

## B.A./ B.Sc. with Mathematics

### Program Outcomes (PO) for Under Graduate Programme in the Faculty of Sciences, Dyal Singh College, Karnal

<b>PO1</b>	Knowledge	Capable of acquiring comprehensive subject knowledge to compete globally
<b>PO2</b>	Communication	To have effective communication skills with their peers , society around them and the scientific community
<b>PO3</b>	Problem Solving	To be able to solve scientific and other Mathematical problems
<b>PO4</b>	Individual and Team Work	Capable of working effectively and efficiently as an individual, as a member or a leader in diverse teams in multidisciplinary areas
<b>PO5</b>	Investigation of Problems	To be able to develop critical thinking, logical and analytical reasoning and research based knowledge, design of experiments, analysis and data interpretation to reach logical conclusions
<b>PO6</b>	Modern Tool usage	Ability to learn techniques, skills and modern tools and apply them in various areas of Science and Mathematics
<b>PO7</b>	Science and Society	Ability to apply reasoning and critical thinking to assess the different issues related to world and discharging their responsibilities towards the society
<b>PO8</b>	Life-Long Learning	To gain natural liking to apply knowledge and skills required to keep learning process on throughout the life
<b>PO9</b>	Environment and Sustainability	Ability to have awareness of and able to develop solution oriented approach towards various social and environmental issues, understand the importance of sustainable development and contribute in sustainable environment
<b>PO10</b>	Ethics	Apply and adhere to ethical principles, professional responsibilities in scientific practices and discharging duties in serving the world
<b>PO11</b>	Project Management	Ability to apply knowledge and understanding of the scientific principles and apply these to manage various projects in Science and Mathematics

### Program Specific Outcomes (PSO)

After successful completion of the programme, a student will be able to:

<b>PSO1</b>	Have basic understanding and knowledge in different core areas of Mathematics such as Algebra, Real analysis, Calculus, Differential Equations, Statics, Dynamics and Numerical Analysis. Develop thinking in a critical way. Demonstrate and to be able to effectively use that information to find the solution of problems at hand
<b>PSO2</b>	Gain a good knowledge of Mathematical concepts and develop the mathematical reasoning, knowledge, critical thinking, skills and aptitude for pursuing high quality research in Mathematics. Understand, formulate and use quantitative models
<b>PSO3</b>	Inculcate problem solving skills, creative talent and power of communication necessary for various kinds of employment and have good and effective communication by presentation, written, computational and graphical means
<b>PSO4</b>	Inculcate a new perspective to look at problems from scientific point of view and enabling them to pursue higher studies at post-graduate and research level. Enhance their employability in government/private sectors, jobs in banking/insurance and investment sectors

### BM-111 ALGEBRA

**Course objectives:** The aim of this course is to study the concepts of Algebra.

**Course outcomes:** This course will enable the student to:

BM-111.1 Understand the basic concepts of symmetric, skew symmetric, Hermitian and skew Hermitian matrices. Determine rank of a matrix ,inverse , eigen values , eigen vectors and the characteristic equations of matrices. Understand linear independence and dependence of vectors and to solve related problems.

BM- 111.2 Find the solutions of Homogenous and non homogeneous system of linear equations using matrices. Know about unitary and orthogonal matrices and to solve related problem.

BM-111.3 Determine relations between the roots of and coefficients of polynomial equations. Identify Common and multiple roots.

BM-111.4 Applications of Descartes's rule of sign. Solve cubic and biquadratic equations. Solve practical problem of cubic equations by Cardon's method and biquadratic equations by Ferrari's method.

#### CO-PO Mapping matrix for course code: BM-111: ALGEBRA

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-111.1	3	3	3	3	3	2	2	2	2	2	2
BM-111.2	3	3	3	3	3	2	3	2	2	2	3
BM-111.3	3	3	3	3	3	2	3	3	2	2	2
BM-111.4	3	3	3	3	3	2	2	3	2	2	3
Average	3	3	3	3	3	2	2.5	2.5	2	2	2.5

#### CO-PSO Mapping matrix for course: BM-111: ALGEBRA

Cos	PSO1	PSO2	PSO3	PSO4
BM-111.1	3	3	3	3
BM-111.2	3	3	3	3
BM-111.3	3	3	3	3
BM-111.4	3	3	3	3
Average	3	3	3	3

## BM-112 : CALCULUS

**COURSE OBJECTIVE:** The aim of this course is to study the fundamental concepts of calculus.

**Course outcomes:** At the end of this course, the students will be able to :

BM-112.1 Familiarize with the basic concepts of limit, continuity and differentiability; successive differentiation of functions and series expansions.

BM-112.2 Understand the concepts of asymptote, curvature, evolute and involute of a curve, their geometrical meanings and to solve related problems; determine singular points of a curve and their types.

BM-112.3 Learn about the tracing of curves and their rectification; Reduction formulae.

BM-112.4 Understand the concepts of quadrature and compute the area bounded by closed curves, volumes and surface areas of solids formed by revolution of curves.

### CO-PO Mapping Matrix for Course Code: BM-112: CALCULUS

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-112.1	3	3	3	3	2	3	2	3	2	2	2
BM-112.2	3	3	3	2	3	2	2	3	2	2	3
BM-112.3	3	3	3	2	3	3	3	3	2	2	2
BM-112.4	3	3	3	3	3	2	3	3	2	2	2
Average	3	3	3	2.5	2.75	2.5	2.5	3	2	2	2.25

### CO-PSO Mapping Matrix for Course Code: BM-112: CALCULUS

Cos	PSO1	PSO2	PSO3	PSO4
BM-112.1	3	3	3	3
BM-112.2	3	3	3	3
BM-112.3	3	3	3	3
BM-112.4	3	3	3	3
Average	3	3	3	3

## BM –113 : SOLID GEOMETRY

**Course Objective:** To understand the concepts & advance topics related to two & three dimensional geometry.

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

BM-113.1 Learn about General equation of second degree. Tracing of conics, Polar equation of a conic, tangent and normal to the conic.

BM-113.2 Know about Co-axial system of spheres Cones. Right circular cone, enveloping cone and reciprocal cone. Cylinder: Right circular cylinder and enveloping cylinder

BM-113.3 Identify Central Conicoids ,Equation of tangent plane, Director sphere.  
 BM-113.4 Know Confocal conicoid, Reduction of second degree equations.

**CO-PO Matrix : BM – 113 : SOLID GEOMETRY**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>BM – 113.1</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM – 113.2</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM – 113.3</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM – 113.4</b>	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

**CO-PSO matrix :BM – 113 : SOLID GEOMETRY**

Cos	PSO1	PSO2	PSO3	PSO4
<b>BM – 113.1</b>	3	3	3	3
<b>BM – 113.2</b>	3	3	3	3
<b>BM – 113.3</b>	3	3	3	3
<b>BM – 113.4</b>	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**BM-121: NUMBER THEORY AND TRIGNOMETRY**

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of number theory and trigonometry.

**Course outcomes:** This course will enable the students to:

- BM-121.1 Understand the basis concepts of number theory and their applications in problem solving. Prove Fermat and Wilson’s theorems and their applications.
- BM-121.2 Learn complete Residue system and Reduced Residue system modulo m.

- Prove Chinese remainder theorem and their applications. Know about Quadratic residues.
- BM-121.3 Prove De -Moivre's theorem and their applications. Understand the direct circular and hyperbolic functions and their properties.
- BM-121.4 Know about the summations of trigonometric series and its problem. Understand the inverse circular and hyperbolic functions and its properties.

**CO-PO Mapping matrix for course code: BM-121: NUMBER THEORY AND TRIGONOMETRY**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-121.1	3	3	3	3	3	3	2	2	2	2	3
BM-121.2	3	3	3	3	3	3	3	3	2	2	2
BM-121.3	3	3	3	3	3	3	2	3	2	2	3
BM-121.4	3	3	3	3	3	3	2	3	2	2	3
Average	3	3	3	3	3	3	2.25	2.75	2	2	2.75

**CO-PSO Mapping matrix for course: BM-121: NUMBER THEORY AND TRIGONOMETRY**

Cos	PSO1	PSO2	PSO3	PSO4
BM-121.1	3	3	3	3
BM-121.2	3	3	3	3
BM-121.3	3	3	3	3
BM-121.4	3	3	3	3
Average	3	3	3	3

**BM-122: ORDINARY DIFFERENTIAL EQUATIONS**

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of ordinary differential equations.

**Course outcomes :** This course will enable the student to:

- BM-122.1 Understand the basic concepts of ordinary differential equations, exact differential equations and to learn various techniques of finding the solutions of first order differential equations.
- BM-122.2 Develop the skills of solving homogenous linear ordinary differential equations with constant co-efficient.
- BM122.3 Know about the linear differential equations of second order and their solutions using different methods. Develop skills of solving ODEs.
- BM-122.4 Learn about ordinary simultaneous ordinary differential equations, total differential equations and their solutions.

**CO-PO Mapping matrix for course code: BM-122: ORDINARY DIFFERENTIAL EQUATIONS**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-232.1	3	3	3	3	3	3	3	3	2	2	3
BM-232.2	3	3	3	3	3	3	3	3	2	2	3
BM-232.3	3	3	3	3	3	3	3	3	2	2	3
BM-232.4	3	3	3	3	3	3	3	3	2	2	3
Average	3	3	3	3	3	3	3	3	2	2	3

**CO-PSO Mapping matrix for course: BM-122: ORDINARY DIFFERENTIAL EQUATIONS**

Cos	PSO1	PSO2	PSO3	PSO4
BM-232.1	3	3	3	3
BM-232.2	3	3	3	3
BM-232.3	3	3	3	3
BM-232.4	3	3	3	3
Average	3	3	3	3

**BM-123: VECTOR CALCULUS**

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of vector calculus.

**Course Outcomes:** At the end of this course, the student will be able to:

- BM-123.1 Learn the concepts of scalar and vector product of vectors and solve related problems. Understand directional derivatives, vector differentiation and scalar and vector valued functions.
- BM-123.2 Know about gradient, divergence and curl operators. Use these operators in problem solving.
- BM-123.3 Learn about the various conditions for orthogonality and also gradient, divergence, curl and Laplacian operators in terms of orthogonal curvilinear co-ordinates.
- BM-123.4 Understand vector integration, line integral, surface integral and volume integral and proof of related theorems and solve problems based on these.

**CO-PO Mapping Matrix for Course Code: BM-123: VECTOR CALCULUS**

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-123.1	3	3	3	3	3	2	2	3	2	2	2
BM-123.2	3	3	3	2	3	2	2	3	2	2	2
BM-123.3	3	3	3	2	3	3	2	3	2	2	2
BM-123.4	3	3	3	2	3	3	2	3	2	2	2
Average	3	3	3	2.25	3	2.5	2	3	2	2	2

**CO-PSO Mapping Matrix for Course Code: BM- 123: VECTOR CALCULUS**

COs	PSO1	PSO2	PSO3	PSO4
BM-123.1	3	3	3	3
BM-123.2	3	3	3	3
BM-123.3	3	3	3	3
BM-123.4	3	3	3	3
Average	3	3	3	3

**BM-231: ADVANCED CALCULUS**

**Course Objectives :** The aim of this course is to study concepts of Advanced Calculus.

**Course Outcomes:** This course will enable the students to:

BM-231.1 Understand the concepts of Rolle's Theorem, Mean Value Theorem and their geometrical interpretations. To determine indeterminate forms.

BM-231.2 Learn concepts of limit, continuity, partial differentiation of functions of two variables. To understand composite functions, homogeneous functions and to solve related problems.

BM-231.3 Understand differentiability of real valued functions of two variables and to prove associated results. To determine maximum and minimum of functions of two variables and to apply multivariable calculus in optimization problems.

BM-231.4 Learn to find locus of spherical curvature, involutes, evolutes, Tangent planes, one parameter family of surfaces, Envelopes.

**CO-PO Mapping Matrix for Course Code: BM-231: ADVANCED CALCULUS**

COs#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-231.1	3	3	3	3	3	2	2	3	2	2	2
BM-231.2	3	3	3	2	3	2	2	3	2	2	2
BM-231.3	3	3	3	2	3	3	2	3	2	2	2
BM-231.4	3	3	3	2	3	3	2	3	2	2	2
Average	3	3	3	2.25	3	2.5	2	3	2	2	2

**CO-PSO Mapping Matrix for Course Code: BM- 231: ADVANCED CALCULUS**

Cos	PSO1	PSO2	PSO3	PSO4
BM-231.1	3	3	3	3
BM-231.2	3	3	3	3
BM-231.3	3	3	3	3
BM-231.4	3	3	3	3
Average	3	3	3	3



**BM-232: PARTIAL DIFFERENTIAL EQUATIONS**

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of partial differential Equations.

**Course outcomes:** This course will enable the students to:

- BM-232.1 Understand the basic concepts of partial differential equations. Learn methods and techniques for solving linear and non linear PDEs of first order. Understand compatible systems and charpit’s method, Jacobi’s methods for solving PDEs.
- BM-232.2 Learn techniques of solving second and higher order PDEs.
- BM-232.3 Learn classification and canonical forms of second order linear PDEs and methods of solving those. Apply Monge’s method to solve the problems for second order PDEs. Attain skills to reduce PDEs into canonical form.
- BM-232.4 Find characteristics of second order PDEs and Cauchy’s problem. Learn methods of separation of variables: solutions of Laplace’s, Wave and Heat equations in Cartesian coordinate system.

**CO-PO Mapping matrix for course code: BM-232: PARTIAL DIFFERENTIAL EQUATIONS**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-232.1	3	3	3	3	3	3	3	3	2	2	3
BM-232.2	3	3	3	3	3	3	3	3	2	2	3
BM-232.3	3	3	3	3	3	3	3	3	2	2	3
BM-232.4	3	3	3	3	3	3	3	3	2	2	3
Average	3	3	3	3	3	3	3	3	2	2	3

**CO-PSO Mapping matrix for course: BM-232: PARTIAL DIFFERENTIAL EQUATIONS**

Cos	PSO1	PSO2	PSO3	PSO4
BM-232.1	3	3	3	3
BM-232.2	3	3	3	3
BM-232.3	3	3	3	3
BM-232.4	3	3	3	3
Average	3	3	3	3

### BM-233 : Statics

**Course Objective :** To analyze forces and moments in two and three dimensions due to concentrated and distributed forces in various systems.

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

BM-233.1 Composition and resolution of forces. Parallel forces. Moments and Couples.

BM-233.2 Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

BM-233.3 Virtual work. Forces in three dimensions. Poinsons central axis.

BM-233.4 Wrenches. Null lines and planes. Stable and unstable equilibrium

#### CO-PO matrix : BM -233 : Statics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM -233.1	3	3	3	3	3	3	3	3	2	2	3
BM -233.2	3	3	3	3	3	3	3	3	2	2	3
BM -233.3	3	3	3	3	3	3	3	3	2	2	3
BM -233.4	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

#### CO-PSO matrix: BM -233 : Statics

Cos	PSO1	PSO2	PSO3	PSO4
BM -233.1	3	3	3	3
BM -233.2	3	3	3	3
BM -233.3	3	3	3	3
BM -233.4	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

### Course: BM-241: Sequence and Series

**Course objective:** The objective of this course is to study concepts of sequence and series.

**Course outcomes:** This course will enable the students to:

BM-241.1 Study basic concepts of boundedness of set of real numbers, neighbourhoods of a point, interior points, limit points, closure points, open sets, closed sets, compact sets, results related to these concepts.

BM-241.2 Study concept of real sequences, their limits, boundedness, monotone, convergence and divergence behavior, subsequences, Cauchy sequences, theorem related to these concepts.

BM-241.3 Study the convergence and divergence behavior of Infinite series using comparison tests, p-test and other tests.

BM-241.4 Study the convergence, absolute, conditional and divergence behavior of alternating series, arbitrary series. Understand the re-arrangement of terms in series and related theorems.

#### CO-PO matrix for the course BM-241 : Sequence and Series

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-241.1	3	3	3	2	3	2	2	3	2	2	2
BM-241.2	3	3	3	2	3	2	2	3	2	2	3
BM-241.3	3	3	3	2	3	2	2	3	2	2	3
BM-241.4	3	3	3	2	3	2	2	3	2	2	2
Average	3	3	3	2	3	2	2	3	2	2	2.5

**CO-PSO matrix for the course BM-241 : Sequence and Series**

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>BM-241.1</b>	3	3	2	3
<b>BM-241.2</b>	3	3	2	3
<b>BM-241.3</b>	3	3	2	3
<b>BM-241.4</b>	3	3	2	2
<b>Average</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2.75</b>

**BM -242 : Special Functions and Integral Transforms**

**Course Objective:** To analyze properties of special functions by their integral representations.

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

BM.242.1: Power series method, Definitions of Beta and Gamma functions. Bessel equations and its solution: Bessel functions.

BM.242.2: Legendre and Hermite differential equations and their solutions: Legendre and Hermite functions and their properties.

BM.242.3: Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms.

BM.242.4 Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transforms of Derivatives.

**CO-PO matrix: BM -242 : Special Functions And Integral Transforms**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>BM -242.1</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM -242.2</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM -242.3</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM -242.4</b>	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

**CO-PSO matrix: BM -242 : Special Functions And Integral Transforms**

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
BM -242.1	3	3	3	3
BM -242.2	3	3	3	3
BM -242.3	3	3	3	3
BM -242.4	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**BM-243 : Programming in C and Numerical methods (Theory)**

**Course objective:** The objective of this course is to develop skills to solve real time practical problems by using Programming in C and Numerical methods.

**Course Outcomes:** This course will enable the students to:

BM-243.1 Learn algorithms and flow chart corresponding to practical problems, C programming language, character set of C language, data types, constants and variables, operations, operators, expressions, Input / Output functions, tools to write basis programs in C.

BM-243.2 Learn decision making statements, logical and conditional statements, loop structures, arrays, functions and preprocessors. Learn tools to write C programs which involve decision making statements, loop structures, arrays and functions.

BM-243.3 Learn character data types of strings, built-in functions to handle strings, structures and pointers and use of structure and pointers with arrays and functions. Learn tools to write programs related to practical problems involving use of strings, pointers and structures.

BM-243.4 Learn numerical methods to find the roots of algebraic and transcendental equations in single variable and to find the solution of system of algebraic equations. Implementation of these numerical methods to solve practical problems.

**CO-PO matrix for the course BM-243: Programming in C and Numerical methods (Theory)**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>BM-243.1</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.2</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.3</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.4</b>	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

**CO-PSO matrix for the course BM-243: Programming in C and Numerical methods(Theory)**

Cos	PSO1	PSO2	PSO3	PSO4
<b>BM-243.1</b>	3	3	3	3
<b>BM-243.2</b>	3	3	3	3
<b>BM-243.3</b>	3	3	3	3
<b>BM-243.4</b>	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**BM-243: Programming in C and Numerical methods (Practicals)**

**Course objective:** The objective of this course is to provide skill to students to develop programs in C language to solve real life practical problems.

**Course Outcomes:** This course will enable the students to:

BM-243.1 Develop understanding of syntax and structure of simple programs in C.

BM-243.2 Attain skills of writing codes in the C programming language.

BM-243.3 Learn to write programs in the programming language C.

BM-243.4 Learn to run and debug programs in C for different mathematical and other practical problems of daily or scientific use.

**CO-PO matrix for the course BM-243 : Practical**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>BM-243.1</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.2</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.3</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-243.4</b>	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

**CO-PSO matrix for the course BM-243 : Programming in C and Numerical methods (Practicals)**

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
<b>BM-243.1</b>	3	3	3	3
<b>BM-243.2</b>	3	3	3	3
<b>BM-243.3</b>	3	3	3	3
<b>BM-243.4</b>	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

**BM-351: Real Analysis**

**Course objective:** The objective of this course is to provide knowledge of Riemann integration, improper integrals and metric space concepts.

**Course Outcomes:** This course will enable the students to:

- BM-351.1 Understand the concept of Riemann integration theory, conditions of integrability. Learn Fundamental theorem and Mean Value theorems of integral calculus.
- BM-351.2 Study convergence and divergence behavior of Improper integrals using basic definitions and various tests.
- BM-351.3 Learn the concepts of metric spaces, subspaces, limit points, interior points, open and closed sets, sequences and theorems related to these concepts.
- BM-351.4 Study the concepts of continuity, uniform continuity, compactness and connectedness in metric spaces.

**CO-PO matrix for the course BM-351: Real Analysis**

<b>Cos</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>BM-351.1</b>	3	3	3	3	3	2	2	3	2	2	2
<b>BM-351.2</b>	3	3	3	3	3	3	3	2	2	2	3
<b>BM-351.3</b>	3	3	3	3	3	2	2	2	2	2	2
<b>BM-351.4</b>	3	3	3	2	3	2	2	3	2	2	2
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.75</b>	<b>3</b>	<b>2.25</b>	<b>2.25</b>	<b>2.5</b>	<b>2</b>	<b>2</b>	<b>2.25</b>

**CO-PSO matrix for the course BM-351: Real Analysis**

Cos	PSO1	PSO2	PSO3	PSO4
<b>BM-351.1</b>	3	3	2	2
<b>BM-351.2</b>	3	3	2	2
<b>BM-351.3</b>	3	3	2	2
<b>BM-351.4</b>	3	3	2	2
<b>Average</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>

**BM-352: GROUPS AND RINGS**

**Course Objective :** The aim of this course is to study concepts of Groups and Rings.

**Course Outcomes:** The course will enable the students to:

BM-352.1 Recognize the mathematical objects called groups, their elementary properties, order of a group, subgroup, cyclic groups and their properties, normal subgroup, Quotient groups.

BM-352.2 Understand the concepts of homomorphisms, isomorphisms to prove related Theorems.

BM-352.3 Familiarize about ring, subring, integral domain, field , ideal , Quotient ring and related results.

BM-352.4 Study Euclidean rings, Polynomial rings, Polynomials over the rational field and Unique Factorization Domain.

**CO-PO matrix for the course BM-352:Groups and Rings**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>BM-352.1</b>	3	3	3	2	3	3	2	3	2	2	2
<b>BM-352.2</b>	3	3	3	3	2	2	3	3	2	2	3
<b>BM-352.3</b>	3	3	3	3	2	2	2	3	2	2	2
<b>BM-352.4</b>	3	3	3	2	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2.5</b>

**CO-PSO matrix for the course BM-352: Groups and Rings**

Cos	PSO1	PSO2	PSO3	PSO4
<b>BM-352.1</b>	3	3	2	2
<b>BM-352.2</b>	3	3	3	3
<b>BM-352.3</b>	3	3	2	3
<b>BM-352.4</b>	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>2.75</b>



### BM-353: Numerical Analysis (Theory)

**Course objective:** The objective of this course is to provide the skills to students to solve the real life practical problems using numerical methods.

**Course Outcomes:** This course will enable the students to:

BM-353.1 Learn the effects of errors in a tabular values, finite difference operators, numerical methods to study practical problems related to concepts of interpolation and extrapolation.

BM-353.2 Attain numerical skills to find solutions of system of linear equations by different methods.

BM-353.3 Study different Central difference interpolation methods to find values of functions and their derivatives and their use in solving practical problems.

BM-353.4 Learn numerical methods for evaluating integrals and solving differential equations and to develop skills of applying these methods for further use in scientific problems.

#### CO-PO matrix for the course BM-353 : Numerical Analysis(Theory)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>BM-353.1</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-353.2</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-353.3</b>	3	3	3	3	3	3	3	3	2	2	3
<b>BM-353.4</b>	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

#### CO-PSO matrix for the course BM-353 : Numerical Analysis (Theory)

	PSO1	PSO2	PSO3	PSO4
<b>BM-353.1</b>	3	3	3	3
<b>BM-353.2</b>	3	3	3	3
<b>BM-353.3</b>	3	3	3	3
<b>BM-353.4</b>	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

### Course BM-353: Numerical Analysis (Practicals)

**Course objective:** The objective of this course is to demonstrate numerical methods using C language.

**Course Outcomes:** This course will enable the students to:

BM-353.1 Learn to write codes in C language efficiently and skillfully to demonstrate numerical methods.

BM-353.2 Apply numerical methods to obtain solution to mathematical problems.

BM-353.3 Solve scientific problems by applying numerical techniques in C programming language.

BM-353.4 Write and execute programs of numerical methods in C.

#### CO-PO matrix for the course BM-353 : Numerical Analysis(PRACTICAL)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-353.1	3	3	3	3	3	3	3	3	2	2	3
BM-353.2	3	3	3	3	3	3	3	3	2	2	3
BM-353.3	3	3	3	3	3	3	3	3	2	2	3
BM-353.4	3	3	3	3	3	3	3	3	2	2	3
Average	3	3	3	3	3	3	3	3	2	2	3

#### CO-PSO matrix for the course BM-353 : Numerical Analysis (PRACTICAL)

Cos	PSO1	PSO2	PSO3	PSO4
BM-353.1	3	3	3	3
BM-353.2	3	3	3	3
BM-353.3	3	3	3	3
BM-353.4	3	3	3	3
Average	3	3	3	3

### BM- 361: REAL AND COMPLEX ANALYSIS

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of real and complex analysis.

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

BM-361.1 : Familiarize with the concepts of Jacobians, Beta and Gamma functions, double and triple integrals, Dirichlet's integral, change the order of integration and solve related problems.

BM-361.2 : Learn the concepts of fourier series, properties of fourier coefficients, parseval's identity.

BM-361.3: Know about stereographic projection of complex numbers, continuity and differentiability of complex functions, analytic functions, Cauchy-Riemann equations and harmonic functions.

BM-361.4 Understand the concepts of elementary functions, mobius transformations and critical mappings.

**CO-PO Mapping Matrix for Course Code: BM-361: REAL AND COMPLEX ANALYSIS**

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-361.1	3	3	3	3	3	2	2	3	2	2	2
BM-361.2	3	3	3	3	3	2	2	3	2	2	2
BM-361.3	3	3	3	3	3	2	2	3	2	2	2
BM-361.4	3	3	3	3	3	2	2	3	2	2	2
Average	3	3	3	3	3	2	2	3	2	2	2

**CO-PSO Mapping Matrix for Course Code: BM-361: REAL AND COMPLEX ANALYSIS**

Cos	PSO1	PSO2	PSO3	PSO4
BM-361.1	3	3	3	3
BM-361.2	3	3	3	3
BM-361.3	3	3	3	3
BM-361.4	3	3	3	3
Average	3	3	3	3

**BM-362: LINEAR ALGEBRA**

**COURSE OBJECTIVE:** The aim of this course is to study the concepts of Linear Algebra .

**Course Outcomes:** At the end of this course, the student will be able to:

BM-362.1 Understand the concepts of vector spaces, subspaces, linear span and dimension of a vector space, bases and their properties, quotient space, use of these concepts in problem solving.

BM-362.2 Learn the concepts of linear transformations on vector spaces to find out rank and Nullity, dual-spaces and to use these concepts for problems solving.

BM-362.3 Know about the matrix representation of a linear transformation and change of basis; Determine eigen values, eigen vectors, characteristic polynomial and minimal polynomial of a linear transformation and their further use in solutions of problems.

BM-362.4 Understand the concepts of inner product spaces, related theorems and orthogonalization process.

**CO-PO Mapping Matrix for Course Code: BM-362: LINEAR ALGEBRA**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM-362.1	3	3	3	3	2	2	2	2	2	2	2
BM-362.2	3	3	3	3	3	2	2	3	2	2	2
BM-362.3	3	3	3	2	3	2	2	2	2	2	2
BM-362.4	3	3	3	2	2	2	2	3	2	2	2
Average	3	3	3	2.5	2.5	2	2	2.5	2	2	2

**CO-PSO Mapping Matrix for Course Code: BM- 362: LINEAR ALGEBRA**

COs	PSO1	PSO2	PSO3	PSO4
BM-362.1	3	3	3	2
BM-362.2	3	3	3	3
BM-362.3	3	3	3	2
BM-362.4	3	3	3	3
Average	3	3	3	2.5

**Course: BM-363 : Dynamics**

**Course Objective:** Develop the kinematics of displacement, velocity and acceleration for systems of particles and rigid bodies.

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

BM-363.1 Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration.

BM-363.2 Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy.

BM-363.3 Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.


BM-363.4 General motion of a rigid body. Central Orbits, Kepler's laws of motion.

**CO-PO matrix:** BM-363 : Dynamics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
BM -363.1	3	3	3	3	3	3	3	3	2	2	3
BM -363.2	3	3	3	3	3	3	3	3	2	2	3
BM -363.3	3	3	3	3	3	3	3	3	2	2	3
BM -363.4	3	3	3	3	3	3	3	3	2	2	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>

**CO-PSO matrix : BM -363: Dynamics**

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>
BM -363.1	3	3	3	3
BM -363.2	3	3	3	3
BM -363.3	3	3	3	3
BM -363.4	3	3	3	3
<b>Average</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

  
Principal  
Dyal Singh College  
KARNAL