FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL)
MATHEMATICS & COMPUTING

1ST TO 6TH SEMESTER

EXAMINATIONS 2012 - 2013

--:O:--
Outlines of Tests

Semester I

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

(II) Environment & Road Safety Education  -do-

(III) Major Papers-2
  Paper I :  Math 301S :  Calculus-I
  Paper II :  Math 302S :  Coordinate Geometry

(IV) Subsidiary Courses-2
  (1) Statistics
      Paper I :  SC 101S :  Probability & Statistical Methods-I
      Paper II :  SCP 102S :  Practicals of Statistical Methods-II
      Syllabus of these two subsidiary papers will be provided by the Statistics Department, Panjab University, Chandigarh.

  (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
  Paper I :  Math 321S :  Calculus-II
  Paper II :  Math 322S :  Linear Algebra

(IV) Subsidiary Courses-2
  (1) Statistics
      Paper I :  SC 121S :  Probability & Statistical Methods-II
      Paper II :  SCP 122S :  Practicals of Statistical Methods-II
      Syllabus of these two subsidiary papers will be provided by the Statistics Department, Panjab University, Chandigarh.
(2) **Computer Applications**  
Paper I : CA 123S : Advanced Programming in ‘C’ Language  
Paper II : CAP 124S : Practicals of ‘C’ Language

**Semester III**

Major Papers-3  
Paper I : Math 401S : Number Theory  
Paper II : Math 402S : Analysis-1  
Paper III: Math 403S : Ordinary Differential Equations

Subsidiary Courses-2  
1. **Statistics and Computational Methods**  
   Syllabus of these two subsidiary papers will be provided by the Statistics Department, Panjab University, Chandigarh.

2. **Computer Applications**  
   Paper I: CA 203S :Programming with JAVA  
   Paper II: CAP 204S :Practicals of Programming with JAVA

**Semester-IV**

Major Papers-3  
Paper I : Math 421S : Algebra  
Paper II : Math 422S : Analysis-II  
Paper III: Math 423S : Mechanics

Subsidiary Courses-2  
1. **Statistics and Computational Methods**  
   Paper I : SC 221S : Applied Statistics-II  
   Paper II : SCP 222S : Practicals of Applied Statistics-II  
   Syllabus of these two subsidiary papers will be provided by the Statistics Department, Panjab University, Chandigarh.

2. **Computer Applications**  
   Paper I : CA 223S : Software Engineering and Minor Project  
   Paper II: CA P224S : Practicals of Software Engineering and Minor Project
Semester V

Paper-I : Math 501S : Algebra
Paper-II : Math 502S : Calculus of Several Variables and Improper Integrals
Paper-III : Math 503S : Some Special Functions and Integral Transforms
Paper-V : Math 505S : Discrete Mathematics and Graph Theory
Paper-VI : CA 506S : Relational Database Management System and Mathematical Package

Semester VI

Paper-I : Math 521S : Linear Algebra
Paper-II : Math 522S : Lebesgue Integration and Fourier Series
Paper-IV : Math 525S : Numerical Analysis
Paper-V : CA 526S : Advanced Java
Outlines of tests syllabi and courses of reading for B.Sc. (Honours School) First Year
English Subsidiary (Semester System)

FIRST SEMESTER

Objectives:

The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:

(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.

(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.

(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:

I. The Judgement Seat of Vikramaditya, Sister Nivedita
II. Engine Trouble, R. K. Narayan
III. The Conjurer's Revenge, Stephen Leacock

Drama:

I. The Rising of the Moon, Lady Gregory
II. Waterloo, Arthur Conan Doyle

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations.
Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.,

**Practical work:-**

Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

**Note:** In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100.

**Testing Scheme:**

The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

**Section I** (It is text-based and corresponds to unit I in the syllabus)

Q1. It shall consist of *five* short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text *Varieties of Expression* and cover a wide range of issues, topics and problems. It shall consist of *12 marks*.

Q2. It shall consist of *two* long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text *Varieties of Expression*. This shall carry *10 marks*.

**Note:** The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an **Unseen Passage for Comprehension** (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of **12 marks**.

Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column. This shall carry **6 marks**.

**Section II** (Based upon Unit II)

Q5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200
words). The students shall be given an internal choice in this question. This question shall carry 8 marks.

(b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry 4 marks.

Q.6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks

Q.7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.

Q.8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:

(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.

(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:


SECOND SEMESTER

Objectives:

The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

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I    J. C. Bose, Aldous Huxley
II   The Position of Women in Ancient India, Padmini Sen Gupta

Drama:

I    The Proposal, Anton Chekhov
II   Riders to the Sea, J. M. Synge
III  Lithuania, Rupert Brooke

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Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

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(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.

(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:


UNIT I (ENVIRONMENT)

1. **Environment Concept:**
   
   Introduction, concept of biosphere—lithosphere, hydrosphere, atmosphere; Natural resources—their need and types; principles and scope of Ecology; concepts of ecosystem, population, community, biotic interactions, biomes, ecological succession.

2. **Atmosphere:**
   
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. **Hydrosphere:**
   
   Types of aquatic systems. Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks and possible control measures.

4. **Lithosphere:**
   
   Earth crust, Soil—a life support system, its texture, types, components, pollution and pollutants, reasons of soil erosion and possible control measures.

5. **Forests:**
   
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban forests, Chipko Andolan.

6. **Conservation of Environment:**
   
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of conservation, policies of conservation; conservation of life support systems—soil, water, air, wildlife, forests.

7. **Management of Solid Waste:**
   
   Merits and demerits of different ways of solid waste management—open, dumping, landfill, incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic farming.

8. **Indoor Environment:**
   
   Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and polythene; hazardous chemicals, solvents and cosmetics.

9. **Global Environmental Issues:**
   
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity; Stratospheric ozone depletion, dangers associated and possible solutions.
10. **Indian Laws on Environment:**

Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about Laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. **Biodiversity:**

What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. **Noise and Microbial Pollution:**

Pollution due to noise and microbes and their effects.

13. **Human Population and Environment:**


14. **Social Issues:**

Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues:**

Environmental problems in rural and urban areas, Problem of Congress grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals:**

Depending on the available facility in the college, a visit to Vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

*Note: Above 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topics from 2 to 11 and one each for the topics 1 and 12 to 15.*

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
4. Traffic Signs.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

**Examination Pattern:**

- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted question).
- The paper shall have two units: **Unit I (Environment)** and **Unit II (Road Safety)**.
- Unit I shall comprise of 50 questions with minimum of 2 questions from each topics 1, and 12 to 15 and minimum of 4 questions from topics 2 to 11.
• Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
• The entire syllabus of Unit I is to be covered in 25 hours and that of Unit II is to be covered in 10 hours.
• All questions are to be attempted.
• Qualifying Marks 33 per cent i.e. 23 marks out of 70.
• Duration of examination : 90 minutes.
• The paper setters are requested to set the questions strictly according to the syllabus.

**Suggested Readings**

2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

**Websites:**

(a) [www.chandigarhpolice.nic.in](http://www.chandigarhpolice.nic.in)
(b) [www.punjabpolice.gov.in](http://www.punjabpolice.gov.in)
(c) [www.haryanapolice.gov.in](http://www.haryanapolice.gov.in)
(d) [www.hppolice.nic.in](http://www.hppolice.nic.in)
Objective
Calculus is one of the major branches of mathematics that finds application in almost all the fields of science. This course is an introduction to calculus. Students will be introduced to the concepts of limits, derivatives, integrals and infinite series.

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
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


Paper-II

Math302S: Coordinate Geometry

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

Objective
Geometry is derived from real world measurements of lines, planes and solids. A systematic logical approach is required to understand it. The objective is to provide basic understanding of the geometry of two and three dimensions.

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

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 \( O \). 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 –II

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

**Objective**

The objective of this syllabus is to teach computer fundamentals and introduction to ‘C’ Language. This will help students to learn about functioning of computers and familiarity with computer Language ‘C’.

**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.
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**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. Introduction to ‘C’ language: Data types, constants and literals. Operators: arithmetic, relational and logical, precedence and order of Evaluation.

**PART –II**

Statements for: decision control, loop control and case control. Functions and storage classes in C. 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.

**Suggested Readings**


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

Development of programs in C.

The distribution of marks in practical will be as under:

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<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

First Year (Semester System)

Second Semester

Objectives:

The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

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(a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It'll carry 6 marks.

(b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:


Objective

This course is in continuation of Calculus-I course. Here some advanced topics of calculus are included. This will help the students to understand the use of higher Calculus in various physical problems.

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

Vector Analysis


(Scope as in chapters 10, 11 and 14 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

PART-II

Multivariable Functions:


(Scope as in Chapters 12 and 13 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition).

Suggested Readings

Objective

The concepts and techniques from linear algebra are of fundamental importance in many scientific disciplines. The main objective is to introduce basic notions in linear algebra that are often used in mathematics and other sciences. The emphasis will be to combine the abstract concepts with examples in order to intensify the understanding of the subject.

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

Systems of linear equations, matrices, rank, Gaussian elimination.

Determinants and their properties, Cramer's Rule.

Vector spaces, subspaces, bases and dimension, the null space and the column space of a matrix and their dimension.

Linear transformations, representation of linear transformations by matrices, change of basis, rank-nullity theorem, Applications to difference equations and Markov chains.

PART-II

Eigenvalues and eigenvectors, characteristic polynomials, minimal polynomials, Cayley-Hamilton Theorem, triangulation, diagonalization.

Inner product, length, orthogonality, orthogonal projections, Gram-Schmidt orthonormalization process. Least square problems, inner product spaces and their applications.

Diagonalization of symmetric matrices and quadratic forms.

Text Book


References

Objective

The objective of this course is to teach pointers, structures and file concepts in ‘C’ and develop programs for linked list. This will help students to learn about pointers and structures in depth and file operations in detail.

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

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. 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.

PART -II

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)

Development of programs in C.

The distribution of marks in practical will be as under:

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<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 III

Major Papers-3

Paper I : Math 401S : Number Theory

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

Objective:
The aim of this course is to teach the students the very basics of Elementary Number Theory starting with primes, congruences, quadratic residues, primitive roots, arithmetic functions. Apart from teaching the theory, stress will be on solving problems.

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
Paper-II: Math 402S: Analysis -I

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

Objective
The aim of this course is to make the students learn about the metric spaces, series of real terms, relationship between continuous functions, compactness and connectedness of metric spaces.

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
Objective
The objective of this course is to exhibit the techniques for obtaining solutions to ordinary differential equations and the basic ideas and theory behind those techniques.

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

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.

Suggested Reading
Subsidiary Papers: Computer Applications

Paper 1: CA 203S: Programming with JAVA

Theory

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

Objective

The objective of this course is to teach object oriented programming concepts and their implementation in JAVA. This will help students to understand programming techniques with object oriented concepts.

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


Paper-II: CAP 204S: Practicals 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:

- Practical Exercises: 12 marks
- Record of practicals: 4 marks
- Viva-voce: 4 marks
- Internal Assessment: 5 marks
Objective
This is a basic course in Group Theory, which is an integral part of Algebra. Group theory has applications in almost all major branches of science.

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 $\mathfrak{S}_n$, simplicity of $\mathfrak{A}_n$, $n \neq 4$, 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

Objective

The objective of this course is to acquaint the students with the Riemann-Stieltjes integral as a generalisation of Riemann integral, Series of functions, interchange of limit and summations, differentiation and integration.

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

Objective
The contents of this course is designed to make the students understand the Theoretical Principles of Mechanics and to clarify the physical foundations of dynamics and formulating suitable mathematical models for solutions.

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

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 – Computer Applications
Semester IV

CA 223S -Software Engineering and Minor Project

Objective
The syllabus of this course will help the students to understand software development, life cycle from small, medium to large scales projects. In addition, students are expected to develop a small project to implement different phases of software development life cycle.

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

PART -II
Software Engineering: Coding, Testing

Project: Development of mathematical package in C or JAVA (package include at least 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
Objective
This course is a continuation of Math 421S which was an introduction to group theory. Besides covering some advanced topics of group theory, this course also covers the basics of Ring Theory and Module Theory.

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.

Groups and Rings

PART-I


PART-II

Polynomial rings, factorization in $R \langle X \rangle$ 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].

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

Objective
The objective of this course is to acquaint the students with the functions of several variables taking values in several variables and improper integrals.

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

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.
[Scope as in the book ‘Mathematical Analysis’ by T. M. Apostol, Chapter 12(except 12.6) and Chapter 13]

PART-II

The measure of a bounded interval in $\mathbb{R}^n$, the Riemann integral of a bounded function defined on a compact interval in $\mathbb{R}^n$, Sets of measure zero and Lebesgue’s criterion for existence of a multiple Riemann Integral, Evaluation of a multiple integral by iterated integration.
[Scope as in the book ‘Mathematical Analysis’ by T. M. Apostol, Chapter 14 (up to 14.5)]

Improper integrals, Cauchy’s criterion, absolute convergence, tests for convergence and uniform convergence. Elementary notions of functions defined by integrals, continuity, differentiation under the integral sign. Beta and Gamma functions.

Suggested Reading

Objective
The objective of this course is to introduce the special function as a solution of specific differential equations and acquaint the students with their properties, Integral Transforms and their inverse have been introduced which help in solving the various initial and boundary value problems.

Note 1. The question paper will have nine 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

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

Chebyshev Differential Equation, Chebyshev polynomials of first and second kind and relation between them, Generating function, orthogonal property, Recurrence formulae, Fourier Chebyshev Series.

Bessel’s functions. Strum-Liouville Problem – Orthogonality of Bessel functions, Recurrence formulae, Generating function, Fourier-Bessel Series.

PART- II

Laplace Transforms, Inverse Laplace transform, 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 ordinary differential equations.


Books Recommended

Objective
The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics and Graph Theory.

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
Pigeonhole principle, Basic counting principles, permutations and combinations of sets and multisets, Binomial and multinomial theorems, Combinatorial identities, inclusion and exclusion principle, Recurrence relations, Generating functions solution of recurrence relations using difference equations and generating functions, Catalan numbers, Difference sequences and Sterling numbers. Partitions as associated to distribution identical objects in identical boxes.

PART-II
Elements of Graph Theory, Euclerian and Hamiltonian trails and cycles. Bipartite multigraphs, Trees, Spaning Trees, Algorithms for BFS and DFS trees weighted Graphs, Greedy algorithm and Prim’s Algorithm for generating minimum weight spanning graphs, Digraphs, Planer graphs, Euler formula and Chromatic numbers. (Scope as in Introductory Combinatorics, 5th Edition by Brualdi, Chapters 1-3,5-8,11 (except § 11.6), 12.1, 13.1,13.2)

Suggested Readings
Objective
The contents of this course will help the students to understand basic concepts of database development, database connectivity to object oriented programming based language JAVA. This paper also introduces mathematical packages from programming point of view to help Mathematics students to solve their problems.

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
Relational Database Management System, First, Second and Third Normal Forms, Database connectivity with Java, Use of standard Mathematical package (Mathematica or Matlab) which include: conditional statements, loops.

PART II
Use of standard Mathematical package (Mathematica or Matlab) which include: inbuilt or library functions, user defined functions, arrays, graphics, file handling and its connectivity with C or Java.

Suggested Readings

Practical
Practical Exercises: 12 marks
Record of practicals: 4 marks
Viva-voce: 4 marks
Internal assessment: 5 marks
Objective
The objectives of this course is to develop a strong foundation in linear Algebra that provide a basis for advanced studies not only in Mathematics but also in other branches like engineering, physics and computers etc. Particular attention to canonical forms of linear maps, matrices, bilinear forms and quadratic forms is given.

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

Linear transformations, algebra of linear transformations. Dual spaces, matrices and linear transformations.

PART-II

References
Paper II Math-522S: Lebesgue Integration, Fourier Series and Calculus of Several Variables

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

Objective
The objective of this course is to get the students acquainted with Lebesgue Measure as generalizations of length, Lebesgue Integral and fundamental theorem of Calculus in Lebesgue Integral and Theory of Fourier Series.

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
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]

PART-II
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 Riemann-Lebesgue lemma, the Dirichlet integrals, Riemann’s Localization theorem, sufficient conditions for convergence of a Fourier Series at a particular point.

Suggested Reading:
Objective
The objective of the course is to enable the students to understand the basic concepts related to partial differential equations and acquaint with the methods of solutions of partial differential equations.

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

Ordinary differential equations in more than two variables : Simultaneous Differential equations of the first order and the first degree in three variables, Methods of their solution and applications, Pfaffian Differential forms and equations, solutions of Pfaffian Differential equations in three variables.


PART -II


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

Books recommended

Paper-V: Math 525S: Numerical Analysis

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

Objective
The objective of the course is to expose the students with different aspects of basic numerical methods to solve polynomial equation, simultaneous equations, IVP, numerical differentiation and integration.

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

Error: Sources, Propogation and Analysis. [Ref.2 Chap 1]


Linear System of Equations:

Direct Methods: Gauss elimination method, Gauss-Jordan Elimination methods, Decomposition methods (Doolittle, Crout and Cholskey), Partition method and their error analysis.
Iterative Methods: Jacobi iterative method, Gauss-Seidel iterative method, Successive over relaxation iterative method, iterative method to determine $A^{-1}$, Convergence Analysis matrix.
Eigen Value Problems: Gerschgirun Theorem, Jacobi, Givens methods Householder’s method for Symmetric matrices, Ruthishauser, Power and Inverse Power method. [Ref.1, Chap 3]

PART-II

Interpolation and Approximation of Functions:


Numerical solutions to first order ordinary differential equations: Taylor’s Series method, Picard’s Method, Euler’s and modified Euler’s methods, Runge Kutta methods [Ref. 3 Chap 7.1-7.5]

Suggested Readings

Paper-V: CA 526S: Advanced Java

[7 hrs/per week (including Tutorials)]
[Max. Marks: 100]
(Final-60+Internal Assessment-15
Practical-25)
Time : 3hrs.

Objective
The contents of this course help the students to understand advanced concepts of JAVA. The JAVA basic course has been introduced in previous semester. This will enable the students to learn cutting edge development in JAVA.

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

Review of Java Basic Features, Applets, AWT Controls, Event Handling, Multithreading, I/O files. Swing : Features, components, swing vs AWT, swing containers, controls, using Dialogs, sliders, progress bars, tables, creating user interface using swing.

PART II

Java Server Pages: Introduction, JSP Architecture, Java Beans, JSP objects, developing Web Applications.

Suggested Readings

Practical

Practical Exercises : 12 marks
Record of practicals: 4 marks
Viva-voce : 4 marks
Internal assessment: 5 marks

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