BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

CENTRE FOR DISTANCE EDUCATION

B.Sc. Mathematics – Course Structure (Non-Semester)

(For the candidates admitted from the academic year 2007-2008 onwards)

Year	Paper	Title of the Paper	Marks
I	Language Paper – I		100
	English Paper - I		100
	Major Paper - I	Algebra and Calculus	100
	Major Paper - II	Analytical Geometry and Trigonometry	100
	Allied Paper - I	Accountancy	100
II	Language Paper – II		100
	English Paper – II		100
	Major Paper - III	Differential Equations, Lap Lace Transformation, Fourier Series and Vector Analysis	100
	Major Paper - IV	Numerical Methods and C – Programming	100
	Allied Paper - II	Mathematical Statistics	100
III	Major Paper – V	Modern Algebra	100
	Major Paper – VI	Real Analysis	100
	Major Paper – VII	Mechanics (Statics and Dynamics)	100
	Applied Paper - I	Operations Research	100
	Applied Paper - II	Theory of Graphs	100

Question Paper Pattern:

Part A: 10 x 2 = 20 Marks [Answer all questions]

Part B: 5 x 6 = 30 Marks [Answer all questions]

Part C: 5 x 10 = 50 Marks [Answer all questions]

Major Paper I – ALGEBRA AND CALCULUS

Unit I

Binomial, exponential and logarithmic series (proof not needed) – finding the coefficient of x^n in the expansions summation and approximation problems.
Theory of Numbers: Prima and composite numbers – Decomposition of a number, Divisor of N, Euler function ϕ (N) highest power of a prime p contained in N

Unit II

Theory of equations: Polynomial equations – imaginary and irrational roots – relation between the roots symmetric function of roots in terms of coefficients – reciprocal equations – formation / of equations – transformation of equations – Descrate's rule of signs

Unit III

Curvature – radius of curvature in Cartesian and polar co-ordinates – center of curvature – Evolutes and involutes (p,r) equation of curves.

Unit IV

Definite integrals – reduction formulae – double integrals – change of order of integration – triple integrals

Unit V

Beta and gamma functions and the relation between them – integration using Beta and Gamma functions

Text Book: Algebra, by T.K. Manickavasagam Pillai & others
               Calculus by T.K. Manickavasagam Pillai & others
Reference Books: 1. Calculus by M.I. Francis Raj
                       2. Calculus by Edwards, D.J.
                       3. Differential and Integral Calculus by Shanthinarayanan
                       4. Theory of Equations by Khanna

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Major Paper II – Analytical Geometry and Trigonometry

Unit I

Solving Trigonometric equations – principal values and general solutions – inverse trigonometric functions and related problems. Expansions of $\text{Cos}^n\ \theta$, $\text{Sin}^n\ \theta$ and $\text{Tan}^n\ \theta$, $\text{Cos}^n\ \theta$ and $\text{Sin}^n\ \theta$ for numerical values of n – series for $\text{Cos}\ \theta$, $\text{Sin}\ \theta$ and $\tan\ \theta$ – applications to evaluate limit (only simple problems)

Unit II

Hyperbolic functions – relations between trigonometric and hyperbolic functions – related problems, principal and general values of logarithms – separation into real and imaginary parts.

Unit III

Polar equation of straight line, circle and conics, polar equations of tangent and normal to conics and circle.

Unit IV

Preliminaries – Direction cosine and rations of a line – standard equation to a plane – equation of straight line –shortcut distance between two straight lines – equation to the line of shortest distance

Unit V

Sphere – suitable properties and problems – general second degree equation to a cone

Text Book:
Analytical Geometry by T.K. Manickavasagam Pillai

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Allied Paper I - Accountancy

Objectives:
To provide reasonable working knowledge of concepts and techniques of accounting
Level of knowledge: Adequate and application oriented

Unit I

Principles of double entry and the accounting structures – books of prime entry and subsidiary records – Basic accounting concepts and conventions – Bank reconciliation statement – preparation of trial balance and final accounts of sole trader and partnership

Unit II

Rectification of errors, including suspense account and rectification in the subsequent accounting period – Bills of exchange, consignment joint venture; account current; average due data

Unit III

Bulk balancing and sectional ledgers, excluding rectification of errors – accounts from incomplete records preparation of final statements of accounts of no-profit making institutions

Unit IV

Partnership accounts – admission, retirement, debts of partner; dissolution sale to company and piece – meal distribution

Unit V

Hire purchase and installments – Branch and Departmental accounts (excluding foreign branches)

Reference Books:

NCERT   :   Elements of Book keeping and Accountancy
Batliboi. J. R.   :   Double entry book keeping
Batliboi, J. R.   :   Advanced Accountancy

Major Paper III – Differential Equations, Lap lace Transformation, Fourier Series and Vector Analysis

Unit I
Particular integral for second order differential equation with constant coefficients – Linear equations with variable coefficients reducible to ø form – First order higher degree and equations solvable for x,y.p – Clairant's form – simultaneous differential equations – variation of parameters.

Unit II
Partial differential equations – formation of equations, general particular and complete integrals of partial differential equations – Charpit's method for solving pp + qp = R the standard forms

Unit III
Transforms Laplace transform and its applications for solving ordinary edifferential equations

Unit IV
Fourier series – Expansion in odd/even functions expansion in half – range series (simple Problems only) vector differentiation – velocity and acceleration – vector and scalar fields – divergence and curl – applications of laplacian operator

Unit V
Vector integration – tangential line integral, normal surface integral, volume integral – problems on these
Gauss's divergence theorem and stoke's theorem (no proof) – simple verifications of the theorem - problems

Reference Books:
1. Differential Equations : T.K. Manickavasagam and S. Narayanan
2. Differential Equations : M. L. Khanna
3. Laplace Transformations: M.K. Venkatraman and Fourier Series
4. Vector Calculus   :   M.L. Khanna

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MAJOR PAPER IV
NUMERICAL METHODS AND C – PROGRAMMING

(In the first tow units the value of a root may be calculated upto 3 decimal accuracy only)

Unit I

Algebraic & Transcendental equations – Finding a root of the given equation (Deviation of the formula not needed) using Bisection method, method of False position, Newton – Rapluson method. Finite differences – Forward, Backward – Newton's forward & backward difference interpolation formulae – Interpolation with unevenly spaced intervals – Application of Lagrange's interpolating polynomial (proof not needed) – Divided differences and their properties - Applications of Newton's General Interpolating formula (proof not needed) – only problems.

Unit II

Numerical differentiation – Newton's forward, backward method to compute first and second derivative
Numerical integration using Trapezoidal rule – Simpson's $1/3^{rd}$ rule – Theory and problems

UNIT III

Constants ,Variables, data types symbolic constants –Operators & expressions – evaluation of Expressions –reading & writing a character – Formatted input & output.

UNIT II

Decision making and branching – Use of IF , IF-ELSE ,& nesting of IF-ELSE statements – ELSE – IF ladder – Switch statement – Conditional Operator –GOTO statement – Decision making & looping – WHILE , DO , and FOR statements.

UNIT III

Arrays – One dimensional ,two dimensional & multi dimensional groups – Structures – Initialization - comparison –Arrays of structures –Arrays within structures – structures within structures and functions.

Text Book:
1. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall
    of India Pvt., Limited, 1995
Unit I – Chapters 2 & 3 (relevant sections only)
Unit II – Chapter – 4 (relevant sections only)

2. E.Balagurusamy , Programming in ANCI   C, Tata McGraw Hill
    Publishing Company Ltd, 2002 (5th Reprint)
UNIT – III   -   Chapters 2,3 & 4
UNIT – IV   -   Chapters 5 & 6
UNIT – V   -   Chapters 7 & 10

Reference (s):
1) S. Narayanan and others, Numerical analysis, S. Viswanathan
     Publishers, 1994
2) A. Singaravelu, Numerical methods, Meenachi Agency, June 2000
3) Rajaraman, V, Programming in C, Prentice Hall of India, 2000
4) Yeshwant Kanetkar, Let us C, BPB Publications, 2000
5) B.S. Gottpried, Programming with C, Schaym's Series, Tata McGraw
     Hill, 1996.
6) Manish Jain, Let us C, BPB Publications, New Delhi, Third Revised
     Edn., 1999.

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ALLIED PAPER II : MATHEMATICAL STATISTICS

Unit I
Various measures of central tendency (Mean, Median, mode, Geometric mean and Harmonic mean) and their properties merits and demerits. Various measures of dispersion (mean, deviation, quartile deviation and standard deviation) and their merits and demerits and properties, Axiomatic probability and classical probability – addition, multiplication and Baye's theorems – simple problems

Unit II
Random variables and probability distributions – probability function – probability density function – cumulative distribution function – their properties, mathematical expectation, Bivariate distribution – discrete and continuous marginal and conditional distribution, statistical independence, conditional expectation

Unit III

Binomial, Poisson distributions – Probability generation function {P(x=2)} – moment generating function [M x (t)] cumulant generating function [K x (t)] Normal distribution constants – moment generating function – limiting form of Binomial and Poisson distributions

Unit IV
Continuous distributions – rectangular, exponential, beta, game, stuedent's-t, 'F' and chi-square distributions – constants test of significance for large samples and small samples – 't' – test, F-test and chi-square test of goodness of fit

Unit V
Correlation – rank correlation – Karl pearson's correlation coefficient and its properties, Linear regression and its properties – point estimation – properties of good estimator, method moments and maximum likelihood estimation, properties of these two methods.

Reference Books:
Elements of Mathematical statistics by S.C. Gupta & V.K. Kapoor

MAJOR PAPER V – MODERN ALGEBRA

Unit I

Sets, Mappings, equivalence classes – Matrices various types, inverses: product of matrices

Unit II
Groups, subgroups – costs, normal subgroups – permutation groups – factor group – cyclic groups – Homomorphism and Isomorphism of groups – natural homomorphism

Unit III
Rings, subrings and ideals, integral domain – homomorphism and isomorphism of rings – principal ideal domains – quotient rings

Unit IV
Fields, subfields – characteristics of a field – polynomial rings

Unit V
Vector spaces, subspaces, spanning sets, linear dependence, basis, dimension of a vector space – sums and direct sums, Linear transformation of vector spaces

Reference Books:
1. A text book of Modern Algebra – R. Balakrishnan and N. Ramabadran
2. Algebra by S. Arumugam & Issac
3. Modern Algebra – K. Subramanian and others
4. Modern Abstract Algebra - Shanti Narayanan

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MAJOR PAPER VI – REAL ANALYSIS

Unit I
Real number system – field axioms – order relations in R - absolute value of a real number and its properties – supremum and infimum of a set – order completeness property – countable and uncountable sets

Unit II
Neighbourhoods – open and closed sets – limit points – sequences – convergent, divergent and oscillatory – cauchy sequences – important limit theorems.
Infinite series – Cauchy's general principle of convergence – Geometric series – Tests of convergence – Comparison Test, Root Test, D'Alembigs Test and Raahi,s Test only

Unit III
Continuous functions – limit of functions – Algebra of limits – continuity of a function – types of discontinuities – elementary properties of continuous functions and uniform continuity of a function

Unit IV
Differentiability of a function – derivability and continuity – Algebra of derivatives – inverse functions theorem – Darbouse's theorem on derivatives – Rolle's theorem – mean value theorems on derivatives – Taylor's theorem with reminder

Unit V
Riemann integration – definition – Darbou's theorem – conditions for integrability – integrability of continuous and monotonic functions – properties of integrable functions, integral functions, continuing and derivability of integral functions – the first mean value theorem and the fundamental theorem of calculus

Text Books:
1. M.K. Singhal and Asha Singhal – Chand & Co. New Delhi (5th Edn. 1978) Chapter 3 to 9 { For Unit I, II, III & IV - Scope and treatment as in first course in Real Analysis}
2. Shanti Narayan – A course of Mathematical Analysis – Chapter IV (for Unit – V)
3. Chatterjee- Real Analysis, Chand & Company

MAJOR PAPER VII – MECHANICS (STATICS AND DYNAMICS)

Unit I
Introductory ideas on forces, moments, parallel forces, Moment of a force about a point and a line – Theorem on moments – couples – equilibrium of three forces acting on a rigid body – coplanar forces

Unit II
Friction – Laws of friction – coefficient of friction – angle and cone of friction – equilibrium of a particle on a rough inclined plane under a force parallel to the plane and under any force.

Unit III
Kinetics – Velocity and acceleration – tangential and normal components, Projectile in vacuum - maximum height reached – range and time of flight – projectile up / down an inclined plane.

Unit IV
Simple harmonic motion – simple pendulum – load suspended by and elastic string – moment of inertia of simple bodies – theorems of parallel axis and perpendicular axis

Unit V
Impulsive forces and impulses – conservation of linear momentum – direct and obliene impacts of two smooth spheres, central orbit – central force – differential equation to a central orbit in polar and medol co-ordinates. Given the central orbit to find law of force – Kepler's laws of planetary motion (only statement)

Text Book:
1. Statics by M.K. Venkataraman
2. Dynamics by M.K. Venklataraman

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Unit I
Introduction to operations research – elementary treatment of linear programming – simplex method for constraints,

Unit II
Application to transportation problem – transportation algorithm – degeneracy in transportation problem – unbalanced transportation problem – assignment problem – assignment algorithm – unbalanced assignment problem

Unit III
PERT and CPM – CPM net works – critical and sub critical jobs – determining the critical path – Net work calculations PERT networks – probability aspect of PERT – PERT tune, PERT cost

Unit IV
Inventory management – deterministic models – without shortage and with shortage

Unit V
Queing theory – Poisson models – M/M/1 – steady state behaviour – transient behaviour of M/M/1

Books for Reference:
1. Operations Research -   Kanthiswarup, P.K. Gupta & Manmohan (for Units – I, II & III)
2. Operations Research - R.K. Gupta (for Units – IV & V)
3. Operations Research - An introduction by Taha H.A. (MC Graw Hill)

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APPLIED PAPER – II – THEORY OF GRAPHS

Unit I
Definition of a graph – application of graphs – finite and infinite graphs – incidence and degree – isolated vertex pendant vertex and Null graph
Isomorphic graphs – sub graphs – walks, paths and circuits – connected graphs – operations on graphs – more on Euler graphs – Hamiltonian paths and circuits (Chapter I & II)

Unit II
Trees - some properties of trees – pendent vertices in tree – distance and centers in a tree – tooted and binary trees – spanning trees – fundamental circuits – cut – sets – some properties of a cut – set – all cut – sets in a graph – fundamental circuits and cut –sets – connectivity and separability (Chapters III and IV)

Unit III
Planar graphs – Kuratowski's two graphs – different representations of graph – gee metric dual – combinatorial dual – more on criteria of planarity
Incidence matrix – sub matrices of $A(G)$ –

Unit IV
Chromatic number – chromatic partitioning – chromatic polynomial – matching – coverings – the four colour problem five colour theorem – (Chapter VIII)

Unit V
Definition of a digraph – some types of digraphs – digraphs and binary relations – directed paths and connectedness – Euler digraphs – matrices A, B & C of digraphs – adjacency matrix of a digraph
Treatment as in "Graph Theory with Applications to Engineering and Computer Sciences" by Narasingh Deo

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