SYLLABUS
of
Interdisciplinary Courses Under Mathematics

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26

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: 2025-26

Bachelor of Arts/ Bachelor of Science (Honours) Semester-I											
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Honours)	BARL-1333 BECL-1333 BSNL-1333 BCSL-1333	Mathematics (Algebra)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
Bachelor of Arts/ Bachelor of Science (Honours)	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

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–I
Session: 2025-26
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: 2025-26
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 consistency of 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: 2025-26
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: 2025-26
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 eigenvalues 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.

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: 2025-26

Bachelor of Arts/ Bachelor of Science (Honours) Semester-II											
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Honours)	BARL-2333 BECL-2333 BSNL-2333 BCSL-2333	Mathematics (Advanced Calculus)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
Bachelor of Arts/ Bachelor of Science (Honours)	BARP-2333 BECP-2333 BSNP-2333 BCSP-2333	Calculus Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

Bachelor of Science (Honours)	BSNL-2330 BCSL-2330	Statistical Analysis Using Spreadsheet	SEC	1-0-0	1-0-0	1	50	35	-	15	3
Bachelor of Science (Honours)	BSNP-2330 BCSP-2330	Statistical Analysis Using Spreadsheet 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–II
Session: 2025-26
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: 2025-26
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: 2025-26

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: 2025-26

Course Title: Calculus Laboratory

Course Code: BARP/ BECP/ BSNP/ BCSP -2333

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
L T P | CA: 15
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 (4th Edition), PHI, 2008.
2. S.S. Sastry, Engineering Mathematics -Volume II (4th Edition), PHI, 2008.

Bachelor of Science (Honours)
Semester–II
Session: 2025-26
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: 2025-26
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: 2025-26
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: 2025-26
Course Title: Statistical Analysis Using Laboratory
Course Code: BSNP/ BCSP-2330

Examination Time: 3 Hours | Max. Marks: 50

Practical: 35
C A: 15

L T P
0 0 2

List of Practicals

1. Introduction of basics of excel and functions such as ‘sum’, ‘count’, ‘countif’, ‘max’, ‘min’, ‘sort’ etc.
2. To prepare result from the data on marks and number of credits in a given number of courses of a class based on total marks, marks obtained, percentage of marks obtained, grades, and determine SGPA for each student.
3. Create frequency distribution table; plot histogram, bar chart, pie chart, etc.
4. Plotting two dimensional graphs.
5. To find measures of central tendency for a given data.
6. To find measures of dispersion for a given data.
7. To find measures of skewness and kurtosis for a given data.
8. To find Karl Pearson Coefficient of correlation and rank correlation coefficient for a givendata.
9. 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.

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-III

Session: 2025-26

Bachelor of Arts/ Bachelor of Science (Honours) Semester-III											
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Honours)	BARL-3333 BECL-3333 BSNL-3333 BCSL-3333	Mathematics (Differential Equations)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
Bachelor of Arts/ Bachelor of Science (Honours)	BARP-3333 BECP-3333 BSNP-	Differential Equations Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

	3333 BCSP-3333										

DSC-Discipline Specific Course

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–III
Session: 2025-26
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: 2025-26
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: 2025-26

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: 2025-26
Course Title: Differential Equations Laboratory
Course Code: BARP/ BECP/ BSNP/ BCSP-3333

Examination Time: 3 Hours | Max. Marks: 50
Practical: 35
L T P | CA: 15
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-Kutta method.
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-Kutta method.
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

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: 2025-26

Bachelor of Arts/ Bachelor of Science (Honours) Semester-IV											
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Honours)	BARL-4333 BECL-4333 BSNL-4333 BCSL-4333	Mathematics (Analysis)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
Bachelor of Arts/ Bachelor of Science (Honours)	BARP-4333 BECP-4333 BSNP-	Analysis Laboratory		0-0-2	0-0-1	1	50	-	35	15	3

	4333 BCSP-4333										

DSC-Discipline Specific Course

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2025-26
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: 2025-26
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 test and 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: 2025-26

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: 2025-26

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.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three Year Degree Programme

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

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-V

Session: 2025-26

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-V												
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Economics)/ Bachelor of Science (Non-Medical)/ Bachelor of Science (Computer Science)	BARM-5333 BECM-5333 BSNM-5333 BCSM-5333	(I)	Mathematics (Dynamics)	E/C	4-0-0	4-0-0	4	100	80	-	20	3
Bachelor of Arts / Bachelor of Science (Economics)/ Bachelor of	BARM-5333 BECM-5333	(II)	Mathematics (Number Theory)		3-0-0	3-0-0	3	75	60	-	15	3

Science(Non-Medical)/ Bachelor of Science (Computer Science	BSNM-5333 BCSM-5333											

C-Compulsory

E-Elective

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–V
Session: 2025-26
Course Title: Mathematics (Dynamics)
Course Code: BARM /BECM / BSNM /BCSM -5333(I)
Course Outcomes

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

CO 1: Demonstrate the basic relations between distance, time, velocity and acceleration, manage to solve the problems of Newton's Laws of Motion and the motion of particles connected by a string.

CO 2: Illustrate motion along a smooth inclined plane. Solve different types of problems with Variable Acceleration. Discuss Simple Harmonic Motion.

CO 3: Understand the concept of projectile, oscillating system.

CO 4: Define Work, Power and Energy and explain their relationship. Use measurement tools to apply the concepts of Work and power to solve real life problems. Identify the different types of energy.

Bachelor of Arts /Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–V
Session: 2025-26
Course Title: Mathematics (Dynamics)
Course Code: BARM /BECM / BSNM /BCSM -5333(I)

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 80
4 0 0 | CA: 20

Instructions for the paper setter:
Eight questions of equal marks (16 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.

Unit I
Rectilinear motion in a straight line with uniform acceleration, Newton's laws of motion. Motion of two particles connected by a string.

Unit II
Motion along a smooth inclined plane, Variable acceleration, Simple Harmonic Motion.

Unit III
Curvilinear motion of particle in a plane, Definition of velocity and acceleration, projectiles, velocity and direction of motion of a projectile after a given time, projectiles on an inclined plane. Oscillations: Free Vibrations, Simple Pendulum, Conical Pendulum.

Unit IV
Work, Power and Energy: Kinetic and Potential energy, Conservative forces. Theorem of conservation of energy. Work done against gravity.

Text Book:

R. Kumar, Fundamentals of Dynamics, Pardeep Publications, Jalandhar city, second edition, 2004

Reference Books:

1.F. Chorlton, Text Book of Dynamics, CBS Publishers, New Delhi, second edition, 2004 (Scope in chapters 3,8).

2. S.R. Gupta, Elementary Analytical Dynamics, S. Chand and Company, New Delhi, Fourteenth Edition, 1983(Scope in chapters 1,2,3)

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–V
Session: 2025-26
Course Title: Mathematics (Number Theory)
Course Code: BARM /BECM / BSNM /BCSM -5333(II)
Course Outcomes

Successful completion of this course will enable the students to:

CO 1: Prove results involving divisibility and greatest common divisors.

CO 2: Find solutions of specified linear Diophantine equation, basic properties of Congruences.

CO 3: Solve system of linear congruence. Apply Fermat's and Wilson's theorem to solve numerical problems.

CO 4: Apply Euler's theorem and apply properties of phi functions in real world problems. Understand application of important arithmetic functions.

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–V
Session: 2025-26
Course Title: Mathematics (Number Theory)
Course Code: BARM /BECM / BSNM /BCSM -5333(II)

Examination Time: 3 Hours | Max. Marks: 75
L T P | Theory: 60
3 0 0 | CA: 15

Instructions for the Paper Setter:
Eight questions of equal marks (12 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.

Unit I

The division algorithm, The greatest common divisor, least common multiple, The Euclidean algorithm.

Unit II

The Diophantine equation ax + by = c, Prime numbers and their distribution, the fundamental theorem of arithmetic, Basic properties of congruences.

Unit III

Linear congruences, Special divisibility tests, Chinese remainder theorem, The Fermat's theorem, Wilson's theorem

Unit IV

Euler's Phi function, Euler's theorem, some properties of the Phi Function, σ and τ functions, Mobius Inversion formula, Greatest integer function

Text Book:

D. M. Burton, Elementary Number Theory, Mc Graw-Hill, seventh edition, 2010.

Reference Book:

Niven and Zuckerman, An Introduction to the theory of Numbers, John Willey & Sons, 1991.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

Scheme and Curriculum of Examinations of Three Year Degree Programme

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

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-VI

Session: 2025-26

Bachelor of Arts/ Bachelor of Science (Economics, Non-Medical, Computer Science) Semester-VI												
Programme Name	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		
Bachelor of Arts/ Bachelor of Science (Economics)/ Bachelor of Science (Non-Medical)/ Bachelor of Science (Computer Science)	BARM-6333 BECM-6333 BSNM-6333 BCSM-6333	(I)	Mathematics (Linear Algebra)	E/C	4-0-0	4-0-0	4	100	80	-	20	3
Bachelor of Arts /	BARM-6333	(II)	Mathematics (Numerical		3-0-0	3-0-0	3	75	60	-	15	3

Bachelor of Science (Economics)/ Bachelor of Science(Non-Medical)/ Bachelor of Science (Computer Science	BECM-6333 BSNM-6333 BCSM-6333		Analysis)									

C-Compulsory

E-Elective

Bachelor of Arts/Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–VI
Session- 2025-26
Course Title: Mathematics (Linear Algebra)
Course Code: BARM /BECM / BSNM /BCSM -6333(I)
Course Outcomes

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

CO 1: Express the algebraic concepts such as binary operation, groups, rings and fields. Define a vector space and subspace of a vector space and check the linear dependence and linear independence of vectors.

CO 2: Describe the concepts of basis and dimension of vector spaces.

CO 3: Investigate properties of vector spaces and subspaces using linear transformation.

CO 4: Find the matrix representing a linear transformation.

Bachelor of Arts/Bachelor of Science (Economics, Non-Medical, Computer Science)
Semester–VI
Session: 2025-26
Course Title: Mathematics (Linear Algebra)
Course Code: BARM /BECM / BSNM /BCSM -6333(I)

Examination Time: 3 Hours | Max. Marks: 100
L T P | Theory: 80
4 0 0 | CA: 20

Instructions for the paper setters/examiners:

Eight questions of equal marks (16 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

Definition of groups, rings and fields with examples. Definition of a vector space, subspaces with examples. Direct sum of subspaces. Linear span, Linear dependence, Linear independence of vectors. Linear combination of vectors.

Unit II

Basis of a vector space, Finitely generated vector spaces. Existence theorem for basis. Invariance of the number of elements of the basis set. Dimension of sum of two subspaces. Quotient space and its dimension.

Unit III

Linear transformation. Algebra of linear transformation. Rank-Nullity theorem, Isomorphism and Isomorphic spaces.

Unit IV

Matrix of a linear transformation. Changes of basis, Linear operator.

Text Book:

C.W.Curtis, Linear Algebra, Springer, New York, 2017

Reference Books:

1.S. Singh, Linear Algebra, Vikas Publishing, sixth edition, 1983.

2.V. Krishnamurthy, V. P. Mainra and J. L. Arora, An Introduction to Linear Algebra, East West Press, 1976.

3.S. Narayan and P.K. Mittal, A Text Book of Matrices, S. Chand & Co, tenth edition, 1972.

Bachelor of Arts/Bachelor of Science (Economics, Non-Medical, Computer Science)

Semester–VI

Session: 2025-26

Course Title: Mathematics (Numerical Analysis)

Course Code: BARM /BECM / BSNM /BCSM -6333(II)

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

CO 1. Know how to find the roots of transcendental and polynomial equations.

CO 2. Perform computation for solving a system of equations.

CO 3. Learn how to interpolate the given set of values.

CO 4. Learn numerical solution of differential equations & compute numerical integration and differentiation, numerical solution of ordinary differential equations.

Bachelor of Arts/Bachelor of Science (Economics, Non-Medical, Computer Science)

Semester–VI

Session: 2025-26

Course Title: Mathematics (Numerical Analysis)

Course Code: BARM /BECM / BSNM /BCSM -6333(II)

Examination Time: 3 Hours | Max. Marks: 75

L T P | Theory: 60

3 0 0 | CA: 15

Instructions for the Paper Setter: Eight questions of equal marks (12 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.

Unit I

Error generation, propagation, error estimation and error bounds, Solution of non-linear equations, Bisection method, Iteration method, Newton's Method, Generalized Newton's Method, Method of false position, Muller's method, Rate of convergence of these methods.

Unit II

Solution of linear system of equation; Direct method, Gauss elimination variant (Gauss Jordan and Crout reduction), Triangular Method, Iterative Method, Jacobi's Method, Gauss Seidel Method. Finite Differences: Forward, Backward, Central, Divided differences, shift operator, relationship between the operators and detection of errors by use of difference operator. Interpolation with divided difference, Newton's formula, Lagrangian Method.

Unit III

Finite difference interpolation, Gauss formula, Stirling formula, Bessel's formula, Error Estimation Extrapolation. Numerical differentiation, Method based on interpolation. Numerical Integration, Trapezoidal rule, Simpson's rule, Weddle rule, Romberg Integration, Gaussian integration method, Gaussian legendre integration. Double numerical integration.

Unit IV

Numerical solution of ordinary differential equations, Initial value problem, Taylor's method, Euler's methods, Picard's method, Milne's Method, Runge-Kutta Method. Predictor- Corrector's Method.

Text Book:

M K Jain, S R K Iyenger, R K Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Private Limited, Seventh edition, 2019.

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: 2025-26

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	4-0-2	4-0-1	5	100	50	20	30	3+3

DSC-Discipline Specific Course

Bachelor of Science (Honours) (Bio-Technology)
Semester–III
Session 2025-26
Course Title: Biomathematics and Biostatistics
Course Code: BBTM-3332
Course Outcomes

Upon completion of this course, students should be able to:

CO 1: Calculate Significant digits, differentiation and integration and to understand the concept of population and samples, Random sampling.

CO 2: Calculate summary statistics (mean, median, mode, range, standard deviation and variance) from the data.

CO 3: Familiar with the graphical representation of data, concepts of correlation and regression, Binomial, Poisson and Normal Distribution.

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

Bachelor of Science (Honours) (Bio-Technology)
Semester–III
Session 2025-26
Course Title: Biomathematics and Biostatistics
Course Code: BBTM-3332

Examination Time: (3+3) Hours | Max. Marks: 100
L-T-P | Theory: 50
4-0-1 | 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 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, Log, Indices. Differentiation and Integration of Standard Functions, derivative & 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, Geometrical Standard Deviation, 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. Normal distribution, Poisson distribution, Binomial distribution.

Unit-IV

Sampling Data Collection, Testing of hypothesis, null and alternate hypothesis, level of significance, Standard error, Type- I, Type-II error, Student ‘t’ test as a test of single mean and difference of mean and ‘F’ test as a test of equality of variances, Chi-square test (Goodness of fit & Association of Attributes), Wilcoxon Test, Analysis of variance (one way ANOVA).

Text Book:

P.N. Arora, P.K. Malhan, Biostatistics, Himalaya Publishing House, thoroughly revised edition, 2020.

Reference Books:

1. Mathematics Textbook for class XI, NCERT

2. Mathematics Textbook for class XII, NCERT

3. Robert R. Sokal and F. James Rohlf, Introduction to Biostatistics, Dover Publications, INC, Mincola, New York, 2nd Edition 2009

4. Kothari,C.R.(2004)ResearchMethodologyMethodsandTechniques,NewAgeInternational Publications, New Delhi

5. Arora, P.N. & Malhan, P.K.: Biostatistics (HimalayaPublicationHouse)

Practicals:

- Graphical representation of data (bar charts, linegraphs)
- Computation of Descriptive Statistics
- Paired samples t test, and One Way ANOVA
- Computation of Correlation coefficient(Pearson,Spearman)
- Computation of Linear Regression model
- Performs unpaired t test and paired t test using Graph PAD

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- 2025-26

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

Master of Science (Physics) (FYIP)
Semester–I
Session: 2025-26
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: 2025-26
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

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- 2025-26

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–II
Session: 2025-26
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: 2025-26
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 r elations.

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: 2025-26

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 2025-26
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. 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 2025-26
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 (Zoology)
Session: 2025-26

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: 2025-26
Course Title: Biostatistics
Course Code: MZOL-2334
Course Outcomes

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

CO 1: Know how to collect, analyze and interpret data and use this data to find out different measures of central tendency, dispersion, skewness, kurtosis and moments. They able to define event, outcome, trial, simple event, sample space and calculate the probability of events for more complex outcomes related to conditional, additive and multiplicative law of probability.

CO 2: Able to use and stimulate random variable, distribution function, probability mass function and probability density function using calculus to answer the quantitative questions about the outcome of probabilistic systems. And also understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of different probability distributions like Binomial, Poisson and Normal etc.

CO 3: Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

CO 4: Understand how to develop Null and Alternative Hypothesis and examine the process of Hypothesis testing with reference to one or two tailed test at a given level of significance. Also manage to solve problems using t, Z and Chi-Square test and will be able to describe the use of ANOVA for one way and two way classified data with one observation per cell.

Master of Science (Zoology)
Semester–II
Session: 2025-26
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

Statistical Method: Collection of data. Frequency distribution and its graphical representation. Measures of central tendency, dispersion, moments, skewness and kurtosis .

Unit II

Probability: Random experiment, sample space events, mathematical definition of probability, addition and multiplication law of probability. Distribution of binomial, Poisson and normal variables and (without derivation)

Unit III

Correlation and Regression: Relationship between variables, covariance, Karl-Pearson's correlation coefficient, Spearman's rank correlation coefficient, interpretation of correlation coefficients, Least square technique for regression lines (without proof), regression coefficients, relationship between correlation analysis and regression analysis.

Unit IV

Hypothesis Testing: Sample statistics and parameters, population null hypothesis, level of significance. Definitions of Chi-square test, , Application of Chi Square test as a goodness of fit and association of attributes, t-test as a test of single and difference of means and F-test as a test of equality of population variances in testing of hypothesis.
Analysis of Variance: Analysis of variance for one-way classified data.

Text Book:
S.C. Gupta, V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons, Twelth Edition, 2020

Reference Books

1. E. Batschelet, Introduction to Mathematics for Life Scientists, Springer Publisher, Third Edition, 1979
2. P.N. Arora, P.K. Malhan, Biostatistics, Himalaya Publishing House, Mumbai, Reprint 2013.

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)
Session: 2025-26

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	Mathematics for Biologists	C	3	3-0-0	3	100	70	-	30	3
MBTP-2078	Botany Practicals II	C	6	0-0-3	3	100	-	70	30	6

C- Compulsory

Master of Science (Botany)
Semester–II
Session: 2025-26
Course Title: Mathematics for Biologists
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: Use Correlation and Regression to identify the strength and direction of a linear relationship between the variables in real life scenario and manage to solve problems using t test, Chi- Square test and Z-test.

Master of Science (Botany)
Semester–II
Session: 2025-26
Course Title: Mathematics for Biologists
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.

Unit IV

8.Statistics: Mean, standard deviation, Normal Distribution, Simple linear regression and correlation.
9.Hypothesis testing: Sample Statistics and parameters, standard error, Z-test, 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)

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: 2025-26
Botany Practical II
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: 2025-26
Botany Practicals II
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 chlorophyll content in SO_2fumigated and unfumigated plant leaves.
10. To estimate rate of CO_2 evolution from different soil using soda lime or alkali absorption method.
11. To determine sulphate content of water samples.
12. 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.

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- 2025-26

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: 2025-26
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: 2025-26
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.