Annexure No.	18 D
SCAA Dated	29.02.2008

BHARATHIAR UNIVERSITY: COIMBATORE 641046
SCHOOL OF DISTANCE EDUCATION
B.SC MATHEMATICS NON-SEMESTER PATTERN
(For the student admitted during academic year 2007-08 or later)
SCHEME OF EXAMINATION

Year	Part	Subject & Paper	University Examination	
			Duration in Hours	Max Marks
First	**I**	Language –Paper I - Tamil	3	100
	II	English – Paper I - English	3	100
	III	Gr.A Core- Paper I- Classical Algebra and Calculus	3	100
		Gr.A Core Paper II - Trigonometry ,Vector Calculus and Analytical Geometry	3	100
		Gr.B Allied A –Paper –Statistics for Mathematics	3	100
Second	**I**	Language – Paper II – Tamil	3	100
	II	English – Paper II- English	3	100
	III	Gr.A Core Paper III- Differential Equation & Lap lace Transforms	3	100
		Gr.A Core-Paper IV-Mechanics	3	100
		Gr.B Allied B-Paper-Accountancy	3	100
Third	**III**	Gr.A Core Paper V-Real Analysis	3	100
		Gr.A Core Paper VI-Complex Analysis	3	100
		Gr.A Core Paper VII-Modern Algebra	3	100
		*Gr.C Appl.Ori.Sub.A –Paper	3	100
		*Gr.C Appl.Ori.Sub.B –Paper	3	100
		Total		1500

*Application Oriented Subjects (Any Two Selects)

1) Astronomy
2) Numerical Methods
3) Discrete Mathematics
4) Graph Theory

BHARATHIAR UNIVERSITY, COIMBATORE 641 046
SCHOOL OF DISTANCE EDUCATION

B. Sc MATHEMATICS
NON- SEMESTER PATTERN
(For the students admitted during academic year 2007-2008 or later**)**
FIRST YEAR

Paper I
Subject Title : Classical Algebra and Calculus

Subject Description: This course presents important concepts in summation of algebraic series, theory of equations, differential calculus and integral calculus,.

Goals: To enable students to learn the concepts, techniques and applications of calculus and classical algebra.

Objectives: On successful completion of the course the students should have:
(i) understood the basic concepts of classic algebra- in particular theory of equation and convergence of series
(ii) learnt the techniques of calculus and learnt its applications in finding curvature, envelopes, areas, volumes etc
(iii) learnt numerical methods for integration and solving of equations.

Contents:

I Binomial, exponential theorems –their statements and proofs – their immediate application to summation only**.** Logarithmic series theorem – statement and proof – immediate application to summation only. Convergence and divergence of series – definitions, elementary results- Comparison tests – De Alemberts and Cauchy's tests.

II Absolute convergence- series of positive terms – Cauchy's condensation test –Raabe's test. Theory of equations- roots of an equations – relations connecting the roots and coefficients . Transformations of equations –character and position of roots – Descarte's rule of signs – symmetric functions of roots.

III Multiple roots – Rolle's theorem – position of real roots of f(x) = 0. Newton's method of approximation to a root and Fourier's rule – Horner's method.

Curvature – radius of curvature in cartesian and polar forms – Evolutes and envelopes – pedal equations – total differentiation – Euler's theorem on homogeneous functions.

IV Integration of $f'(x)/f(x)$, $(px+q)/(ax^2 + bx + c)$, $\sqrt{[(x-\alpha)/(\beta-x)]}$, $\sqrt{[(x-\alpha)(\beta-x)]}$, $1/\sqrt{[(x-\alpha)(\beta-x)]}$, $1/(a\cos x + b\sin x + c)$, $1/(a\cos^2 x + b\sin^2 x + c)$. Integration by parts. Reduction formulae – problems – double and triple integrals –definitions – applications to calculations of areas and volumes – area in polar coordinates.

V Approximate integration- Simpson's rule and Trapezoidal rule, change of order of integration in double integral- change of variables in double and triple integrals – Jacobians. Notion of improper integrals- their convergence- simple tests for convergence- simple problems- Beta and Gamma integrals – their properties-.relation between them.

Treatment as in:
1) Algebra by T. Natarajan and others .
2) Calculus Volume I and Volume II by S. Narayanan and T K M Pillai.

Reference:
B.Sc Mathematics for branch I- Vol I & Vol II by P.Kandasamy and K.Thilagavathi,
S Chand & Co ,2004

Paper II

Subject Title : Trigonometry ,Vector Calculus and Analytical Geometry

Subject Description: This course presents concepts and techniques of trigonometry, vector calculus and analytical geometry.

Goals: To enable students to learn the basic concepts, techniques and applications of trigonometry, vector calculus and analytical geometry.

Objectives: On successful completion of this course the student should have
- (i) learnt the properties of trigonometric functions
- (ii) understood the basic concepts of vector calculus and learnt its various applications
- (iii) learnt the use of polar coordinates and concepts of 3D analytical geometry

Contents:
I Expansion of Cosnφ. Sinnφ , $\text{Cos}^n\varphi$. $\text{Sin}^n\varphi$ – Hyperbolic functions – seperation of real and imaginary parts of Sin(α+iβ), Cos(α+iβ), tan(α+iβ), Sinh(α+iβ), Cosh (α+iβ), tan(α+iβ), tanh(α+iβ). Logarithm of a complex number –summation of trigonometric series.

II Scalar and vector point functions –differentiation of vectors - differential operators – directional derivative – gradient, divergence, curl. Integration for vectors- line,surface and volume integrals – Theorems of Gauss, Green, Stokes (Statements only) –Verifications.

III Fourier series –definition – finding Fourier coefficients for a given periodic function with period 2π- odd and even functions – half range series – change of interval.

Analytical geometry of two dimensions – polar coordinates-equation of a conic – directrix- chord- tangent –normal-simple problems.

IV Analytical geometry of three dimension- staight lines – coplanarity of straight lines – shortest distance and equation of shortest distance of between two lines – simple problems.

Sphere – standard equation – results based on the properties of a sphere- tangent plane to a sphere – equation of a circle.

V Cone and cylinder – cone whose vertex is at the origin – enveloping cone of a sphere – right circular cone – equation of a cylinder – right circular cylinder.

Conicoids – nature of a conicoid – standard equation of a central conicoid – enveloping cone – tangent plane – conditions for tangency – director sphere and director plane.

Treatment as in:
1)B.Sc Mathematics for branch I- Vol I , Vol II& Vol IV by P.Kandasamy and K.Thilagavathi, S Chand & Co ,2004
2)Analytical Geometry of 2 D by T.K.M.Pillai and others.
3)Analytical Geometry by P.Duraipandian and others.

Reference
Trigonometry by S . Narayanan
Vector Calculus by P.Duraipandian
Fourier Series by S . Narayanan

First year Group B: Allied A

Subject Title: Statistics for Mathematics

Subject description: This course introduces Statistical concepts and mathematical analysis.

Goal: To enable the students to understand mathematical aspects of statistics

Objective: On successful completion of the paper the students should have understood the concepts of random variable, various discrete and continuous probability distributions and the concepts of correlation and regression.

UNIT-I:

Random variables- discrete and continuous random variables –distribution function- properties- probability mass function, probability density function-mathematical expectation – addition and multiplication theorems on expectations

Unit-II:

Moment generating and cumulating generating & characteristic functions and their properties.Joint probability distributions-marginal and conditional probability distributions- independence of random variables.-Simple problems. Tchebychev's inequality, weak law of large numbers and central limit theorem.

Unit – III:

Probability distributions: Binomial, Poisson and Normal distributions and their properties and fitting of distributions.

Unit – IV:

Transformation of variables (one & two dimensional only).Chi-square, t and F Statistics, their probability functions and their properties.

Unit – V:

Curve fitting and principle of least squares: fitting of curves of straight line, second degree parabola, power curve and exponential curves-correlation and regression analysis.

Books recommended for study:

1. Fundamentals of Mathematical statistics by Guptha, S.C &Kapoor, V.K
2. Introduction to Statistical methods by Guptha ,C.B and Vijay Guptha (1988)

SECOND YEAR
Core paper III

Subject Title: Differential Equations and Lap lace Transforms

Subject Descriptions:

This course presents the method of solving ordinary differential Equations of First Order and Second Order, Partial Differential equations. Also it deals with Laplace Transforms, its inverse and Application of Laplace Transform in solving First and Second Order Differential Equations with constant coefficients.

Goals:

It enables the students to learn the method of solving Differential Equations.

Objectives:

End of this course, the students should gain the knowledge about the method of solving Differential Equations. It also exposes Differential Equation as a powerful tool in solving problems in Physical and Social sciences.

Unit I:

Ordinary Differential Equations: Equations of First Order and of Degree Higher than one – Solvable for *p, x, y* – Clairaut's Equation – Simultaneous Differential Equations with constant coefficients of the form

i) $f_1(D)x + g_1(D)y = \phi_1(t)$

ii) $f_2(D)x + g_2(D)y = \phi_2(t)$

where f_1 , g_1 , f_2 and g_2 are rational functions $D = \frac{d}{dt}$ with constant coefficients ϕ_1 and ϕ_2 explicit functions of *t*.

Unit II:

Finding the solution of Second and Higher Order with constant coefficients with Right Hand Side is of the form Ve^{ax} where *V* is a function of *x* – Euler's Homogeneous Linear Differential Equations – Method of variation of parameters.

Unit III:

Partial Differential Equations: Formation of equations by eliminating arbitrary constants and arbitary functions – Solutions of P.D Equations – Solutions of Partial Differential Equations by direct integration – Methods to solve the first order P.D. Equations in the standard forms - Lagrange's Linear Equations.

Unit IV:

Laplace Transforms: Definition – Laplace Transforms of standard functions – Linearity property – Firsting Shifting Theorem – Transform of $tf(t)$, $\frac{f(t)}{t}$, $f^{1}(t)$, $f^{11}(t)$.

Unit V:

Inverse Laplace Transforms – Applications to solutions of First Order and Second Order Differential Equations with constant coefficients.

Treatment as in

Kandasamy. P, Thilagavathi. K "Mathematics for B.Sc – Branch – I Volume III", S. Chand and Company Ltd, New Delhi, 2004.

References:

1) S. Narayanan and T.K. Manickavasagam Pillai, Calculus, S. Viswanathan (Printers and Publishers) Pvt. Ltd, Chennai 1991
2) N.P. Bali, Differential Equations, Laxmi Publication Ltd, New Delhi, 2004
3) Dr. J. K. Goyal and K.P. Gupta, Laplace and Fourier Transforms, Pragali Prakashan Publishers, Meerut, 2000

Core Paper IV - Mechanics

Subject Description:

This course contains the nature of forces acting on a surface, friction and center of gravity.

Goal:

To enable the students to realize the nature of forces and resultant forces when more than one force acting on a particle.

Objectives:

On successful completion of course the students should realize the concept about the forces, resultant force of more than one force acting on a surface, friction and center of gravity. Also he can differentiate static and dynamic forces.

UNIT-I

Forces acting at a point: Resultant and Component - Lami's theorem – Resultant of any number of forces (Analytical and graphical methods) – Parallel forces and moments: - Couples: Definition - Equivalence of two couples – Resultant of a couple and a force.

UNIT II

Three forces acting on a rigid body - coplanar forces – condition of equilibrium of a system of coplanar forces – Friction - Equilibrium of a particle on a rough inclined plane under any force

UNIT III

Centre of gravity by integration – Principle of virtual work for a system of coplanar forces acting on a body - Kinematics – velocity – motion down a smooth inclined plane - Laws of motion - potential energy and kinetic energy

UNIT IV

Projectiles : Definition – Two fundamental particles – finding the velocity of the projectile in magnitude and direction ate the end of line 't' – Motion under the action of central forces – Introduction – Velocities in a central orbit – Law of the inverse square

UNIT V

Introduction – Simple harmonic motion in a straight line – composition of two simple harmonic motions of the same period in two perpendicular directions – Introduction – Definition – Fundamental laws of impact – Oblique impact of two smooth spheres

Treatment as in M.K.Venkataraman, Statics, Agasthiar Publications, Trichy, 1999.
Treatment as in M.K.Venkataraman, Dynamics, 11th Ed. Agasthiar Publications, Trichy, 1994.

References

1. A.V.Dharmapadam, Statics , S.Viswanathan Printers and Publishing Pvt., Ltd, 1993.
2. P.Duraipandian and Laxmi Duraipandian, Mechanics , S.Chand and Company Ltd, Ram Nagar, New Delhi -55, 1985.
3. Dr.P.P.Gupta, Statics , Kedal Nath Ram Nath, Meerut, 1983-84.
4. A.V.Dharamapadam , Dynamics, S.Viswanathan Printers and Publishers Pvt., Ltd, Chennai, 1998.
5. K.Viswanatha Naik and M.S.Kasi, Dynamics, Emerald Publishers, 1992.
6. Naryanamurthi, Dynamics, National Publishers, New Delhi, 1991.

Core Paper – V
THIRD YEAR

Subject title : Real Analysis

<u>Subject Description :</u>

This Course focuses on the Real and Complex number systems, set theory, point set topology and metric spaces.

<u>Goal :</u>

To introduce the concepts which provide a strong base to understand and analysis mathematics.

Objective:

On successful completion of this course the students should gain the knowledge about real and complex numbers, sets and metric space.

UNIT I

The Real and Complex number systems the field axioms, the order anixms, integers, the unique Factorization thorium for intcgcrs, Rational numbers, Irrational numbers --- Upper bounds , Maximum Elements, least upper bound, the completeness axiom, some properties for the sypremum, properties of the integers deduced from the completeness anxiom- The Archimedian property of the real number system Rational numbers with finite decimal representation of real numbers absolute values and the triangle inequality – the Cauchy-Sohewarz,inequality-plus and minus infinity and the extended real number system.

Basic notions of asset theory. Notations –ordered pairs – Cartesian product of two sets, Relations and functions further terminology concerning functions one one functions and inverse composite functions- sequences-similar sets – countable and uncountable sets- uncountability of the real number system-set algerbra-countable of collection of countable sets.

UNIT II

Elements of point set topology: Euclidean space R". The strcture of open Sets in R" – closed sets and adherent points- The Bolzno – Weierstrass theorem – the Cantor intersection theorem. Covering Lindelof covering theorem the Heine Borel covering Compactness in R" Metric Spaces – Point set topology in metric spaces – compact subsets of a metric space – Boundary of a set.

Unit III

Convergent sequences in a metric space- Cauchy sequences – complete metric Spaces. Limit of a function Continuous functions composite functions. Continuous complex valued functions. Examples of continuous functions - continuity and inverse images of open or closed sets – functions continuous on compact sets – Topological mappings – Bolzano's theorem.

Unit IV

Connectedness – components of metric space – Uniform continuity and compact sets-fixed point theorem for contractions – monotonic functions.Definition of derivative-Derivative and continuity- Algebra of derivatives- the chain rule – one sided derivatives and infinitives derivatives- functions with non-zero derivatives-zero derivatives and local extrema – Roll's theorem – the mean value theorem for derivatives- Taylor's formula with remainder.

Unit V

Properties of monotonic functions- functions of bounded variation – total Variation – additive properties of total variation on (a,x) as a function of x- functions of bounded variation expressed as the difference of increasing functions- continuous functions of bounded variation. The Riemann – Stieltjes integral : Introduction – Notation – The definition of Riemann stieltjes integral Reduction to a Riemann integral.

Treatment as in

T.M. Apostol, Mathematical Analysis, 2nd ed. Narosa Publishing Chennai – 1990.

Unit I	chapter 1	Sections 1,2, 1,3, 1,6, to 1.16, 1.18 to 1.20
	Chapter 2	Sections 2.2 to 2.15
Unit II	Chapter 3	Sections 3.2 to 3.9
	Chapter 4	Sections 4.11 to 4.15
Unit III	Chapter 4	Sections 4.16, 4.17,4.19,4.20,4.21,4.23
	Chapter 5	Sections 5.2 to 5.10 and 5.12
Unit IV	Chapter 6	Sections 6.2 to 6.8
Unit V	Chapter 7	Sections 7.1 to 7.7

References

1. R.R.goldberg, Methods of Real Analysis, NY John Wiely, New York 1976.
2. G.f.simmons, Introduction to Topology and Modern analysis, McGraw IIill, NewYork,1963.
3. G.Birkhoff and MacLane, A survery of Modern Algerba, 3rd Edition,Macmillian, Newyork, 1965.
4. N.N.sharma and A.R. Vasistha ,Real Analysis, Krishna Prakashan Media (p) Ltd, 1997.

Core Paper VI

Subject title : Complex Analysis

Subject Description : This course provides the knowledge about complex number system and complex functions.

Goal: To enable the students to learn complex number system, complex function and complex integration.

Objectives:

On successful completion of this course the students should gained knowledge about the origin, properties and application of complex numbers and complex functions.

UNIT I

Complex number system, Complex number – Field of Complex numbers – Conjugation – Absolute value – Arguments Simple Mappings.

i) w= z+a ii) w= az iii) w=1/z

invariance of cross-ratio under bilincar transformation-Definition of extended complex planc – Stereographic projection.

Complex functions : Limit of a function – continuity – differentiability- Analytical function defined in a region – necessary conditions for differentiability – sufficient conditions for differentiability – Cauchy- Riemann equation in polar coordinates- Definition of entire function.

UNIT II

Power Series : Absolute convergence – circle of convergence – Analyticity of the sum of power series in the Circle of convergence (term by term differentiation of a series) Elementary functions : Exponential, Logarithmic, Trigonometric and Hyperbolic functions.

Conjugate horonic functions : Definition and determination, Conformal Mappings : Isogonal mapping – Conformal mapping- Mapping z --- f (z),where f is analystic, particularly the mappings.

w=ez ; w =z ½ ; w=sin z ; w=1/2 (z+1/z)

UNIT III

Complex Integration : Simply and multiply connected regions in the complex plane. Integration of f(z) from definition along a curve joining Z1 and Z2 . Proff of Cauchy's Theorem (using Goursat's lemma for a simply connected region). Cauchy's integral formula for higher derivatives (statement only) – Morera's theorem.

Results based on Cauchy's theorem (I) : Zero-Cauchy's Inequality – Lioville's theorem – Fundamental theorem of algebra Maximum modulus theorem Gauss mean value theorem Gauss mean value theorem for a harmonic function on a circle.

UNIT IV

Results based on Cauchy's theorem (II) – Taylor's series-Laurent's series.

Singularities and Residues: Isolated singularities (Removable Singularity, pole and essential singularity) Residues Residue theorem.

UNIT V

Real definite integrals : Evaluation using the calculus of residues- Integration on the unit circle-Integral with - and as lower and upper ,limits with the following integrals:

I. P(x) / Q(x) where the degree of Q(x) exceeds that of P(x) at least.
II. (sin ax).f(x),(cos ax).f(x), where a>0 and f(z) ---- 0 as z ----- and f(z) does not have a pole on the real axis.
III. f(x) where f(z) has a finite number of poles on the real axis.
Integral of the type

Meromorphic functions : Theorem on number of zeros minus number of poles – Principle of argument : Rouche's throrem – theorem that a function which is mcromorphic in the extended plane is a rational function.

Treatment as in

P.Duraipandian and Laxmi Duraipanidian ,Complex Analysis, Emerald Publishers, Chennai – 2, 1986.

Unit I	Chapter 1	Sections 1.1 to 1.3, 1.6, to 1.9
	Chapter 2	Sections 2.1 to 2.2, 2.6, to 2.9,
	Chapter 7	Sections 7.1
	Chapter 4	Sections 4.1 to 4.10
Unit II	Chapter 6	Sections 6.1 to 6.11
	Chapter 6	Sections 6.12 to 6.13
	Chapter 7	Sections 7.6 to 7.9
Unit III	Chapter 8	Sections 8.1 to 8.9
	Chapter 8	Sections 8.10 to 8.11

Unit IV	Chapter 9	Sections 9.1 to 9.3, 9.13
	Chapter 9	Sections 9.5 to 9.12, 9.13.
	Chapter 10	Sections 10.3 and 10.4
Unit V	Chapter 10	Sections 10.3 and 10.4
	Chapter 11 Sections 11.1 to 11.3	

<u>Reference</u>

1. Churchill and Others, Complex Variable and Applications, Tata Mecgrow Hill Publishing Company Ltd, 1974.
2. Sathinarayan , Theory of functions of Complex variable, S.Chand and Company, Meerut, 1995.
3. Tyagi B.S, Functions of Complex Variable, 17^{th} Edition, Pragati Prakasham Publishing Company Ltd, Meerut, 1992 – 93.

Core Paper VII

Subject title: Modern Algebra

Subject description:

This course provides knowledge about sets, mappings, different types of groups and rings.

Goals: To enable the students to understand the concepts of sets, groups and rings. Also the mapping on sets, groups and rings.

Objective:

On successful completion of course the students should have concrete knowledge about the abstract thinking like sets, groups and rings by proving theorems.

UNIT I:

Matrices : Introduction – Transpose of a matrix – Inverse matrix – Symmetric and Skew – Symmetric matrices - Hermitian and Skew-Hermitian Matrices – Orthogonal and Unitary Matrices – Rank of a Matrix –Characteristic Roots and Characteristic Vectors of a Square Matrix.

UNIT II:

Sets – Relations and binary operations – Groups – Symmetric Group definitions and Examples – Subgroups – Index of a group – Fermat theorem - Normal subgroups and quotient groups.

UNIT III:

Homomorphisms – Cauchy's theorem, Sylow's theorem for Abelian groups Automorphisms – permutation groups – Rings : Definition and Examples – Some special classes of Rings

UNIT IV:

Field – Integral domain - Homomorphisms of Rings. - Ideals and Quotient Rings – Vector space: Subspace of a Vector space - Homomorphism – Isomorphism - Linear Independence and Bases.

UNIT V:

Dual spaces – Innerproduct spaces – Orthonormal set – Linear transformations – Characteristic roots and characteristic vectors of a square matrix

Treatment as in

1) R. Balakrishnan and M.Ramabadran, Modern Algebra, Vikas Publishing House Pvt Ltd, New Delhi.

   For unit I

2) For units II, III, IV, V : Topics in algebra by I.N.Herstein.

References

1) Surjeet Singh and Qazi Zameeruddin, Modern Algebra, Vikas Publishing house, 1992.
2) A.R.Vasishtha, Modern Algebra, Krishna Prakashan Mandir, Meerut, 1994 – 95.

APPLICATION ORIENTED SUBJECT

SUBJECT TITLE : ASTRONOMY

Subject Description

This course focuses on the Solar system, Celestial sphere, Dip-Twilight & Keplar's laws.

Goal: To enable the students to understand the Astronomical aspects and about the laws governing the planet movements.

Objectives: On successful completion of this course the students should gain knowledge about Astronomy.

UNIT I:

General description of the Solar System. Comets and meteorites – Spherical trigonometry. Celestial sphere – Celestial co-ordinates- Diurnal motion – Variation in length of the day.

UNIT II:

Dip – Twilight – Geocentric parallax. Refraction – Tangent formula – Cassinis formula.

UNIT III:

Kepler's laws – Relation between true eccentric and mean anomalies.

Time : Equation of time - Convertion of time – Seasons – Calendar.

UNIT IV:

Annual Parallax – Abberation.

Precession – Nutation.

UNIT V

The Moon – Eclipses.

Planetory Phenomenon – The Stellar System.

Treatment as in “ASTRONOMY” by S.Kumaravelu and Susheela Kumaravelu.

Question paper setters to confine to the above text book only.

APPLICATION ORIENTED SUBJECT

NUMERICAL METHODS

Subject Description:

This course presents method to solve linear algebraic and transcendental equations and system of linear equations. Also interpolation by using finite difference formulae.

Goal:

It exposes the students to study numerical techniques as powerful tool in scientific computing.

Objective:

On Successful completion of this course the student gain the knowledge about solving the linear equations numerically and finding interpolation by using difference formulae.

Unit I :

The solution of numerical algebraic and transcendental Equations:
Bisection method – Iteration Method – Convergence condition – Regula Falsi Method – Newton – Raphson method – Convergence Criteria – Order of Convergence.
Solution of simultaneous linear algebraic equations: gauss elimination method – Gauss Jordan method – Method of Triangularization - Crouts method Gauss Jacobi method Gauss Seidel method.

Unit II: Finite Differences:

Differences – operators – forward and backward difference tables – Differences of a polynomial – Factorial polynomial – Error propagation in difference table. Interpolation (for equal intervals): Newton’s forward and backward formulae equidistant terms with one or more missing values Central differences and central differecnces table – Gauss forward and backward formulae- Stirlings formula.

Unit III:Interpolation (for unequal intervals):

Divided differences – Properties- Relations between divided differences and forward differences – Newton’s divided differences formula – Lagrangc’s formula and inverse interpolation.

Numerical differentiations :

Newton’s forward and backward formulae to computer the derivatives- Derivative using starlings formulae –to find maxima and minima of the function given the tabular values .

Unit IV

Numerical Integration :

Newton –Cote's formula –Trapezoidal rule –Simpson's 1/3rd and 3/8th rules –Gaissian quadrature.

Difference Equation :

Order and degree of a difference equation –solving homogeneous and non –homogeneous liner difference equations

Unit V

Taylor series method – Euler's method –improved and modified Euler method –Runge Kutta method (fourth order Runge Kutta method only)

Numerical solution of O.D.E. (for first order only)

Milne's predictor corrector formulae – Adam –Bashforth predictor corrector formulae – solution of ordinary differential equations by finite difference method (for second order O.D.E)

Treatment as in

Kandasamy . P,Thilagavathi. K. and Gunavathi K " Numercial methods" – S. Chand and Company Ltd, New Delhi – Revised Edition 2007. (Chapters : 3,4,5,6,7 and 8). (Chapters:9,10,11, Appendix and Appendix E) .

References:

1. Venkataraman M.K., " Numerical Methods in Science and Engineering" National Pulishing company V Edition 1999.
2. Sankara Rao K., " Numerical Methods for Scientists and Engineers " 2nd Edition Prentice Hall India 2004.

APPLICATION ORIENTED SUBJECT

Subject Title : DISRETE MATHEMATICS

Subject Description : This course focuses on the mathematical logic .Relations 7 Functions ,Formal languages and Automata , Lattices Boolean Algebra and Graph Theories .

Goal: To enable the students to learn about the interesting branches of Mathematics .

Objective :

On successful completion of this course should gain knowledge about the Formal languages Automata Theory ,Lattices & Boolean Algebra and Graph Theory .

UNIT -1

Mathematical logic : Connections well formed formulas ,Tautology ,Equivalence of formulas, Tautological implications, Duality law, Normal forms, Predicates , Variables, Quantifiers , Free and bound Variables. Theory of inference for predicate calcules .

UNIT –II Relations and functions: Composition of relations, Composition of functions , Inverse functions , one –to-one, onto ,one & onto, onto functions ,Hashing functions Permutation function, Growth of functions. Algebra structures Semi groups, Free semi groups, Monoids ,Groups ,Cosets ,Sets , Normal subgroups, Homomorphism .
(2-3.5,2-3.7,2-4.2,2-4.3 ,2-4.6,3-2,3-5,3-5.3,3-5.4)

UNIT-III

Formal languages and Automata: Regular expressions .Types of grammar ,Regular grammar and finite state automata, Context free and sensitive grammars .
(3-3.1,3-3.2,4-6.2)

UNIT –IV

Lattices and Boolean algebra: Partial ordering ,Poset ,Lattices , Boolean algebra, Boolean functions, Theorems, Minimisation of Boolean functions.
(4-1.1,4-2,4-3,4-4.2)

UNIT –V

Graph Theories : Directed and undirected graphs, Paths, Reach ability, connectedness , Matricrepresentation , Eular paths , IIamiltonean paths, Trees, Binary trees simple theorems , and applications .(5-1.1,5-1.2,5-1.3,5-1.4)

Text Books :

J.P .Tremblay and R.P. Manohar " Discrete Mathematical Structures with applications to computer science" Mc. Graw IIill , 1975.

APPLICATION ORIENTED SUBJECT

Subject title: GRAPH THEORY

Subject Description : **Credit Hours -5**

This course focuses on the Graphs ,Sub Graphs , Trees , Planar graphs ,Directed graphs .If also deals about matrix representation of Graphs .

Goal :

To enable the students to understand the basic concepts of Graphs Theory .

Objectives:

On successful completion of this course the students should gain knowledge about Graph Theory .

UNIT :I Graphs –Sub graphs –Degree of vertex walks, paths and cycles in a Graphs –Trees .

UNIT –II

Entoriom and Hamiltonion Graphs –Algorithm for Entoriom circuits –Bipartite Graphs -Trees.

<u>UNIT –III</u>

Matrix representation of a graph - vector spaces , associated with a Graph – cycle spaces and act set spaces.

<u>UNIT –IV</u>

Planar graphs- Enter's theorem on planar graphs – Characterization of planar graphs (no proofs) of the difficult part of the characterization .

<u>UNIT –V</u>

Directed graphs –Connectivity – Enteoriom Digraph -Tournaments .

Treatment as in "A First Course in Graph Theory " by A. Chandran (Macmillan)
Chapters 1 to 7 .

<u>Books for Reference s :</u>

1. Narasingh Deo." Graph Theory " (Prentice Hall of India).
2. IIarary : "Graph Theory " (Narosa Publishing IIQCK).

APPLICATION ORIENTED SUBJECT

Subject Title: DISCRETE MATHEMATICS

<u>Subject Description</u>: This course focuses on the mathematical logic, Relations& Functions, Formal languages and Automata, Lattices and Boolean Algebra and Graph Theories.

<u>Goal:</u> To enable the students to learn about the interesting branches of Mathematics.

<u>Objectives</u>:

On successful completion of this course should gain knowledge about the Formal languages Automata Theory, Lattices & Boolean Algebra and Graph Theory.

UNIT-I:

Mathematical logic: Connections well formed formulas, Tautology, Equivalence of formulas, Tautological implications, Duality law, Normal forms, Predicates, Variables, Quantifiers, Free and bound Variables. Theory of inference for predicate calcules.
(1-2, 1-2.7. 1-2.9, 1-2.10, 1-2.11, 1-3, 1-5.1, 1-5.2, 1-5.4, 1-6.4)

UNIT-II:

Relations and functions: Composition of relations, Composition of functions, Inverse functions, one-to- one, onto, one-to-one& onto, onto functions, Hashing functions, Permutation function, Growth of functions. Algebra structures: Semi groups, Free semi groups, Monoids, Groups, Cosets, Sets, Normal subgroups, Homomorphism.
(2-3.5, 2-3.7, 2-4.2, 2-4.3, 2-4.6, 3-2, 3-5, 3-5.3, 3-5.4)

UNIT-III:

Formal languages and Automata: Regular expressions, Types of grammar, Regular grammar and finite state automata, Context free and sensitive grammars.
(3-3.1, 3-3.2, 4-6.2)

UNIT-IV:

Lattices and Boolean algebra: Partial ordering, Poset, Lattices, Boolean algebra, Boolean functions, Theorems, Minimisation of Boolean functions.
(4-1.1, 4-2, 4-3, 4-4.2)

UNIT-V:

Graph Theories: Directed and undirected graphs, Paths, Reachability, Connectedness, Matric representation, Eular paths, Hamiltonean paths, Trees, Binary trees simple theorems, and applications. (5-1.1, 5-1.2, 5-1.3, 5-1.4)

Text Books:

J.P Tremblay and R.P Manohar “Discrete Mathematical Structures with applications to computer science”, Mc.Graw Hill, 1975.

MODEL QUESTION PAPERS

Core Paper III – Differential Equation and Laplace Transformations

Time : 3hrs Max marks : 100

Five out of eight questions to be answered

Passing minimum = 35 marks $5 \times 20 = 100$ marks

1) Solve the following equations
   (a) i) $xp^2 - 2yp + x = 0$
   ii) $p^2 + 2yp\cot x = y^2$
   iii) $x^2(y - px) = yp^2$
   (b) Solve : $4\frac{dx}{dt} + 9\frac{dy}{dt} + 2x + 31y = e^t$

   $3\frac{dx}{dt} + 7\frac{dy}{dt} + x + 24y = 3$
2) (a) Solve: $(D^2+1)y = x^2e^{2x} + x\cos x$
   (b) Solve the equation $\frac{d^2y}{dx^2} + y = \sec x$ by the method of variation of parameters

3) Form a differential equation by eliminating the
   (a) function φ from $\varphi(x+y+z, x^2+y^2-z^2) = 0$
   (b) Eliminate the arbitary constants a,b from $(x-a)^2 + (y-b)^2 + z^2 = 1$

4) Solve the standard forms of the equations
   (i) $p^2+p-3q=2$,
   (ii) $q=xp+p^2$
   (iii) $p(1+q^2) = q(z-1)$
   (iv) $p^2y(1+x^2) = q^2$

5) (a) Find the laplaces transforms of the following
   (i) $t^2 e^t smt$ (ii) $t\cos^3 t$
   (b) (i) $L^{-1}\left(\frac{s}{(s^2-a^2)^2}\right)$ (ii) $L^{-1}\left(\frac{1}{s(s+1)(s+2)}\right)$

6) Using Laplace transforms solve the differential equation
   $y'' + 2y' - 3y = \sin t$, given $y=0$, $y'(0)=0$ when $t=0$
7) Find the general solution of the equations
   (a) $(x^2-yz)p + (y^2-zx)q = z^2-xy$
   (b) $yp - xq + x^2 - y^2 = 0$

8) Solve the equations
   (a) $x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = \frac{1}{(1-x^2)}$
   (b) $(5+2x)^2\frac{d^2y}{dx^2} - 6(5+2x)\frac{dy}{dx} + 8y = 6x$

Core Paper IV – Mechanics

Time : 3hrs Max marks : 100
Five out of eight questions to be answered
Passing minimum = 35 marks $5 \times 20 = 100$ marks

1. (a) State and prove Lami's theorem.
   (b) ABCDEF is a regular hexagon and at A, act forces represented by AB, 2AC, 3AD , 4AE and 5AF. Show that the magnitude of the resultant is AB. $\sqrt{351}$ and that it mages an angle $\tan^{-1}(7/\sqrt{3})$ with AB.

2. (a) Find the resultant of two like parallel forces acting on a rigid body.
   (b) If two couples, whose moments are equal and opposite, act in the same plane upon a rigid body, then they balance one another.

3. (a) A beam of wight W hinged at one end is supported at the other end by a string so that the beam and the string are in a vertical plane and make the same angle θ with a horizon. Show that the reaction at the hinge is
   $$\frac{W}{4}\sqrt{8 + \operatorname{cosec}^2 \theta}$$
   (b) Forces P, Q, R, S act along the sides AB, BC, CD, DE of the cyclic quadrilateral ABCD, taken in order, where A and B are the extremities of a diameter. If they ate in equilibrium then prove that
   $$R^2 = P^2 + Q^2 + S^2 + \frac{2PQS}{R}$$

4. (a) A uniform ladder is in equilibrium with one end resting on the ground and the other against a vertical wall; if the ground and wall be both rough, the co-efficients of friction being μ and μ' respectively, and if the ladder be on the point of slipping at both ends, show that θ, the inclination of the ladder to the horizon is given by $\tan \theta = \frac{1 - \mu \mu'}{2 \mu}$

   (b) A uniform heavy inextensible string hangs freely under the action of gravity, then find the equation of the curve which it forms.

5. (a) A particle is projected vertically upwards with a velocity u cm/sec and after t seconds, another particle is projected upwards from the same point and with the same velocity. Prove that the particles will meet at a height $\frac{4u^2 - g^2 t^2}{8g}$ cm. after a time $\left(\frac{t}{2} + \frac{u}{g}\right)$ secs.
   (b) Verify the principle of consideration of energy in the case of a particle sliding down a smooth inclined plane.

6. (a) Prove that the path of a projectile is a parabola.
   (b) Show that for a given velocity of projection the maximum range down an inclined plane of inclination α bears to the maximum range up the inclined plane the ratio $\frac{1 + \sin\alpha}{1 - \sin\alpha}$

7. (a) Find the differential equation of central orbits.
   (b) Find the law of force towards the pole under which the curve $r^n = a^n \cos n\theta$ can be described.

8. (a) Find the composition of two Simple Harmonic Motions of the same period in two perpendicular directions.
   (b) Two equal elastic balls moving in opposite parallel direction with equal speeds impinge on one another. If the inclination of their direction of motion to the line of centres be $\tan^{-1}(\sqrt{e})$ where e is the coefficient of restitution, show that their direction of motion will be turned through a right angle.

Core Paper V - Real Analysis

Time : 3 hours Maximum Marks :100

Answer any five Questions

5 x 20 = 100

1) a) Prove that every subset of a countable set is countable
   b) State and prove the unique factorization theorem.

2) a) Show that e is irrational
   b) If F is a countable collection of countable sets, prove that the union of all sets in F is countable.

3) a) State and prove Bolzano-weierstrass theorem
   b) State and prove the Cantor – intersection theorem.

4) a) In the Euclidean Space R^k, prove that every Cauchy sequence is convergent.
   b) Show that every compact subset of a metric space is closed and bounded.

5) a) If f: S ---- R^k is continuous on a compact subset x ot S, then f is bounded on X.
   b) If f : S---M , x be a connected subset of S and if f is continuous on x , then f (x) is a connected subset of M.

6) a) Prove that a metric space S is connected if and only if every two-valued function on S is constant.

b) Let f be defined on [a,b]. Then prove that f is of bounded variation on [a,b] if and only fcan be expressed as the difference of two increasing functions.

7) a) If f is a monotonic on [a,b], then f is of bounded variation on [a,b]
b) State and prove the additive property of total variation.

8) a) Prove that b

b) Derive the formula for integration by parts.

Core Paper VI - Complex Analysis

Time : 3 hours Maximum : 100 Marks

Answer any five Questions 5 x 20 = 100

1) a) If one of a and (b) is equal to 1 show that

$$\left| \frac{a - b}{1 - ab} \right| = 1$$

b) Explain stereographic projection.

2) a) If f (2) is analytic in a region D and if f (2) is constant then show that f (2) is constant in D.
b) Establish the polar form of C – R equations for on an anakytic function.

3) a) Discuss the transformation w= ½ (2+½)
b) Show that the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is a harmonic function.

4) a) Evaluate

b) State and prove Morea's theorem.

5) a) If c is the positively oriented circle, lt – il = 2, show that I =

b) State and prove Liourille's throrem.

6) a) State and prove Taylor's Series
b) Expand f (z) = 1 ir Lavent's series if (i)

7) a) Define removable signulaity and essential singularity

b) Find reside of $f(z) = \frac{\text{Sin } z}{z \cos z}$

c) Evaluate c is a closed curve and z=0 lies inside c.

8) a)State and prove Roche's theorem

b) Show that one root of $z^4 + z^3 + 1 = 0$ lies in the first Quadrant

Core Paper VII – Modern Algebra

Time : 3hrs Max marks : 100

Five out of eight questions to be answered

Passing minimum = 35 marks $5 \times 20 = 100$ marks

1. For any square matrix A of order n
   (a) Prove that $A(\text{adj}A) = (\text{adj}A)A = (\det A)I_n$
   (b) Find the inverse of the matrix
   $$\begin{matrix} 1 & 2 & -1 \\ 2 & 0 & 1 \\ 3 & 2 & 1 \end{matrix}$$

2. (a) State and prove Cayley – Hamilton theorem.
   (b) Find the characteristic roots and vectors of the matrix
   $$\begin{matrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{matrix}$$

3. (a) Let $\sigma : S \to T$ and $\tau : T \to V$ then
   (i) $\sigma \circ \tau$ is onto if each of σ and τ is onto
   (ii) $\sigma \circ \tau$ is one-to-one if each of σ and τ is one-to-one

   (b) If H and K are finite subgroups of G of order O(H) and O(K) respectively then
   $$O(HK) = \frac{O(H)O(K)}{O(H \cap K)}$$

4. (a) Let Φ be a homomorphism of G onto $\bar{a}$ with kernel K, then prove that $G/K \approx \bar{a}$
   (b) $I(G) \approx G/Z$ where I(G) is the group of inner automorphisms of G and Z is the centre of G.

5. (a) Prove that S_n has as a normal subgp of index 2, the alternating group A_n, consisting of all even permutations.
   (b) Every finite Integral Domain is a field

6. Every Integral Domain can be imbedded in a field

7. (a) If V is the internal direct sum of V_1 , V_2,…… U_n then V is isomorphic to the external sum of U_1 , U_2,…… U_n

(b) If V is finite dimensional and if W is a subspace of V then W is also a finite dimensional and dim W ≤ dim V;
dim V/W = dim V – dim W

8. (a) If V is a finite dimensional inner product space then V has an orthonormal set as a Basis
(b) If V is a finite dimensional over F then for S,T Є A(V)
(i) r(ST) ≤ r(T)
(ii) r(TS) ≤ r(T)
(iii) r(ST) = r(TS) = r(T) for S regular in A(V)

Application oriented subject - Numerical Methods

Time : 3 hours Maximum : 100 Marks

Answer any five questions

1 a) Explain the bisection method of finding a real root of an equation.
b) Find a real root of the equation cosx=3x-1 correct to 4 decinal places using interaction method.

2) a) Find the real root of the equation ex= 4x correct to 3 decinal places using Newton's Raphson method.
b) discuss the geometrical interpretation of Newton – Raphson's Method.

3) a) Use Gauss – Elimnation method to solve:

x + 2y + z = 3
2x + 3y + 3z =10
3x – 3y + 2z = 13

b) Use Gauss – Seidel method to slove

10 x – 2y + z = 12 ; x + 9y – z = 10 ; 2 x – y + 11 z =20

4) a) Express any value of y in terms of yn and the backward differences.
b) From the following data find the valuecof f (1919)

x :	1917	1918	1919	1920	1921
f(x) :	443	384	-	397	467

5 a) Find the value of f (15) from the following data using lagrage's interpolation formula

x :	14	17	31
f (x) :	42	84	100

b) Solve : $y_{x+2} - 8y_{x+1} + 15 Y_x = 0$

6 a) Use stirling's formula to find the value of tan 16 o from the following data:

Q	: 0^o	5^o	10^o	15^o	20^o	25^o
Tan	:0	0.0875	0.1763	0.2679	0.3640	0.4663

b) Use lagrarge's formula to find the value of y when x = 301, from the following data:

x :	300	304	305	307
y :	2.4771	2.4829	2.4843	2,4871

7 a) Derive Gauss's backward differences interpolation formula

b) From the following data, use Bessel's formula. Find the value of $\left(\frac{dy}{dx}\right)$ at x = 0.04

x :	0.01	0.02	0.03	0.04	0.05	0 .06
y :	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

8 a) Using simpson 's rule,
evaluate sin x dx with h :

b) Solve : $y_{x+2} - 5y_{x+1} + 6y_x = 6^x$

Application oriented subject – Discrete mathematics

Time : 3hrs Max marks : 100

Five out of eight questions to be answered

Passing minimum = 35 marks $5 \times 20 = 100$ marks

1) (a) Define Negation, Conjunction and disjunction with their truth tables and examples
Also prove that

P → ((Q→R) <=> P→(┐QV┐P)) <=> (P∩Q) → R

(b) Obtain the Principal disjunctive natural forms of

P→((P→Q) ^ ┐ (┐QV┐P))

(c) State that the following premises are inconsistent

(i) If Ram misses many classes through illness, then he fails high school
(ii) If Ram fails high school, then he is uneducated.
(iii) If Ram reads a lot of books, then he is not uneducated
(iv) Ram misses many classes through illness and reads a lot of books.

2) (a) Given the rule 'US', 'ES' and 'UG'
Also, State that from (эx)(F(x) ^ ┐S(x)) → (y)(M(y) ^ W(y)) , the conclusion (x)(F(x) → 7S(x)) follows.

(b) Show that

(x)(P(x) u Q(x)) => (x)P(x) u (эx)Q(x)

3) Define function

(a) let X={1,2,3}; Y={p,q}; Z= {a,b}
Also let f:X →Y be f={<1,p>,<2,p>,<3,q>} and g:Y → Z be given by g={<p,b>,<q,b>} Find g o f.

(b)Define : Equivalence relations
let x={1,2,……,7} and

R= {<x,y>| x-y is divisible by 3}.

Show that R is an equivalence relation. Draw the graph of R.

4) (a) Define : Grammar

: Direct derivative

: Context – free grammar

: Sentential form

The language $L(G_3) = \{a^n b^n c^n \mid n \geq 1\}$ is generated by the following grammar. $G_3 = \langle\{S,B,C\}, \{a,b,c\}, S, \varphi\rangle$ where φ consists of the productions

$S \rightarrow aSBC$

$S \rightarrow aBC$

$CB \rightarrow BC$

$aB \rightarrow ab$

$bB \rightarrow bb$

$bC \rightarrow bc$

$cC \rightarrow cc$,

Then derive $a^2 b^2 c^2$

(b) The language $L(G_4) = \{ a^n b c^n \mid n \geq 1\}$ is generated by the grammar, $G_4 = \langle\{S,C\}, \{a,b\}, S, \varphi\rangle$ where φ is a set of productions.

$S \rightarrow aCa$

$C \rightarrow aCa$

$C \rightarrow b$, then derive $a^2 b a^2$

5) Define : Finite state automata .

(a) Find the finite state acceptor that will accept the set of natural numbers x which are divisible by 3.

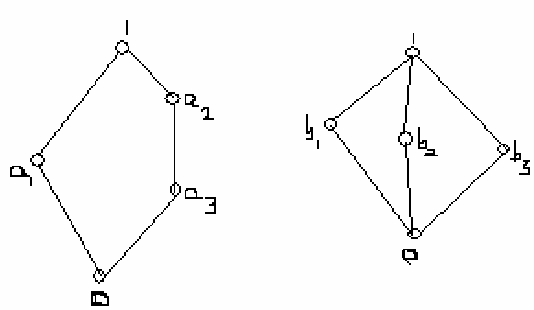
(b)Define : Non deterministic finite automata

Let $G\langle V_n, V_t, S, \varphi\rangle$ be a T_3 grammar which generates the language L(G). Then there exists a Finite state automata $M = \langle V_T, Q, S, , F\rangle$ such that T(M) = L(G). Prove.

Define : Lattice

Define : Distributive lattice

(b) From the following figure show that the lattices are not distributive.



(c) Let <L, * , φ > be a distributive lattice for any a,b,c Є L, Prove that (a*b = a*c) ∩ (a + b = a + c) => b = c

(d) Prove that every chain is a distributive lattice

6) (a) Write the following Boolean expressions in an equivalent sum-of-products canonical form in three variables x_1 ,x_2 and x_3

(i) $x_1 * x_2$

(ii) $x_1 + x_2$

(iii) $(x_1 + x_2)' * x_3$

Also show that

$(x_1' * x_2' * x_3' * x_4') + (x_1' * x_2' * x_3' * x_4) + (x_1' * x_2' * x_3 * x_4) + (x_1' * x_2' * x_3 * x_4') = x_1' * x_2'$

(b) State that the following Boolean expressions are equivalent to each other by using truth tables

(i) (x + y) * (x' + z) * (y+ z)

(ii) (x * z) + (x' * y) + (y * z)

(iii) (x + y) * (x' + z)

(iv) (x * z) + (x' * y)

7) (a) Define the following with examples

(i) Multi graph

(ii) Eular graph

(iii) Isomorphic graph

(b) Define adjacency matrix and path matrix of a simple digraph. Obtain the adjacency matrix A of the digraph given below