertex and edge connectivity. Some external problems, Mengers theorems (statement), Properties of n-Connected graphs with respect to vertices and edges, Matrix representation: Incidence, adjacency, power of adjacency matrix, edge sequence in adjacency matrix, circuit matrix, some applications **15Hrs**

Note: Internal marks: 30

References:

1. Robin J Wilson: Introduction to Graph theory Longman (London), UK.
2. Narsing Deo : Graph theory and applications (PHI), India.
3. Frank . Harrary : Graph Theory, Narosa Publications, India.
4. V.K.Balakrishnan: Graph Theory, (Schum's Outline Series).

Paper XI (B): DISCRETE MATHEMATICS-I

Sets and propositions-Cardinality. Mathematical induction. Principle of Inclusion and exclusion. Computability and formal languages- Ordered sets. Languages, Phrase structure grammers. Types of grammers and languages.

Permutation, Combinations and discrete probability. Relations and Functions: Binary relations. Equivalence relations and partitions. Partial order relations and lattices. Chains and anti-chains. Functions and the pigeonhole principle.

Graphs and Planar Graphs: Basic terminology, Multi-Graphs. Weighted graphs. Paths and circuits. Hamiltonian paths and circuits. Travelling salesman problem. Planar Graphs.
Trees: Trees, Routed trees, Binary search trees. Spanning trees and cut sets. Transport Networks
Finite state Machines: Equivalent machines. Finite state machines as Language Recognizers.
Recurrence relations: First order relations, second order linear homogeneous relations, Third and higher order linear homogeneous relations, linear non-Homogeneous relations of second and higher order.

52Hrs

Note: Internal marks: 30

References:

1. Liu C.L: Elements of discrete Mathematics (McGraw Hill).
2. Trambley J.P. and Manohar P: Discrete Mathematical Structures with Application to computer Science (TMH).
3. Narsingh Deo: Graph Theory with Application to Engineering and Computer Science (PHI).
4. Kolamn B. and Busy R.C: Discrete Mathematical Structures for Computer Science (PHI).

Paper XI(C): OPERATION RESEARCH-I

Probability Theory:

Nation probability- Random experiment, sample space, axion of probabiltity, elementary properties of probabilty, equally likely outcome problems.

Rnadom variable – concept, cumulative distribution function discrete and continuous random variable, expectation mean variance, moment generation functions.

Discrete Random variables- Bernoulli random variable, Binomial random variable, geometric random variable, Normal random variable.

Conditional probability and conditional expectations – Bayes theorem, Independence, computing expectation by conditioning; some application – a list model, a random graph, Poly's urn model.

Bivarite random variable – Joint distribution, joint and conditional distribution, the correlation coefficient.

Function of random Variable – Sum of random variable, the law of large numbers and limit theorem, the approximation of distribution **52Hrs**

Note: Internal marks: 30

References:

1. Ross S.M: introduction to probabilty models (Acdemic Press).
2. Gupta S.C. and Kapoor V.K. : Fundamental of mathematical statistics (S.chand & sons)
3. Pitman J : Probability (Narosa)
4. Blake I : An Introdection to Applied Probability (Jophn wiley & Sons)

Paper XI (D): MECHANICS-I

Dynamics of a Particle and System of Particles:

Conservation Principle. Mechanics of particle Conservation of linear momentum, angular momentum and Energy. Mechanics and system of particles- Conservation of linear momentum, angular momentum and Energy. Tangential and normal components of velocity and acceleration. Constrained motion of a particle under gravity along, inside and outside of a circle and a cycloid. Radial and transverse compounds of velocity and acceleration. Motion of a particle in a central force field, determination of orbit from central forces and vice-versa, Kepler's Laws of Planetary Motion. **27 Hrs**

Dynamics of Rigid Bodies:

Centre of mass of a rigid body, static equilibrium of rigid body, rotation of rigid body about a fixed axes. Moment of Inertia. Laminar motion of a rigid body, body rolling down an inclined plane. Angular momentum of a rigid body. Product of inertia, moment of inertia of a rigid body, about an arbitary axes, momental ellipsoid. D'Alembert's Principle, General equation of motion of a rigid body, motion of centre of inertia, motion relavative to centre of inertia. **25 Hrs**

Note: Internal marks: 30

References:

1. S.L.Gupta, V.Kumar and H.V.Sharma: Classical Mechanics, Pragati Prakashan, Meerut.
2. F.Chorlton: Textbook of Dynamics, CBS Publishers, New Delhi.
3. Murray R Spiegal: Theoretical Mechanics, Schaum Series.
4. S.L.Loney: An elementary treatise on the dynamics of a particle and of rigid bodies, Cambridge University Press, 1958.
5. Grant R.Fowles: Analytical Mechanics, Holt, Rinehart and Winston Inc.

Paper XI (E): MATHEMATICAL MODELLING-I

Introduction

The technique of mathematical modeling, Characteristics of mathematical models, Limitations of mathematical modeling.

Mathematical Modelling through Ordinary Differential Equations:

Linear Growth and decay models: Single Sprecies population models, Population growth, effecta of immigration and emigration on populations size, spread of scientific and technological innovation, radioactive decay, diffusion, diffusion of medicine in the blood stream.

Higher Order Linear Models:

A model for the detection of diabetes, modeling in dynamics, vibration of a mass on a spring free and undamped, damped forced motion, electric circuit problem

Modelling of Epidemics:

A simple epidemic model, a susceptible-infected-susceptible (SIS) model, simple epidence model with carriers and removal model for arm race, combat model, traffic model.

52Hrs

Note: Internal marks: 30

References:

1. Differential Equation Models, Eds. Martin Braun, C.S.Colman, D.A.Drew, Springer Verlag, 1982.
2. Discrete & System models, W.R.Lucas, F.S.Roberts, R.M.Thrall, Springer Verlag, 1982.
3. Life Science Models, H.M.Roberts and M.Thompson, Springer Verlag, 1982.
4. Models in Applied Mathematics, Springer Verlag, 1982.
5. Mathematical Modelling, J.N.Kapur, Wiley Eastern, 1988.

Optional paper for sixth Semester

Paper XIV (A): Graph Theory- II

Planar Graphs:

Line graph, Total graph, subdivision graph, inner vertex set and inner vertex number, Plane and planar graphs, Euler identity, non-planar graphs, Maximal planar graphs, outer planar graphs.

Matrix representation:

Incidence matrix, Circuit matrix, Characteristic polynomials, Eigen values, Spectra of a graph.

Directed graphs:

Preliminaries of digraph, oriented graph, indegree and out degree, Elementary theorems in digraph, Types of digraph, Tournament, cyclic and transitive.

Colorability:

Vertex coloring, color class, n-coloring, chromatic index of a digraph, chromatic number of standard graphs, bichromatic graphs, colorings in critical graphs, relation between chromatic number and clique number/independence number/maximum degree, edge coloring, edge chromatic number of standard graphs and coloring of a plane map, chromatic polynomial.

52Hrs

Note: Internal marks 30

References:

1. Robin J Wilson: Introduction to Graph theory Longman (London), UK.
2. Narsing Deo: Graph theory and applications (PHI), India.
3. Frank. Harrary: Graph Theory, Narosa Publications, India.
4. V.K.Balakrishnan: Graph Theory, (Schum's Outline Series).

Paper XIV (B): DISCRETE MATHEMATICS-II

Analaysis of Algorithms:

Time complexity of algorithms, shortest path algorithm, complexity of problems, tractable and intractable problems, Discrete numeric functions and generating function. Recurrence relation and recursive algorithms: Linear recurrence relation with constant coefficients. Homogenous solutions. Particulars solutions. Total solutions. Solution by the method of generating function.

Coding Theory:

Semigroups, monoids and groups, codes and group codes, codes, coding of binary information and error detection, decoding and error correction. **27 Hrs**

Boolean algebra:

Lattices and Algebraic Structures. Principal of duality. Distributive and complemented lattices. Boolean lattices and Boolean algebras. Boolean functions and expressions. Propositional calculus. Design and implementation of digital network. Switching circuits. **25Hrs**

Note: Internal marks: 30

References:

1. Liu C.L. Elements of Discrete mathematics (McGraw Hill).
2. Trambly J.P. and Manohar.R. Discrete Mathematical strucutres with application to computer science (TMH).
3. Narsing Deo, Graph theory with application to Engineering and computer Science (PHI).
4. Kolamn B and Busy R.C. Discreate Mathematical structures for computer science (PHI).

Paper XIV (C): OPERATIONS RESEARCH-II

Linear Programming:

Formulation, linear programming in matrix notation, Graphical solution, some basic properties of convex sets, convex functions and concave functions, simplex methods, artificial variables, M-technique, two-phase method. Principal of duality in linear programming problem. Fundamental duality theorem. Simple problems, dual simplex method, sensitivity analysis, transportation and assignment problems. Netwoprk analysis-CPM and PERT. **40Hrs**

Integer Programming:

Gomory's constrainits, cutting plane algorithm, branch and bound algorithms **12Hrs**

Note: Internal marks: 30

References:

1. Taha H: Operations Research (Mcmillan).
2. Kanti Swarup, Gupta P.K. and Manmohan: Operations Research (S.Chand & Co.,)
3. Kalavathy S.: Operations Research (Vikas).
4. Sharma S.D.: Operation Research.

Paper XIV (D): MECHANICS–II

Analytical Statics:

Resolution of forces in two and three – dimensions, parallelogram law, triangular law of forces Lamis theorem, Resultant of parallel forces, couples, moment of a couple, varignan's theorem and theorem of couples. A System of force action in one plane at different points of a body be reduced to a single force through a given point and couple. A static equilibrium, General conditions of equilibrium, common centenary. **25Hrs**

Hydrostatics:

Pressure equation, condition for equilibrium, lines of force, surface of equal pressure, pressure in fluids, center of pressure, resultant pressure on plane and curved surfaces. Equilibrium of floating bodies, curves and surfaces of buoyancy, stability of hydrostatic Equilibrium of floating bodies, meta center, work done in producing a displacement, vessel contacting liquid. **27Hrs**

Note: Internal marks: 30

References:

1. S.L. Loney: Statics, Mc Millan & Co. London.
2. R.S. Verma, A. Textbook on statics, Pothishala publ. Allahabad.
3. M.Ray and P.T. Chandi: Statics.
4. W.H. Besant & A.S. Ramsey: A Treatise on Hydromechanics: Part – I Hydrostatics,ELBS & G Bell & Sons Ltd., London.

Paper XIV (E): MATHEMATICAL MODELLING–II

Modelling through differential equations. Non-Linear Model: non- linear population growth model, multi-species models, age structured population model, prey – predator model, competition model, epidemic growth model, spread of technological innovations and infectious diseases, chemical reactions.

Modelling in dynamics- simple pendulum, falling body. Mathematical modelling through difference equations: the need for modelling through difference equations, simple models population growth model, logistic model, prey-predator model, completion model, epidemic model, non-linear population growth model, an age structured model, Hardy- Weinberg law in Genetics.

52Hrs

Note: Internal marks: 30

References:

1. Differential equations Models, Eds. Martin Braun, C.S. Colman, D.A. Drew, Springer Verlag, 1982.
2. Discrete & system models, W.R. Lucas, F.S. Roberts, R.M.Thrall, Springer Verlag 1982.
3. Life science Models, H.M. Roberts & M.Thompson, Springer – Verlag, 1982.
4. Models in applied mathematics springer Verlag, 1982.
5. Mathematical Modeling, J.N. Kapur, Wiley Estern, 1988.