

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Mathematics (GE)

Name of the Course: B.Sc. I Sem. I & II (Liberal Science)

(Syllabus to be implemented from June 2022)



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science)

Semester-I

Generic Elective: MATHEMATICS (Paper-I) Discrete Mathematics

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credit

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

About Course: This course is structured to emphasize the development of mathematical skills in Discrete Mathematics.

Course Prerequisite:

Student shall have knowledge of Mathematics.

Preamble:

Mathematics is an indispensable tool for much of science and engineering. It provides the basic language for understanding the world and lends precision to scientific thought.

The mathematics program aims to provide a foundation for pursuing research in Mathematics as well as to provide essential quantitative skills to those interested in related fields. With the maturing of the Indian industry, there is a large demand for people with strong analytical skills and broad-based background in the mathematical sciences.

Course Objectives:

1. The course introduces set theory, permutations and combinations and counting principles.
 2. One can learn the concepts of lattices and Boolean algebra in analysis of various applications.
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Course Outcomes: This course will enable the students to:

1. Construct logical arguments and rigorous proofs.
2. Understand the basic principles of set theory, lattices and Boolean algebra.

3. Understand the ideas of mathematical induction and basic counting techniques.

Unit 1 A: Logical Mathematics – I (8)

Set theory, Operation on sets, Types of binary relations, Equivalence relations, Congruence and its properties, Partial and total ordering, Lattices, Properties of integers

Unit 1 B: Logical Mathematics – II (7)

Fundamental Theorem of Arithmetic, Division algorithm, Divisibility and Euclidean algorithm, GCD, LCM, Relatively prime.

Unit 2 A: Applications of Numbers (8)

Prime numbers, Statement of fundamental theorem of arithmetic, Fermat primes, Mathematical induction, Recursive relations and its solution (characteristics polynomial and generating function), Principles of counting (inclusion/exclusion, pigeon-hole), Permutation and combinations (with and without repetition).

Unit 2 B: Lattices and its Properties (7)

Duality principle, Lattices as ordered sets, Lattices as algebraic structures, Sub lattices, Products and homomorphism, Distributive lattices, Boolean algebras,

• **Continuous Internal Evaluation (CIE):**

CIE will consist of Home Assignment/Tutorials/Tests/Seminars, etc.

• **Text Books:**

1. Davey, B A., & Priestley, H. A. (2002). *Introduction to Lattices and Order* (2nd ed.). Cambridge University Press. Cambridge. 7th Printing 2012.
2. Goodaire, Edgar G., & Parmenter, Michael M. (2003). *Discrete Mathematics with Graph Theory* (2nd ed.). Pearson Education (Singapore) Pte. Ltd. Indian Reprint.
3. Lidl, Rudolf & Pilz, Günter. (1998). *Applied Abstract Algebra* (2nd ed.). Undergraduate Texts in Mathematics. Springer (SIE). Indian Reprint 2004.

• **Reference Books:**

1. Kenneth Rosen Discrete Mathematics and its applications Mc Graw Hill Education 7thedition.
2. V Krishna Murthy, V. P. Mainra, J. L. Arora, An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science)

Semester-I

Generic Elective: MATHEMATICS (Paper-II) FOURIER SERIES

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credit

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

About Course: This course is structured to emphasize the development of mathematical skills in Fourier Series.

Course Prerequisite:

Student shall have knowledge of Mathematics.

Preamble:

Mathematics is an indispensable tool for much of science and engineering. It provides the basic language for understanding the world and lends precision to scientific thought.

The Mathematics program aims to provide a foundation for pursuing research in Mathematics as well as to provide essential quantitative skills to those interested in related fields. With the maturing of the Indian industry, there is a large demand for people with strong analytical skills and broad-based background in the mathematical sciences.

Course Objectives:

1. The aim of the course is to offer introduction to the concepts of Fourier series
 2. Learn to use Fourier series to represent periodical physical phenomena in engineering analysis.
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Course Outcomes: This course will enable the students to:

1. To understand the concepts of Fourier series.
2. To solve the problems based on Fourier series.

Unit 1: Fourier Series - I**(15)**

Fourier series, Theorems, Dirichlet's conditions, Fourier series for even and odd functions.

Unit 2: Fourier Series - II**(15)**

Half range Fourier series, other forms of Fourier series.

- **Continuous Internal Evaluation (CIE):**

CIE will consists of Home Assignment/Tutorials/Tests/Seminars, etc.

- **Text Books:**

1. Dr. S. Sreenadh, S. Ranganatham, Dr. M.V.S.S.N. Prasad, Dr. V. Ramesh Babu, FOURIER SERIES AND INTEGRAL TRANSFORMS, S. Chand and Company Pvt. Ltd., first edition 2014.

- **Reference Books:**

1. Integral Transform by Vasistha A. R., Gupta R. K., Krishna Prakashan Media Pvt. Ltd. 11, Shivaji Road, Meerut India.
2. Dr. J. R. Goyal and K. P. Gupta Integral Transform Pragati prakashan Meerut.
3. An Introduction to Laplace Transform and Fourier series by Phill Dyke, Springer publication.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science)

Semester-II

Generic Elective: MATHEMATICS (Paper-III) REAL ANALYSIS

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credit

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

About Course: This course is structured to emphasize the development of mathematical skills in Real Analysis.

Course Prerequisite:

Student shall have knowledge of Mathematics.

Preamble:

Mathematics is an indispensable tool for much of science and engineering. It provides the basic language for understanding the world and lends precision to scientific thought.

The mathematics program aims to provide a foundation for pursuing research in Mathematics as well as to provide essential quantitative skills to those interested in related fields. With the maturing of the Indian industry, there is a large demand for people with strong analytical skills and broad-based background in the mathematical sciences.

Course Objectives: The objective of the course is to have

1. The knowledge on basic properties of the field of real numbers, studying Bolzano-Weierstrass Theorem, sequences and convergence of sequences, series of real numbers and its convergence etc.

2. One of the core courses essential to start doing mathematics.
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Course Outcomes: On completion of this course, students will be able to

1. Appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.
 2. Handle fundamental properties of the real numbers that lead to the formal development of real analysis and understand limits and their use in sequences, series, differentiation and integration.
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Unit 1: The Real Numbers – I **(15)**

Sets and functions, Mathematical Induction, Finite and Infinite Sets, The Algebraic and Order Properties of R , s -neighborhood of a point in R , Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Application of Supremum Property.

Unit 2: The Real Numbers – II **(15)**

The Completeness Property of R , The Archimedean Property, Density of Rational (and Irrational) numbers in R , Intervals, Absolute Value and the Real Line, Limit points of a set, Illustrations of Bolzano-Weierstrass theorem for sets, closure, interior and boundary of a set, Cantor's theorem.

• **Continuous Internal Evaluation (CIE):**

CIE will consist of Home Assignment/Tutorials/Tests/Seminars, etc.

• **Text Books:**

1. R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis(3rd Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore,2002.
2. G. Das and S. Pattanayak, Fundamentals of Mathematical Analysis, TMH Publishing Co.

• **Reference Books:**

1. S.C. Mallik and S. Arora-Mathematical Analysis, New Age International Publications.
2. A.Kumar, S. Kumaresan, *A basic course in Real Analysis*, CRC Press, 2014.
3. A Course of Mathematical Analysis by Shanti Narayan, S. Chand and company, New Delhi.



Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B. Sc. First Year (Liberal Science)

Semester-II

Generic Elective: MATHEMATICS (Paper-IV) Numerical Methods

Teaching Scheme:

Lectures – 3 Hours/week, 2 Credits

Practical – 4 Hours/week, 4 Credit

Examination Scheme:

UA – 40 Marks

CIE – 10 Marks

About Course: This course is structured to emphasize the development of mathematical skills in Numerical Methods.

Course Prerequisite:

Student shall have knowledge of Mathematics.

Preamble:

Mathematics is an indispensable tool for much of science and engineering. It provides the basic language for understanding the world and lends precision to scientific thought.

The Mathematics program aims to provide a foundation for pursuing research in Mathematics as well as to provide essential quantitative skills to those interested in related fields. With the maturing of the Indian industry, there is a large demand for people with strong analytical skills and broad-based background in the mathematical sciences.

Course Objectives:

1. To acquaint students' various topics in Numerical Analysis such as solutions of nonlinear equations in one variable, interpolation and approximation,
 2. Numerical solution of ordinary differential equations using Computer Algebra System (CAS).
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Course Outcomes: After completion of this course, students will be able to:

1. Find the consequences of finite precision and the inherent limits of numerical methods.
 2. Solve first order initial value problems of ODE's numerically using Euler methods.
 3. Appropriate numerical methods to solve algebraic and transcendental equations.
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Unit 1: Algebraic Linear Systems and Interpolation-I (15)

Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method.

Gaussian elimination method (with row pivoting), Gauss-Jordan method; Iterative methods: Jacobi method, Gauss-Seidel method.

Unit 2: Algebraic Linear Systems and Interpolation-II (15)

Interpolation: Lagrange form, Newton form, Finite difference operators, Gregory-Newton forward and backward difference interpolations, Piecewise polynomial interpolation (linear and quadratic), Ordinary differential equation: Euler's method, Modified Euler's methods (Heun's and midpoint).

• **Continuous Internal Evaluation (CIE):**

CIE will consist of Home Assignment/Tutorials/Tests/Seminars, etc.

• **Text Books:**

1. Numerical Analysis and Programming in C by Pundir and Pundir (Pragati Prakashan)

2. Reference Books:

1. Chapra, Steven C. (2018). *Applied Numerical Methods with MATLAB for Engineers and Scientists* (4th ed.). McGraw-Hill Education.
2. Fausett, Laurene V. (2009). *Applied Numerical Analysis Using MATLAB*. Pearson. India.
3. Jain, M. K., Iyengar, S. R. K., & Jain R. K. (2012). *Numerical Methods for Scientific and Engineering Computation* (6th ed.). New Age International Publishers. Delhi.

PRACTICAL (GENERIC ELECTIVE)
B. Sc. First Year (Liberal Science)
Semester-I & II

Practical – I: MATHEMATICS

Teaching Scheme:

Practical – 4 Hours/week, 4 Credit

Examination Scheme:

UA – 80 Marks

CIE – 20 Marks

List of Practicals:

(Minimum 20 Maximum 25)

Students should perform minimum 20 practical during Semester I & II

Assignment No.1: Logical Mathematics – I (Set theory, Operation on sets, Types of binary relations, Equivalence relations,)

Assignment No.2: Partial and total ordering, Lattices, Properties of integers, Congruence and its properties

Assignment No.3: Logical Mathematics – I (Division algorithm, Divisibility and Euclidean algorithm, GCD, LCM, Relatively prime.)

Assignment No.4: Logical Mathematics – I (Principle of counting (inclusion/exclusion, pigeon-hole), Permutation and combinations (with and without repetition))

Assignment No.5: Lattices and its Properties

Assignment No.6: Examples on Fourier Series of function.

Assignment No.7: Examples on functions having point of discontinuity

Assignment No.8: Examples on Fourier series for Even and Odd functions.

Assignment No.9: Examples on Half range series

Assignment No.10: Examples on Fourier series for functions having period $2l$

Assignment No.11: The Real Numbers - I (Sets and functions, Mathematical Induction, Finite and Infinite Sets)

Assignment No.12: The Real Numbers - I (Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Application of Supremum Property.

Assignment No.13: The Real Numbers – II (Intervals, Limit points of a set, closure, interior and Boundary of a set.)

Assignment No.14: The Real Numbers – II (Order Properties of \mathbb{R} and Absolute value and the real line)

Assignment No.15: Bisection method, Secant method.

Assignment No.16: Regula-Falsi method, Newton-Raphson method.

Assignment No.17: Gaussian elimination method, Gauss-Jordan method.

Assignment No.18: Iterative methods: Jacobi method, Gauss-Seidel method;

Assignment No.19: Interpolation: (Lagrange form, Newton form, Finite difference operators, Gregory-Newton forward and backward difference interpolations)

Assignment No.20: Piecewise polynomial interpolation (linear and quadratic), Ordinary differential equation: Euler's method,