FACULTY OF SCIENCES

SYLLABUS
Of

Interdisciplinary Courses Under Mathematics
(Under Credit Based Continuous Evaluation Grading System)

Session: 2026-27

The Heritage Institution

KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Four Year Undergraduate Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Bachelor of Arts/ Bachelor of Science (Honours)
Semester-I
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-I										
Course Code	Course Title	Course Type	Hours Per Week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-1333 BECL-1333 BSNL-1333 BCSL-1333	Mathematics (Algebra)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-1333 BECP-1333 BSNP-1333 BCSP-1333	Algebra Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

DSC-Discipline Specific Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Four Year Undergraduate Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Bachelor of Arts/ Bachelor of Science (Honours)
Semester-II
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-II										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-2333 BECL-2333 BSNL-2333 BCSL-2333	Mathematics (Advanced Calculus)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-2333 BECP-2333 BSNP-2333 BCSP-2333	Calculus Laboratory		0-0-2	0-0-1	1	50	-	35	15	3
BSNL-2330 BCSL-2330	Statistical Analysis Using Spreadsheet	SEC	1-0-0	1-0-0	1	50	35	-	15	3
BSNP-2330 BCSP-2330	Statistical Analysis Using Laboratory	SEC	0-0-4	0-0-2	2	50	-	35	15	3

DSC-Discipline Specific Course
SEC-Skill Enhancement Course

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–I
Session: 2026-27
Course Title: Mathematics (Algebra)
Course Code: BARL/ BECL/ BSNL/ BCSL-1333
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand the concept of matrix congruence of skew symmetric matrices and its reduction in real field. Solve system of linear equations.

CO 2: Obtain Eigen values, Eigen vectors, minimal and characteristic equation of a matrix and to apply it in advanced dynamics and electric current.

CO 3: Classify real quadratic form in variables, definite, semi- definite and indefinite real quadratic form.

CO 4: To find the relations between the roots and coefficients of general polynomial equation in one variable, distinguish between solution of cubic equations and Bi-quadratic equations.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–I
Session: 2026-27
Course Title: Mathematics (Algebra)
Course Code: BARL/ BECL/ BSNL/ BCSL -1333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter: Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Partitioning of Matrices, Matrices Partitioned conformably for Multiplication, Rank of a Matrix, Normal form, Row rank, Column rank of a matrix, Equivalence of column and row ranks, rank of product of matrices, Linear independence of row and column vectors Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistencyof a system of linear equations.

Unit II

Eigenvalues, Eigenvectors, Hermitian Matrix, Skew Hermitian matrix and unitary matrix and properties of Eigen value, minimal and the characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

Unit III

Quadratic Forms, quadratic form as a product of matrices. The set of quadratic forms over a field. Congruence of quadratic forms and matrices. Congruent transformations of matrices. Elementary congruent transformations. Congruent reduction of a symmetric matrix. Reduction in the real field. Classification of real quadratic forms in n variables. Definite, semi–definite and indefinite real quadratic forms. Characteristic properties of definite, semi–definite and indefinite forms.

Unit IV

Relations between the roots and coefficients of general polynomial equation of degree n in one variable. Vieta ‘s Formula, Fundamental Theorem of Algebra (Statement only) Transformation of equations, Equations of Squared differences, Solution of cubic equations by Cardan method, Discriminant of polynomial equation, Discriminant of Cubic equation, nature of roots of cubic, Solution of Biquadratic by Ferrari’s Method with illustrations, Descartes’s Rules of Signs with illustrations.

Text Books:-

1. Shanti Narayan and P.K. Mittal: Text Book of Matrices.
2. K.B. Datta : Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

Reference Book:-

Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2023

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–I
Session: 2026-27

Course Title: Algebra Laboratory

Course Code: BARP/ BECP/ BSNP/ BCSP-1333

Course Outcomes

After passing this course, the students will be able to:

CO 1: To develop practical skills in applying computational tools for performing various matrix operations, including addition, multiplication, inversion, transposition, and determinant calculation.

CO 2: To enhance problem-solving abilities in linear algebra by determining matrix rank, reducing matrices to row echelon form, and solving systems of linear equations using numerical methods.

CO 3: To enable students to analyze and interpret matrix properties through the computation of eigenvalues, eigenvectors, and other numerical techniques using built-in software functions.

CO 4: To bridge theoretical concepts of linear algebra with practical implementation using computational packages, fostering efficiency, accuracy, and deeper understanding of engineering mathematics applications.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–I
Session: 2026-27

Course Title: Algebra Laboratory

Course Code: BARP/ BECP/ BSNP/ BCSP -1333

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. Introduction to the computer package in the practicals.
2. Matrix operations: addition, multiplication, inverse. transpose, determinant of matrix.
3. Find Rank of matrix: Row Rank, Column Rank.
4. Find row reduced echelon form
5. Create the coefficient matrix A and vector b. Solve for x using the inverse, using the built-in function.
6. Solving a linear system, using Gauss elimination numerically.
7. Finding eigen values and eigenvectors, numerically.

Reference Books:-

1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI, 2008.

SEMESTER-II

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Mathematics (Advanced Calculus)
Course Code: BARL/BECL/ BSNL/BCSL-2333
Course Outcomes

After passing this course, the students will be able to:

CO 1: Understand real number system, limit of a function, basic properties of limit, continuity, and classification of discontinuities & to apply it in real world problem.

CO 2: To Classify the difference between Hyperbolic and Inverse Hyperbolic functions and understand the concept of Taylor's and Maclaurin theorem with its applications.

CO 3: Demonstrate Asymptotes and De Moivre's theorem (for integer and Rational index) and its applications, primitive nth roots of unity.

CO 4: To understand the concepts of definite integrals and their properties and Reduction Formulae.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Mathematics (Advanced Calculus)
Course Code: BARL/BECL/ BSNL/BCSL -2333

Examination Time: 3 Hours | Max. Marks: 100

L T P | Theory: 70

4 0 0 | CA: 30

Instructions for the Paper Setter: Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Real number system and its order properties: lub, glb of sets of real numbers, Completeness property, Archimedean property, Dense property of Rational numbers, Limit of a function of real variable, Properties of Limits, Squeeze Theorem, Continuous function and classification of discontinuities, Differentiability of a function of real variable, Concavity and Convexity of function, Point of inflexion.

Unit II

Derivatives of Hyperbolic and Inverse Hyperbolic functions, nth order derivatives, Leibnitz theorem on nth derivative and its applications, Taylor's and Maclaurin theorem with Lagrange form of remainder, Application of Taylor's theorem in error estimation; Taylor's series expansions of $Sinx, Cosx, e^{cosx}. logx$ etc. Indeterminate forms and L'Hopital rule.

Unit III

Asymptotes, Horizontal Asymptotes, Vertical Asymptotes, Oblique Asymptotes, Asymptotes of general Rational Algebraic Curve with illustrations, Intersection of curve and its Asymptotes, de Moivre's theorem (for integer and Rational index) and its applications, primitive nth roots of unity.

Unit IV

Integration of hyperbolic functions, Properties of definite integral, Reduction formulae of type $\tan^n x\,dx$, $\int \cot^n x\,dx$, $\int \sec^n x\,dx$, $\int \operatorname{cosec}^n x\,dx$, $\int x\cos^n x\,dx$, $\int \cos^m x \sin nx\,dx$, Reduction formulae of using rule of smaller index +1 of type $\int_0^{\frac{\pi}{2}} \sin^n x \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$

Text Books:-

1. S. Narayan and P.K.Mittal: Integral Calculus.Sultan Chand & Sons.
2. Gorakh Prasad, Differential Calculus (19th ed.). Pothishala Pvt. Ltd. Allahabad,2016.

Reference Books:-

1. Tom M.A postol, Calculus: An Indian Adaptation, Wiley India,2023.
2. MurrayR.Spiegel, Theory and Problems of Advanced Calculus, Schaum' soutlineseries, Schaum Publishing Co.NewYork.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Calculus Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP-2333

Course Outcomes:

After passing this course, students will be able to:

CO1: Apply computational tools to plot and analyze graphs of elementary, polynomial, trigonometric, logarithmic, and hyperbolic functions, interpreting the effect of parameters on their shapes.

CO2: Demonstrate the ability to trace and visualize conic sections and conicoids using their standard and general equations in Cartesian coordinates.

CO3: Use numerical methods to approximate limits, derivatives, and higher-order derivatives, and compare results with analytical solutions.

CO4: Integrate graphical and numerical techniques to model and interpret curves, surfaces, and their derivatives for solving practical mathematical problems.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Calculus Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -2333

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. Plotting graphs of elementary functions e^{ax+b} ,sin(bx+c) , log(ax+b), 1/(ax+b), sin(ax+b),cos(ax+b), |ax+b| and to illustrate the effect of a and b on the graphs.
2. Plotting the graphs of the polynomial of degree 4 and 5, the derivative graph, the second derivative graph
3. Tracing of conics in Cartesian coordinates and using the general equation of second degreein x and y.
4. Tracing of conicoids: Ellipsoid, Hyperbolic paraboloid, Elliptic paraboloid, Hyperboloid ofone and two sheets etc.
5. Graphs of hyperbolic functions.
6. Approximation of limit.
7. Approximations of derivatives.

Reference Books:-

1. S.S. Sastry, Engineering Mathematics -Volume I (4^{th} Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics -Volume II (4^{th} Edition), PHI, 2008.

Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Statistical Analysis Using Spreadsheet
Course Code: BSNL/ BCSL-2330

Course outcomes:

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

CO:1 Understand the basic concepts and functions of Statistics, collect and present data using tabulation and charts (including Excel/SPSS), and compute measures of central tendency such as mean, median, mode, weighted mean, geometric mean, and harmonic mean.

CO:2 Analyze variability in data by calculating and interpreting measures of dispersion including range, quartile deviation, mean deviation, standard deviation, and coefficient of variation.

CO:3 Evaluate the shape of data distribution by computing and interpreting Karl Pearson's and Bowley's coefficients of skewness and understanding the concept of kurtosis.

CO:4 Examine relationships between variables by identifying types of correlation and applying Karl Pearson's coefficient of correlation and rank correlation methods.

Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Statistical Analysis Using Spreadsheet
Course Code: BSNL/ BCSL -2330

Examination Time: 3 Hours | Max. Marks: 50
Theory: 35
L T P | CA: 15
1 0 0

Instructions for Paper Setters:

Eight questions of equal marks (7 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Introduction to statistics, functions of statistics, collection of data, presentation of data, tabulation of data, charting of data, introduction to excel/spss, graphs in excel, measures of central tendency-, mean, median - meaning and computation, mode- meaning and computation, weighted average mean, geometric mean and harmonic mean.

Unit II

Measures of dispersion, types of dispersion- range, quartile deviation, mean deviation, standard deviation, co-efficient of variation.

Unit III

Skewness- Karl Pearson co-efficient of skewness, Bowley's co-efficient of skewness and Kurtosis.

Unit IV

Correlation, Types of correlation, positive, negative, linear. methods of correlations - Karl Pearson's Co-efficient of correlation, rank correlation coefficient.

Reference Books:-

1. S.C. Gupta. Fundamentals of Mathematical Statistics, S. Chand Publication, 2000.
2. K. Berk, & P. Carey. Data Analysis with Microsoft Excel, Duxbury Press, 2000.

Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Statistical Analysis Using Laboratory
Course Code: BSNP/ BCSP-2330

Course Outcomes:

After passing this course, the students will be able to:

CO:1 Apply spreadsheet functions such as SUM, COUNT, COUNTIF, MAX, MIN, and SORT to perform data organization, calculation, and analysis effectively.

CO:2 Prepare and analyze academic results by calculating total marks, percentages, grades, SGPA, and credits using Spreadsheet formulae and functions.

CO:3 Construct and interpret graphical representations including histograms, bar charts, pie charts, and two-dimensional graphs for better data visualization.

CO:4 Compute and interpret statistical measures such as central tendency, dispersion, skewness, kurtosis, correlation, and regression using Spreadsheet tools.

Bachelor of Science (Honours)
Semester–II
Session: 2026-27
Course Title: Statistical Analysis Using Laboratory

Course Code: BSNP/ BCSP-2330

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
L T P | C A: 15
0 0 2

List of Practicals

1. Introduction of basics of excel and functions such as ‘sum’, ‘count’, ‘countif’, ‘max’, ‘min’,‘sort’ etc.
2. Create frequency distribution table; plot histogram, bar chart, pie chart, etc.
3. Plotting two dimensional graphs.
4. To find measures of central tendency for a given data.
5. To find measures of dispersion for a given data.
6. To find measures of skewness and kurtosis for a given data.
7. To find Karl Pearson Coefficient of correlation and rank correlation coefficient for a givendata.
8. To find regression coefficient for bivariate data and plotting regression lines.

Reference Books:-

1. S. C. Gupta, Fundamentals of Mathematical Statistics, Himalaya Publication.
2. K. Berk, Partrick Carey, Data Analysis with Microsoft Excel.

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Scheme and Curriculum of Examinations of Four Year Undergraduate Degree Programme
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Bachelor of Arts/ Bachelor of Science (Honours)
Semester-III
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-III										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-3333 BECL-3333 BSNL-3333 BCSL-3333	Mathematics (Differential Equations)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-3333 BECP-3333 BSNP-3333 BCSP-3333	Differential Equations Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

DSC-Discipline Specific Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Four Year Undergraduate Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Bachelor of Arts/ Bachelor of Science (Honours)
Semester-IV
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-IV										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-4333 BECL-4333 BSNL-4333 BCSL-4333	Mathematics (Analysis)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-4333 BECP-4333 BSNP-4333 BCSP-4333	Analysis Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

DSC-Discipline Specific Course

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–III
Session: 2026-27
Course Title: Mathematics (Differential Equations)
Course Code: BARL/ BECL/ BSNL/ BCSL-3333

Course Outcomes

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

CO1: Identify differential equation, its order and degree, exact differential equations and special rules to find integrating factors.

CO2: Demonstrate the concept of linear differential equations with constant coefficients, complete solution of the differential equations, orthogonal trajectories of Cartesian and polar curves.

CO 3: Demonstrate the concept of linear differential equations with variable coefficients and its solution.

CO 4: Analyze System of ordinary simultaneous equations, Power Series, convergence of power series, Radius of convergence.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–III
Session: 2026-27
Course Title: Mathematics (Differential Equations)
Course Code: BARL/ BECL/ BSNL/ BCSL -3333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter: Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Differential equation of first order and first degree, Linear differential equation reducible to Linear Bernoulli's equation, Ordinary differential equation of first order. Exact differential equations. Necessary and sufficient conditions for Mdx + Ndy to be Exact, integrating factors by inspections, special rules to find integrating factors with proof.

Unit II

Geometrical meaning of a complete solution of the differential equations, General solution of homogeneous equation of second order, Orthogonal trajectories of cartesian and polar curve, Homogeneous differential equations, Linear differential equations with constant coefficients.

Unit III

Singular solution, p-discriminant, c- discriminant, illustrations of singular solutions Variation of Parameters method, Reduction of order. Linear differential equations with variable coefficients, Define Cauchy's linear equations, Legendre's Linear equation.

Unit IV

First order and higher degree equations, equations solvable for y, x, p, equations not containing x, equations not containing y, Clairaut's equation and equations reducible to Clairaut's form.

System of ordinary simultaneous equations, Power Series, convergence of power series, Radius of convergence, Power Series solution about an ordinary point, solutions about singular points, Frobenius method when roots of indicial equations differ by non-integers, and when roots are equal.

Text Book:-

M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand, (20th edition)

Reference Book:-

Tom M. Apostol: Calculus: An Indian Adaptation, Wiley India, 2022

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–III
Session: 2026-27

Course Title: Differential Equations Laboratory

Course Code: BARP/ BECP/ BSNP/ BCSP-3333

Course Outcomes

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

CO1: Apply numerical techniques such as Euler's and Runge–Kutta methods to solve first-order differential equations and visualize their solutions.

CO2: Develop computational solutions for higher-order differential equations using suitable numerical methods.

CO3: Solve and plot systems of ordinary differential equations using appropriate software tools/packages.

CO4: Analyze and numerically solve nonlinear differential equations arising in physical systems such as the simple pendulum.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–III
Session: 2026-27

Course Title: Differential Equations Laboratory

Course Code: BARP/ BECP/ BSNP/ BCSP -3333

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. Plotting solution of first order differential equation.
2. Solve the first-order differential equation $\frac{dy}{dx}$ = ay, numerically using Runge-Kuttamethod.
3. Solve the second-order differential equation $\frac{d^2y}{dx^2}$ = ay, numerically using Runge-Kutta method.
4. Plotting of solution of family of second order differential equation.
5. Solution of system of ordinary differential equations, numerically using Runge-Kuttamethod.
6. Numerical solution of the nonlinear simple pendulum equation.

Text Books:-

1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI

SEMESTER-IV

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2026-27
Course Title: Mathematics (Analysis)
Course Code: BARL/ BECL/ BSNL/ BCSL -4333

Course Outcomes

After passing this course, the students will be able to:

CO 1: Demonstrate an understanding of limits and how they are used in sequences.

CO 2: Understanding how limits are used in series and apply various test on series.

CO 3: To understand the concepts of Riemann sum, partitions, upper and lower sums, Riemann Inerrability of continuous functions and of monotone functions. Distinguish between the absolute convergence and conditional convergence.

CO 4: To know Conditions for existence of improper integrals, Tests for the convergence of the improper integrals of different kinds, Absolute convergence.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2026-27
Course Title: Mathematics (Analysis)
Course Code: BARL/ BECL/ BSNL/ BCSL -4333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter: Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Sequence, Subsequence, Limit point of a sequence, Theorems on limits of sequences, Convergence and divergence of a sequence, Bounded and monotonic sequences and their behavior, Squeeze Theorem on sequences, Bolzano-Weierstrass theorem (statement only), Definition of Cauchy sequence, Cauchy's convergence Criterion, Cauchy's first theorem on limits with its applications, Cauchy's second theorem on limits with its applications.

Unit II

Series of non-negative terms, Convergence and divergence of infinite series, Cauchy convergence criterion for series, Comparison tests for convergence. Cauchy's condensation test, Cauchy's integral test, Cauchy's root test, D'Alembert's ratio test, Comparison between Cauchy's root testand D'Alembert's ratio test, Logarithmic test, Gauss test, Alternating series, Leibnitz's test.

Unit III

Partition of an interval, Riemann upper and lower sums, Riemann upper and lower integrals, Riemann integrability, Necessary and sufficient conditions for a bounded function to be Riemann integrable, Riemann integrability of continuous functions, monotone functions, and composition of functions, Darboux theorem, Fundamental Theorem of calculus.

Unit IV

Improper integrals, Conditions for existence of improper integrals, Tests for the convergence of the improper integrals of different kinds, Absolute convergence.

Text Book:-

S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd. (1991).

Reference Book:

Tom M. Apostol, Calculus: An Indian Adaptation, Wiley India, 2022.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2026-27
Course Title: Analysis Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -3333

Course Outcomes

After passing this course, the students will be able to:

CO1. Generate and analyze various types of sequences, including bounded and monotonic sequences, using computational tools.

CO2. Visualize mathematical concepts through plotting techniques to understand the behavior and properties of sequences and series.

CO3. Investigate convergence of sequences and series using analytical and numerical methods such as the Cauchy Root Test and D'Alembert Ratio Test.

CO4. Approximate and interpret the radius of convergence of power series for practical and theoretical applications.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2026-27
Course Title: Analysis Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -3333

Examination Time: 3 Hours

Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. Generate bounded sequences.
2. Visualize bounded sequences using plots.
3. Study the convergence of sequences through plotting.
4. Visualize monotonic sequences using plots.
5. Investigate convergence of series.
6. Visualization of convergence tests: Cauchy Root test and D' Alembert Ratio test.
7. Approximating radius of convergence of a power series.

Text Books:-

1. S.S. Sastry, Engineering Mathematics - Volume I (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics - Volume II (4th Edition), PHI, 2008.

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Semester-V
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-V										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-5333 BECL-5333 BSNL-5333 BCSL-5333	Mathematics (Statics and Dynamics)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-5333 BECP-5333 BSNP-5333 BCSP-5333	Statics and Dynamics Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

DSC- Discipline Specific Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Four Year Undergraduate Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Bachelor of Arts/ Bachelor of Science (Honours)
Semester-VI
Session: 2026-27

Programme: Bachelor of Arts/ Bachelor of Science (Honours) Semester-VI										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-6333 BECL-6333 BSNL-6333 BCSL-6333	Mathematics (Multivariate Calculus)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
BARP-6333 BECP-6333 BSNP-6333 BCSP-6333	Multivariate Calculus Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

DSC- Discipline Specific Course

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–V
Session: 2026-27
Course Title: Mathematics (Statics and Dynamics)
Course Code: BARL/ BECL/ BSNL/ BCSL -5333
Course Outcomes

CO1: Students will be able to analyze systems of coplanar forces using laws of composition and resolution, and determine conditions of equilibrium.

CO2: Students will be able to apply concepts of moments and friction to solve problems involving equilibrium on rough planes and parallel force systems.

CO3: Students will be able to apply Newton's laws of motion to analyze linear and curvilinear motion, including projectile motion and connected particle systems.

CO4: Students will be able to analyze motion using concepts of work, energy, and simple harmonic motion, and apply the principle of conservation of energy.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–V
Session: 2026-27
Course Title: Mathematics (Statics and Dynamics)
Course Code: BARL/ BECL/ BSNL/ BCSL -5333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Composition and resolution of forces, parallelogram law, triangle law, polygon law, Lami's Theorem and its converse, (ג-μ) theorem, Resultant of a number of coplanar forces, Condition of equilibrium of a number of coplanar forces.

Unit II

Parallel forces, Moment of a force about a point, Varignon's theorem of moments, Friction, Kinds of Friction, Laws of friction, Problems of a body placed on a rough inclined plane, Equilibrium of a particle on a rough plane.

Unit III

Definition of velocity and acceleration, Newton's laws of motion. Weight carried by a lift, Motion of two particles connected by a string, Motion of two bodies connected by a string. Curvilinear motion of particle in a plane, Projectile and its equation of motion, time of flight, horizontal range, greatest height attained.

Unit IV

Simple Harmonic Motion, Work, Power and Energy; work done in stretching an elastic string, Conservative forces, Kinetic energy, Potential energy, Work done against gravity, Potential energy of a gravitational field, Principle of work and energy, Principle of conservation of energy

Text Books:-

1. R. S. Varma. A Text Book on Statics, Pothishala, 1962.
2. M. Ray & G.C. Sharma. A Text Book on Dynamics, S. Chand Publishers, 2005

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–V
Session: 2026-27
Course Title: Statics and Dynamics Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -5333

Course Outcomes

CO1: Students will be able to simulate particle motion under various forces using Newton's second law and analyze changes in acceleration and trajectory.

CO2: Students will be able to model and analyze oscillatory motion of a simple pendulum and study the effect of parameters like length and amplitude.

CO3: Students will be able to evaluate equilibrium conditions and compute moments (torque) for systems of forces acting on bodies.

CO4: Students will be able to simulate and analyze dynamic systems using numerical methods and predict projectile motion under given initial conditions.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–V
Session: 2026-27
Course Title: Statics and Dynamics Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -5333

Examination Time: 3 Hours

Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. To simulate the motion of a particle under various forces using Newton's second law F=ma (Students can input different forces and masses to see how the particle's acceleration and trajectory change).

2. Create a simulation that analyzes the motion of a simple pendulum (Students can explore how the period and amplitude of oscillation vary with different parameters).

3. Calculate the equilibrium of forces acting on an object. (Given the forces' magnitudes, directions, and points of application, determine whether the object is in equilibrium or not).

4. Calculate the moment of force (torque) around a specified point. (Input the force magnitude, distance from the point, and direction. Compute the resulting moment).

5. Simulate the motion of particles or rigid bodies using numerical integration methods (e.g., Euler's method). (Input initial conditions (position, velocity, mass) and external forces. Observe the dynamic behavior over time).

6. Predict the trajectory of a projectile given initial conditions such as angle, velocity, and height. (This can include air resistance and show the path of the projectile in real-time.)

Text Books:-

1. R. P. Adrian. Statics and Dynamics with Background Mathematics, Cambridge University Press, 2003. 2. C. Gomez, C. Bunks, J.P. Chancelier, F. Delebecque, M. Goursat, R. Nikoukhah, and S. Steer. Engineering and Scientific Computing with Scilab, Springer Verlag New York Inc., 1999.

SEMESTER-VI

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–VI
Session: 2026-27
Course Title: Mathematics (Multivariate Calculus)
Course Code: BARL/ BECL/ BSNL/ BCSL -6333

Course Outcomes

CO1: Students will be able to analyze functions of several variables, evaluate limits and continuity, and apply partial differentiation and Taylor's theorem to study differentiability and homogeneous functions.

CO2: Students will be able to compute double and triple integrals over various regions, apply change of variables, and use these integrals to determine area, volume, surface area, and center of mass.

CO3: Students will be able to analyze vector fields by computing gradient, divergence, and curl, and apply line and volume integrals to solve problems involving work, mass, and circulation.

CO4: Students will be able to apply major integral theorems such as Green's theorem, Stokes' theorem, and the Divergence theorem to evaluate integrals and solve physical problems.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–VI
Session: 2026-27
Course Title: Mathematics (Multivariate Calculus)
Course Code: BARL/ BECL/ BSNL/ BCSL -6333

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter:
Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Functions of several variables, limit and continuity of functions of two variables Partial differentiation, Differentiability of real valued functions of two variables, Total differentiability, sufficient condition for differentiability, Schwarz's Theorem, Young's Theorem, Euler's Theorem on homogeneous functions of two variables, Euler's Theorem on homogeneous functions of three variables, Taylor's theorem for functions of two variables.

Unit II

Double integration over rectangular and non-rectangular region, Change of variables in double integrals, Triple integrals, Triple integral over a parallelepiped and solid regions, Change of variables in triple integrals, Area by use of double integrals, Volume by use of triple integration, Surface Area by use of double integrals, Centre of Gravity (or Centre of Mass) in R^2, Centre of Mass in R^3

Unit III

Definition of vector field, divergence and curl, directional derivatives, Divergence of a vector point function, Solenoidal Vector, Irrotational Vector, Physical interpretation of Curl of a vector point function, Laplacian operator, Integration of Vectors, the gradient, Tangential Line integrals, Applications of line integrals: Mass and Work, conservative vector fields, Circulation, Volume Integral .

Unit IV

The Divergence theorem, Green's theorem in a plane, Stoke's theorem and problems based on these theorems.

Text Books:-

1. G.B. Thomas and R.L. Finney. Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley, and K. J. Smith. Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba, and A. Weinstein. Basic Multivariable Calculus, Springer (SIE), Indian reprint, 2005.
4. J. Stewart. Multivariable Calculus Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001

Reference Books:-

1. S.R. Ghorpade & B.V. Limaye. A Course in Multivariable Calculus and Analysis, Springer, 2020.
2. M. Fitzpatrick. Advanced Calculus, American Mathematical Society, 2006.
3. T.M. Apostol. Calculus-II: An Indian Adaptation, Wiley India, 2023

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–VI
Session: 2026-27
Course Title: Multivariate Calculus Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -6333

Course Outcomes

CO1: Students will be able to determine and visualize maxima and minima of functions of two variables and plot surfaces $z=f(x,y)$.

CO2: Students will be able to approximate areas and volumes using double integrals.

CO3: Students will be able to approximate triple integrals for evaluating volumes and related quantities.

CO4: Students will be able to represent and analyze vector fields in a plane graphically.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–VI
Session: 2026-27
Course Title: Multivariate Calculus Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP -6333

Examination Time: 3 Hours

Max. Marks: 50
Practical: 35
CA: 15

L T P
0 0 1

List of Practicals (using any package)

1. Finding and visualizing extremes of function of two variables.

2. Approximating area and volume using double integration.

3. Plotting graph of the surface z=f (x, y).

4. Approximating triple Integrals.

5. Draw vector fields in plane.

Text Books:-

1. G.B. Thomas and R.L. Finney. Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley, and K. J. Smith. Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba, and A. Weinstein. Basic Multivariable Calculus, Springer (SIE), Indian reprint, 2005.
4. J. Stewart. Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Years Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Physics) (FYIP)
Semester-I
Session- 2026-27

Master of Science (Physics) (FYIP) (Semester-I)										
Course Code	Course Title	Course Type	Hours per week L-T-P	L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							Th	P		
FPHL-1335	Mathematical Physics-I	C	4-0-0	4-0-0	4	100	70	-	30	3

C-Compulsory

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Five Years Integrated Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Physics) (FYIP)
Semester-II
Session- 2026-27

Master of Science (Physics) (FYIP) (Semester-II)										
Course Code	Course Title	Course Type	Hours per week L-T-P	L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							Th	P		
FPHL-2335	Mathematical Physics-II	C	4-0-0	4-0-0	4	100	70	-	30	3

C-Compulsory

Master of Science (Physics) (FYIP)
Semester–I
Session: 2026-27
Course Title: Mathematical Physics-I
Course Code: FPHL-1335

Course outcomes

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

CO1: Understand the concept of function plotting and series approximations using Taylor and binomial series. Students will learn to solve first-order differential equations (separable, homogeneous, exact/inexact) and second-order linear differential equations using operator methods and Wronskian concepts.

CO2: They will learn advanced techniques for solving second-order differential equations using the methods of undetermined coefficients and variation of parameters. Students will also understand Euler's differential equations and solve systems of simultaneous differential equations. Additionally, they will grasp fundamental concepts of vector algebra including scalar and vector products and their geometric interpretations.

CO3: Learn the basics of vector calculus including directional derivatives, gradient, divergence, curl, and Laplacian. Students will understand and apply vector identities and evaluate double and triple integrals, including change of order and Jacobians.

CO4: They will apply vector integration to compute line, surface, and volume integrals. Students will understand and verify the Gauss divergence theorem, Green's theorem, and Stokes' theorem. They will also learn the formulation of vector operators in orthogonal curvilinear coordinate systems like Cartesian, spherical, and cylindrical.

Master of Science (Physics) (FYIP)
Semester–I
Session: 2026-27
Course Title: Mathematical Physics-I
Course Code: FPHL-1335

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setters:

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 14 marks.

Unit I

Calculus: Plotting of functions. Approximation: Taylor and binomial series (statements only). First Order Differential equations (variable separable, homogeneous, non- homogeneous), exact and inexact differential equations and Integrating Factor.

Second Order Differential equations-1:Homogeneous Equations with constant coefficients. Wronskian and general solution.Particular Integral with operator method

Unit II

Second Order Differential equations-2: Method of undetermined coefficients and variation method of parameters. Eulerdifferential equation and simultaneous differential equations of First and Second order.

Vector Algebra: Properties of vectors. Scalar product and vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

Unit III

Vector Calculus:Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.
Vector Integration-1: Ordinary Integrals of Vectors. Double and Triple integrals, change of order of integration, Jacobian. Notion of infinitesimal line.

Unit IV

Vector Integration-2: Surface and volume elements. Line, surface and volume integrals of Vector fields Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their verification (no rigorous proofs).
Orthogonal Curvilinear Coordinates:
Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

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Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E.Harris,2013, 7th Edn., Elsevier.
2. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
3. Differential Equations, George F. Simmons, 2007, McGraw Hill.
4. Advanced Engineering Mathematics, D.G.Zill and W.S. Wright, 5 Ed.,2012,Jones and Bartlett Learning
5. Mathematical Physics, Goswami, 1st edition, Cengage Learning

SEMESTER-II

Master of Science (Physics) (FYIP)
Semester–II
Session: 2026-27
Course Title: Mathematical Physics-II
Course Code: FPHL-2335

Course outcomes

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

CO1: Understand the concept of Fourier series and the orthogonality of sine and cosine functions. Students will be able to expand periodic functions using Fourier series, determine Fourier coefficients for even and odd functions, and apply Parseval's identity to the summation of infinite series.

CO2: They will learn the Frobenius method for solving second-order linear differential equations with singular points. Students will understand the Legendre, Bessel, Hermite, and Laguerre differential equations along with important properties and recurrence relations of Legendre polynomials.

CO3: Learn the expansion of functions in terms of Legendre polynomials and the properties of Bessel functions of the first kind. Students will understand the generating functions, recurrence relations, zeros, and orthogonality of special functions, and apply Beta and Gamma functions in evaluating special integrals.

CO4: They will understand and solve partial differential equations using the method of separation of variables. Students will be able to solve Laplace's equation in rectangular geometry, wave equations for vibrating systems, and the 1D heat conduction equation for physical applications.

Master of Science (Physics) (FYIP)
Semester–II
Session: 2026-27
Course Title: Mathematical Physics-II
Course Code: FPHL-2335

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 14 marks.
Note: Students can use Non-Scientific calculators or logarithmic tables.

Unit I

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Parseval Identity and its application to summation of infinite series.

Unit II

Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations.

Unit III

Special Functions-2: Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality

Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions.

Unit IV

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular geometry. Solution of wave equation for vibrational modes of a stretched string, rectangular and circular membranes. Solution of 1D heat flow equation (equation not to be derived).

Reference Books:
1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
5. Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press
6. Mathematical methods for Scientists & Engineers, D.A. Mc Quarrie, 2003, Viva Books

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Two Year Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Chemistry)

Session: 2026-27

Master of Science (Chemistry) Semester-II										
Course Code	Course Title	Course Type	Hours Per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	TH	P	CA	
MCHL-2336	Mathematics for Chemists	C	2-0-0	2-0-0	2	50	35	-	15	3

C- Compulsory

Master of Science (Chemistry)
Semester-II
Session 2026-27
Course Title: Mathematics for Chemists
Course Code-MCHL-2336

Course Outcomes

After the successful completion of this subject, the students should be able to:

CO 1: Understand the trigonometric functions with the help of unit circle and application of trigonometric identities and able to solve determinants with the help of its various properties.

CO 2: Demonstrate the concept of matrices and type of matrices and how to calculate transpose, adjoint and inverse of matrices. Manage to solve problems related to addition, subtraction and multiplication and to understand the concept and solve system of linear equations.

CO 3: Solve Complex problems related to derivative of sum, difference, product and quotient of functions and also to find derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions.

CO 4: Recognize integration as an inverse of differentiation and to calculate area under curve and understand integrals as limit of sum and its geometrical interpretation.

Master of Science (Chemistry)
Semester-II
Session 2026-27
Course Title: Mathematics for Chemists
Course Code-MCHL-2336

Examination Time: 3 Hours | Max. Marks: 50
LT P | Theory: 35
2 0 0 | CA: 15

Instructions for the Paper Setters:
Eight questions of equal marks (7 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Trigonometry:

Definition of sin, cos, tan, cot, sec, cosec functions with the help of unit circle, values of sin x, cos x for x = 0, π/6, π /3, π /2. Trigonometric identities (without proofs) and their applications.

Unit II

Matrices and Determinants:

Introduction to various forms of Matrices, row, column, diagonal, unit, Sub matrix, square, equal matrices, null, symmetric and skew symmetric matrices, transpose of a matrix, adjoint and inverse of matrices. Addition, multiplication, Rank of matrix, condition of consistency of a system of linear equations. Definition and expansion properties of determinants, product of two determinants of 3rd order.

Unit III

Differential Calculus

Differentiation of standard functions, derivative of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, differentiation of implicit functions, logarithmic differentiation

Unit IV

Integral Calculus

Integration as an inverse of differentiation, indefinite integrals of standard forms, method of substitution, method of partial fractions, integration by parts, definite integrals, area under a curve. Reference Books:

1. Mathematics Textbook for class XI, NCERT

2 Mathematics Textbook for class XII, NCERT

3. J. B. Dence, Mathematical Techniques in Chemistry, John Wiley & Sons, First edition, 1975.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Two Year Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Botany)
Semester-II

Session: 2026-27

Master of Science (Botany) Semester-II										
Course Code	Course Title	Course Type	Hours Per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Th.	P	CA	
MBTL-2336	Mathematical Biology	C	3	3-0-0	3	100	70	-	30	3
MBTP-2078	Botany Practicals IV	C	6	0-0-3	3	100	-	70	30	6

C- Compulsory

Master of Science (Botany)
Semester–II
Session: 2026-27
Course Title: Mathematical Biology
Course Code: MBTL-2336

Course outcomes

After the successful completion of this subject, the students should be able to:
CO 1: Recognize linear function, power function, periodic function, exponential function and trigonometric relation and apply differentiation and integration in real life Scenario.

CO 2: Calculate differentiation and integration of some important functions by using different rules.

CO 3: Understand the concept of random experiment and laws of probability.

CO 4: State the null hypothesis and alternative hypothesis (both one way and two ways) for the application of t-test, Chi Square test and ANOVA.

Master of Science (Botany)
Semester–II
Session: 2026-27
Course Title: Mathematical Biology
Course Code: MBTL-2336

Examination time: 3 Hrs. Max. Marks- 100
L T P Theory - 70
3 0 0 CA – 30

Instructions for the Paper Setters:
Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. The question paper must contain 30% of the article/theory from the syllabus.
The students can use only Non-Programmable & Non-Storage Type Calculator and statistical tables.

Unit I

1. Linear Function: y=ax and y=ax+b
2. Power Function: $y=ax^n$.
3. Sine and cosine, trigonometric relations.
4. Exponential and Logarithmic Functions: Exponential function $y=aq^x$, logarithmic function.

Unit II

5. Differentiation and Integration: differentiation of some important functions (Linear function, Power function, Logarithmic, Exponential, Trigonometric functions), product rule and quotient rule of differentiation, chain rule of differentiation.
6. Integration: Rules of integration (Linear function, Power function, Logarithmic, Exponential, Trigonometric Functions), integration by substitution, integration of product of two functions.

Unit III

7. Probability: Random experiment, sample space events, mathematical definition of probability, addition and multiplication law of probability. Statistics: Mean, standard deviation, Normal Distribution, Simple linear regression and correlation.

Unit IV

8. Hypothesis testing: Sample Statistics and parameters, standard error, t-test as a test of single mean, chi square test as a goodness of fit and association of attributes (For uniformity, ratio and proportion), One way ANOVA & Two way ANOVA

Reference Books:

1. O.P Arora, V.K Bhandari, Mathematics, S.Dinesh and Co., Jalandhar city, Second edition, 2000 (Scope in Chapter-6)
2. O.P Arora, V.K Bhandair, Mathematics, S.Dinesh and Co., Jalandhar city, ninth edition, 2004 (Scope in Chapters-3,5,7,8)
3. P.N Arora, P.K Malhan, Biostatistics, Himalaya Publishing House, New Delhi, Second edition, 2013 (Scope in Chapters-5,6,8,9,10,11,12,13,14).

Master of Science (Botany)
Semester-II
Session: 2026-27
Botany Practicals IV
MBTP-2078
(Based on MBTL-2074, MBTL-2075 and MBTL-2336)

Course Outcomes:
After passing this course the student will be able to:
CO1: Understand structures of various cell organelles.

CO2: Examine cell divisions in plant cells.

CO3: Perform different experiments based on plant ecology.

CO4: Analyze nutrients and pigment contents in plants using various techniques.

CO5:Learn application of Statistics in Life Science.

CO6: Analyze and interpret the observations Statistically

Master of Science (Botany)
Semester-II
Session: 2026-27
Botany Practicals IV
MBTP-2078
(Based on MBTL-2074, MBTL-2075 and MBTL-2336)

Examination time: 6 Hrs. Max. Marks- 100
L T P Practical - 70
0 0 3 CA – 30

Instructions for the paper setter: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Practicals

Based on MBTL-2074:

1. Understanding the cytology laboratory- components of compound/electron microscope.
2. Examination of electron micrographs of eukaryotic cells with special reference to organelles.
3. Examination of various stages of mitosis and meiosis using appropriate plants material (e.g. onion root tips, onion flower buds).
4. Calculation of Mitotic and meiotic index from dividing root tip cells and pollen grains.
5. Study on cyclosis in *Tradescantia* and *Hydrilla* leaves.
6. Observations on Barr bodies in Squamous epithelium.
7. Preparation of Feulgen stained chromosomes in root tip cells.
8. Effect of colchicine on chromosome movements during mitosis.
9. Use of fluorescent dye to visualize cell components.

Based on MBTL-2075:

1. To determine minimum size and number of quadrats required for reliable estimate of biomass in grassland.
2. To find out association between grassland species using chi square test.
3. To analyse plant communities using Bray-Curtis ordination method.
4. To determine soil moisture content, porosity, bulk density of different soil samples collected from different locations.
5. To study chlorophyll content of SO_2 fumigated and unfumigated plant leaves.
6. To determine Na, K concentration of water sample using flame photometer.
7. To determine water holding capacity of different soil samples.
8. To determine percent organic Carbon and organic matter in different soil samples.
9. To estimate rate of CO_2 evolution from different soil using soda lime or alkali absorption method.
10. To determine sulphate content of water samples.
11. To determine O_2 content of water samples.

Based on MBTL-2336:

1. To Study the Exponential Growth of Microbes with the help of Graph.
2. To Find the rate of change of Bacterial Growth w.r.t time, nutrient etc.
3. To Study the Application of Probability in Life Sciences / Genetics.
4. To Analyse the Biostatistical data using mean and Standard deviation.
5. To Find Correlation and Regression between two Variables of Biostatistical data.
6. Application of t-test as a Single mean in Life Sciences.
7. Application of χ^2-test as a Goodness of fit in Life Sciences.
8. Application of χ^2- test in association of attributes in Life Sciences.
9. Application of Z- test as test of single Mean in Life Sciences in Botany.

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Scheme and Curriculum of Examinations of Two Year Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Science (Zoology)
Semester-II

Session: 2026-27

Master of Science (Zoology) Semester–II										
Course Code	Course Title	Course Type	Hours Per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Th.	P	CA	
MZOL-2334	Biostatistics	C	4-0-0	4-0-0	4	100	70	-	30	3

C-Compulsory

Master of Science (Zoology)
Semester–II
Session: 2026-27
Course Title: Biostatistics
Course Code: MZOL-2334

Course Outcomes

After the Successful Completion of the subject students will be able to

CO1: Represent and summarize statistical data using graphical and numerical methods, and interpret measures of central tendency, dispersion, skewness, and sampling techniques.

CO2: Apply the concepts of probability, conditional probability, Bayes' theorem, and analyze random phenomena using standard probability distributions.

CO3: Analyze multivariate data using correlation, regression, cluster analysis, and principal component analysis (PCA) for data interpretation and decision-making.

CO4: Evaluate random variables and probability distributions, and perform statistical inference using hypothesis testing techniques such as t-test, Chi-square test, F-test, and ANOVA.

Master of Science (Zoology)
Semester–II
Session: 2026-27
Course Title: Biostatistics
Course Code: MZOL-2334

Examination Time: 3 Hrs | Max. Marks: 100
L T P | Theory: 70
4 0 0 | CA: 30

Instructions for the Paper Setter:
Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.
The students can use only Non Programmable& Non Storage Type Calculator and statistical tables.

Unit I

Elementary Statistics: Representation of data- discrete data, continuous data, histogram, polygons, frequency curves. The mean Variability of data, Standard deviation. Median, Quantiles, Percentile, Skewness, Box and whisker diagrams (box plots), Introduction to statistical sampling from a population, Random Sampling.

Unit II

Probability: Experimental Probability, Probability when outcomes are equally likely, Subjective Probabilities, Probability laws Probability rules for Combined events, Conditional Probability and Independent Events, Probability trees, Bayes theorem. Probability Distribution Bernoulli Distribution, Binomial Distribution Poisson Distribution Uniform Distribution Normal Distribution.

Unit III

Multivariate Analysis: Regression and correlation:, Correlation & Regression, Scatter diagram, Regression function, Linear correlation and regression lines, Product moment correlation coefficient. Cluster analysis: Basics (Tree clustering), Distance Measures, Hierarchial tree, linkage rules (single and complete linkage, UPGMA), Two-way joining, k-means clustering and interpretation of results, expectation maximization. Principal Component Analysis (PCA): Principles and Applications to real life data

Unit IV

Random Variables Discrete and continuous Random variables Cumulative distribution function, Probability Mass function, Probability Density Function Expectation of random variables. Hypothesis Testing: Fischer test, Chi Square test, Student t test, One way ANOVA & Two way ANOVA

Text Books:

1. Brian S., Ripley D. and Venables W. N. (2002). Modern Applied Statistics. Springer Verlag
2. J. Crawshaw and J Chamber (2002) Advanced level Statistics, 4th Edition, Melson Thornes.
3. Kapoor V.K. and Gupta S.C. (2000) Fundamentals of Mathematical Statistics. Sultan Chand and Company, New Delhi
4. Gupta S.P. (2000). Statistical methods. Sultan Chand and Company, New Delhi.
5. Mendenhall W. and Sincich T. (1995). Statistics for engineering and sciences (IVth edition). Prentice Hall.
6. Elhance D.N. (1984). Fundamentals of Statistics. Kitab Mahal, Allahabad.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Four Year Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Bachelor of Arts/Bachelor of Science (Honours) (Economics)
Semester-II

Session- 2026-27

Bachelor of Arts/Bachelor of Science (Honours) (Economics) Semester-II										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							TH	P		
BARL-2453/ BECL-2453	Quantitative Techniques (Quantitative Techniques- II)	E	4-0-0	4-0-0	4	100	70	-	30	3

E-Elective

Bachelor of Arts/Bachelor of Science (Honours) (Economics)
Semester-II
Session: 2026-27
Course title: Quantitative Techniques (Quantitative Techniques–II)
Course Code: BARL-2453/BECL-2453

Course Outcomes

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

CO 1: Solve linear equations of two variables and its applications in economics under the quadratic equations, arithmetic progression, geometric progression and their applications in economics.

CO 2: Develop understanding of elements of analytical geometry, straight lines, basic concepts of permutations and combinations.

CO 3: Differentiate between a constant and a variable, graph of linear and quadratic functions and its applications in economics.

CO 4: Recognize derivative of implicit functions, parametric functions, exponential functions, logarithmic functions and how to apply these derivatives in economics theory.

Bachelor of Arts/Bachelor of Science (Honours) (Economics)
Semester-II
Session: 2026-27
Course title: Quantitative Techniques (Quantitative Techniques–II)
Course Code: BARL-2453/BECL-2453

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 70
4-0-0 | CA : 30

Note: Instructions for the Paper–Setters/Examiners:
Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit I

Solution of Linear Equations: Solution of Simultaneous Linear Equations (up to two variable case), Application of Linear Equation in Economics; Solution of Quadratic Equations. Series: Arithmetic Progression Series, Geometric Progression Series and their applications in economics.

Unit II

Elements of Analytical Geometry: Straight line; Concepts of combination and permutation, Elements of set theory, union, intersection, difference, symmetric difference, complementation, Venn diagrams.

Unit III

Difference between a constant and a variable, concept of functions, classifications of functions, graph of linear and quadratic functions (Economic applications). Limits and continuity of a function. Concept of differentiation (ab-intioprinciple).

Unit IV

Derivatives (Excluding Trigonometric / and Inverse Functions): Rules of derivatives; functions of functions rule; derivatives of implicit functions, parametric functions, exponential functions, logarithmic functions (Application in Economics).

Reference Books:

1. Monga, G.S.: Mathematics and Statistics for Economics
2. Yamane, Taro: Mathematics for Economists.
3. Allen, R.G.D.: Mathematical Analysis for Economists.
4. Edward T Dowling: Introduction to Mathematical Economics.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Scheme and Curriculum of Examinations of Two Year Degree Programme
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Master of Computer Applications (MCA)
Semester-I

Session: 2026-27

Master of Computer Applications (MCA) Semester-I										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							Th	P		
MCAL-1331	Fundamental Mathematics for Computing	B	2-0-0	2-0-0	2	50	35	-	15	3

B-Bridge Course

Programme: Master of Computer Applications
Semester – I
Course Title: Fundamental Mathematics for Computing
Course Code: MCAL-1331

Course Outcomes

CO1: Demonstrate an understanding of fundamental concepts of set theory and perform set operations to solve problems relevant to computing applications.

CO2: Apply the principles of mathematical logic, logical connectives, equivalence, tautologies, and contradictions to analyze and construct logical arguments.

CO3: Perform matrix operations, including addition, multiplication, transpose, and scalar multiplication, and apply matrices to solve computational and mathematical problems.

CO4: Compute determinants, adjoints, and inverses of matrices, and solve systems of linear equations using determinant-based methods.

Programme: Master of Computer Applications
Semester – I
Course Title: Fundamental Mathematics for Computing
Course Code: MCAL-1331

Examination Time : 3 Hrs. Max. Marks: 50
L-T-P Theory: 35
2-0-0 CA: 15

Instructions for Paper Setter - Eight questions of equal marks (7 Marks each) are to set, two in each of the four sections (A- D). Questions of sub-sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

SET THEORY: Set Introduction, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set.

Unit-II

MATHEMATICAL LOGIC: Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation), Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.

Unit-III

MATRICES: Matrix Introduction, Types of Matrices (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix, Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.

Unit-IV

DETERMINANT: Determinant, Minor, Cofactor, Adjoint of a matrix, Inverse of a matrix, Solution of System of Linear equations using determinants.

Text Books

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, Mc Graw Hill, 6th Edition.

2. College Mathematics, Schaum's Series, TMH. 2. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.

3. Deo Narsingh, Graph Theory with Application to Engineering and Computer Science, Prentice Hall, India, 1979. 4. Vasishtha A. R. and Vasishtha A. K., Matrices, Krishna Prakashan, 2022.

Reference Books :

1. Discrete Mathematics and its applications, Kenneth H. Rosen, (Fifth Edition), Tata McGraw Hill Publishing Company.

2. Theory and Problems of Discrete Mathematics, Semmour Lipschutz, Marc Lipson, Second Edition, Schaum's Outline, T.M.H

3. Elementary Mathematics, Dr. RD Sharma 4. Comprehensive Mathematics, Parmanand Gupta

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Four Year Degree Programme

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Bachelor of Science (Honours) (Bio-Technology) Four Year Degree Programme
Semester-III

Session: 2026-27

Bachelor of Science (Honours) (Bio-Technology) Semester-III										
Course Code	Course Title	Course Type	Hours per week L-T-P	Credits L-T-P	Total Credits	Marks				Examination Time (in Hours)
						Total	Ext.		CA	
							Th	P		
BBTM-3332	Biomathematics and Biostatistics	DSC	3-0-2	3-0-1	4	100	50	20	30	3+3

DSC-Discipline Specific Course

Bachelor of Science (Honours) (Bio-Technology)
Semester–III
Session 2026-27
Course Title: Biomathematics and Biostatistics
Course Code: BBTM-3332

Examination Time: (3+3) Hours | Max. Marks: 100
L-T-P | Theory: 50
3-0-1 | Practical: 20
CA: 30

Instructions for the paper setters: Eight questions of equal marks (10 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

Scientific notation, Significant digits, Rounding off, Scientific notations, Sampling, Problem identification, Concept of population and samples, Random sampling, Data collection, Log, Indices, Design of experiments, differentiation and integration of trigonometric functions, inverse trigonometric functions, logarithmic functions and exponential functions, logarithmic differentiation & integration, results relating to the sum, difference, product and quotient of functions (without proofs).

Unit-II

Measurement of central tendency, mean, geometric mean, harmonic mean, Median, Mode, Quartile mean, decile, percentile, Dispersion, Mean deviation, Standard deviation, Standard error, Coefficient of variation , Variance, Coefficient of determinant, moments, skewness and kurtosis

Unit-III

Graphical representation of data, scattered diagram, Straight line, Least square test, Correlation coefficient, Regression coefficient, Correction of experimental data and model development

Unit-IV

Testing of hypothesis, null and alternate hypothesis, type-I, TYPE II errors, level of significance, Normal distribution, Binomial distribution, Student ‘t’-test, ‘F’-test, chi- square test, analysis of variance (One-way and Two way ANOVA)

Text Books:

1. Kothari, C.R. (2004) Research Methodology Methods and Techniques, New Age International Publications, New Delhi

2. Arora, P.N. & Malhan, P.K. : Biostatistics (Himalaya Publication House)

3. Robert R. Sokal and F. James Rohlf Introduction to Biostatistics

Practicals:

1. Graphical representation of data (bar charts, line graphs)
2. Introduction to Statistical Computing
3. Computation of Descriptive Statistics
4. Paired samples t test, and One Way ANOVA,
5. Repeated Measures ANOVA
6. Fisher exact test
7. Computation of Correlation coefficient (Pearson, Spearman) and Linear Regression model
8. Performs unpaired t test, Weldh's t test (doesn't assume equal variances) and paired t test