

Annexure F

FACULTY OF SCIENCES

SYLLABUS

For

Bachelor of Arts/Bachelor of Science (Honours)

(Semester: I - IV)

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

Session: 2025-26



The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

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 BEC-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/ BCSL/ BSNL-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/ BCSL/ BSNL-1333

Examination Time: 3 Hours

L T P
4 0 0

Max. Marks: 100

Theory: 70

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:-

1. 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/ BCSP/ BSNP-1333

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA: 15

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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	Credits	Total Credits	Marks				Examination time (in Hours)
				L-T-P	L-T-P	Total	Ext.		CA		
							Th	P			
Bachelor of Arts/ Bachelor of Science (Honours)	BARL-2333	Mathematics (Advanced Calculus)	DSC	4-0-0	4-0-0	4	100	70	-	30	3
	BECL-2333										
	BSNL-2333										
	BCSL-2333										
Bachelor of Arts/ Bachelor of Science (Honours)	BARP-2333	Calculus Laboratory		0-0-2	0-0-1	1	50	-	35	15	3
	BECP-2333										
	BSNP-2333										
	BCSP-2333										

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/ BCSL/BSNL-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 & to apply in a wide variety of disciplines like Bio, Eco, Physics & Engineering.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II

Session: 2025-26

Course Title: Mathematics (Advanced Calculus)

Course Code: BARL/BECL/ BCSL/BSNL-2333

Examination Time: 3 Hours

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4 0 0

Max. Marks: 100

Theory: 70

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 $\sin x, \cos x, e^{\cos x}, \log x$ 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

$\tan^n x \, dx, \int \cot^n x \, dx, \int \sec^n x \, dx, \int \operatorname{cosec}^n x \, dx, \int x \cos^n x \, dx, \int \cos^m x \sin^n x \, dx$, 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. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum's outline series, Schaum Publishing Co. New York.

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–II

Session: 2025-26

Course Title: Calculus Laboratory

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

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA: 15

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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 degree in x and y .
4. Tracing of conicoids: Ellipsoid, Hyperbolic paraboloid, Elliptic paraboloid, Hyperboloid of one 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: BCSL/ BSNL-2330

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

CO:1 Introduce the meaning of statistics, Collection, presentation and interpretation of data with the help of excel.

CO:2 To Enhance the knowledge of Measures of dispersion, Skewness and Bowley's co-efficient of skewness and Kurtosis.

CO:3 To comprehend the concept of Correlation and its methods with rank correlation coefficient.

CO:4 To understand the concept of Linear Regression, regression Y on X, regression X on Y, Regression Coefficient, Difference between regression and Correlation, and calculation of these using MS excel.

Bachelor of Science (Honours)
Semester–II

Session: 2025-26

Course Title: Statistical Analysis Using Spreadsheet

Course Code: BCSL/ BSNL-2330

Examination Time: 3 Hours

Max. Marks: 50

Theory: 35

CA: 15

L T P

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

Unit III

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

Unit IV

Regression analysis- Linear Regression, regression Y on X, regression X on Y, Regression Coefficient, Relations between regression coefficients and correlation coefficients, Difference between regression and Correlation, Calculation of these using MS excel.

Reference Books:-

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

Bachelor of Science (Honours)
Semester–II

Session: 2025-26

Course Title: Statistical Analysis Using Spreadsheet Laboratory

Course Code: BCSP/ BSNP-2330

Examination Time: 3 Hours

Max. Marks: 50

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0 0 2

Practical: 35
C A: 15

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.

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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: 2025-26

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

Examination Time: 3 Hours

Max. Marks: 50

Practical: 35

CA: 15

L T P

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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

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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-IV

Session: 2025-26

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

Bachelor of Arts/ Bachelor of Science (Honours)
Semester–IV
Session: 2025-26
Course Title: Analysis Laboratory
Course Code: BARP/ BECP/ BCSP/ BSNP-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.