

Maths

Department Of Mathematics
P.N.G. Govt.P.G.College Ramnagar, Nainital

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COURSE EDUCATIONAL OBJECTIVE

Technical Proficiency:

Provide a degree course, suitable for students of high ability, combining and relating mathematics, statistics, and the social sciences.

Professional Growth:

Prepare students for further study, or for professional and managerial careers, particularly in areas requiring the application of quantitative skills.

Management Skills:

Provide students with knowledge of mathematics, Management and the interaction between the two.

COURSE SPECIFIC OUTCOME

COs describe what students are expected to know or be able to do by the time of graduation from the course. The Course Specific Outcomes of UG in Mathematics are:

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

- Think in a critical manner.
- Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- Formulate and develop mathematical arguments in a logical manner.
- Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- Understand, formulate and use quantitative models arising in social science, business and other contexts.

UG Course Outcomes Mathematics

Semester- I

Course Title: **Elementary Algebra, Matrix and Trigonometry**

Paper- I

Status: Compulsory Course

Course Instructor: 1. Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Distinguish among different numbers and Identify the relation and mapping between different sets.
- Find the roots of the Equation.
- Know the concept of matrix and define different type of matrices.
- Understand different Trigonometrical functions and Trigonometric series and their applications.

Semester- I

Course Title: **Differential Calculus**

Paper- II

Status: Compulsory Course

Course Instructor: 1. Dr. Dharendra Singh Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Define limit, continuity and differentiability of a function and applications of mean value theorem.
- Find the successive differentiation and n^{th} differential coefficient of function.
- Expand functions, identify indeterminate forms and solve it.
- Define tangent and normal and their application both in Cartesian and polar form
- Trace the curve and find singular points.
- Understand curvature and asymptotes and find them for a given curve.

Semester- II

Course Title: **Group Theory**

Paper- I

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor
Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Find the cardinality and congruency of the set.
- Define Group and Subgroup and create it.
- Understand the concept of homomorphism, isomorphism and automorphism.
- Understand the concept of Normaliser and center of group.

Semester- II

Course Title: **Integral Calculus**

Paper- II

Course Instructors: 1. Dr Pramod Joshi, Assistant Professor
Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

2. Dr Dharendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of integral as a limit of sum and properties of definite integrals.
- Know the infinite integrals and differentiation and integration under the integral sign.
- Know about the Beta function. Gamma function, their properties, their relation and evaluation of them.
- Evaluate double integrals and repeated integrals.
- Understand the concept of change of order of integration and Drichlet's Theorem.
- Know quadrature, rectification, volumes and surfaces of solids of revolution.

Semester- II

Course Title: **Analytic Geometry**

Paper- III

Course Instructor: Dr Dharendra Singh, Assistant Professor
Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Know about the system of coordinates, curvilinear coordinates;
- Know about definition and equation of sphere, power of a point, tangent plane and radical plane;
- Know about definition and equation of a cone, generators, tangent plane and reciprocal cone;

Semester- III

Course Title: **Advanced Algebra**

Paper- I

Status: Compulsory Course

Course Instructors: 1. Dr Pramod Joshi, Assistant Professor
Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

2. Dr Dharendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Define Ring, Sub ring and their properties.
- Understand the concept of ideal and define different type of ideals.
- Define Integral domain, field and their properties.
- Explain the concept of polynomial rings and their properties.

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.

Semester- III

Course Title: **Differential Equations**

Paper- II

Course Instructor: Dr Pramod Joshi, Assistant Professor
Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of order and degree, complete primitive and existence and uniqueness of the solution.
- To solve the differential equations of first order and first degree and the differential equations of first order but not of first degree.
- To understand the concept of trajectory, orthogonal trajectory, and self orthogonal family of curves.
- Find the solution of linear differential equations with constant coefficients and homogeneous differential equations.
- Solve simultaneous, exact, total differential equations and linear differential equations of second order with variable coefficients.
- Solve a differential equation by series solution method and also learn about the simple application of differential equations.

Semester- III

Course Title: **Mechanics**

Paper- III

Course Instructor: Dr Dhirendra Singh, Assistant Professor
Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Know about the rectilinear motion, simple harmonic motion;
- Understand the concept of kinematics in two dimension, radial and transverse components of velocity;
- Understand the concept of motion in resisting medium, constrained motion, cycloidal motion;
- Know about the central orbits, pedal equation, apse and apsidal distance;
- Understand the concept of coplaner forces and equilibrium of forces in 3-D;
- Know about common catenary and virtual work.

Semester- IV

Course Title: **Vector Spaces and Matrices**

Paper- I

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor
Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Define Vector space, Sub space and their properties.
- Understand the concept of liner dependence and independence, bases and dimensions.
- Explain rank of a matrix and elementary transformation of a matrix.
- Application of matrices to find the solutions of system of linear homogenous equations and system of linear non- homogenous equations.

Semester- IV

Course Title: **Real Analysis**

Paper- II

Course Instructor: Dr Dhirendra Singh, Assistant Professor
Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of continuity and differentiability of functions;
- Know about Riemann integral and mean value theorem of integral calculus;
- Identify the improper integral and test their convergence;
- Understand the concept of sequence and series, Cauchy's convergence criterion;
- Know about uniform convergence, point wise convergence, test of uniform convergence.
- Know about definition and equation of a cylinder, right circular cylinder and enveloping cylinder;
- Understand the concept of conicoids, central conicoids and conjugate plane.

Semester- IV

Course Title: **Mathematical Methods**

Paper- III

Course Instructors: 1. Dr Pramod Joshi, Assistant Professor

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

2. Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Define Kernel, Integral Transform and Laplace Transform;
- Develop Existence theorem, linearity property, Laplace transforms of elementary functions, derivatives, integrals and Periodic functions, Initial and Final- Value theorem;
- Find inverse Laplace Transforms using partial fractions and convolution;
- Solve differential and integro-differential equations using Laplace transforms;
- Evaluate Fourier Complex Transforms, Fourier sine and cosine transforms and Inverse Fourier transform;

Semester- V

Course Title: **Linear Algebra**

Paper- I

Status: Compulsory Course

Course Instructors: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Explain the concept of linear transformation, rank, nullity and linear operators.
- Understand algebra of linear transformation.
- Find eigen value and eigen vector of different matrices and its application.
- Explain the concept of linear functionals, dual space and dual basis.
- Explain the fundamental concepts of different bilinear forms.

Semester- V

Course Title: **Complex Analysis**

Paper- II

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of complex variable, limit, continuity and differentiability;
- Know about analytic functions, Cauchy's Riemann; equations, harmonic functions;
- Know about complex integration, Cauchy's theorem, poles and singularities;
- Know about residues, the residues theorem, evaluation of improper real integral;
- Know about Liouville's theorem, Taylor's series and Laurent's series.

Semester- V

Course Title: **Functions of several variables and partial differential equations**

Paper- III

Course Instructors: 1. Dr Pramod Joshi, Assistant Professor

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Email: pramod.joshi1975@gmail.com

2. Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of limit, continuity and differentiability of functions of several variables.
- Geometrically interpret the partial derivatives and to find derivatives of composite and implicit functions.
- Know Euler's theorem on homogeneous functions, jacobians, harmonic functions and Taylor's expansion of several variables.
- Understand the concept of maxima and minima and can use Lagrange's method of multipliers easily.
- Formulate and solve first order PDE by Charpit's method.
- To classify second order PDE's in two independent variables.
- To find general solution of higher order PDE's with constant coefficients;

Semester- VI

Course Title: **Numerical Methods**

Paper- I

Course Instructors: 1. Dr Pramod Joshi, Assistant Professor

Mobile: 9412954452

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2. Dr Dhirendra Singh, Assistant Professor

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After Successful completion of this course, students will be able to:

- Find Absolute, Relative, Percentage and general errors involved in calculations;
- Solve Algebraic and transcendental equations by Bisection method, False position method, Newton-Raphson method, Picard's iteration method;
- Check the consistency and inconsistency of system of linear equation;
- Find the solution of linear system of equations by direct and iterative methods;
- Find finite differences, differences of a polynomial and errors in polynomial interpolation;
- Apply Newton's forward and Backward interpolation formula, Gauss, Stirling, Bessel's, Everett's and Lagrange's interpolation formula;
- Numerically differentiate and numerically integrate a function by using a set of tabulated values of function;

Semester- VI

Course Title: **Mathematical Statistics**

Paper- II

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Know about descriptive statistics and exploratory data analysis, measures of central tendency;
- Understand the concept of correlation and regression, scatter diagram and rank correlation coefficient;
- Know about probability, random experiment, sample space, axiom of probability;
- Define the equally likely, mutually exclusive, independent and compound events;
- Know about conditional probability, mathematical expectation, Baye's theorem.

Semester- VI

Course Title: **Operations Research**

Paper- III

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Explain the basics of Operations Research.
- Solve linear programming problem by different method like Graphical, Simplex and duality.
- Formulation of transportation problem.
- Finding initial basic feasible solution, test of optimality, degeneracy by MODI method and stepping stone method.
- Find the solution of Assignment problems by Hungarian method.

PG Course Outcomes **Mathematics**

PROGRAM EDUCATIONAL OBJECTIVE

Technical Proficiency:

Provide a pg degree course, suitable for students of high ability, combining and relating mathematics, statistics, and the social sciences.

Professional Growth:

Prepare students for further study & research, or for professional and managerial careers, particularly in areas requiring the application of quantitative skills.

Management Skills:

Provide students with knowledge of mathematics, Management and the interaction between the two.

PROGRAMME OUTCOME

POs describe what students are expected to know or be able to do by the time of post-graduation from the programme. The Program Outcomes of PG in Mathematics are:

At the end of the programme, the students will be able to:

- Think in a critical manner.
- Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
- Formulate and develop mathematical arguments in a logical manner.
- Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
- Understand, formulate and use quantitative models arising in social science, business and other contexts.

Semester I

Course Title: **Real Analysis**

Paper I

Coursecode: MAT 401 C

Status: compulsory

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After successful completion of this course the students will be able to:

(Knowledge Based)

- Understand the concept of distance function and Metric spaces.
- Use the definitions of convergence as they apply to sequences, series and functions.
- Define a function of several variables and related notions such as simultaneous limit and iterated limits etc.
- Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability and integrability.
- (Skills)
- Explain the difference between open and closed sets.
- Know the relation between continuity and differentiability.
- To teach the topics learned to newcomers.
- To find sufficient marks in the paper containing topics of real analysis in any competitive examination.

Semester- I

Course Title: **Topology**

Paper- II

Course Code: MAT403C
Status: Compulsory Course
Course Instructor: Dr Pramod Joshi, Assistant Professor
Dept. of Mathematics,
Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

(Knowledge based)

- Distinguish among open and closed sets on different topological spaces;
- Know the two fundamental topologies: discrete and indiscrete topologies.
- Identify precisely when a collection of subsets of a given set equipped with a topology forms a topological space;
- Understand when two topological spaces are homeomorphic.
- Identify the concepts of distance between two sets; connectedness, denseness, compactness and Separation axioms.

(Skills)

- Use the concepts of open sets to prove continuity different from the ϵ - δ approach;
- Ability to establish the denseness of a given subset of a space;
- Ability to determine that a given point in a topological space is either a limit point or not for a given subset of a Topological space;
- Using the right language when talking about topological concepts
- Topology uses to analyze complex networks Ex: Social networks, Biological networks, Internet etc.

Semester- I

Course Title: **Differential Geometry and Tensor Calculus**

Paper III

Course code: MAT 405 C

Status: Compulsory

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After successful completion of this course, the students will be able to:

(Knowledge Based)

- Define and explain the curves in space and find the equations of tangent, normal, principal normal, binormal, and osculating, normal, rectifying planes.
- Define the different notions concerning the differential Geometry.
- Define n-dimensional real vector space and use the fundamental algebraic operations for tensors.
- (Skills)
- Understand and explain the difference between involutes and evolutes for curves.
- Find curvature and torsion of a curve at a point.
- Teach the topics learned to aspirants of this course.

Semester- I & III

Course Title: **Fluid Mechanics**

Paper- IV

Course Code: MAT 05 E

Status: Elective Course

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Know about the fluids and their properties;
- Understand the concept of continuity;
- Construct the mathematical model for fluid systems;
- Derive the equation of motion for fluid systems ;
- Understand the concept of stream line, velocity potential and stream function;
- Identify the source, sink, doublet, images and vortex in fluid systems;

- Understand the concept of waves, theory of stress and strain.

Semester- I & III

Course Title: **Special Functions**

Paper- V

Course Code: MAT 11 E

Status: Elective Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Know about the Beta and Gamma functions and their properties;
- Understand the concept of Special functions;
- Find the special functions by solving the particular differential equations;
- Know about the Recurrence Formulae, Orthogonality, Generating functions of different special functions ;
- Do long calculation and manipulation on functions;
- Identify Bessel's, Legendre's, Hermite's and Hypergeometric's functions.

Semester- II

Course Title: **Complex Analysis**

Paper- I

Course Code: MAT 402 C

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Know about the conformal mapping and their application;
- Understand the concept of linear transformation and bilinear transformation and their application;
- Understand the concept of analytic function, and their representation as power series;
- Know about the Maximum modulus principal and Schwarz lemma;
- Understand the concept of stream line, velocity potential and stream function;
- Identify the Harmonic, Entire and Meromorphic functions;
- Know about Poisson and Jensen's formula.

Semester II

Course Title: **Abstract Algebra**

Paper: II

Course code: MAT 404

Status: compulsory

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After successful completion of the course the students will be able to:

- Define and explain differently notions such as normal and subnormal series, composition series etc. by citing examples.
- Define commutators, Rings, ideals, fields and field extensions.
- (Skills)
- Verify and analyse facts and theorems by taking examples.
- Teach and explain the topics of this course to newcomers of the subject in degree and postgraduate level.

Semester- II

Course Title: **Differential Equations**

Paper- III

Course Code: MAT 406 C

Status: Compulsory Course

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Distinguish ordinary, partial, linear, nonlinear, homogeneous and non homogeneous differential equations;
- Solve ordinary differential equations;
- Formulate, classify and find complete, general and singular integrals of P.D.E.'s of first order;
- The concept of Integral surfaces, Orthogonal surfaces and characteristic curves;
- To solve partial differential equations by Charpit's and Jacobi's method;
- To classify second order PDE's and to reduce PDE's into canonical forms;
- To find general solution of higher order PDE's with constant coefficients;

Semester II & IV

Title of the course: **Advanced Abstract Algebra**

Course code: MAT06E

Paper: V

Status: Elective

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After successful completion of the course the students will be able to:

(Knowledge Based)

- Define notions such as modules over a ring, factorisation of polynomials in extension fields etc.
- To give proof of various theorems such as fundamental theorem of Galois theory, Dedekind's theorem etc.
- (Skills)
- Verify the theorems by taking examples and other results/ facts of the course.
- Take up some topics for research and extend the theory.

Semester- II & IV

Course Title: **Riemannian Geometry**

Paper- IV & V

Course Code: MAT04E

Status: Elective Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Distinguish between Contravariant vector and covariant vectors within a tensor of any order;
- Know the concept of Riemannian geometry like Riemannian metric, Cristoffel symbols, Differential operators, geodesics Fernet's formula etc.
- Know the concept of Tensor calculus and Carten's structural equations.
- Understand Ricci,s Coefficients of Rotation.
- Identify the concepts of Sub-manifolds and Hyperspaces.

Semester- III

Course Title: **Linear Algebra**

Paper- I

Course Code: MAT 501C

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of vector space and inner product space;
- Know about orthogonality and Cauchy-Schwarz inequality;
- Identify the adjoint, self adjoint, unitary and normal operators;
- Know about spectral theory for normal operator and polar decomposition of linear operator;
- Understand the concept of eigen vectors and eigen values of a linear operator;

- Know about minimal polynomial and Caley-Hamilton theorem.

Semester III

Title of the course: **Measure Theory and Integration**

Paper: II

Course code: MAT 503C

Status: Compulsory

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After the successful completion of this course the students will be able to:
(Knowledge Based)

- Define countable and uncountable sets, Cardinality, Boolean rings, set function.
- Know Lebesgue measure of sets, The Lebesgue integral of a bounded function and non negative functions.
- Define the functions of bounded variation, Differentiation of an integral.
- Explain the general Measure and Integration theory.
- (Skills)
- Explain how an infinite set can be countable and uncountable.
- Understand the complicated notions of the course.

Semester- III

Course Title: **Numerical Analysis**

Paper- III

Course Code: MAT 505C

Status: Compulsory Course

Course Instructors Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Find Absolute, Relative, Percentage and general errors involved in calculations;
- Solve Algebraic and transcendental equation by different methods;
- Check the consistency and inconsistency of system of linear equation;
- Find the solution of linear system of equations by direct and iterative methods;
- Apply different interpolation formula with evenly and unevenly spaced points;
- Numerically differentiate and numerically integrate a function by using a set of tabulated values of function;
- Numerically solve the ordinary and partial differential equations by different methods.

Semester- I & III

Course Title: **Theory of Numbers**

Paper- IV & V

Course Code: MAT03E

Status: Elective Course

Course Instructors: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Prove results involving divisibility and greatest common divisors;
- Solve systems of linear congruences;
- Find integral solutions to specified linear Diophantine Equations;
- Find the values of different arithmetic functions.
- Apply Euler-Fermat's Theorem to prove relations involving prime numbers;
- Apply the Wilson's theorem.

Semester- I & III

Title of the course: **Mathematical Statistics**

Course code: MAT 01 E

Status: Elective

Course Instructor Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After successful completion of this course the students will be able to:

(Knowledge Based)

- Know and explain the topics such as Measures of central tendency, Elements of probability, random variates etc. Of the descriptive Statistics.
- Define mathematical expectation, moments and cumulants of a frequency distribution.
- Know the interesting theory of correlation, regression.
- Understand the concept of sampling.
- (Skills)
- Use the principles of statistical reasoning in understanding, analyzing and developing formal arguments.
- Choose appropriate statistical methods and apply them in various data analysis problems.

Semester- IV

Course Title: **Dynamics of Rigid Bodies**

Paper- I

Course Code: MAT 502 C

Status: Compulsory Course

Course Instructors: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After Successful completion of this course, students will be able to:

- Explain D' Alembert's principle;
- Understand the concept of rigid body, its motion and forces acting on it;
- Know the motion of the body about the axis of rotation;
- Understand the concept of compound pendulum, simple equivalent pendulum;
- Make the concept about the motion in two dimensions under finite and impulsive forces;
- Know the principle of conservation of momentum and energy;
- Develop Euler's geometrical and dynamical equations;
- Find Lagrange's equations in generalized coordinates;
- Define Hamilton's principle and principle of least action.

Semester- IV

Title of the course: **Functional Analysis**

Paper: II

Course code: MAT 504C

Status: Compulsory

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After successful completion of this course the students will be able to:

(Knowledge Based)

- Understand and define metric convergence of sequences, Normed spaces, Banach Spaces, inner product spaces.
- Define Hilbert spaces and different linear operators.
- Understand some principles and theorems concerning different notions of functional analysis.
- (Skills)
- Explain the fundamental concepts of functional analysis and their role in modern mathematics and applied contexts.
- Apply problem-solving using functional analysis techniques applied to diverse situations in Physics, Engineering and other mathematical contexts.

Semester- IV

Course Title: **Calculus of variation and Integral Equations**

Paper- III

Course Code: MAT 506 C

Status: Compulsory Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Understand the concept of functionals, extremals and variation;
- Know about necessary and sufficient condition for extrema;
- Know about Euler equation and variational methods for ODE and PDE;
- Classify the linear integral equation and relation between differential and integral equations;
- Know about Fredholm equations of second kind and Eigen values problems.
- Solve the Fredholm and Volterra equations with successive approximation method.

Semester- II & IV

Title of the course: **Statistical Analysis**

Course code: MAT 10 E

Status: Elective

Course Instructor: Dr Dhirendra Singh, Assistant Professor

Dept. of Mathematics,

Mobile: 9410614935

Email: dsingh94106@gmail.com

After the successful completion of this course the students will be able to:

(Knowledge Based)

- Understand how statistical inferences can be derived.
- Test a hypothesis.
- Define critical region, level of significance and two types of errors.
- Use likelihood Ratio test, Chi square distribution and its application.
- Define and explain simple and multiple regressions, Hazard function.
- (Skills)
- Represent statistically analyse data both graphically and numerically.
- Perform parameter testing techniques including single and multi- sample tests for means, standard deviations and proportions.
- Explain and successfully apply the Central Limit theorem to describe inferences using normal distribution.
- Identify and demonstrate appropriate sampling and data collection processes.

Semester- IV

Course Title: **Operation Research**

Paper- IV & V

Course Code: MAT08E

Status: Elective Course

Course Instructor: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

After Successful completion of this course, students will be able to:

- Explain the basics of Operations Research.
- It is used to find optimal or near optimal solutions to complex decision making problems.
- It is used in finding maximum (of profit or yield) in real-world objective.
- It is used in finding minimum (of loss or cost) in real-world objective.
- Solve linear programming problem by different methods like Graphical, Simplex and duality.
- Formulation of transportation problem.
- Develop a working knowledge of concepts and methods related to designing and managing operations and supply chains.
- Finding initial basic feasible solution, test of optimality, degeneracy by MODI method and stepping stone method.
- Find the solution of Assignment problems by Hungarian method.

- Understand the concept of sensitivity analysis.
- Define the concept of dynamic and Integer programming.
- Solve the problem related to network flow
- Formulate and non linear programming problems (NLPP).

Semester- IV

Course Title: **Viva Voce, Comprehensive Test and Seminar**

Paper- VI

Course Code: MAT508C

Status: Compulsory Course

Internal Examiner: Dr Pramod Joshi, Assistant Professor

Dept. of Mathematics,

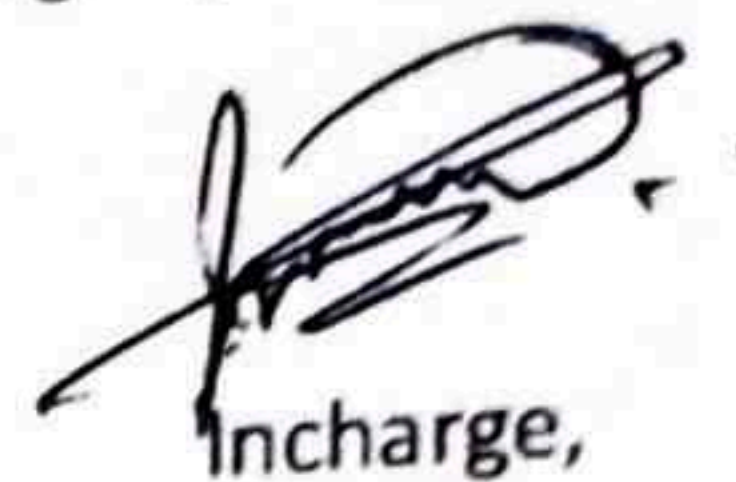
Mobile: 9412954452

Email: pramod.joshi1975@gmail.com

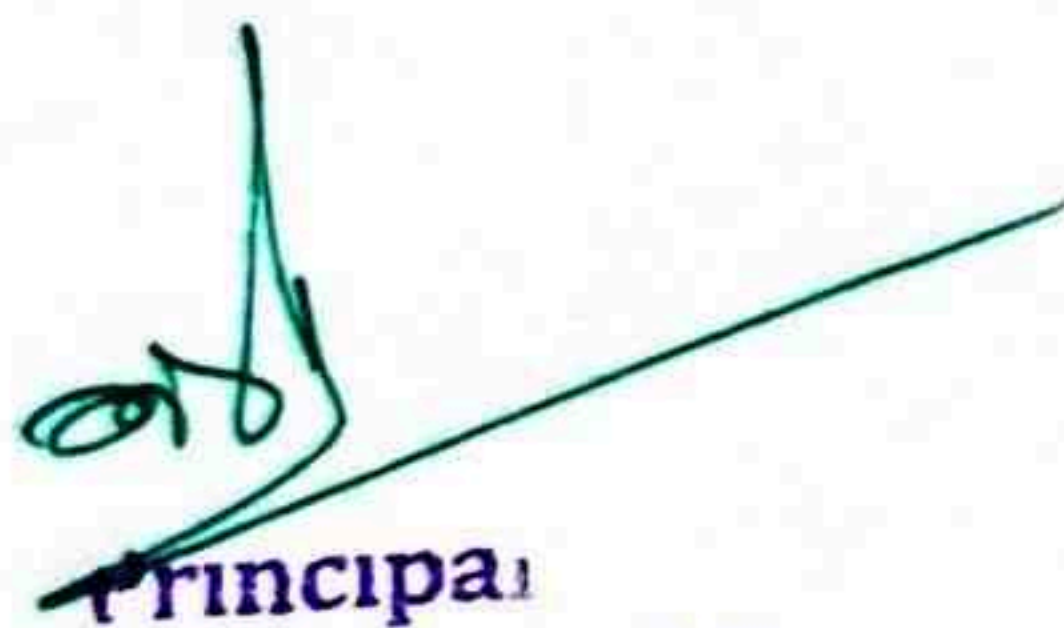
After Successful completion of this course, students will be able to:

Know the projects preparation.

- Present their presentations confidently.
- Know to prepare good & effective presentations.
- To raise questions in any mathematical topics.
- Know to express their appropriate knowledge on any topic during any Viva Voce.



Incharge,
Department of Mathematics



Principal
P.N.G. Government P.G. College
Ramnagar (Nainital)