FACULTY OF SCIENCE

SYLLABI

FOR

B.SC. (HONOURS SCHOOL) MATHEMATICS & COMPUTING

1ST TO 4TH SEMESTER

&

3RD YEAR (ANNUAL SYSTEM)

EXAMINATIONS 2010-2011
OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR THE FIRST, SECOND AND THIRD YEARS (MAJOR AND SUBSIDIARIES) FOR THE B.Sc.(HONS.SCHOOL) IN MATHEMATICS & COMPUTING FOR THE ACADEMIC SESSION 2010-2011

Outlines of Tests

B.Sc.(H.S.) First Year in Mathematics and Computing

Semester I

(I) Preliminary English (common to all Hons. School)

(II) Environmental Education -do-

(III) Major Papers-2

   Paper I : Math 301S : Calculus-I
   Paper II : Math 302S : Matrices and Theory of Equations

(IV) Subsidiary Courses-2

   (1) Statistics and Computational Methods
       Paper I : SC 101S : Probability & Statistical Methods-I
       Paper II : SCP 102S : Practicals of Statistical Methods-I

   (2) Computer Applications
       Paper I : CA 103S : Computer Fundamentals and Introduction to ‘C’ Language
       Paper II : CAP 104S : Practicals of ‘C’ Language

Semester II

(I) Preliminary English (common to all Hons. School)

(II) Environmental Education -do-
### (III) Major Papers-2

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<thead>
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<th>Calculus-II</th>
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<tbody>
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<td>Paper II</td>
<td>Math 322S</td>
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### (IV) Subsidiary Courses-2

#### (1) Statistics and Computational Methods

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<thead>
<tr>
<th>Paper I</th>
<th>SC 121S</th>
<th>Probability &amp; Statistical Methods-II</th>
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<tr>
<td>Paper II</td>
<td>SCP 122S</td>
<td>Practicals of Statistical Methods-II</td>
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#### (2) Computer Applications

<table>
<thead>
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<th>Paper I</th>
<th>CA 123S</th>
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<tr>
<td>Paper II</td>
<td>CAP 124S</td>
<td>Practicals of ‘C’ Language</td>
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**B.Sc.(H.S.) Second Year in Mathematics & Computing**

#### Semester III

(i) **Major Papers-3**

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<th>Paper I</th>
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<th>Number Theory</th>
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<td>Math 402S</td>
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<tr>
<td>Paper III</td>
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<td>Ordinary Differential Equations</td>
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(ii) **Subsidiary Courses-2**

#### (1) Statistics and Computational Methods

<table>
<thead>
<tr>
<th>Paper I</th>
<th>SC 201S</th>
<th>Applied Statistics-I</th>
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<tbody>
<tr>
<td>Paper II</td>
<td>SCP 202S</td>
<td>Practicals of Applied Statistics-I</td>
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#### (2) Computer Applications
Paper I: CA 203S : Programming with JAVA

Paper II: CAP 204S : Practicals of Programming with JAVA

Semester-IV

(i) Major Papers-3

Paper I : Math 421S : Algebra
Paper II : Math 422S : Analysis-II
Paper III: Math 423S : Mechanics

(IV) Subsidiary Courses-2

(1) Statistics and Computational Methods

Paper I : SC 221S : Applied Statistics-II
Paper II : SCP 222S : Practicals of Applied Statistics-II

(2) Computer Applications

Paper I : CA 223S : Software Engineering and Minor Project
Paper II : CA P224S : Practicals of Software Engineering and Minor Project
B.Sc.(Hons. School) Third Year in Mathematics & Computing

Major Papers

Paper I   Math 501A: Algebra

Paper II  Math 502A: Lebesgue Integration, Fourier Series and Calculus of several variables

Paper III Math 503A: Special Functions, Integral Transforms and Partial Differential Equations

Paper IV  Math 505A: Discrete Mathematics and Numerical Analysis

Paper V   CA506A: Operating Systems, Data Base Management and Use of Mathematical Packages (Theory & Practicals)
B.Sc.*(Honours School) 1st Year in Mathematics & Computing

Examinations 2010-11

Semester I

Major Papers

Paper I

MATH 301S: Calculus-I

(7 hrs/week (including tutorials)/Marks: 100)

Time: 3 hrs.

Note: 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer atleast two questions from each part.
3. All questions carry equal marks.

PART –I

Differential Calculus

(Scope as in Chapters 1,2,3 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Integral Calculus

Integration of functions. Reimann sum and definite integrals. Properties, Area and the Mean value theorem, The fundamental theorem.

(Scope as in Chapters 4 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)
Part II

Integral Calculus

(Scope as in Chapters 5 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Infinite Series:

(Scope as in Chapters 8 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Suggested Readings

3. Lipmen Bers: Calculus.

Paper II

MATH 302S: Matrices and Theory of equations

(7 hrs/week (including tutorials)/Marks: 100)
Time: 3 hrs.

Note: 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

PART –I

system of linear (both homogeneous and non homogeneous) equations. Theorems on consistency of a system of linear equations.

PART-2

Polynomials, Euclid’s Algorithm greatest common divisor, unique factorization of polynomials over a field F of numbers (statement only), Fundamental theorem of Algebra (statement only), roots and their multiplicity, Irreducible polynomials over Q, R, C. Relationship between roots and the coefficients, Fundamental theorem of symmetric polynomials (without proof) Evaluation of symmetric functions of roots. Rational roots of polynomials with integral coefficients. Descartes rule of sign, Strum’s theorem (statement only) Solution of cubic equation and biquadratic equation.

References


Subsidiary Paper – Computer Applications

SEMESTER-I

PAPER I - CA 103S: COMPUTER FUNDAMENTAL AND INTRODUCTION TO ‘C’ LANGUAGE

Theory (5 hrs/week/marks : 75)
(Time : 3 hrs.)

Note : 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer atleast two questions from each part.
3. All questions carry equal marks.
PART I

Introduction and uses of computers, block diagram of computers, uses of CPU and I/O devices, software and hardware, application software and system software, primary and secondary storage devices. Introduction to flowcharts and algorithms.

PART II

Introduction to ‘C’ language: Data types, constants and literals. Operators: arithmetic, relational and logical, precedence and order of Evaluation. Statements for: decision control, loop control and case control. Functions and storage classes in C.

Suggested Readings

1. Computer Fundamentals by B. Ram,
2. Let Us C by Yashwant Kanetkar, BPB publications.
4. Programming with C by Byron Gottfried, Tata Mcgrawhill.

PAPER II (PRACTICAL)- CAP 104S : PRACTICALS OF ‘C’ LANGUAGE (PART-I)

(3 hrs/week/marks : 25)

Development of programs in C.

The distribution of marks in practical will be as under:

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<tr>
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<th>Marks</th>
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<tr>
<td>Practical Exercises</td>
<td>12</td>
</tr>
<tr>
<td>Record of practicals</td>
<td>4</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>4</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td>5</td>
</tr>
</tbody>
</table>
Semester II

**Major Papers**

MATH 321S: Calculus-II

(7 hrs/week (including tutorials)/Marks: 100)

Time: 3 hrs.

**Note:**
1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

**PART-I**

**Vector Analysis**


**PART-II**

**Multivariable Functions:**


**Suggested Readings**

3. Lipmen Bers: Calculus.
**MATH 322S: Coordinate Geometry**

(7 hrs/week (including tutorials)/Marks: 100)

Time : 3 hrs.

**Note :**
1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

**Part –1**

**Pair of Straight lines:** Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

**Circle:** General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t circle, radical axis, co-axial family of circles, limiting points.

**Conic:** General equation of conic, Tangents, normals, chord of contact, pole and polar, of tangents from a point, equation of chord in terms of midpoint, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

**Transformation of axes in two dimensions:** shifting of origin, rotation of axes, the second degree equation \( S = ax^2+2hxy+by^2+2gx+2fy+c=0 \), its invariants \( t \), \( \Delta \) and \( \Omega \). Reduction of the second degree equation into standard form. Identification of curves represented by \( S=0 \) (including pair of lines)

**Polar coordinates:** Polar equations of straight lines, circles and conics. Polar equation of chords, tangents normals only.

**Part-2**

Review of lines and planes in 3-dimension, change of axes, shift of origin, rotation of axes, sphere, section of a sphere by a plane. Sphere through a given circle. Intersection of a line and sphere, tangent line, tangent plane, angle of intersection of two spheres and condition of orthogonality, power of a point w.r.t a sphere, Radical planes, radical axis, radical centre, coaxial family of spheres, limiting points, Cylinder, Cone with vertex at origin as the graph of homogeneous equation of second degree in \( x,y,z \), cone as a surface generated by a line passing through fixed curve and a fixed point outside the plane of the curve, reciprocal cones, right circular and elliptic cones, right circular cone as a surface of revolution obtained by rotating the curve in a plane about an axis, enveloping cones, ellipsoid, equations of hyperboloids, paraboloids in the standard form, tangent planes and normals.
References


Subsidiary Papers

SEMESTER-II

PAPER I - CA 123S: ADVANCED PROGRAMMING IN ‘C’ LANGUAGE
Theory (5 hrs/week/marks : 75)
(Time : 3 hrs.)

Note:
1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

PART I

Arrays: declaring an array, initializing an array, one dimensional arrays: array manipulation; searching, insertion, deletion of an element from an array; finding the largest/smallest element in array; two dimensional arrays, addition/multiplication of two matrices, transpose of a square matrix; null terminated strings as array of characters.
Pointers: concept of pointers, address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, indirection operator, pointers to pointers, functions and pointers, arrays and pointers, pointer arrays.

PART II

Structures and Unions: basic of structures, structures variables, initialization, structure assignment, nested structure, structure and functions, structures and arrays: arrays of structures, structures containing arrays unions.
Self Referential Structures and Linked Lists: creation of a singly linked list, traversing a linked list, insertion into a link list, deletion from a linked list.
File processing: concept of files, file operation in various modes and closing of a file, reading from file, writing onto a file.

**Suggested Readings**


**PAPER II (PRACTICAL)- CAP 124SA : PRACTICALS OF ‘C’ LANGUAGE (PART-II)**

(3 hrs/week/marks : 25)

Development of programs in C.

The distribution of marks in practical will be as under:

- Practical Exercises 12 marks
- Record of practicals 4 marks
- Viva-voce 4 marks
- Internal Assessment 5 marks
B.Sc. (Hons. School) Second Year

Semester III

**Major Papers**

Paper I: Math 401S: Number Theory

[7 hrs per week (including tutorials)]

Max. Marks: 100

[Final-80+Internal Assessment-20]

Time: 3hrs.

**Note:**
1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer two questions from each part.
3. All questions carry equal marks

**PART-I**

Divisibility, Greatest common divisor, fundamental theorem of arithmetic, congruences, residue classes and reduced residue classes, Euler-Fermat’s Theorem. Wilson’s Theorem, linear congruences, Chinese Remainder Theorem, polynomial congruences, Arithmetical functions, \(\phi(n)\), \(\tau(n)\), \(\mu(n)\), \(\sigma(n)\) etc. Mobius Inversion Formula.

**PART-II**

Primitive roots, indices, quadratic residues, Legendre’s symbol, Euler’s Criterion. Gauss’ Lemma, Quadratic reciprocity Law, Jacobi symbol,. The Diophantine Equations \(x^2+y^2=z^2\), \(x^4+y^4=z^4\). (Scope as in Elementary Number Theory by D.M. Burton, Chapters 1-11). Farey Sequences (Scope as in Chapter 6 (Sections 6.1 and 6.2) of Elementary Number Theory by Niven & Zuckerman)

**Suggested Readings**

Casino de Monte Carlo: An Analysis of Strategy -II

[7 hrs per week (including tutorials)]
Max.Marks : 100
[Final-80+Internal Assessment-20]
Time: 3hrs.

Note: 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

PART-I

The real number system, least upper bound property, countable and uncountable sets, topology of real line and $\mathbb{R}^n$, metric spaces, compact sets, connected sets, arcwise connectedness, completion of a metric space, limit superior and limit inferior of a real sequence. Series, review of various tests of convergence, Abel’s test and Dirichlet’s test.

PART-II

Absolute convergence, alternating series. Addition and multiplication of series, rearrangements, limits of functions, continuous functions, continuity and compactness, continuity and connectedness, discontinuity, monotone functions, infinite limits and limits at infinity, the derivative of a real function, mean value theorems, L’Hospital’s rule, Taylor’s theorem.

[Scope as in the book ‘Principles of Mathematical Analysis’ by W.Rudin (3rd edition) Chapter I-V]

Books recommended

Note : 1. The question paper will have eight questions. Candidates will attempt five questions.
   2. There will be four questions from each part and the students will be required to answer atleast two questions from each part.
   3. All questions carry equal marks.

PART-I

Ordinary differential equations

Basic definitions: order and degree of differential equation, primitives, solutions of differential equations, integral curves, isoclines.

First order differential equations: Linear, non-linear differential equations, Variables separable, homogeneous, non-homogeneous exact equations and integration factors, equations reducible to first order, Clairaut’s equation and Geometrical interpretation of first order differential equation, applications.

Successive approximations, Lipschitz condition, Statements of Existence and Uniqueness of solution of first order differential equations.

PART- II


Euler equation, regular singular points, ordinary points, series solution. Method of Frobenius, Applications, Legendre’s, Hermite’s and Bessel’s equation.
Subsidiary Paper –

Semester-III

CA 203S : Programming with JAVA

Theory

[5 hrs/week/ Max.marks : 75(Final-60+15 Int.Assess.)]

(Time : 3 hrs.)

Note :  1. The question paper will have eight questions. Candidates will attempt five questions.
        2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
        3. All questions carry equal marks.

Part I

Fundamentals of Object-Oriented Programming, data types, operators, expressions, decision making, looping, arrays and strings, classes, objects and methods, constructors, static members,
Part II

Subclass, final variables and methods, abstract methods, interfaces, packages, errors and exceptions, input/output files handling, graphics programming.

SUGGESTED READINGS


CAP 204S: Practical of Programming with JAVA

[3 hrs/week/marks: 25(Practicals-20+5 Int.Assess.)]

Practical

The distribution of marks in practical will be as under:

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<thead>
<tr>
<th>Practical Exercises</th>
<th>12 marks</th>
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</thead>
<tbody>
<tr>
<td>Record of practicals</td>
<td>4 marks</td>
</tr>
<tr>
<td>Viva-voce</td>
<td>4 marks</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td>5 marks</td>
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</table>
Semester-IV

Major Papers-

Paper I: Math 421S: Algebra

[7 hrs per week (including tutorials)]
Max. Marks: 100
[Final-80+Internal Assessment-20]
Time: 3hrs.

Note: 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer two questions from each part.
3. All questions carry equal marks

PART-I

Group Theory: Definitions, examples and simple properties of groups, order of an element, cyclic groups, connection with primitive roots, subgroups, cosets. Lagrange’s Theorem, subgroups of a cyclic group, subgroup generated by a subset, conjugacy, normal subgroups, quotient groups, homomorphisms, the isomorphism theorem.

PART II

Cayley’s Theorem, detailed study of $S_n$, simplicity of $A_n$, $n \neq 4$, Class Equations, Cauchy’s Theorem, Sylow’s Theorems, Direct Products. Elementary properties of finite p-groups, Fundamental Theorem of finite Abelian groups (scope as in Chapter 2 of I.N. Herstein - Topics in Algebra, Second Edition).

Suggested Readings

Paper-II: Math 422S: Analysis –II

[7 hrs per week (including tutorials)]
Max.Marks : 100
[Final-80+Internal Assessment-20]
Time: 3hrs.

Note: 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

PART-I

Functions of bounded variation, Total variation, Additive property of total variation, functions of bounded variation expressed as the difference of increasing functions, rectifiable curves and arc length.

The Riemann-Stieltjes integrals with emphasis on Riemann Integral, step functions as integrators, additive and linearity properties of upper and lower integrals, Integrators of bounded variation, Mean value theorems for Riemann-Stieltjes integrals, Fundamental theorem of integral calculus, Mean value theorems for Riemann Integrals.

PART-II

Sequences and series of functions, uniform convergence, uniform convergence and continuity, uniform convergence and integration, uniform convergence and differentiation, The Stone-Weierstrass Theorem power series, exponential and logarithmic functions, trigonometric functions.

[Scope as in the book Mathematical Analysis by T.M. Apostol , Chapter VI (upto 6.10), VII (upto 7.22), ‘Principles of Mathematical Analysis’ by W. Rudin (3rd edition) Chapter VII (Sections 7.1 to 7.18, 7.26). Chapter VIII upto Theorem 8.8 ]

Books recommended
Paper-III: Math 423S: Mechanics

[7 hrs per week (including tutorials)]
Max. Marks: 100
[Final-80+Internal Assessment-20]
Time: 3hrs.

Note:
1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer at least two questions from each part.
3. All questions carry equal marks.

PART-I

Statics
Forces acting on a particle, parallel Forces, Couples, Moments and Coplanar forces acting on a rigid body and their resultant. Equilibrium of concurrent and Non-Concurrent coplanar forces, Friction, Virtual Work, Stable and unstable equilibrium and the Physical situations via problems.

PART-II

Dynamics
Motion in a straight line, Newton’s law of motion, Motion on an inclined plane. Motion under variable acceleration, Simple harmonic motion, Relative Motion, Projectiles, Work, Power, Energy.

Suggested Reading

2. A Text Book of Mechanics for TDC I, TDC II Publication Bureau, Panjab University, Chandigarh.
Subsidiary Papers-
CA 223S -Software Engineering and Minor Project

Theory
[5 hrs/week/ Max.marks : 75(Final-60+15 Int.Assess.)]
(Time : 3 hrs.)

Note : 1. The question paper will have eight questions. Candidates will attempt five questions.
2. There will be four questions from each part and the students will be required to answer atleast two questions from each part.
3. All questions carry equal marks.

Part I

Part II
Software Engineering: Coding, Testing
Project: Development of mathematical package in C or JAVA (package include atleast 20 functions)

SUGGESTED READINGS:

CA P224S –Practicals of Software Engineering and Minor Project
[3 hrs/week/marks : 25(Practicals-20+5 Int.Assess.)]

Practical
The distribution of marks in practical will be as under:

- Practical Exercises 12 marks
- Record of practicals 4 marks
- Viva-voce 4 marks
- Internal Assessment 5 marks
B.Sc. (Honours School) Third Year Examination, 2011

Paper I - Math 501A: Algebra

[7 hrs/per week (including Tutorials)]
[Marks: 200]

Note 1. The question paper will have nine questions. Candidates will attempt five questions.

2. The first question is compulsory and of short answer type spread evenly over the entire syllabus.

3. There will be four questions from each part and the students will be required to answer two questions from each part.

4. All questions carry equal marks.

Part I: Groups and Rings


Rings, integral domains, division rings, fields. Subrings and ideals. Algebra of ideals. Quotient rings. Prime ideals and maximal ideals. Homomorphism, fundamental theorem of homomorphisms, the first and the second theorems of isomorphism. Field of quotients and embedding theorems. Polynomial rings, factorization in $R \left[ X \right]$ and in integral domains. Divisibility, Euclidean domains, unique factorization domains. Gauss’ lemma and Eisenstein’s criteria of irreducibility [Scope as in Chapters 7, 8, 9 and 10 of the book - Surjeet Singh and Quazi Zameeruddin: Modern Algebra, 7th edition].

Part II: Vector Spaces and Linear Transformations


Modules, definition and examples. Fundamental theorem of finitely generated modules over Euclidean domains [Scope as in Section 4.5 of the book – I.N. Herstein: Topics in Algebra].
Suggested Readings

3. N.S. Gopalakrishnan: University algebra; Wiley eastern Ltd.
Paper II Math-502A: Lebesgue Integration, Fourier Series and Calculus of Several Variables

[7 hrs/per week (including tutorials)]
(Marks: 200)

Note 1. The question paper will have nine questions. Candidates will attempt five questions.
2. The first question is compulsory and of short answer type spread evenly over the entire syllabus.
3. There will be four questions from each part and the students will be required to answer two questions from each part.
4. All questions carry equal marks.

Part-I : Lebesgue Integration and Fourier Series

Lebesgue outer measure, measurable sets and Lebesgue measure, Construction of a non-measurable set, measurable functions, Littlewood three principles.

Lebesgue integral of a bounded function over a set of finite measure, the integral of a non-negative function, the general Lebesgue Integral.
[Scope as in the relevant sections from Chapter 4 of the book ‘Real Analysis’, 3rd Edition, 2000 by H. L. Royden]

Differentiation of monotone functions, functions of bounded variation, differentiation of an integral, absolute continuity.
[Scope as in the relevant sections from Chapter 5 of the book ‘Real Analysis’, 3rd Edition, 2000 by H. L. Royden]

The set $L^2_{[a,b]}$ of square integrable real valued functions on [a,b]. Orthogonal/orthonormal system of functions, the theorem of best approximation, the Fourier Series of a function relative to an orthonormal set, Bessel’s inequality, the Reimann-Lebesgue lemma, the Dirichlet integrals, Riemann’s Localization theorem, sufficient conditions for convergence of a Fourier Series at a particular point.
Part-II : Calculus of Several Variables

Limit and continuity of functions between Euclidean spaces, Partial derivatives, directional derivatives and the Jacobian matrix, Derivatives and their elementary properties. Chain rule and its matrix form. Mean value theorem for differentiable functions, Sufficient condition for differentiability and sufficient condition for the equality of mixed partial derivatives, higher order derivatives, Taylor Theorem for function of n-variables.

Inverse function theorem. Implicit function theorem. Maxima and Minima at interior points. Criteria for local maxima and local minima. The method of Lagrange multipliers. [Scope as in the book ‘Mathemtical Analysis’ by T. M. Apostol, Chapter 12(except 12.6) and Chapter 13]


Suggested Reading:

1. H.L.Royden : Real Analysis (3rd Ed.), Prentice Hall of India.
5. Shanti Narayan : A course of Mathematical Analysis (12th Ed.)
Paper III  Math-503A: Special Functions, Integral Transforms and Partial Differential Equations

[7 hrs/per week (including tutorials)]

(Marks: 200)

Note 1. The question paper will have nine questions. Candidates will attempt five questions.
   2. The first question is compulsory and of short answer type spread evenly over the entire syllabus.
   3. There will be four questions from each part and the students will be required to answer two questions from each part.
   4. All questions carry equal marks.

PART-I

Legendre Polynomials—Rodrigue’s formula, generating function, recurrence relations, Orthogonal and Orthonormal functions, Orthogonal property of Legendre polynomials, Fourier-Legendre series.

Chebyshev Differential Equation and Chebyshev polynomials of first and second kind.

Bessel’s Differential Equation and Bessel’s functions.

Strum-Liouville Problem – Orthogonality of Bessel functions, Fourier-Bessel Series.

Laplace Transforms – Solution of initial value problems using Laplace transforms, Translation theorems, Laplace transform of Dirac-Delta function, Differentiation and Integration of Laplace transform, Convolution theorems, Laplace transform of periodic functions, Laplace transform method to solve some partial differential equations.

Review of Fourier series, Fourier integrals, applications of Fourier series, Fourier transforms, Fourier transform solution of some partial differential equations.

PART- II

Partial differential equations, solution of Partial differential equations in three variables. Partial
differential equations of the first order. Partial differential equations of the second order and their
classification into hyperbolic, elliptic and parabolic types, canonical forms. Linear partial
differential equations with constant coefficients. Dirichlet and Neumann boundary conditions.
Laplace, diffusion and wave equations, and their solution in cartesian, spherical, polar and
cylindrical polar coordinates by separation of variables.

[Scope as in the book ‘Differential Equations’ by I.N.Sneddon, Chapter 1(3, 4, 5, 6), Chapter 2,
Chapter 3(4, 5, 9)]

Books recommended

3. Loknath Debnath : Integral Transform
4. E. D. Rainkilla : Special Function
PAPER IV– Math 505A: Discrete Mathematics and Numerical Analysis
[7 hrs./ per week(including tutorials)]
[Marks: 200]

Note 1. The question paper will have nine questions. Candidates will attempt five questions.

2. The first question is compulsory and of short answer type spread evenly over the entire syllabus.

3. There will be four questions from each part and the students will be required to answer two questions from each part.

4. All questions carry equal marks.

Part I: Discrete Mathematics

Pigeonhole principle, Basic counting principles, permutations and combinations of sets and multisets, Binomial and multinomial theorems, Combinatorial identities, inclusion and exclusion principle, Generating functions, Catalan numbers, Difference sequences and Sterling numbers. Elements of Graph Theory, Euclerian and Hamiltonian trails and cycles. Bipartite multigraphs, Trees, Spaning Trees, Digraphs, Planer graphs, Euler formula and Chromatic numbers. (Scope as in Introductory Combinatorics, 3rd edition by Brualdi, Chapters 1-3,5-8,11 (except § 11.6), 12.1, 13.1,13.2)

Partially Ordered sets, Lattices, Distributive lattices, Complements, Boolean algebras and Boolean expressions. (Scope as in Discrete Mathematics for computer scientists and Mathematicians by Malt, Kandal and Baker Chapter 6)

Part II : Numerical Analysis

Suggested Readings

Paper V- CA 506A: Operating Systems, Data Base Management and Use of Mathematical Packages (Theory and Practical)

[5 hrs/per week]
[Marks: 150]

Note 1. The question paper will have nine questions. Candidates will attempt five questions.
2. The first question is compulsory and of short answer type spread evenly over the entire syllabus.
3. There will be four questions from each part and the students will be required to answer two questions from each part.
4. All questions carry equal marks.

PART I: OPERATING SYSTEMS AND JAVA PROGRAMMING

Operating systems and its functions, various components of operating systems, single user operating systems, multi users, multitasking, multiprocessing and real time operating systems.

Examples of multiprocessing operating systems, Introduction to UNIX, UNIX commands, Administration of UNIX operating system (opening of new accounts, usage accounting, resource allocation and other management functions in UNIX), Introduction to shell programming.

Introduction to Object Oriented Programming using JAVA.

PART II: DATA BASE MANAGEMENT AND USE OF MATHEMATICAL PACKAGES

Introduction to DBMS, types of DBMS systems – Relational, Hierarchical and Network based DBMS, Relational database design, Use of standard mathematical packages like Mathematika, Matlab and Maple for solving various mathematical problems.

Suggested Readings

2. Introduction to UNIX System V by Morgan, McGraw Hill.
4. JAVA Complete Reference, McGraw Hill.
5. Data Base Management System by C.J.Date.
6. Introduction to Data Base Management System by Bipin, C. Desai.

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