S.S.J.D.V.S.S.S. Govt. P.G. College, Ranikhet, Almora

ESTD. 1973

UG/PG

POs/PSOs/COs OF SYLLABUS

Name of Programme- B.A./B. Sc. Mathematics

Programme Outcome/Programme Specific Outcome

Programme Outcome:

PO1: It is to give in-depth knowledge of geometry, algebra, calculus, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects.

PO2: The skills and knowledge gained in this program will be helpful for modeling and solving of real life problems.

PO3: Students will become employable in various government and private sector.

PO4: The completing this programme develop enhanced quantitative skills and pursuing higher mathematics and research as well.

PO5: The completion of this programme develop ability to communicate mathematics effectively by written, computational and graphic means.

Programme Specific Outcome:

PSO1: Student should be able to think in a critical manner and develop problem solving skills.

PSO2: Students should be able to recall basic facts about mathematics and display knowledge of conventions such as notations, terminology etc.

PSO3: Students are able to formulate and develop mathematical arguments in a logical manner.

PSO4: Students are motivate and prepare for research studies in mathematics and related fields.

PSO5: Student should be able to apply their skills and knowledge in various fields of studies including, science, engineering, commerce and management etc.

Name of Programme- M.Sc. Mathematics

Programme Outcome/Programme Specific Outcome

Programme Outcomes

- To develop critical thinking to carry out scientific investigation.
- To develop problem solving skills in students. So that they can analyse problems and solve them with the help of logical reasoning techniques.
- Help students in pursuing research or careers in industry in mathematical sciences and allied fields.
- The student shall able to apply the knowledge acquired in mathematics in Science, technology as well as research and its extensions.
- To Create awareness to be an enlightened citizen with commitment to fulfill your responsibilities within the ambit of rights and privileges provided.

Programme Specific Outcomes

- Apply the tools to model the problems mathematically and develop the ability to access and communicate mathematical information.
- Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
- Develop a strong base in theoretical and applied Mathematics.
- Provide advanced knowledge on topics in pure mathematics, empowering the
- students to pursue higher degrees at reputed academic institutions.
- Assist students in preparing (personal guidance, books) and qualifying for national level tests like NET/GATE and other competitive examinations.
- To develop problem solving skills, thinking and creativity.

Year 2021-22

Semester wise Course Outcomes (COs) of Undergraduate Programme (Mathematics)

B.A. / B.Sc. I (SEMESTER-I)

- **PAPER-I**

ELEMENTARY ALGEBRA AND TRIGONOMETRY

Class: B.A. / B.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Title: Elementary Algebra and Trigonometry		
Course outcomes: **CO1:** The course outcome is to give foundation knowledge for the students to understand basics of mathematics including applied aspect for developing enhanced quantitative skills and pursuing higher mathematics and research as well. **CO2:** By the time students complete the course they will have wide ranging application of the subject and have the knowledge of numbers, matrices and basics of equations. **CO3:** The student will be able to sum the trigonometric series of real and complex numbers. **CO4:** The main objective of the course is to equip the student with necessary analytic and technical skills. **CO5:** The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.		

- **PAPER II**

DIFFERENTIAL CALCULUS

Class: B.A. / B.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Title: Differential Calculus		
Course outcomes: **CO1:** The main objective of this course to equip the students with necessary and important concept of differentiation. **CO2:** By the time students complete the course they will have the ability to handle the problems related to limit, continuity and differentiability. **CO3:** The student will be able to do successive differentiation and learn to apply various theorems e.g., Leibnitz Theorem, Taylor's Theorem, Maclaurin's Theorem. **CO4:** By applying the principles of differentiation, he learns to solve a variety of practical problems in science and engineering.		

- **PAPER III**

GEOMETRY AND VECTOR ANALYSIS

Class: B.A. / B.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Title: Geometry and vector analysis		

Course outcomes:
CO1: The course outcome is to give foundation knowledge for the students to understand basics of geometry & vectors with the application of the subject and have the knowledge of surface area and volume of shapes. **CO2:** On successful completion of the course students have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in geometry. **CO3:** The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering. **CO4:** The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.

B.A. / B.Sc. I (SEMESTER-II)

- ## PAPER-I

GROUP THEORY

Class: B.A. / B.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Title: Group Theory		
Course outcomes: **CO1:** Group theory is one of the building blocks of modern algebra. Objective of this course is to introduce students to basic concepts of Group and their properties. **CO2:** This course will lead the student to basic course in advanced mathematics. **CO3**: By the time students complete the course they will have the ability to handle the problems related to sets, functions and set operations. **CO4:** The student will be able to understand various types of groups and learn to apply various theorems e.g., Lagrange theorem and its consequences, theorems related to homomorphism and isomorphism, Cayley's theorem.		

- ## PAPER-II

INTEGRAL CALCULUS

Class: B.A. / B.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Title: Integral Calculus		
Course outcomes: **CO1:** The main objective of this course to equip the students with necessary and important concept of integration. **CO2:** By the time students complete the course they will have wide ranging application of the subject and have the knowledge of surface area and volume of shapes. **CO3:** The main objective of the course is to equip the student with necessary analytic and technical skills. By applying the principles of integral he learns to solve a variety of practical problems in science and engineering. **CO4:** The student will be able to understand definite integral as well as geometrical applications of it.		

- ## PAPER-III

ANALYTICAL GEOMETRY

Class: B.A. / B.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Title: Analytical geometry		

Course outcomes:
CO1: The main objective of this course to provide basic knowledge of shapes e.g., sphere, cone, cylinder, conicoids etc.
CO2: This course will lead the student to basic course in advanced mathematics and geometry.
CO3 The subjects learn and visualize the fundamental ideas about coordinate geometry and learn to describe some of the surface by using analytical geometry.
CO4: On successful completion of the course students have gained knowledge about regular geometrical figures and their properties. They have the foundation for higher course in geometry.

B.A. / B.Sc. II (SEMESTER-III)

- ## PAPER-I

ADVANCED ALGEBRA

Class: B.A. / B.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Title: Advanced Algebra		
Course outcomes: **CO1:** Objective of this course is to introduce students to basic concepts of rings and their properties. **CO2:** This course will lead the student to basic course in advanced mathematics. **CO3**: By the time students complete the course they will have the ability to handle the problems related to rings, field and integral domain.		

- ## PAPER-II

DIFFERENTIAL EQUATIONS

Class: B.A. / B.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Title: Differential Equations		
Course outcomes: **CO1:** The objective of this course is to familiarize the students with various methods of solving differential equations of first and second order and to have qualitative applications. **CO2:** A student doing this course is able to solve differential equations and is able to model problems in nature using ordinary differential equations. **CO3:** After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, nonlinear evolution equation etc.		

- ## PAPER III

MECHANICS

Class: B.A. / B.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Title: Mechanics		
Course outcomes: **CO1:** The course is aimed at exposing the students to foundations of analysis which will be useful in understanding various physical phenomena and gives the student the foundation in mathematics. **CO2:** Upon successful completion, students will be able to understand the various types of motions in resisting medium, constrained motion and Central orbits.		

CO3: The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces.
CO4: The student, after completing the course can go for higher problems in mechanic such as hydrodynamics, this will be helpful in getting employment in industry.

B.A. / B.Sc. II (SEMESTER-IV)

- **PAPER-I**

VECTOR SPACES AND MATRICES

Class: B.A. / B.Sc.	Year: Second	Semester: Fourth
Subject: Mathematics		
Course Title: Vector Spaces And Matrices		
Course outcomes: **CO1:** By the time students complete the course they will have wide ranging application of the subject and have the knowledge of vector spaces and matrices. **CO3:** The student will be able to understand bases and dimensions and various types of operations in matrices. **CO4:** By using the concept of basis, the students learn to solve a variety of practical problems in science and engineering. **CO5:** The student is equipped with standard concepts and tools at an intermediate to advance level that will serve him well towards taking more advance level course in mathematics.		

- **PAPER-II**

REAL ANALYSIS

Class: B.A. / B.Sc.	Year: Second	Semester: Fourth
Subject: Mathematics		
Course Title: : Real Analysis		
Course outcomes: **CO1:** Students will be able to know the basic concepts and developments of real analysis which will prepare the students to take up further applications in the relevant fields. **CO2:** On successful completion of the course students should have knowledge about continuity & differentiability of functions and integration. **CO3:** The main objective of the course is to equip the student with necessary analytic and technical skills.		

- **PAPER III**

MATHEMATICAL METHODS

Class: B.A. / B.Sc.	Year: Second	Semester: Fourth
Subject: Mathematics		
Course Title: Mathematical Methods		
Course outcomes: **CO1:** The student will be able to find the integral transform, Laplace transform, inverse Laplace transform and Fourier transform. **CO2:** The course in mathematical methods basically develops a problem-solving skill in the students. **CO3:** Upon successful completion, students will have the knowledge of various types of transforms, their terminology and applications.		

B.A. / B.Sc. III (SEMESTER-V)

- **PAPER-I**

LINEAR ALGEBRA

Class: B.A. / B.Sc.	Year: Third	Semester: Fifth
Subject: Mathematics		
Course Title: Linear Algebra		
Course outcomes: **CO1:** Liner algebra is a basic course in almost all branches of science. The objective of this course is to introduce a student to the basics of linear algebra and some of its applications. **CO2:** After Successful completion of this course, students should be able to understand the concept of linear transformation. **CO3:** On successful completion of the course students should have knowledge about eigen vectors and eigen values.		

- **PAPER-II**

COMPLEX ANALYSIS

Class: B.A. / B.Sc.	Year: Third	Semester: Fifth
Subject: Mathematics		
Course Title: Complex Analysis		
Course outcomes: **CO1:** The course is aimed at exposing the students to foundations of analysis which will be useful in understanding various physical phenomena and gives the student the foundation in mathematics. **CO2:** The object of the paper is to give students knowledge of fundamentals of complex numbers. **CO3:** Upon successful completion, students will be able to understand the complex variables, analytic functions, complex integration and residues.		

- **PAPER III**

FUNCTIONS OF SEVERAL VARIABLES AND PARTIAL

DIFFERENTIAL EQUATIONS

Class: B.A. / B.Sc.	Year: Third	Semester: Fifth
Subject: Mathematics		
Course Title: Functions Of Several Variables And Partial Differential Equations		
Course outcomes: **CO1:** Students will be able to know the basic concepts and developments of functions of several variables which will prepare the students to take up further applications in the relevant fields. **CO2:** On successful completion of the course, it will help students in going for higher studies and research. **CO3:** The main objective of the course is to equip the student with necessary analytic and technical skills. **CO4:** The course in partial differential equation intends to develop problem solving skills for solving various types of partial differential equation especially hyperbolic, parabolic and elliptic types of PDE.		

B.A. / B.Sc. III (SEMESTER-VI)

- **PAPER-I**

NUMERICAL METHODS

Class: B.A. / B.Sc.	Year: Second	Semester: Sixth
Subject: Mathematics		
Course Title: Numerical Methods		
Course outcomes: **CO1:** After Successful completion of this course the student will be able to perform error analysis for arithmetic operations. **CO2:** Upon successful completion, students will be able to understand the use of interpolation and curve fitting and finite differences. **CO3:** After Successful completion of this course students will be able to use numerical differentiation and integration.		

- ## PAPER-II

MATHEMATICAL STATISTICS

Class: B.A. / B.Sc.	Year: Third	Semester: Sixth
Subject: Mathematics		
Course Title: Mathematical Statistics		
Course outcomes: **CO1:** The course is aimed at exposing the students to fundamentals of statistics which will be useful in various branches of science and technology. **CO2:** The object of the paper is to give students knowledge of data and its processing. **CO3:** Upon successful completion, students will be able to understand the correlation, regression and probability.		

- ## PAPER III

OPERATIONS RESEARCH

Class: B.A. / B.Sc.	Year: Third	Semester: Sixth
Subject: Mathematics		
Course Title: Operations Research		
Course outcomes: **CO1:** After Successful completion of this course the student will be able to solve various linear programming problems. **CO2:** Upon successful completion, students will be able to understand the Transportation and assignment Models. **CO3:** After Successful completion of this course students will be able to use some solution methods for solving the linear programming problems.		

Year 2021-22

Semester wise Course Outcomes (COs) of Postgraduate Programme (Mathematics)

M.Sc. I (SEMESTER-I)

- **PAPER-I**

REAL ANALYSIS

Class: M.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Code: 5311	Course Title: Real Analysis	

Course Outcomes:
CO1: Students will be able to know the basic concepts and developments of real analysis which will prepare the students to take up further research in this field.
CO2: On successful completion of the course students should have knowledge about metric space, sequences and functions of several variables.
CO3: The main objective of the course is to equip the student with necessary analytic and technical skills.

- **PAPER-II**

TOPOLOGY

Class: M.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Code: 5312	Course Title: Topology	

Course outcomes:
CO1: The course is aimed at exposing the students to fundamentals of topology which will be useful in various branches of science and technology.
CO2: The object of the paper is to give students knowledge of topologies of real number system.
CO3: Upon successful completion, students will be able to understand the local base, compact space and continuous function.

- **PAPER-III**

DIFFERENTIAL GEOMETRY AND TENSOR CALCULUS

Class: M.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Code: 5313	Course Title: Differential Geometry And Tensor Calculus	

Course outcomes:
CO1: The course is aimed at exposing the students to foundations of differential geometry and vector calculus.
CO2: The object of the paper is to give students knowledge of curves and surfaces in space.
CO3: Upon successful completion, students will be able to understand the order of contact, curvature, Christoffel symbols, n-dimensional real vector space etc.

- **PAPER-IV (Elective)**

FLUID DYNAMICS

Class: M.Sc.	Year: First	Semester: First
Subject: Mathematics		
Course Code: 5353	Course Title: Fluid Dynamics	
Course outcomes: **CO1:** Objective of this course is to introduce students to basic concepts of fluid dynamics. **CO2:** This course will lead the student to the advance research in hydrology. **CO3**: By the time students complete the course they will have the ability to handle the problems related to rotational and irrotational motion, vortex motion, motion in two dimensions etc.		

M.Sc. I (SEMESTER-II)

- **PAPER-I**
COMPLEX ANALYSIS

Class: M.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Code: 5321	Course Title: Complex Analysis	
Course Outcomes: **CO1:** The course is aimed at exposing the students to foundations of analysis which will be useful in understanding various physical phenomena and gives the student the foundation in mathematics. **CO2:** The object of the paper is to give students fundamental and advanced knowledge of complex numbers. **CO3:** Upon successful completion, students will be able to understand the entire, harmonic and analytic function.		

- **PAPER-II**

ABSTRACT ALGEBRA

Class: M.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Code: 5322	Course Title: Abstract Algebra	
Course outcomes: **CO1:** Groups and rings are the building blocks of modern algebra. Objective of this course is to provide advance knowledge of some important concepts of algebra. **CO2**: By the time students complete the course they will have the ability to handle the problems related to Sylow's theorem, rings and fields. **CO3:** The student will be able to understand various types of groups & rings and learn to apply various theorems e.g., Sylow's theorem, U.F.D.		

- **PAPER-III**

DIFFERENTIAL EQUATIONS

Class: M.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Code: 5323	Course Title: Differential Equations	

Course outcomes:
CO1: The course is aimed at exposing the students to foundations of differential equations. **CO2:** The object of the paper is to give students knowledge of various types of differential equations and methods to solve them. **CO3:** Upon successful completion, students will be able to understand the ordinary differential equations, partial differential equations, Charpit's method, Jacobi's method, method of separation of variables.

- ## PAPER-IV (Elective)

OPERATIONS RESEARCH

Class: M.Sc.	Year: First	Semester: Second
Subject: Mathematics		
Course Code: 5374	Course Title: Operations Research	
Course outcomes: **CO1:** After Successful completion of this course the student will be able to solve various advanced linear programming problems and nonlinear programming problems. **CO2:** Upon successful completion, students will be able to understand the integer programming, network analysis and game theory. **CO3:** After Successful completion of this course students will be able to use some solution methods for solving general nonlinear programming.		

M.Sc. II (SEMESTER-III)

- ## PAPER-I

LINEAR ALGEBRA

Class: M.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Code: 5331	Course Title: Linear Algebra	
Course outcomes: **CO1:** Liner algebra is a basic course in almost all branches of science. The objective of this course is to provide advance knowledge of linear algebra and some of its applications. **CO2:** After Successful completion of this course, students should be able to understand the concept of linear transformation. **CO3:** On successful completion of the course students should have knowledge about normal operators, spectral theory for normal operator, eigen vectors and eigen values of a linear operator		

- ## PAPER-II

MEASURE THEORY AND INTEGRATION

Class: M.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Code: 5332	Course Title: Measure Theory and Integration	
Course outcomes: **CO1:** The course is aimed at exposing the students to foundations of measure theory and integration. **CO2:** The object of the paper is to give students knowledge of various types of sets and measures. **CO3:** Upon successful completion, students will be able to understand the Lebesgue measure, the Lebesgue integral, general measure and integration theory.		

- **PAPER-III**

NUMERICAL SOLUTIONS OF ODE AND PDE

Class: M.Sc.	Year: Second	Semester: Third
Subject: Mathematics		
Course Code: 5333	Course Title: Numerical Solutions of ODE And PDE	
Course outcomes: **CO1:** Students will be able to know the basic concepts numerical solutions of ordinary and Partial differential equations. **CO2:** Successful completion of the course will help students in going for higher studies and research. **CO3**: The course in partial differential equation intends to develop problem solving skills for solving various types of partial differential equation especially hyperbolic, parabolic and elliptic types of PDE.		

- **PAPER-IV (Elective)**

THEORY OF NUMBERS

Class: M.Sc.	Year: Second	Semester: First
Subject: Mathematics		
Course Code: 5352	Course Title: Theory of Numbers	
Course outcomes: **CO1:** After Successful completion of this course the student will be able to understand various properties of numbers. **CO2:** The object of the paper is to give students knowledge of primitive roots, residues, Fermet's theorem, Wilson's theorem. **CO3:** Upon successful completion, students will be able to understand the Prime numbers and their properties.		

M.Sc. II (SEMESTER-IV)

- **PAPER-I**

DYNAMICS OF RIGID BODIES

Class: M.Sc.	Year: Second	Semester: Fourth
Subject: Mathematics		
Course Code: 5341	Course Title: Dynamics of Rigid Bodies	
Course Outcomes: **CO1:** Objective of this course is to introduce students to basic concepts of dynamics of rigid bodies. **CO2:** This course will lead the student to the advance research in this field. **CO3**: By the time students complete the course they will have the ability to handle the problems related to D'Alembert's principle, Lagrange's equation, Hamilton's principle etc.		

- **PAPER-II**

FUNCTIONAL ANALYSIS

Class: M.Sc.	Year: Second	Semester: Fourth
	Subject: Mathematics	
Course Code: 5342	Course Title: Functional Analysis	

Course outcomes:

CO1: Objective of this course is to provide advance knowledge of various types of spaces.
CO2: By the time students complete the course they will have the ability to handle the problems related to Normed and Banach Spaces, Inner product space; Hilbert space.
CO3: The student will be able to understand various inequalities (Auxiliary, Cauchy Schwarz, Holder and Minkowski) and Banach Contraction Principle (BCP) with applications.

- **PAPER-III**

CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

Class: M.Sc.	Year: Second	Semester: Fourth
	Subject: Mathematics	
Course Code: 5343	Course Title: Calculus Of Variations And Integral Equations	

Course outcomes:

CO1: The course is aimed at exposing the students to foundations of calculus of variations and integral equations.

CO2: The object of the paper is to give students knowledge of various types of equations and their solutions.

CO3: Upon successful completion, students will be able to understand the Euler equations, Fredholm equations of second kind with separable kernels, method of successive approximation for Fredholm and Volterra equations.

- **PAPER-IV (Elective)**

RIEMANNIAN GEOMETRY

Class: M.Sc.	Year: Second	Semester: Fourth
	Subject: Mathematics	
Course Code: 5372	Course Title: Riemannian Geometry	

Course outcomes:

CO1: Objective of this course is to provide advance knowledge of geometry.
CO2: By the time students complete the course they will have the ability to handle the problems related to Dual vector Spaces, Riemannian geometry, Ricci's Coefficients of Rotation, differentiable manifold.
CO3: The student will be able to understand various Sub-manifolds and Hypersurfaces .