

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAACAccredited-2022
'B⁺⁺'Grade(CGPA2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

(According to NEP 2020)

Syllabus: Mathematics

Name of the Course: B.Sc. II (Sem. III & IV)

(Syllabus to be implemented from June 2025)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

Syllabus of B.Sc. Part-II-Mathematics

Preamble:

The B.Sc. II Mathematics program is designed to provide students with a strong foundation in the fundamental concepts and principles of Mathematics. Mathematics, as the language of nature and science, plays a pivotal role in understanding complex systems, solving real-world problems, and advancing technology. In the first year of this program, students will be equipped with analytical and logical thinking skills that are essential for exploring deeper mathematical theories and for applying mathematical methods to a variety of fields. This program also encourages the development of problem-solving techniques, computational skills and the ability to think abstractly.

Aims: The aim of the course is to generate Intelligent and Skillful human beings with adequate theoretical and practical knowledge of the various mathematical systems. To include conceptual understanding in basic Phenomena, statements, theorems and development of appropriate problem solving skills suitable for applications and sufficient logical connectivity has provided.

Program Outcomes:

1. Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.
2. Ability to pursue advanced studies and research in pure and applied mathematical science.
3. Ability to relate scientific knowledge to real-world phenomena and applications.
4. Equipped with the skills and knowledge to pursue careers in industries such as research, teaching, healthcare, environmental science, data science, or technology.
5. Develop critical thinking and analytical reasoning skills to identify, assess and solve complex scientific problems.

Program Specific Outcomes:

1. A student should be able to recall basic facts about Mathematics and should be able to display knowledge of conventions such as notations, terminology.
2. Enabling students to develop a positive attitude towards Mathematics as an interesting and valuable subject of study.
3. Formulate and develop mathematical arguments in a logical manner.
4. Utilize Mathematics to solve theoretical and applied problems by critical understanding, analysis.
5. Develop the ability to conduct independent research in Mathematics or related interdisciplinary fields.
6. Develop a strong foundation in core areas of Mathematics, including calculus, algebra, analysis, geometry and differential equations.
7. Understanding of ethical issues in Mathematics and its applications.

B.Sc. Part-II (Semester-III) Mathematics						
Course Type	Course Code	Course Title	Credits	Teaching hours/week		
				T	P	Total
Major	DSC1-3	Differential Calculus	2	2	--	2
	DSC1-3 (P)	Mathematics Practical (Major)-III	1	--	2	2
	DSC1-4	Laplace Transform	2	2	--	2
	DSC1-4 (P)	Mathematics Practical(Major)-IV	1	--	2	2
Minor	DSC2-3	Fundamentals of Differential Calculus	2	2	--	2
	DSC2-3 (P)	Mathematics Practical(Minor)-I (Practical's related to DSC 2-3)	1	--	2	2
	DSC2-4	Fundamentals of Laplace Transform	2	2	--	2
	DSC2-4 (P)	Mathematics Practical(Minor)-II Practical's related to DSC 2-4	1	--	2	2
OE	OE-3	Boolean Algebra	2	2	--	2
VSC	VSC1	Practical's Related to Major	2	--	4	4
	VSC2	Practical's Related to Minor	2	--	4	4
B.Sc. Part-II (Semester-IV) Mathematics						
Major	DSC1-5	Ordinary Differential Equations	2	2	--	2
	DSC1-5 (P)	Mathematics Practical (Major)-V	1	--	2	2
	DSC1-6	Abstract Algebra-I	2	2	--	2
	DSC1-6 (P)	Mathematics Practical (Major)-VI	1	--	2	2
Minor	DSC2-5	Principles of Ordinary Differential Equations	2	2	--	2
	DSC2-5 (P)	Mathematics Practical(Minor)-III (Practicals related to DSC 2-5)	1	--	2	2
	DSC2-6	Introduction to Abstract Algebra	2	2	--	2
	DSC2-6 (P)	Mathematics Practical(Minor)-IV (Practicals related to DSC 2-6)	1	--	2	2
OE	OE-4	Finite Automata and Theory of Equation	2	2	--	2
VSC	VSC3	Practical Related to Major	2	--	4	4
	VSC4	Practical Related to Minor	2	--	4	4
Field Project	FP1	Field Project	2	--	4	4

Semester–III

Paper Name: Differential Calculus (Major)	Course Code:
Paper Number: DSC1-3	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the term radius of curvature of a curve
2. Obtain the radius of curvature of a curve of the Cartesian, polar, parametric and Pedal Form.
3. Compute the Jacobian of explicit, composite and implicit of functions.
4. Find the extreme values of the function of one, two and three variables.

Unit-I A. Curvature

[8]

Definition of Curvature, Length of arc as a function, Radius of curvature, Cartesian Equation, Parametric Equations, Polar Equations, Pedal Equations.

Unit-I B. Jacobians

[7]

Definition of a Jacobian, Jacobian of a function of function, Jacobian of implicit function, Condition of dependent functions (statement only).

Unit-II. Maxima and Minima

[15]

Definition of Maximum value and minimum value of a function of one, two variables, Necessary condition for extreme values (Statements only), sufficient condition for extreme values (Statements only), Use of second order derivatives, Maxima and Minima of a function of two variables, Lagrange's Method of undetermined multipliers (for two and three independent variables).

Recommended Book:

Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.

Reference Books:-

1. Calculus Vol. I and II by Tom M. Apostol, Wiley Publication
2. Differential Calculus by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad
3. Differential and Integral Calculus by N. Piskunov, , Peace Publishers, Moscow
4. A Text Book of Applied Mathematics, Vol.I by P.N.Wartikar and J.N.Wartikar, , Poona Vidyarthi Griha Prakashan, Poona 30.

Paper Name: Mathematics Practical (Major)-III	Course Code:
Paper Number: DSC1-3 (P)	Credits: 01

Course Outcomes: At the end of the course students will be able to,

1. Solve the examples on Curvature.
2. Compute the examples on Jacobians.
3. Identify the Maxima and Minima of Function of one and two variable.

List of Practicals

Assignment No.1 Curvature-I (Examples based on basic formulas of Curvature)

Assignment No.2 Curvature-II (Cartesian Equation-I)

Assignment No.3 Jacobians-I (Examples based on definition)

Assignment No. 4 Jacobians-II (Examples based on function of function)

Assignment No. 5 Jacobians-III (Examples based on Implicit function)

Assignment No. 6.Maxima and Minima-I (Function of one Variable)

Assignment No. 7 Lagranges method of undetermined multiplier for function of two variables

Recommended Book:

Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.

Reference Books:-

1. Calculus Vol. I and II by Tom M. Apostol, Wiley Publication
2. Differential Calculus by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad
3. Differential and Integral Calculus by N. Piskunov, , Peace Publishers, Moscow
4. A Text Book of Applied Mathematics, Vol.I by P.N.Wartikar and J.N.Wartikar, , Poona Vidyarthi Griha Prakashan, Poona 30.

Paper Name: Laplace Transform (Major)	Course Code:
Paper Number: DSC1-4	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the term of Laplace Transform.
2. Obtain the Laplace Transform of Standard function.
3. Find the Inverse Laplace Transform of function using translation property, use of partial fraction and convolution Theorem.
4. To solve Ordinary Differential equation with constant coefficients using Inverse Laplace Transform

Unit-I: Laplace Transform. [15]

Integral Transform (Definition), Laplace Transform (Definition), Linearity property of Laplace Transform, Piecewise continuous functions, Existence of Laplace Transform, Functions of exponential order, functions of Class A, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Laplace Transform of the derivatives of $F(t)$, Laplace Transform of the n^{th} order derivatives of $F(t)$, Initial value theorem, Final value theorem, Laplace Transform of Integrals, Multiplication by t , Multiplication by t^n , Division by t , Evaluation of Integrals, periodic functions.

Unit-II A: The Inverse Laplace Transform. [8]

Inverse Laplace Transform, Null Function, Linearity Property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Use of Partial function, Inverse Laplace Transform of the derivatives, Inverse Laplace Transform of Integrals, Multiplication by powers of p , Division by powers of p , Convolution (definition), Convolution theorem. Heaviside's expansion formula, Beta function.

Unit-II B : Application of Laplace Transforms. [7]

Application of Laplace Transforms using Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients, Application of Laplace Transforms using partial Differential equations.

Recommended Book:

Integral Transform by Vasistha A. R. Gupta R. K., Krishna Prakashan Media Pvt. Ltd.11. Shivaji Road, Meerut India.

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr.J.R.Goyal and K.P.Gupta ,Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRCPress.
5. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication.

Paper Name: Mathematics Practical (Major)-IV	Course Code:
Paper Number: DSC1-4 (P)	Credits: 01

Course Outcomes: At the end of the course students will be able to,

1. Find basic properties of Laplace Transform
2. Find properties of Inverse Laplace Transform.
3. Work out Application of Laplace Transform

List of Practicals

Assignment No.1 Examples based on Definition, linearity property and change of scale

Property of Laplace Transform

Assignment No. 2 Examples based on First and second Translation Property.

Assignment No. 3 Examples based on Derivative of Laplace Transform.

Assignment No. 4 Examples based on multiplication by powers of t .

Assignment No.5 Examples based on definition of Inverse Laplace Transform linearity property and change of scale property.

Assignment No. 6 Examples based on First and second Translation Property of Inverse Laplace Transform.

Assignment No. 7 Examples based on Application of Laplace Transform (O.D.E. with Constant coefficients)

Recommended Book:

Integral Transform by Vasistha A. R. Gupta R. K., Krishna Prakashan Media Pvt. Ltd.11. Shivaji Road, Meerut India.

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr.J.R.Goyal and K.P.Gupta ,Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRCPress.
5. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication

Paper Name: Fundamentals of Differential Calculus (Minor)	Course Code:
Paper Number: DSC 2-3	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the term radius of curvature of a curve
2. Obtain the radius of curvature of a curve of the Cartesian, polar, parametric and Pedal Form.
3. Compute the Jacobian of explicit, composite and implicit of functions.
4. Find the extreme values of the function of one, two and three variables.

Unit-I A. Curvature

[8]

Definition of Curvature, Length of arc as a function, Radius of curvature, Cartesian Equation, Parametric Equations, Polar Equations, Pedal Equations.

Unit-I B. Jacobians

[7]

Definition of a Jacobian, Jacobian of a function of function, Jacobian of implicit function, Condition of dependent functions (statement only).

Unit-II. Maxima and Minima

[15]

Definition of Maximum value and minimum value of a function of one, two variables, Necessary condition for extreme values (Statements only), sufficient condition for extreme values (Statements only), Use of second order derivatives, Maxima and Minima of a function of two variables, Lagrange's Method of undetermined multipliers (for two and three independent variables).

Recommended Book:

Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.

Reference Books:-

1. Calculus Vol. I and II by Tom M. Apostol, Wiley Publication
2. Differential Calculus by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad
3. Differential and Integral Calculus by N. Piskunov, , Peace Publishers, Moscow
4. A Text Book of Applied Mathematics, Vol.I by P.N.Wartikar and J.N.Wartikar, , Poona Vidyarthi Griha Prakashan, Poona 30.

Paper Name: Mathematics Practical (Minor)-I (Practicals related to DSC 2-3)	Course Code:
Paper Number: DSC 2-3 (P)	Credits: 01

Course Outcomes: At the end of the course students will be able to,

1. Solve the examples on Curvature.
2. Compute the examples on Jacobians.
3. Identify the Maxima and Minima of Function of one and two variable.

List of Practicals

Assignment No.1 Curvature-I (Examples based on basic formulas of Curvature)

Assignment No.2 Curvature-II (Cartesian Equation-I)

Assignment No.3 Jacobians-I (Examples based on definition)

Assignment No. 4 Jacobians-II (Examples based on function of function)

Assignment No. 5 Jacobians-III (Examples based on Implicit function)

Assignment No. 6.Maxima and Minima-I (Function of one Variable)

Assignment No. 7 Lagranges method of undetermined multiplier for function of two variables

Recommended Book:

Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.

Reference Books:-

1. Calculus Vol. I and II by Tom M. Apostol, Wiley Publication
2. Differential Calculus by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad
3. Differential and Integral Calculus by N. Piskunov, , Peace Publishers, Moscow
4. A Text Book of Applied Mathematics, Vol.I by P.N.Wartikar and J.N.Wartikar, , Poona Vidyarthi Griha Prakashan, Poona 30.

Paper Name: Fundamentals of Laplace Transform (Minor)	Course Code:
Paper Number: DSC2-4	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the term of Laplace Transform.
2. Obtain the Laplace Transform of Standard function.
3. Find the Inverse Laplace Transform of function using translation property, use of partial fraction and convolution Theorem.
4. To solve Ordinary Differential equation with constant coefficients using Inverse Laplace Transform

Unit-I: Laplace Transform. [15]

Integral Transform (Definition), Laplace Transform (Definition), Linearity property of Laplace Transform, Piecewise continuous functions, Existence of Laplace Transform, Functions of exponential order, functions of Class A, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Laplace Transform of the derivatives of $F(t)$, Laplace Transform of the n^{th} order derivatives of $F(t)$, Initial value theorem, Final value theorem, Laplace Transform of Integrals, Multiplication by t , Multiplication by t^n , Division by t , Evaluation of Integrals, periodic functions.

Unit-II A: The Inverse Laplace Transform. [8]

Inverse Laplace Transform, Null Function, Linearity Property, Table of Inverse Laplace Transform, First Translation or Shifting Theorem, Second Translation or Shifting Theorem, Change of Scale Property, Use of Partial function, Inverse Laplace Transform of the derivatives, Inverse Laplace Transform of Integrals, Multiplication by powers of p , Division by powers of p , Convolution (definition), Convolution theorem. Heaviside's expansion formula, Beta function.

Unit-II B : Application of Laplace Transforms. [7]

Application of Laplace Transforms using Ordinary Differential equations with constant coefficients, Ordinary Differential equations with variable coefficients, Application of Laplace Transforms using partial Differential equations.

Recommended Book:

Integral Transform by Vasistha A. R. Gupta R. K., Krishna Prakashan Media Pvt. Ltd. 11. Shivaji Road, Meerut India.

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr.J.R.Goyal and K.P.Gupta ,Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRC Press.
5. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication.

Paper Name: Mathematics Practical (Minor)-II (Practicals related to DSC 2-4)	Course Code:
Paper Number: DSC 2-4 (P)	Credits: 01

Course Outcomes: At the end of the course students will be able to,

1. Find basic properties of Laplace Transform
2. Find properties of Inverse Laplace Transform.
3. Work out Application of Laplace Transform

List of Practicals

Assignment No.1 Examples based on Definition, linearity property and change of scale Property of Laplace Transform

Assignment No. 2 Examples based on First and second Translation Property.

Assignment No. 3 Examples based on Derivative of Laplace Transform.

Assignment No. 4 Examples based on multiplication by powers of t .

Assignment No.5 Examples based on definition of Inverse Laplace Transform linearity property and change of scale property.

Assignment No. 6 Examples based on First and second Translation Property of Inverse Laplace Transform.

Assignment No. 7 Examples based on Application of Laplace Transform (O.D.E. with Constant coefficients)

Recommended Book:

Integral Transform by Vasistha A. R. Gupta R. K., Krishna Prakashan Media Pvt. Ltd.11. Shivaji Road, Meerut India.

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr.J.R.Goyal and K.P.Gupta ,Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRCPress.
5. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication

Paper Name: Boolean Algebra	Course Code:
Paper Number: OE-3	Credits: 02

Course Outcomes:

At the end of the course students will be able to

1. Use truth tables and laws of identity, distributive, commutative.
2. Simplify and prove boolean expressions
3. Convert boolean expressions to logic gates and vice-versa.

Unit 1: Boolean algebra

Boolean Algebra, Examples, Properties, Subalgebra (diagrams, l.u.b., g.l.b.), Posets, Atoms, Exercise.

Unit 2: Logic – Circuits

Boolean expressions, logic gates, switching circuits (Parallel and series arrangement of switches), Exercise.

Reference Books:

- 1) Analysis of Boolean Functions, by Ryan O'Donnell
- 2) Boolean Algebra and Its Applications by J Eldon Whitesitt
- 3) Boolean Algebra Essentials by Alan D Solomon

Paper Name: Practical's related to Major	Course Code:
Paper Number: VSC-1	Credits: 02

Course Outcomes: At the end of the course students will be able to,

1. Solve the examples on Curvature.
2. Compute the examples on Jacobians.
3. Identify the Maxima and Minima of Function of one and two variable.
4. Find basic properties of Laplace Transform
5. Find properties and application of Inverse Laplace Transform

List of Practicals

Assignment No.1 Curvature-I (Cartesian Equation)

Assignment No.2 Curvature –II (Parametric Equation-I)

Assignment No.3 Curvature –III (Parametric Equation-II)

Assignment No.4 Curvature –IV (Polar Equation-I)

Assignment No.5 Curvature –V (Polar Equation-II)

Assignment No.6 Curvature –VI (Pedal Equation)

Assignment No.7 Jacobians (Examples based on Condition of dependent functions)

Assignment No.8 Maxima and Minima (Function of two variable)

Assignment No. 9 Lagranges method of undetermined multiplier for function of two variable-I

Assignment No. 10 Lagranges method of undetermined multiplier for function of two variable-II

Assignment No.11 Examples based on Laplace Transform of Integral .

Assignment No. 12 Examples based on periodic function.

Assignment No. 13 Examples based on division by t .

Assignment No. 14 Examples based on Initial and final value theorem.

Assignment No. 15 Examples based on Inverse Laplace Transform of Integral.

Assignment No. 16 Examples based on Inverse Laplace Transform of derivative.

Assignment No. 17 Examples based on Convolution Theorem.

Assignment No. 18 Examples based on Heaviside's expansion formula.

Assignment No. 19 Examples based on Application of Laplace Transform (O.D.E. with variable coefficients)

Assignment No. 20 Examples based on Application of Laplace Transform using partial Differential equations

Recommended Book:

Differential Calculus by Shanti Narayan and P.K.Mittal S.Chand Publication Revised Edition 2005.

Reference Books:-

1. Calculus Vol. I and II by Tom M. Apostol, Wiley Publication
2. Differential Calculus by Gorakh Prasad, Pothishala Pvt. Ltd., Allahabad
3. Differential and Integral Calculus by N. Piskunov, , Peace Publishers, Moscow
4. A Text Book of Applied Mathematics, Vol. I by P.N. Wartikar and J.N. Wartikar, , Poona Vidyarthi Griha Prakashan, Poona 30.

Paper Name: Practical's related to Minor	Course Code:
Paper Number: VSC-2	Credits: 02

Course Outcomes: At the end of the course students will be able to,

1. Solve the examples on Curvature.
2. Compute the examples on Jacobians.
3. Identify the Maxima and Minima of Function of one and two variable.
4. Find basic properties of Laplace Transform
5. Find properties and application of Inverse Laplace Transform

List of Practicals

Assignment No.1 Curvature-I (Cartesian Equation)

Assignment No.2 Curvature –II (Parametric Equation-I)

Assignment No.3 Curvature –II (Parametric Equation-II)

Assignment No.4 Curvature –III (Polar Equation-I)

Assignment No.5 Curvature –IV (Polar Equation-II)

Assignment No.6 Jacobians (Examples based on Condition of dependent functions)

Assignment No.7 Maxima and Minima (Function of two variable)

Assignment No. 8 Lagranges method of undetermined multiplier for function of two variable

Assignment No. 9 Examples based on Laplace Transform of Integral .

Assignment No. 10 Examples based on periodic function.

Assignment No. 11 Examples based on division by t .

Assignment No. 12 Examples based on Initial and final value theorem.

Assignment No. 13 Examples based on Inverse Laplace Transform of Integral and derivative

Assignment No. 14 Examples based on Convolution Theorem.

Assignment No. 15 Examples based on Heaviside's expansion formula.

Assignment No. 16 Examples based on Application of Laplace Transform (O.D.E. with variable coefficients)

Recommended Book:

Integral Transform by Vasistha A. R. Gupta R. K., Krishna Prakashan Media Pvt. Ltd. 11.
Shivaji Road, Meerut India.

Reference Books:

1. The Laplace Transform by Rainville E.D.
2. Integral Transform by Dr.J.R.Goyal and K.P.Gupta ,Pragati Prakashan Meerut.
3. Differential equation by Sharma and Gupta, Krishna Prakashan Media Co. Meerut
4. Integral Transform and their Applications by Lokenath Debnath, CRCPress.
5. An introduction to Laplace Transforms and Fourier series by Phill Dyke, Springer publication

Semester IV

Paper Name: Ordinary Differential Equations	Course Code:
Paper Number: DSC 1-5	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the method of solving first order and higher than first degree differential equation
2. Explain the method of solving second order and Homogeneous differential equation
3. Explain the method of solving Simultaneous and Total differential equation
4. Solve the first order and higher than first degree differential equation
5. Solve the second order and Homogeneous differential equation

Unit -I A: Differential Equations of the first order and of degree higher than the first [8]

Equations solvable for p, Equations solvable for x, Equations solvable for y, Clairaut's equation, Equations reducible to Clairaut's form.

Unit-I B: Linear Equations of the second Order [7]

General form of the second order linear equation, complete solution when one integral belonging to complementary function is known, Rules of getting an integral belonging to complementary function, Removal of the First order Derivative, Transformation of the linear equation of second order by changing the independent variable.

Unit-II A: Homogeneous linear equations [8]

Homogeneous linear equations, working rule for finding the solution, Equations reducible to Homogeneous form.

Unit-II B: Simultaneous Equations and Total Differential Equations [7]

Nature of the solution of simultaneous equations, Rules of solving the Equation. Total Differential Equation, Necessary and sufficient condition for the integrability of total differential equation (proof of Necessity only), Condition for exactness, Criterion for exactness, Method of Solving the Equation.

Recommended Books:

Differential Equation: Ordinary and Partial Differential Equations: by M. D.

Raisinghania, S.Chand Co.Ltd. Ramanagar, New Delhi-110055(19thEdition)

Reference Books:

1. Introductory course in Differential Equation by D.A.Murrey, University Press Pub.
2. Differential Equation by Diwan and Agashe.
3. Differential Equation by Sharma-Gupta, Krishna Prakashan Media(Pvt.)Ltd, Meerut.

Paper Name: Mathematics Practical (Major)-V	Course Code:
Paper Number: DSC 1-5 (P)	Credits: 01

Course Outcome: At the end of the course students will be able to

1. Solve Clairaut's equation.
2. Solve second order linear equation.
3. Solve homogeneous linear equations, Simultaneous and total differential equations.

List of Practicals

Assignment no.1 Examples based on equations solvable for p.

Assignment no. 2 Examples based on Clairaut's equation

Assignment no.3 Examples based on General form of second order linear equation

Assignment no.4 Examples based on Rules of getting an integral belonging to complementary
Function-I

Assignment no.5 Examples based on homogeneous linear equations

Assignment no.6 Examples based on equations reducible to homogeneous form-I

Assignment no. 7 Examples based on Simultaneous differential equations (Rule-I)

Recommended Books:

Differential Equation: Ordinary and Partial Differential Equations: by M. D.

Raisinghania, S.Chand Co.Ltd. Ramanagar, New Delhi-110055(19thEdition)

Reference Books:

1. Introductory course in Differential Equation by D.A.Murrey, University Press Pub.
2. Differential Equation by Diwan and Agashe.
3. Differential Equation by Sharma-Gupta, Krishna Prakashan Media(Pvt.)Ltd, Meerut.

Paper Name: Abstract Algebra-I	Course Code:
Paper Number: DSC 1-6	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Define Group, subgroup and examples of groups
2. Find the order of element and group
3. Describe the equivalence relation and congruent modulo n
4. Define cosets of Group.
5. Identify homomorphism or isomorphism structure.

Unit-I A:

Introduction to Groups

[8]

Definition and Example of Groups, Permutations, Subgroups, Groups and symmetry.

Unit-I B: Equivalence, Congruence, Divisibility

[7]

Equivalence relation and partitions, Congruence and Division Algorithm, Integer Modulo n , Greatest Common Divisors, The Euclidean Algorithm, Factorization, Euler's Phi Function.

Unit-II B: Groups

[8]

Elementary Properties of Groups, Generators, Direct products, Cosets, Lagrange's Theorem, Isomorphism, More on Isomorphism, Cayley's Theorem.

Unit-II B: Group Homomorphism

[7]

Homomorphism of Groups, Kernels, Normal Subgroup, Quotient Groups, the Fundamental theorem of Homomorphism.

Recommended Book:

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Reference Books:

1. A First Course in Abstract Algebra by J.B. Fraleigh, Pearson Education 7th edition
2. University Algebra by N.S. Gopalakrishnan.
3. Abstract Algebra by David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
4. Fundamentals of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen Mc.Graw Hill International Edition.
5. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd.

Paper Name: Mathematics Practical (Major)-VI	Course Code:
Paper Number: DSC 1-6(P)	Credits: 01

Course Outcome: At the end of the course student will be able to,

1. Identify Group structure and equivalence class.
2. Find Permutation cycles.
3. Solve examples of normal subgroup, order of group and homomorphism.

List of Practicals

Assignment no.1 Examples based on definition of Group.

Assignment no.2 Examples based on Subgroups

Assignment no.3 Examples based on Permutations

Assignment no.4 Examples based on Equivalence relation

Assignment no. 5 Examples based on Order of an element of a group

Assignment no.6 Examples based on Generators , cyclic groups –I

Assignment no.7 Examples based on Group isomorphism-I

Assignment no.8 Examples based on Group Homomorphism-I

Assignment no. 9 Examples based on Kernels, Normal Subgroup

Recommended Book:

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Reference Books:

1. A First Course in Abstract Algebra by J.B. Fraleigh, Pearson Education 7th edition
2. University Algebra by N.S. Gopalakrishnan.
3. Abstract Algebra by David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
4. Fundamentals of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen Mc.Graw Hill International Edition.
5. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd

Paper Name: Principles of Ordinary Differential Equations (Minor)	Course Code:
Paper Number: DSC 2-5	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain the method of solving first order and higher than first degree differential equation
2. Explain the method of solving second order and Homogeneous differential equation
3. Explain the method of solving Simultaneous and Total differential equation
4. Solve the first order and higher than first degree differential equation
5. Solve the second order and Homogeneous differential equation

Unit -I A: Differential Equations of the first order and of degree higher than the first [8]

Equations solvable for p, Equations solvable for x, Equations solvable for y, Clairaut's equation, Equations reducible to Clairaut's form.

Unit-I B: Linear Equations of the second Order [7]

General form of the second order linear equation, complete solution when one integral belonging to complementary function is known, Rules of getting an integral belonging to complementary function, Removal of the First order Derivative, Transformation of the linear equation of second order by changing the independent variable.

Unit-II A: Homogeneous linear equations [8]

Homogeneous linear equations, working rule for finding the solution, Equations reducible to Homogeneous form.

Unit-II B: Simultaneous Equations and Total Differential Equations [7]

Nature of the solution of simultaneous equations, Rules of solving the Equation. Total Differential Equation, Necessary and sufficient condition for the integrability of total differential equation (proof of Necessity only), Condition for exactness, Criterion for exactness, Method of Solving the Equation.

Recommended Books:

Differential Equation: Ordinary and Partial Differential Equations: by M. D.

Raisinghania, S.Chand Co.Ltd. Ramanagar, New Delhi-110055(19thEdition)

Reference Books:

1. Introductory course in Differential Equation by D.A.Murrey, University Press Pub.
2. Differential Equation by Diwan and Agashe.
3. Differential Equation by Sharma-Gupta, Krishna Prakashan Media(Pvt.)Ltd, Meerut.

Paper Name: Mathematics Practical (Minor)-III (Practicals related to DSC 2-5)	Course Code:
Paper Number: DSC 2-5 (P)	Credits: 01

Course Outcome: At the end of the course students will be able to

1. Solve Clairaut's equation.
2. Solve second order linear equation.
3. Solve homogeneous linear equations, Simultaneous and total differential equations.

List of Practicals

Assignment no.1 Examples based on equations solvable for p.

Assignment no. 2 Examples based on Clairaut's equation

Assignment no.3 Examples based on General form of second order linear equation

Assignment no.4 Examples based on Rules of getting an integral belonging to complementary
Function-I

Assignment no.5 Examples based on homogeneous linear equations

Assignment no.6 Examples based on equations reducible to homogeneous form-I

Assignment no. 7 Examples based on Simultaneous differential equations (Rule-I)

Recommended Books:

Differential Equation: Ordinary and Partial Differential Equations: by M. D.

Raisinghania, S.Chand Co.Ltd. Ramanagar, New Delhi-110055(19thEdition)

Reference Books:

1. Introductory course in Differential Equation by D.A.Murrey, University Press Pub.
2. Differential Equation by Diwan and Agashe.
3. Differential Equation by Sharma-Gupta, Krishna Prakashan Media(Pvt.)Ltd, Meerut.

Paper Name: Introduction to Abstract Algebra (Minor)	Course Code:
Paper Number: DSC 2-6	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Define Group, subgroup and examples of groups
2. Find the order of element and group
3. Describe the equivalence relation and congruent modulo n
4. Define cosets of Group.
5. Identify homomorphism or isomorphism structure.

Unit-I A:
Introduction to Groups
[8]

Definition and Example of Groups, Permutations, Subgroups, Groups and symmetry.

Unit-I B: Equivalence, Congruence, Divisibility
[7]

Equivalence relation and partitions, Congruence and Division Algorithm, Integer Modulo n , Greatest Common Divisors, The Euclidean Algorithm, Factorization, Euler's Phi Function.

Unit-II B: Groups
[8]

Elementary Properties of Groups, Generators, Direct products, Cosets, Lagrange's Theorem, Isomorphism, More on Isomorphism, Cayley's Theorem.

Unit-II B: Group Homomorphism
[7]

Homomorphism of Groups, Kernels, Normal Subgroup, Quotient Groups, the Fundamental theorem of Homomorphism.

Recommended Book:

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Reference Books:

6. A First Course in Abstract Algebra by J.B. Fraleigh, Pearson Education 7th edition
7. University Algebra by N.S. Gopalkrishnan.
8. Abstract Algebra by David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
9. Fundamentals of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen Mc.Graw Hill International Edition.
10. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd.

Paper Name: Mathematics Practical (Minor)-IV (Practicals related to DSC 2-6)	Course Code:
Paper Number: DSC 2-6(P)	Credits: 01

Course Outcome: At the end of the course student will be able to,

1. Identify Group structure and equivalence class.
2. Find Permutation cycles.
3. Solve examples of normal subgroup, order of group and homomorphism.

List of Practicals

Assignment no.1 Examples based on definition of Group.

Assignment no.2 Examples based on Subgroups

Assignment no.3 Examples based on Permutations

Assignment no.4 Examples based on Equivalence relation

Assignment no. 5 Examples based on Order of an element of a group

Assignment no.6 Examples based on Generators , cyclic groups –I

Assignment no.7 Examples based on Group isomorphism-I

Assignment no.8 Examples based on Group Homomorphism-I

Assignment no. 9 Examples based on Kernels, Normal Subgroup

Recommended Book:

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Reference Books:

1. A First Course in Abstract Algebra by J.B. Fraleigh, Pearson Education 7th edition
2. University Algebra by N.S. Gopalkrishnan.
3. Abstract Algebra by David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
4. Fundamentals of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen Mc.Graw Hill International Edition.
5. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd

Paper Name: Finite Automata and Theory of Equation	Course Code:
Paper Number: OE-4	Credits: 02

Course Outcomes: At the end of the course students will be able to

1. Explain and manipulate the different concepts in automata theory.
2. Understand the concept of abstract machines and their power to recognize the languages.
3. Find the number of roots, relations between roots and coefficients.

Unit 1: Automata

Algebraic and Arithmetic expression, record structure, directed graphs, digraphs and relations, connectedness digraphs and matrices, finite state machine, finite automata, strings: inputs and outputs tapes, accepted strings, automata as a finite state machine, exercise.

Unit 2: Theory of Equation

The Remainder Theorem, complex roots, surd roots, equation with given roots, number of roots, relations between roots and coefficients, test for integral roots, test for rational roots, Descartes rule of sign, transformation of equations, roots with sign changed, multiple of a root by given quantity, reciprocals of the roots, increase or decrease in the roots by given quantity.

Reference Books:

- 1) Analysis of Boolean Functions, by Ryan O'Donnell
- 2) Boolean Algebra and Its Applications by J Eldon Whitesitt
- 3) Boolean Algebra Essentials by Alan D Solomon .

Paper Name: Practicals related to Major	Course Code:
Paper Number: VSC-3	Credits: 02

Course Outcome: At the end of the course students will be able to

1. Solve Clairaut's equation.
2. Solve second order linear equation.
3. Solve homogeneous linear equations, Simultaneous and total differential equations
4. Identify Group structure and equivalence class.
5. Solve examples of Permutation cycles, normal subgroup, order of group and homomorphism

List of Practicals

Assignment no.1 Examples based on equations solvable for x.

Assignment no.2 Examples based on equations solvable for y.

Assignment no. 3 Examples based on equation reducible to Clairaut's form

Assignment no.4 Examples based on complete solution when one integral is known

Assignment no. 5 Examples based on Rules of getting an integral belonging to complementary Function-II

Assignment no.6 Examples based on transformation of the linear equation of second order by change of independent variable

Assignment no.7 Examples based on equations reducible to homogeneous form-I

Assignment no.8 Examples based on Simultaneous differential equations (Rule-II)

Assignment no.9 Solution of total differential equations –I

Assignment no. 10 Solution of total differential equations -II

Assignment no.11 Examples based on Permutations

Assignment no.12 Examples based on Equivalence relation

Assignment no.13 Examples based on Congruence

Assignment no.14 Examples based on Divisibility

Assignment no.15 Examples based on Generators , cyclic groups –II

Assignment no.16 Examples based on Cosets, Lagranges Theorem

Assignment no.17 Examples based on Group isomorphism-II

Assignment no.18 Examples based on Group Homomorphism-II

Assignment no.19 Examples based on Kernels, Normal Subgroup

Assignment no.20 Examples based on Quotient group

Recommended Books:

Differential Equation: Ordinary and Partial Differential Equations: by M.

D. Raisinghania, S.Chand Co.Ltd. Ramanagar, New Delhi-

110055(19thEdition)

Reference Books:

1. Introductory course in Differential Equation by D.A.Murrey, University Press Pub.
2. Differential Equation by Diwan and Agashe.
3. Differential Equation by Sharma-Gupta, Krishna Prakashan Media(Pvt.)Ltd, Meerut.

Paper Name: Practical's related to Minor	Course Code:
Paper Number: VSC-4	Credits: 02

Course Outcome: At the end of the course student will be able to,

1. Solve Clairaut's equation.
2. Solve second order linear equation.
3. Solve homogeneous linear equations, Simultaneous and total differential equations
4. Identify Group structure and equivalence class.
5. Solve examples of Permutation cycles, normal subgroup, order of group and homomorphism

List of Practicals

Assignment no.1 Examples based on equations solvable for x,y.

Assignment no.2 Examples based on equation reducible to Clairaut's form

Assignment no.3 Examples based on complete solution when one integral is known

Assignment no. 4 Examples based on Rules of getting an integral belonging to
complementary Function-II

Assignment no.5 Examples based on transformation of the linear equation of second
order by change of independent variable

Assignment no.6 Examples based on equations reducible to homogeneous form-I

Assignment no.7 Examples based on Simultaneous differential equations (Rule-II)

Assignment no.8 Solution of total differential equations –I,II

Assignment no. 9 Examples based on Permutations

Assignment no.10 Examples based on Equivalence relation

Assignment no.11 Examples based on Congruence and divisibility.

Assignment no.12 Examples based on Generators , cyclic groups –II

Assignment no.13 Examples based on Cosets, Lagranges Theorem

Assignment no.14 Examples based on Group isomorphism , Group Homomorphism.

Assignment no.15 Examples based on Kernels, Normal Subgroup

Assignment no.16 Examples based on Quotient group

Recommended Book:

Modern Algebra-An Introduction, by John R. Durbin, John Wiley & Sons, Inc. Fifth Edition

Reference Books:

1. A First Course in Abstract Algebra by J.B. Fraleigh, Pearson Education 7th edition
2. University Algebra by N.S. Gopalkrishnan.
3. Abstract Algebra by David S. Dummit & Richard M. Foote Wiley & Sons, Inc.
4. Fundamentals of Abstract Algebra by D.S. Malik & N. Mordeson & M.K. Sen Mc.Graw Hill International Edition.
5. A Course in Abstract Algebra by Vijay K. Khanna and S.K. Bhambri, Vikas Publishing House Pvt. Ltd

Paper Name: Field Project	Course Code:
Paper Number: FP1	Credits: 02

Objective:

To introduce students to the practical applications of Mathematical concepts in real-life situations and develop skills in data collection, analysis, interpretation, and report writing.

Instructions:

1. Topic Selection:

Students shall choose a topic related to the application of mathematics in fields such as statistics, economics, biology, environmental science, architecture, or other interdisciplinary areas.

2. Project Proposal:

A brief project proposal (1 page) must be submitted for approval. It should include the title, objective, scope, and methodology.

3. Project Work:

Students are required to collect data through surveys, field visits, experiments, or secondary sources. The data should be analyzed using appropriate mathematical or statistical techniques.

4. Report Writing:

A project report must be submitted in the following format:

- Title Page
- Certificate
- Acknowledgement
- Introduction and Objectives
- Methodology
- Data Presentation and Analysis
- Interpretation of Results
- Conclusion
- References

5. Presentation and Viva Voce:

Each student or group shall present their project findings before an internal evaluation committee, followed by a viva voce.

6. Evaluation Criteria. :

- Project work will be assessed for 50 marks (02 credits), out of which 20 marks are reserved for internal evaluation based on primary preparation for the project like selection of topic, preparation of questionnaire, synopsis presentation and day-to-day project work reporting, mid-term project presentation etc.
- End of Term assessment of the project for 30 marks will be done on the basis of presentation, findings and report of the project, out of which 20 marks are reserved for VIVA.

Equivalence of Papers

Paper Code	Old Paper	Paper Code	Equivalent paper
B.Sc. Part-II (Semester-III) Mathematics			
	Differential Calculus		Differential Calculus
	Laplace Transform		Laplace Transform
B.Sc. Part-II (Semester-IV) Mathematics			
	Differential Equations		Ordinary Differential Equations
	Abstract Algebra-I		Abstract Algebra-I