Course Title/Code	Multivariate Calculus and Vector Calculus (MAH220B)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	Students shall be able to understand and apply the concept of multiple integral, improper integral and vector calculus.	
Course Outcomes (COs)		Mapping
CO1	Apply change of variables, change of order of integration involving double and triple integrals.	Skill Development
CO2	Apply the concept of triple integral to evaluate volume of region.	Skill Development
CO3	Analyse problems related to improper integrals.	Skill Development
CO4	Explain physical meaning of gradient of a scalar field, curl and divergence in terms of fluid flow and also be able to evaluate line integrals, surface integrals and volume integrals	Skill Development
CO5	Solve & analyze the Mathematical problems related to Integral calculus & vector calculus and its applications using mathematical software.	Skill Development
Prerequisites (if any)	Basic knowledge of sets and real number system.	

Section A

Multiple Integrals: Definition of a line integral and basic properties, Evaluation of line integrals, Definition of double integral, Conversion to iterated integrals, Evaluation of Double integral, change of variables, Surface areas. Definition of atriple integral, Evaluation, Volume as a Triple integral.

Section B

Improper Integral: Improper integrals of the first and second kinds, Convergence, Gamma and Beta functions, Connection between Beta and Gamma functions, Application to Evaluation of Integrals, Duplication formula, Sterling formula.

Section C

Vector Differentiation: Limit & Continuity of vector functions, differentiation of vector functions, tangent and normal components of vector functions, vector fields and scalar fields, gradient of a scalar field and directional derivative. Divergence and Curl of a vector field and their physical interpretations, Irrotational and Solenoidal fields. Laplacian operator.

Section D

Vector Integration: Integration of vector functions Line integral, Integrals independent of path, Surfaces in space,Surface integral, Volume integral, Gauss Divergence theorem, Stoke's theorem and Green's theorem.

References Books and Readings:

1. Calculus by Lipman Bers, Vols 1 and 2, Holt Rinehart and Winston publishers.
2. First Course in Calculus by Serge Lang, Springer.
3. Calculus – Single and Multivariable by Hughes Hallet, Wiley.
4. Calculus by Thomas and Finny, Pearson

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	1	----	----	----	----	----	----	----	3	----	----
CO2	3	1	3	1	----	----	----	----	----	----	----	3	----	----
CO3	3	1	3	1	----	----	----	----	----	----	----	3	----	----
CO4	3	1	3	1	----	----	----	----	----	----	----	3	----	----
CO5	3	1	3	1	3	----	----	----	----	----	----	3	----	----

Course Title/ Code	Probability & Statistics (MAH221B-T)	
Course Type:	Core	
Course Nature	Hard	
L-T-P	(3-0-0)	
Credits	3	
Course Objective	To equip the students with the concepts of Statistics & Probability Distributions and their applications in the real world.	
Course Outcomes (COs)	Mapping	
CO1	Compute measures of central tendency & measures ofdispersion and solve related problems in the real world.	Skill Development, Employability
CO2	Assess the shape and peakness of data and calculate thevarious methods of measurements	Skill Development, Employability
CO3	Apply correlation and regression techniques to check the dependency in data.	Skill Development, Employability
CO4	Apply the concept of probability theory and probability distributions to solve related problems.	Skill Development, Employability
CO5	Apply the knowledge of sampling theory to analyse andinterpret given data.	Skill Development, Employability
Pre-requisites	NA	

SECTION A

Measures of Central Tendency: Introduction, types of averages- Mean, Median, Mode, Quartile, Percentile

Measures of Dispersion: Introduction, Significance of measuring variations, Range, Quartile deviation, Mean deviation, Standard deviation, Relation between them, Coefficient of variation

SECTION B

Skewness, Moments & Kurtosis: Introduction, Difference between dispersion and skewness, Measures of skewness, Karl Pearson's coefficient of skewness, Moments, Moments about arbitrary point, about mean, Measures of Kurtosis.

Correlation & Regression Analysis: Introduction, Types of correlation, Karl Pearson's coefficient of correlation, Introduction to regression analysis, Difference between correlation and regression analysis, Regression lines and Regression equations.

SECTION C

Probability Distributions: Random variable, probability distribution of a discrete & continuous random variable, cumulative probability function, moments, Mathematical expectation. Theoretical Distributions: Binomial, Poisson and normal.

SECTION D

Test of significance: large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Small samples: t – test, Test for single mean, difference of means and correlation coefficients, test for ratio of variances F Test, Chi-square test for goodness of fit and independence of attributes.

References Books and Readings:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press,Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.),Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), TataMcGraw-Hill Pub. Co. Ltd.
4. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, Educational publishers, New Delhi
5. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	---	---	---	---	1	1	2	---	3	2	1
CO2	1	1	2	---	---	---	---	1	1	2	---	3	2	1
CO3	1	1	2	---	---	---	---	1	1	2	---	3	2	1
CO4	1	1	2	---	---	---	---	1	1	2	---	3	2	1
CO5	1	1	2	---	---	---	---	1	1	2	---	3	2	1

Course Title/ Code	Probability & Statistics Lab (MAH221B-P)	
Course Type:	Core	
Course Nature	Hard	
L-T-P	(0-0-2)	
Credits	1	
Course Objective	To apply the concepts of Statistics & Probability Distributions using mathematical software.	
Course Outcomes (COs)	Mapping	
CO1	Create graphical representation of Data using Charts & Diagrams inExcel	Employability
CO2	Compute Measures of Central Tendency, measures of Dispersionand coefficient of skewness in Excel	Employability
CO3	Analyse data dependency using correlation & regression techniquesin excel	Employability
CO4	Calculate probability of various distributions	Employability
CO5	Apply Statistical and probability distributions on Real time data andAnalyse the same.	Employability
Pre-requisites	NA	

List of Experiments

1. Graphical representations of data: Pie Charts, Line Graphs, Bar Graphs, Histographs, frequency polygon.
2. Calculating mean using excel
3. Calculating median and mode using excel
4. Calculate Quartile deviation, Mean Deviation
5. Calculate Standard Deviation & coefficient of variation
6. Rank & Karl Pearson's Coefficient of Correlation
7. Plotting of Regression lines
8. Compute probability of each element of the matrix row wise and column wise.
9. Discrete & continuous probability distributions.
10. Testing of hypothesis

Mini Projects:

a) Collect data live – class test scores/ survey data and generate frequency distribution table and represent it graphically.
b) Collect test scores of any school subject of any class and compute Mean, Quartile Deviation and Standard Deviation.
c) Compute coefficient of correlation among language subject papers and core subject papers like – English and History, Mathematics and Science, etc.
d) Study the sampling procedures adopted by taking various school contexts like selecting a team for school reports, team for debate competition

References Books and Readings:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The WorldPress, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7thEdn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint),Tata McGraw-Hill Pub. Co. Ltd.
4. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, Educational publishers, New Delhi
5. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	2	---	---	---	---	2	---	---	---	3	2	1
CO2	1	1	2	---	---	---	---	2	---	---	---	3	2	1
CO3	1	1	2	---	---	---	---	2	---	---	---	3	2	1
CO4	1	1	2	---	---	---	---	2	---	---	---	3	2	1
CO5	1	1	2	---	---	---	---	2	---	---	---	3	2	1

Course Title/Code	**Complex Analysis & Numerical Analysis (MAH321B-T)**	
Course Type	Core	
Course Nature	Hard	
L-T-P-Structure	3-1-0	
Credits	3	
Course Objective	Students would be able to understand and apply the concepts of complex analysis and numerical techniques for solving the mathematical problems and their applications.	
Course Outcomes (COs)		Mapping
CO1	Demonstrate understanding of the basic concepts underlying complex analysis.	Skill Development
CO2	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	Skill Development
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, and the solution of nonlinear equations.	Skill Development
CO4	Apply numerical methods in Real Life problems.	Skill Development
CO5	Solve & analyze the Mathematical problems related to Numerical Analysis and its applications using software.	Skill Development
Prerequisites (if any)	NA	

SECTION A

Numerical Methods: Numerical Solutions of Algebraic and Transcendental equations, Bisection Method, Method of false position, Newton-Raphson method. Finite differences, Forward and Backward differences, Interpolation, Newton-Gregory forward and backward interpolation formula, Divided differences, Lagrange's interpolation formula.

SECTION B

Numerical Differentiation: Finding first and second derivatives using interpolation formulae, Integration: General quadrature formula, Newton-Cotes quadrature formula, Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule, Gauss quadrature.

SECTION C

Functions of a Complex Variable: Limits, Continuous Functions, Differentiability, The Cauchy-Riemann Equations, Analytic Functions, Harmonic Functions. Conformal Mappings: Elementary Transformations, Bilinear Transformations, Cross ratio, Fixed Points of Bilinear Transformations.

SECTION D

Complex Integration: Introduction, Definite Integral, Cauchy's Theorem, Cauchy's integral Formula. Higher Derivatives. Power Series: Introduction, Sequences and Series, Sequences and Series of Functions, Power Series,

Elementary Functions. (Remove) Add: - Taylor and Laurent Series, singularities and their types, Residue Theorem Application of residue theorem.

References:

1. Theory of Functions of a Complex Variable by Shanti Narayan, S. Chand and Co. Ltd.
2. Foundations of Complex Analysis by Ponnuswamy, Narosa Publishing House.
3. Complex Variables and Applications by Churchill, Brown and Verhey, McGraw Hill International Book Company.
4. Functions of One Complex Variable by Conway, Narosa Publishing House.
5. Complex Variables, Murray R. Spiegel, Schaum Outline Series, McGraw Hill Book Company.
6. Complex Analysis by Armugam, Tangapandi, Somasundaram, Scitech Publications Pvt. Ltd.
7. Numerical Analysis by Gupta, S. Chand and Co. Ltd.
8. Finite Difference and Numerical Analysis by Saxena, S.Chand and Co. Ltd.
9. Introductory Methods of Numerical Analysis by Shastry, PHI.
10. Numerical Methods for Scientists and Engineers, Grewal, Wiley Eastern Ltd.
11. Higher Engineering Mathematics by Grewal, Wiley Eastern Ltd.
12. Numerical Calculus by William Edmund Milne, Princeton University Press.
13. Introduction to Numerical Analysis by Hildebrand, Tata McGraw Hill Publishing Ltd.
14. Numerical Analysis by Schield, Schaum's Outline Series.
15. Introduction to Numerical Methods by Peter A. Stark, MacMillan Co. Ltd.

CO PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1			2	3				2	3		1	1	3	1
CO2	2		2	3				2	3		1	3	3	1
CO3			3	2				2	3		1	2	2	1
CO4			3	3				2	3		1	3	2	1
CO5	1		2	3				2	3		1	2	3	1

Course Title/Code	**Complex Analysis & Numerical Analysis Lab (MAH321B-P)**	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	Students would be able to develop the skills for solving the mathematical problems and their applications.	
Course Outcomes (COs)		Mapping
CO1	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	Skill Development

Prerequisites (if any)	NA	

List of Programmes

1. Introduction to Conditional statements –if and else using Octave
2. Introduction to iteration-based programming – for loop using Octave
3. To find roots of an equation using Bisection method.
4. To find roots of an equation using Regula Falsi method.
5. To find roots of an equation using Newton Raphson method.
6. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
7. To find the value of a dependent variable for a given value of an independent variable using
8. Newton divided difference interpolation for a given set of data.
9. To find the value of a definite integral using Trapezoidal rule of integration.
10. To find the value of a definite integral using Simpson's 1/3 rule of integration.
11. To find the value of a definite integral using Simpson's 3/8 rule of integration.
12. To find the solution of an ordinary differential equation of first order by Euler's modified method.
13. To find the solution of an ordinary differential equation of first order by R-K method.

CO PO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	2	2	2								3		

Course Title/Code	Electrochemistry and Photochemistry Lab (CHH314-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To give an in-depth exposure of Electrochemistry and familiarize the students with basic concepts of Photochemistry	
Course Outcomes (COs)		Mapping
CO1	Explain the nature of Electrolytic conduction using different electrolytes	Skill Development
CO2	Understand the calculation of free energy change for an electrochemical cell using the measured cell potential value.	Skill Development
CO3	To be able to Measure the cell potential for an electrochemical cell.	Skill Development
CO4	Able to explain theory and practice of common photochemical and photophysical methods, and be able to execute these experimentally	Skill Development
Prerequisites		

Laboratory Techniques:

1. To study the effect of dilution on Molar Conductivity of weak and strong electrolytes.
2. Conductometric titrations
3. Construction and measurement of EMF of Cells.
   Potentiometric Titrations

4. To measure the absorbance of $KMnO_4$ solution using Colorimeter
5. To measure the absorbance of $K_2Cr_2O_7$ solution using Colorimeter
6. To measure the absorbance of $K_2Cr_2O_7$ unknown solution using Colorimeter
7. To measure the absorbance of $KMnO_4$ unknown solution using Colorimeter
8. Crystallization: Benzoic acid from hot water, naphthalene from ethanol
9. Sublimation of camphor / phthalic acid/succinic acid
10. Preparation of *p*-bromoacetanilide from acetanilide by bromination

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	-	-	3	1	-	1	1	
CO2	3	2	3	3	-	-	-	-	3	1	-	2	1	1
CO3	3	2	3	3	-	-	-	-	3	1	-		2	1
CO4	3	2	3	3	-	-	-	-	3	1	-	1	1	2

Course Title/Code	Relativity and Quantum Mechanics Lab (PHH331-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To enable students to understand the essentials of relativity and quantum mechanics, the two theories of 20th century. - To develop the ability to set up apparatus, collect data and to analyze the data for determiningthe desired physical quantity.	
Course Outcomes (COs)		Mapping
CO1	Demonstrate an ability to conduct investigations of practical/technical issues consistent with their level of knowledge and understanding while designing/performing/resolving the experiments to develop their individual capabilities and representing the collective team work. Demonstrate an ability to analyze data and reach a valid conclusion.	Employability
Prerequisites (if any)	Mathematical knowledge and experimental understanding of electronics components and their behavior is required	

The list of experiments are:

1. To determine the Planck's constant and work function of cathode material.
2. To determine the work function of cathode using thyratron valve.
3. To determine the energy band gap of a PN junction diode.
4. To determine the Hall coefficient and hence carrier concentration of a material.
5. To find the ionization potential and to verify the quantization of energy values.
6. To study the variation of magnetic field along the axis of a current carrying coil and hence to estimate the radius of the coil.
7. To study the V-I characteristics of a solar cell hence to find the fill factor.
8. To determine the wavelength of laser light using Plane transmission diffraction grating

References:

1. Advanced Practical Physics- B. L. Worsnop and Flint.
2. Practical Physics- S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics- Harnam Singh and P. S. Hemine
4. Advanced Practical Physics- Chauhan and Singh

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	3	3	----	2	----	3	3	2	1	3	1	2

Course Title/Code	Spectroscopy, Natural Products and Heterocycles (CHH315-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To give an in-depth exposure of Natural products and familiarize the students with basic concepts of Spectroscopic techniques	
Course Outcomes (COs)		Mapping
CO1	Study and understand the working of instrumentation techniques like UV, FTIR and NMR	Skill Development
CO2	Hands-on-training on the synthesis and structure elucidation of natural products	Skill Development
CO3	Synthesis of drug and macromolecules	Skill Development
CO4	Experimental understanding of heterocyclic compounds with structure elucidation	Skill Development
Prerequisites	NA	

Laboratory Synthesis

1. To synthesize Urea Formaldehyde Resin
2. To synthesize Phenol Formaldehyde
3. To Detect the presence of Carbohydrate- Glucose, Fructose, Sucrose
4. To Synthesize Osazone

Isolation and extraction of natural products.

1. Limonene from Orange peel
2. Nicotine from Tobacco
3. Lactose from Milk

Spectroscopic Experiments

1. To calculate the maximum wavelength of organic compounds using UV spectroscopy
2. To study the Effects of sample concentration Dependence of Absorbance (Beer Law)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO2	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO3	-	2	3	3	-	-	-	-	3	1	-	2	1	-
CO4	-	2	3	3	-	-	-	-	3	1	-	2	1	-

Course Title/Code	Group and Ring (MAH320B)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	To equip the students with the concepts of advanced group theory and ring structure with their properties.	
Course Outcomes (COs)		Mapping
CO1	Recognize the mathematical objects called groups & rings and apply the fundamental concepts of thesealgebraic structures	Skill Development
CO2	Explain the significance of the notions of cosets,normal subgroups, and factor groups and analyze consequences of Lagrange's theorem.	Skill Development
CO3	Illustrate structure preserving maps between different algebraic structures & its consequences.	Skill Development
CO4	Apply the basic concepts of ring of polynomials andirreducibility tests for polynomials over ring of integers.	Skill Development
CO5	Appreciate the significance of unique factorization in rings and integral domains	Skill Development
Prerequisites (if any)	NA	

SECTION – A

Group Theory I: Groups, Examples, Properties and types, Sub-groups. Cyclic groups and properties, Cosets, Lagrange'stheorem and its Consequences, Dihedral groups, Normal subgroups, Quotient groups.

SECTION B

Group Theory II: Homomorphism and Isomorphism of groups, Kernel of a Homomorphism, Fundamental theorem ofHomomorphism, Cauchy's theorem for abelian groups, Permutation group, Alternating Group, Cayley's Theorem.

SECTION C

Ring Theory I: Rings, Integral Domains, Division Rings, Fields, Properties, Field of quotients. Ideals, Quotient ringsMaximal, Prime and Principal ideals, Principal ideal ring, Divisibility in an Integral domain, Units and Associates.

SECTION D

Ring Theory II: Homomorphism of a ring, Kernel, Isomorphism, Fundamental theorem of Homomorphism, Polynomial rings, Divisibility, Irreducible polynomials, Division Algorithm, Greatest Common Divisor, Euclidean Algorithm, Unique Factorization Theorem, Eisenstein's Criterion of irreducibility.

Test Books:

- Topics in Algebra by Herstein, Vikas.

- A First Course in Abstract Algebra by Fraleigh, Addison-Wesley.
- Modern Algebra by Vasishtha, Krishna Prakashan Media Pvt. Ltd.
- Contemporary Abstract Algebra by Joseph A. Gallian, Narosa Publishing House.
- Basic Abstract Algebra, 2nd Edition by P.B.Bhattacharya, S K Jain and S R Nagpaul, Cambridge University Press.
- Modern Algebra – An Introduction by Durban, 5th Edition, Wiley.
- Algebra by Michael Artin, Prentice Hall of India Pvt. Ltd.
- A Brief Survey of Modern Algebra by Birkhoff and Maclane, IBH.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	1	2	----	----	2	1	2	----	2	2	----	----
CO2	2	3	1	2	----	----	2	1	2	----	2	2	----	----
CO3	2	3	1	2	----	----	2	1	2	----	2	2	----	----
CO4	2	3	1	2	----	----	2	1	2	----	2	2	----	----
CO5	-	-	-	-	----	----	2	-	-	----	-	-	----	----

Course Title/Code	Complex Analysis & Numerical Analysis (MAH321B-T)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	3-1-0	
Credits	4	
Course Objective	"Students (A) would be able to understand and apply (B) the concepts of complex analysis and numerical techniques (C) for solving the mathematical problems and their (D) applications."	
Course Outcomes (COs)		Mapping
CO1	Demonstrate understanding of the basic concepts underlying complex analysis .	Skill Development
CO2	Apply the methods of complex analysis to evaluate definite integrals and infinite series.	Skill Development
CO3	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, and the solutionof nonlinear equations.	Skill Development
CO4	Apply numerical methods in Real Life problems.	Skill Development
CO5	Solve & analyze the Mathematical problems related to Numerical Analysis and itS applications usingsoftware.	Skill Development
Prerequisites (if any)	NA	

Section A

Numerical Methods: Numerical Solutions of Algebraic and Transcendental equations, Bisection Method, Method of false position, Newton-Raphson method. Finite differences, Forward and Backward differences, Interpolation, Newton-Gregory forward and backward interpolation formula, Divided differences, Lagrange's interpolation formula.

Section B

Numerical Differentiation: Finding first and second derivatives using interpolation formulae, Integration: General quadrature formula, Newton-Cotes quadrature formula, Trapezoidal Rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddle's rule, Gauss quadrature.

Section C

Functions of a Complex Variable: Limits, Continuous Functions, Differentiability, The Cauchy-Riemann Equations, Analytic Functions, Harmonic Functions. Conformal Mappings: Elementary Transformations, Bilinear Transformations, Cross ratio, Fixed Points of Bilinear Transformations.

Section D

Complex Integration: Introduction, Definite Integral, Cauchy's Theorem, Cauchy's integral Formula. Higher Derivatives. Power Series: Introduction, Sequences and Series, Sequences and Series of Functions, Power Series, Elementary Functions. (Remove) Add: - Taylor and Laurent Series, singularities and their types, Residue Theorem Application of residue theorem.

References:

1. Theory of Functions of a Complex Variable by Shanti Narayan, S. Chand and Co. Ltd.
2. Foundations of Complex Analysis by Ponnuswamy, Narosa Publishing House.
3. Complex Variables and Applications by Churchill, Brown and Verhey, McGraw Hill International BookCompany.
4. Functions of One Complex Variable by Conway, Narosa Publishing House.
5. Complex Variables, Murray R. Spiegel, Schaum Outline Series, McGraw Hill Book Company.
6. Complex Analysis by Armugam, Tangapandi, Somasundaram, Scitech Publications Pvt. Ltd.
7. Numerical Analysis by Gupta, S. Chand and Co. Ltd.
8. Finite Difference and Numerical Analysis by Saxena, S.Chand and Co. Ltd.
9. Introductory Methods of Numerical Analysis by Shastry, PHI.
10. Numerical Methods for Scientists and Engineers, Grewal, Wiley Eastern Ltd.
11. Higher Engineering Mathematics by Grewal, Wiley Eastern Ltd.
12. Numerical Calculus by William Edmund Milne, Princeton University Press.
13. Introduction to Numerical Analysis by Hildebrand, Tata McGraw Hill Publishing Ltd.
14. Numerical Analysis by Schield, Schaum's Outline Series.
15. Introduction to Numerical Methods by Peter A. Stark, MacMillan Co. Ltd.

List of Programes

1. Introduction to Conditional statements –if and else using Octave
2. Introduction to iteration-based programming – for loop using Octave
3. To find roots of an equation using Bisection method.
4. To find roots of an equation using Regula Falsi method.
5. To find roots of an equation using Newton Raphson method.
6. To find the value of a dependent variable for a given value of an independent variable using Lagrange'sinterpolation method for a given set of data.
7. To find the value of a dependent variable for a given value of an independent variable using
8. Newton divided difference interpolation for a given set of data.
9. To find the value of a definite integral using Trapezoidal rule of integration.
10. To find the value of a definite integral using Simpson's 1/3 rule of integration.
11. To find the value of a definite integral using Simpson's 3/8 rule of integration.
12. To find the solution of an ordinary differential equation of first order by Euler's modified method.
13. To find the solution of an ordinary differential equation of first order by R-K method.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	**2**	**3**	----	----	-	**2**	**3**	----	**1**	**1**	**3**	**1**
CO2	**2**	-	**2**	**3**	----	----	-	**2**	**3**	----	**1**	**3**	**3**	**1**
CO3	-	-	**3**	**2**	----	-	-	**2**	**3**	----	**1**	**2**	**2**	**1**
CO4	-	-	**3**	**3**	----	-	-	**2**	**3**	----	**1**	**3**	**2**	**1**
CO5	**1**		**2**	**3**	----	-	-	**2**	**3**	----	**1**	**2**	**3**	**1**

Course Title/Code	Complex Analysis & Numerical Analysis Lab (MAH321B-P)	
Course Type	Core	
Course Nature	Hard	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	Students would be able to develop the skills for solving the mathematical problems and their applications.	
Course Outcomes (COs)		Mapping
CO1	Apply the numerical methods in real life problems	Skill Development
Prerequisites (if any)	NA	

List of Programes

1. Introduction to Conditional statements –if and else using Octave
2. Introduction to iteration-based programming – for loop using Octave
3. To find roots of an equation using Bisection method.
4. To find roots of an equation using Regula Falsi method.
5. To find roots of an equation using Newton Raphson method.
6. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
7. To find the value of a dependent variable for a given value of an independent variable using
8. Newton divided difference interpolation for a given set of data.
9. To find the value of a definite integral using Trapezoidal rule of integration.
10. To find the value of a definite integral using Simpson's 1/3 rule of integration.
11. To find the value of a definite integral using Simpson's 3/8 rule of integration.
12. To find the solution of an ordinary differential equation of first order by Euler's modified method
13. To find the solution of an ordinary differential equation of first order by R-K method.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	2	----	----	----	----	----	----	----	3	----	----