Nalbari College, Nalbari
Teaching Plan for the Session: 2022 - 23

Name of Teacher: Gautam Sarma
Department: Mathematics
Semester: II
Paper Name: Real Analysis
Paper Code: MAT-HC- 2016
Course Objectives:

The course will develop a deep and rigorous understanding of real line R and of defining terms to prove the results about convergence and divergence of sequences and series of real numbers. These concepts have wide range of applications in real life scenario.

Course Learning Out comes:

This course will enable the students to:

i) Understand many properties of the real line R, including completeness and Archimedean properties.

ii) Learn to define sequences in terms of functions from N to a subset of R.

iii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence. Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

Course outline & suggested reading:

UNIT 1: Algebraic and order properties of R, absolute value and real line, bounded sets, supremum and infimum, completeness property of R, the Archimedean property, the density theorem, intervals, nested interval theorem.

UNIT-2: Real sequences, limit of a sequence, convergent sequence, bounded sequence, limit theorems, monotone sequences, monotone convergence theorem, subsequences, monotone subsequence theorem, Bolzano Weierstrass theorem for sequences, Cauchy sequences, Cauchy's convergence criterion, properly divergence sequences.

UNIT 3: Infinite series, convergence and divergence of infinite series, Cauchy criterion, Tests for convergence: comparison test, limit comparison test, ratio test, root test, integral test, Absolute convergence, rearrangement theorem, alternating series, Leibniz test, conditional (non-absolute) convergence.

Textbooks :

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 3rdEd., John Wiley and Sons,2002.

Reference Books:

1. Gerald G. Bilodeau, Paul R. Thie, G.E. Keough, *An Introduction to Analysis*, Jones &Bartlett, Second Edition, 2010.

2. A. Kumar and S. Kumaresan, *Basic Course in Real Analysis*, CRC Press,2014.

3. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Time plan for the course :

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks	Interactive lecture		
2	Algebraic and order properties of R	Textbooks & Internet	Interactive lecture & PPT		
3	absolute value and real line	Textbooks & Internet	Interactive lecture & PPT		Assignments
4-5	bounded sets, supremum and infimum	Reference Books	Interactive lecture & discussion		Quizzes
6-7	completeness property of R, the Archimedean property	Reference Books	Interactive lecture & PPT		Assignments
8	the density theorem	Textbooks	Interactive lecture & PPT		
9-10	intervals, nested interval theorem	Textbooks	Interactive lecture & PPT		Class test
11	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
12	Unit Test – 1				
13-14	Real sequences, limit of a sequence	Reference Books	Interactive lecture & PPT		
15-17	convergent sequence, bounded sequence	Reference Books	Interactive lecture & PPT		Quizzes
18-19	limit theorems	Reference Books	Interactive lecture & discussion		Assignments
20-21	monotone sequences, monotone convergence theorem.	Textbooks & Internet	Interactive lecture & PPT		Quizzes
22-23	subsequences, monotone subsequence theorem	Textbooks & Internet	Interactive lecture & discussion		
24	Tutorial Class	Textbooks	Problem solving session		Based on active participation

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
25-26	Bolzano Weierstrass theorem for sequences	Textbooks & Internet	Interactive lecture & PPT		Assignments
27	Cauchy sequences	Reference Books	Interactive lecture & discussion		Quizzes
28-29	Cauchy's convergence criterion	Textbooks & Internet	Interactive lecture & PPT		
30-31	properly divergence sequences,	Reference Books	Interactive lecture & PPT		Class test
32	Tutorial Class	Textbooks	Problem solving session		Based on active participation
33	Unit test 2				
34-36	Infinite series	Textbooks & Internet	Interactive lecture & PPT		
37-39	convergence and divergence of infinite series,	Textbook	Interactive lecture & PPT		
40-41	Cauchy criterion, Tests for convergence:	Reference Books	Interactive lecture & discussion		Quizzes
42-43	comparison test	Textbooks & Internet	Interactive lecture & PPT		Assignments
44-45	limit comparison test	Textbooks & Internet	Interactive lecture & discussion		
46-47	ratio test	Reference Books	Interactive lecture & discussion		
48-49	root test	Reference Books	Interactive lecture & discussion		
50-51	integral test	Textbooks	Problem solving session		Assignments
52	Absolute convergence,	Textbooks	Interactive lecture & PPT		
53-54	rearrangement theorem	Textbook	Interactive lecture & discussion		Quizzes
55	alternating series	Textbook	Interactive lecture & PPT		
56-57	Leibniz test	Textbook	Interactive lecture & PPT		

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
58-59	conditional (non-absolute) convergence	Textbooks & Internet	Interactive lecture & PPT		Class Test
60	Tutorial Class	Reference Books	Interactive lecture & discussion		Based on active participation
61	Unit Test 3				
62-65	Solving previous Question papers and discussed	Library	Problem Solving Session		Based on active participation
66-Rest	Tutorial Class		Problem Solving Session		Based on active participation

Signature of teacher

Signature of HOD

Nalbari College, Nalbari

Teaching Plan for the Session: **2022 - 2 3**

Name of the Teacher: R. Kundu

Department: Mathematics

Semester: II

Paper Name: Differential Equations (including practical

Paper Code: MAT-HC-2026

Learning Objectives:

1. Learn basics of differential equations and mathematical modeling.
2. Formulate differential equations for various mathematical models.
3. Solve first order non-linear differential equations and linear differential equations of higher order using various techniques.
4. Apply these techniques to solve and analyze various mathematical models.
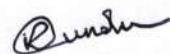
Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books &Internet	Lecture		
2-5	General, particular solutions of a differential equation	Books &Internet	Reading/Writing learning method		Quizzes
6-8	explicit, implicit solutions of a differential equation	Books &Internet	Reading/Writing learning method		Assignments.
9	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes

10,11	singular solutions of a differential equation	Books &Internet	Reading/Writing learning method		Quizzes
12,13	separable equations and equations reducible to this form	Books &Internet	Reading/Writing learning method		Assignments.
14	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
15,16	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
17,20	linear equation	Books &Internet	Reading/Writing learning method		Assignments.
21-23	Exact differential equations and integrating factors	Books &Internet	Reading/Writing learning method		Assignments.
24	Practical			Hands-on activities, curve tracing by coding in lab	Quizzes
25	Bernoulli equations	Books &Internet	Reading/Writing learning method		Quizzes
26,27	Special integrating factors and transformations	Books &Internet	Reading/Writing learning method		Assignments.
28	Tutorial	Books &Internet	Review session, problem solving practice, Interactive Discussion		Based on active participation
29	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
30	Unit test-1				

31,32	Introduction to compartmental model	Books &Internet	Reading/Writing learning method		Assignments.
33,34	Exponential decay model	Books &Internet	Reading/Writing learning method& Visual Learning Method.	Hands-on activities by Coding in the lab	Quizzes
35	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
36	Tutorial				Based on active participation
37-38	Exponential growth of population	Books &Internet	Reading/Writing learning method& Visual Learning Method		Assignments.
39	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
40,41	Limited growth of population.	Books &Internet	Reading/Writing learning method& Visual Learning Method		Assignments.
42	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
43	Problem solving		Reading/Writing learning method		
44	Practical exam in the lab				
45,46	Tutorial		Review session, problem solving practice, Interactive Discussion		
47	Unit test-2				
48,49	General solution of homogeneous equation of second order	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Assignments.

50,51	Principle of superposition for homogeneous equation,		Reading/Writing learning method& Visual Learning Method.		quizzes
52	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
53,54	Wronskian: its properties and applications		Reading/Writing learning method& Visual Learning Method.		Assignments.
45-57	Linear homogeneous equations of higher order with constant coefficients.		Reading/Writing learning method& Visual Learning Method.		Assignments.
58	Practical			Hands-on activities by Coding in the lab	Quizzes
59-62	non-homogeneous equations of higher order with constant coefficients	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Assignments.
63	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
64,65	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
66,67	Euler's equation,	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Quizzes
68.69	method of undetermined coefficients	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Quizzes
70	Practical			Hands-on activities by Coding in the lab	Quizzes
71,72	Method of variation of parameters.	Books &Internet	Reading/Writing learning method&		Assignments.

			Visual Learning Method.		
73,74	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
75	Unit test-III				
76 on wards	Revision and discussion on Work out question papers and solve problems arises by the students and discussion				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 – 23

Name of the Teacher: M. S. Dutta

Department: Mathematics

Semester: II

Paper Name: Algebra

Paper Code: MAT-HG-2016/MAT-RC-2016

Learning Objectives:

1. Learn how to solve the cubic and biquadratic equations, also learn about symmetric functions of the roots for cubic and biquadratic
2. Employ De Moivre's theorem in a number of applications to solve numerical problems.
3. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix. Finding inverse of a matrix.
4. Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, ring etc.

Syllabus:

Unit 1: General properties of equations, Theorems related to real roots of equations, Existence of a root in the general equation, Imaginary roots, Equal roots, Theorems determining the number of roots of an equation. Relation between roots and coefficients of nth degree equation, Solutions of cubic and biquadratic equations, when some conditions on roots of the equation are given, expression of an equation when a relation exists between two of its roots, Symmetric functions of the roots for cubic and biquadratic. De Moivre's theorem

(both integral and rational index), Roots of complex numbers, Solutions of equations using trigonometry and De Moivre's theorem.

Unit 2: Matrix Algebra, Addition, Transposition, Symmetry, Multiplication of matrices and their properties, Matrix inversion and properties, Row Echelon form and Rank of a matrix, Reduced row Echelon form, Consistency of linear systems, Solutions of system of homogeneous and non- homogeneous linear equations with number of equations and unknowns up to four. Invariance of rank under elementary transformations, Reduction to normal form.

Unit 3: Permutations. Congruence of Integers. Groups, Properties of group elements. Subgroups. Cyclic groups, Permutation groups, Cosets of a subgroup. Definition of Ring, Subring, Ring with unity, Commutative Ring.

Text Books:

1. Gilbert, Linda & Gilbert, Jimmie. *Elements of Modern Algebra,* (8th Edition) 2013, Cengage Learning.
2. Burnside, William Snow & Panton, Arthur William. *The Theory of Equations*, Vol. 1 (8th Edition), Dublin University Press Series.
3. Meyer, Carl D. (2000). *Matrix Analysis and Applied Linear Algebra*. Society for Industrial and Applied Mathematics (Siam).

Reference Books:

1. Dickson, Leonard Eugene (2009). *First Course in The Theory of Equations*. The Project Gutenberg eBook (http://www.gutenberg.org/ebooks/29785)
2. Gilbert, William J. (2004). *Modern Algebra with Applications* (2nd ed.). John Wiley & Sons.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course				
2 - 5	General properties of equations, Theorems related to real roots of equations	Text books	Interactive lectures, problem solving sessions		
6 - 10	Existence of a root in the general equation, Imaginary roots, Equal roots	-do-	-do-		Quizzes
11, 12	Theorems determining the number of roots of an equation	-do-	-do-		
13, 14	Relation between roots and coefficients of nth degree equation	-do-	-do-		Class Test
15 - 17	Solutions of cubic and biquadratic equations, when some conditions on roots of the equation are given	-do-	-do-		
18, 19	Expression of an equation when a relation exists between two of its roots	-do-	-do-		
20 - 22	Symmetric functions of the roots for cubic and biquadratic.	-do-	-do-		
23 - 25	De Moivre's theorem (both integral and rational index)	-do-	-do-		Class Test

26 -	Roots of complex numbers	-do-	-do-		
47 - 49	Solutions of equations using trigonometry and De Moivre's theorem	-do-	-do-		
50 - 51	Matrix Algebra: Addition, Transposition, Symmetry, Multiplication of matrices and their properties	-do-	-do-		Quizzes & Class Test
52 - 54	Matrix inversion and properties	-do-	-do-		
55 - 57	Row Echelon form and Rank of a matrix	-do-	-do-		
58	Reduced row Echelon form	-do-	-do-		
59 - 63	Consistency of linear systems, Solutions of system of homogeneous and non-homogeneous linear equations with number of equations and unknowns up to four	-do-	-do-		Class Test
64	Invariance of rank under elementary transformations	-do-	-do-		
65, 66	Reduction to normal form.	-do-	-do-		Class Test
67	Permutations	-do-	-do-		
68	Congruence of Integers	-do-	-do-		Class Test

69 - 71	Groups, Properties of group elements	-do-	-do-		
72	Subgroups	-do-	-do-		Class Test
73 - 75	Cyclic groups, Permutation groups	-do-	-do-		
76, 77	Cosets of a subgroup	-do-	-do-		Class Test
78 - 80	Definition of Ring, Subring	-do-	-do-		
81	Ring with unity	-do-	-do-		Class Test
82, 83	Commutative ring	-do-	-do-		

There will be tutorial classes every week.

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 - 23

Name of the Teacher: R. Kundu

Department: Mathematics

Semester: IV

Paper Name: Multivariate Calculus

Paper Code: MAT-HC-4016

Learning Objectives:

1. Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion.
2. Understand the maximization and minimization of multivariable functions subject to the given constraints on variables.
3. Learn about inter-relationship amongst the line integral, double and triple integral formulations.
4. Familiarize with Green's, Stokes' and Gauss divergence theorems.

Syllabus:

Unit 1: Functions of several variables, Level curves and surfaces, Limits and continuity, Partial differentiation, Higher order partial derivative, Tangent planes, Total differential and differentiability, Chain rule, Directional derivatives, The gradient, Maximal and normal property of the gradient, Tangent planes and normal lines.

Unit 2: Extrema of functions of two variables, Method of Lagrange multipliers, Constrained optimization problems; Definition of vector field, Divergence and curl.

Unit 3: Double integration over rectangular and nonrectangular regions, Double integrals in polar coordinates, Triple integral over a parallelepiped and solid regions, Volume by triple integrals, triple integration in cylindrical and spherical coordinates, Change of variables in double and triple integrals.

Unit 4: Line integrals, Applications of line integrals: Mass and Work, Fundamental theorem for line integrals, Conservative vector fields, Green's theorem, Area as a line integral; Surface integrals, Stokes' theorem, The Gauss divergence theorem.

Text Books:

1. Strauss, Monty J., Bradley, Gerald L., & Smith, Karl J. (2007). *Calculus* (3rd ed.). Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). Delhi. Indian Reprint 2011

Reference Books:

1. G. Strang and E. Herman, Calculus, LibreTexts.
2. Marsden, J. E., Tromba, A., & Weinstein, A. (2004). *Basic Multivariable Calculus*. Springer (SIE). First Indian Reprint.
3. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
4. M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus (3 Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
5. James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course				

		Text & Reference books	Interactive lectures, problem solving sessions, PPT		
2, 3	Functions of several variables	Text & Reference books	Interactive lectures, problem solving sessions, PPT		
4 - 6	Level curves and surfaces	-do-	-do-	Mathematica	
7 - 10	Limits and continuity	-do-	-do-	Mathematica	Quizzes
11 - 15	Partial differentiation and higher order partial derivative	-do-	-do-		
16 - 19	Total differential & differentiability	-do-	-do-		
20 - 21	Chain rule	-do-	-do-		Class Test
22 - 24	Directional derivatives and the gradient	-do-	-do-	Mathematica	
25 - 27	Maximal and normal property of gradient	-do-	-do-	Mathematica	Class Test
28 - 30	Tangent planes and normal lines	-do-	-do-	Mathematica	
31 - 36	Extrema of functions of two variables, Lagrange multipliers	-do-	-do-		
37 - 38	Constrained optimization problems	-do-	-do-		Quizzes & Class Test
39 - 44	Double integration over rectangular & non-rectangular regions	-do-	-do-		
45 - 48	Double integration over polar region	-do-	-do-		Quizzes
49 - 54	Triple integration over a parallelepiped and solid regions	-do-	-do-		

55 - 57	Volume by triple intregrals	-do-	-do-		Quizzes
58 - 62	Triple integration in cylindrical and spherical co-ordinates	-do-	-do-		Quizzes & Class Test
63 - 66	Change of variables in double and triple integrals	-do-	-do-		Quizzes
67	Definition of vector field, divergence and curl	-do-	-do-	Mathematica	
68	Line integrals and its applications: mass & work	-do-	-do-		
69, 70	Fundamental theorem of line integral	-do-	-do-		Quizzes
71	Conservative vector fields	-do-	-do-	Mathematica	
72, 73	Green's theorem	-do-	-do-		
74, 75	Area as a line integral	-do-	-do-		Quizzes
76, 77	Surface integrals	-do-	-do-		
78 - 81	Stokes' and the Gauss divergence theorem	-do-	-do-		Class Test

There will be tutorial classes every week.

Signature of the Teacher

Signature of the HoD

Teaching Plan for the Session: **2022 - 23**

Name of the Teacher: **P. Begum**

Department: Mathematics

Semester: IV

Paper Name: Numerical Methods (including practical

Paper Code: MAT-HC-4026

Learning Objectives:

1. Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
2. Know about methods to solve system of linear equations, such as False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.
3. Interpolation techniques to compute the values for a tabulated function at points not in the table.
4. Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction	Books &Internet	Lecture		
2-5	Algorithms	Books &Internet	Reading/Writing learning method		Quizzes
6,7	Convergence	Books &Internet	Reading/Writing learning method		Assignments.
8	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
9,10	Tutorial class		Review session, problem solving		Based on active participation

			practice, Interactive Discussion		
11-15	Bisection method	Books &Internet	Reading/Writing learning method		Quizzes
16-18	False position method	Books &Internet	Reading/Writing learning method		Assignments.
19	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
20,21	Fixed point iteration method,		Reading/Writing learning method		Quizzes
22-24	Newton's method	Books &Internet	Reading/Writing learning method		Assignments.
25	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes.
25-28	Secant method	Books &Internet	Reading/Writing learning method		Assignments.
29	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
30-33	LU decomposition	Books &Internet	Reading/Writing learning method		Quizzes
34	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
35	Unit test-1				
36,37	Lagrange interpolation:,	Books &Internet	Reading/Writing learning method	Hands-on activities by Coding in the lab	Assignments.

38,39	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
40,41	Newton interpolation	Books &Internet	Reading/Writing learning method		Quizzes
42	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
43,44	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
45	linear and higher order				
46,47	finite difference operators.	Books &Internet	Reading/Writing learning method		Assignments.
48	Practical		Coding in the lab	Hands-on activities by Coding in the lab	
49	Problem solving				
50,51	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
52	Unit test-2				
53-55	Numerical differentiation	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Quizzes
56,57	Forward difference.		Coding in the lab		Assignments

58,59	backward difference	Books &Internet	Reading/Writing learning method& Visual Learning Method	Hands-on activities by Coding in the lab	Assignments.
60,61	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
62	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
63	Problem solving				
64,65	central difference		Coding in the lab		Quizzes
66	Integration	Books &Internet	Reading/Writing learning method& Visual Learning Method		Assignments.
67,68	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
69	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
70	trapezoidal rule				Quizzes
71-73	Simpson's rule		Reading/Writing learning method		Assignments
74,75	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
76	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes

					Assignments
77-79	Euler's method				
80	Unit test-III				
81-onwards	Question paper discussion and problem solving				

Signature of the Teacher

Signature of the HoD

Name of Teacher: Gautam Sarma
Department: Mathematics
Semester: IV
Paper Name: Ring Theory
Paper Code: MAT-HC- 4036

Objectives:

The objective of this course is to introduce the fundamental theory of rings and their corresponding homomorphisms. Also introduces the basic concepts of ring of polynomials and irreducibility tests for polynomials over ring of integers.

Courses Learning Outcomes:

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

i) Appreciate the significance of unique factorization in rings and integral domains.

ii) Learn about the fundamental concept of rings, integral domains and fields.

iii) Know about ring homomorphisms and isomorphisms theorems of rings.

iv) learn about the polynomial rings over commutative rings, integral domains, Euclidean domains, and UFD

Course outline & suggested reading:

UNIT 1: Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideals, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals. Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

UNIT 2: Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in $Z[x]$. Divisibility in integral domains, irreducibles, primes, unique factorization domains, Euclidean domains.

Text Books:

1. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.

Reference Books:

1. John B. Fraleigh (2002), A First Course in Abstract Algebra, 7th Ed., Pearson.

2. M. Artin (2011), Abstract Algebra, 2nd Ed., Pearson.

3. D.A.R. Wallace (1998), Groups, Rings and Fields, Springer Verlag London Ltd.

4. G. Santhanam (2017), Algebra, Narosa Publishing House

Time Plan for the course :

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks	Interactive lecture		
2-3	Definition and examples of rings	Textbooks & Internet	Interactive lecture & PPT		
4-6	properties of rings	Textbooks & Internet	Interactive lecture & PPT		Assignments
7-8	Subrings	Reference Books	Interactive lecture & discussion		Quizzes
9-10	integral domains and fields.	Reference Books	Interactive lecture & PPT		
11	characteristic of a ring	Textbooks & Internet	Interactive lecture & discussion		
12	Ideals	Textbooks & Internet	Interactive lecture & PPT		Assignments
13	ideal generated by a subset of a ring	Reference Books	Interactive lecture & PPT		Quizzes
14-15	Factor rings	Reference Books	Interactive lecture & PPT		Class Test
16-17	operations on ideals	Reference Books	Interactive lecture & discussion		
18-19	prime and maximal ideals	Textbooks & Internet	Interactive lecture & PPT		Assignments
20	Ring homomorphisms	Textbooks & Internet	Interactive lecture & discussion		Quizzes
21-22	properties of ring homomorphisms	Textbooks	Interactive lecture & discussion		Class test
23	First isomorphism theorem	Text books	Interactive lecture & discussion		
24	Second isomorphism theorem	Reference books	Interactive lecture & PPT		
25	Third isomorphism theorem	Textbooks	Interactive lecture & PPT		Assignments
26-27	field of quotients.	Reference Books	Interactive lecture & discussion		Quizzes
28-29	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
30	Unit Test- I				

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
31-32	Polynomial rings over commutative rings	Textbooks & Internet	Interactive lecture & PPT		Assignments
33-34	division algorithm and consequences	Reference Books	Interactive lecture & discussion		Quizzes
35	principal ideal domains	Textbooks & Internet	Interactive lecture & PPT		
36	factorization of polynomials	Reference Books	Interactive lecture & PPT		Class test
37	reducibility tests	Textbooks	Interactive lecture & PPT		Assignments
38	irreducibility tests	Textbooks	Interactive lecture & PPT		Quizzes
39-40	Eisenstein criterion	Textbooks & Internet	Interactive lecture & PPT		
41	unique factorization in Z[x]	Textbooks & Internet	Interactive lecture & PPT		
42-43	Divisibility in integral domains	Reference Books	Interactive lecture & discussion		
44-45	Irreducible and primes	Textbooks & Internet	Interactive lecture & PPT		Assignments
46	unique factorization domains	Textbooks & Internet	Interactive lecture & discussion		Quizzes
47-48	Euclidean domains	Reference Books	Interactive lecture & discussion		Class test
49-50	Tutorial Class	Textbooks	Problem solving session		Based on active participation
51	Unit Test –II				
52-56	Solving previous Question papers and discussed	Library	Problem solving Session		Based on active participation
57-Rest	Tutorial Class				Based on active participation

Signature of teacher   Signature of HOD

Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher:

Department: Mathematics

Semester: IV

Paper Name: R Programming **(including practical)**
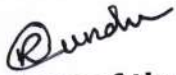
Paper Code: MAT-SE-4014

Learning Objectives:

1. Develop a fundamental understanding of programming concept.

2. Understand the syntax, semantics and features of R programming.

3. Apply mathematical concepts to solve computational problems.

4. Learn techniques for debugging and testing R programs.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to R Programming	Books & Internet	Interactive lecture		
2-5	using R as a calculator, Explore data and relationships in R	Books & Internet	Interactive lecture, PPT	Hands-on activities.	Quizzes
6-9	Reading and getting data into R: combine and scan commands	Books & Internet	Interactive lecture, PPT	Hands-on activities.	Quizzes

10-13	viewing named objects and removing objects from R, Types and structures of data items with their properties	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Assignments.
14,15	Practical class				
16,17	Working with history commands, Saving work in R	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Quizzes
18,19	Manipulating vectors, Data frames, Matrices and lists	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in Lab	Assignments.
20,21	Viewing objects within objects	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Assignments.
22-24	Constructing data objects and their conversions	Books & Internet	Interactive lecture	Hands-on activities, coding in Lab	
25-27	Practical class				
28	**Unit Test-I**				
29-31	Summary statistics for vectors, Data frames	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, coding in lab.	Quizzes
32-35	Summary statistics for, Matrices and lists	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in lab.	
36-39	Summary tables	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.
40-43	Practical class				
44	**Unit Test-II**				
45-47	Stem and leaf plot, Histograms	Books & Internet	Interactive	Hands-on activities,	

			lecture, PPT	coding in lab.	
48-50	Density function and its plotting	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in lab.	Assignments.
51,52	The Shapiro-Wilk test for normality	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Coding Assignment
53,54	Practical class			Coding Assignment to perform in lab	
55	The Kolmogorov-Smirnov test	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in lab.	Based on active participation
56-58	Practical class				
59-61	Box-whisker plots, Scatter plots, Pie charts	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.
62-64	Practical Class				
65-67	Pairs plots, Line charts, Cleveland dot charts	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.
68-70	Practical Class				
71-73	Bar charts; Copy and save graphics to other applications	Books & Internet	Interactive lecture, PPT		Assignments.
74,75	Practical Class				
76-79	Question paper discussion and solve problems asked by the students.				
80	**Unit Test-III**				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 - 23

Name of the Teacher: R. Kundu

Department: Mathematics

Semester: IV

Paper Name: Real Analysis

Paper Code: MAT-HG-4016/MAT-RC-4016

Learning Objectives:

1. Understand many properties of the real line R, including completeness and Archimedean properties.
2. Learn to define sequences in terms of functions from R to a subset of R.
3. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
4. Apply the ratio, root and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

Syllabus:

Unit 1: Algebraic and order properties of Real numbers, Order completeness of Real numbers, Open and closed sets, Limit of functions, Sequential criterion for limits, Algebra of limits, Properties of continuous functions, Uniform continuity.

Unit 2: Sequences, Convergent and Cauchy sequences, Sub sequences, Limit superior and limit inferior of a bounded sequence, monotonically increasing and decreasing sequences, Infinite series and their convergences, Positive term series, Absolute convergence, Comparison tests, Cauchy's nth root test, D'Alembert's ratio test, Raabe's test.

Text Books:

1. Bartle, Robert G., & Sherbert, Donald R. (2015). *Introduction to Real Analysis* (4th ed.) Wiley India Edition.

Reference Books:

1. Ross, Kenneth A. (2013). *Elementary Analysis*: *The Theory of Calculus* (2nd ed.). Undergraduate Texts in Mathematics, Springer. Indian Reprint.
2. Bilodeau, Gerald G., Thie, Paul R., &Keough, G. E. (2010). *An Introduction to Analysis* (2nd ed.). Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course				
2, 3	Algebraic properties of real numbers	Text books	Interactive lectures, problem solving sessions		
4, 5	Order completeness of real numbers	-do-	-do-		
6, 7	Open and closed sets	-do-	-do-		
8 - 12	Limit of functions	-do-	-do-	PPT, Mathematica	Quizzes, Class Test
13 - 17	Sequential criterion for limits	-do-	-do-		

18 - 21	Algebra of limits	-do-	-do-		
22 - 27	Properties of continuous functions	-do-	-do-	PPT, Mathematica	
28 - 33	Uniform continuity	-do-	-do-	PPT, Mathematica	Class Test
34 - 39	Sequences and its convergence	-do-	-do-		
40 - 44	Cauchy sequence	-do-	-do-		
45 - 48	Sub-sequences	-do-	-do-		Quizzes & Class Test
49 - 52	Monotonically increasing & decreasing sequences	-do-	-do-		
53 - 56	Infinite series and their convergence	-do-	-do-		
57 - 60	Positive term series and absolute convergence	-do-	-do-		Quizzes
60 - 70	Comparison test, Cauchy's nth root test, D'Alembert's ratio test and Raabe's test	-do-	-do-		Class Test

There will be tutorial classes every week.

Signature of the Teacher   **Signature of the HoD**

Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: M.S. Dutta

Department: Mathematics

Paper Name: Riemann Integration and Metric spaces

Semester: VI

Paper Code: MAT-HC-6016

Learning Objectives:

1. To learn the properties of Riemann integrable functions, and the applications of the Fundamental theorem of integration.

2. Know about improper integrals including, beta and gamma functions.

3. Learn the concept of distance defined on a set, and thus leading to the concept of metric spaces.

4. To understand the geometrical concepts like, Balls or connected sets etc. in an abstract setting

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books & Internet	Interactive lecture		
2-4	upper and lower sums	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Assignments.
5-8	Darboux integrability, properties of integral	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
9-12	Fundamental theorem of calculus, mean value theorems for integrals	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes
13,14	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
15-18	Riemann sum and Riemann integrability, Riemann integrability of monotone and continuous functions on intervals	Books & Internet	Interactive lecture, Problem solving session		Quizzes
19-21	sum of infinite series as Riemann integrals, logarithm and exponential functions through Riemann integrals	Books & Internet	Interactive lecture, Problem solving session		Assignments.
22-24	Improper integrals, Gamma functions.	Books & Internet	Interactive lecture, Problem solving session		Assignments.
25,26	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation

27	Unit Test-I				
28-30	Metric spaces: definition and examples	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Quizzes
31-34	sequences in metric spaces, Cauchy sequences	Books & Internet	Interactive lecture, Problem solving session		
35-37	Complete metric spaces.	Books & Internet	Interactive lecture, Problem solving session		Assignments.
38	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
29,30	Open and closed balls, neighborhood,	Books & Internet	Interactive lecture, Problem solving session		
31-33	Interior of a set, Limit point of a set, closed set	Books & Internet	Interactive lecture, Problem solving session		Assignments.
34,35	Diameter of a set, Cantor's theorem.	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes
36-40	Subspaces, dense sets, separable spaces	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
41	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
42	**Unit test-2**				
43	Continuous mappings	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	

44	Uniform continuity	Books & Internet	Interactive lecture, Problem solving session		
45	Homeomorphism	Books & Internet	Interactive lecture, Problem solving session		Assignments.
46	Contraction mappings	Books & Internet	Interactive lecture, Problem solving session		Quizzes
47	Tutorial class Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
48-50	Banach contraction mapping principle.	Books & Internet	Interactive lecture, Problem solving session		Assignments.
51,52	Connectedness, connected subsets of R	Books & Internet	Interactive lecture, Problem solving session		
53, 54	Connectedness and continuous mappings.	Books & Internet	Interactive lecture, Problem solving session		Assignments.
55	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
56	Unit test-III				
57-60	Question paper discussion and solve problems asked by the students.				

Signature of the Teacher

Signature of the HoD

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022 – 23

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Name of the Teacher: P. Begum

Department: Mathematics

Paper Name: Linear Algebra

Semester: V

Paper Code: MAT-HC-5026

Learning Objectives:

1. Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.

2. Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix.

3. Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.

4. Compute inner products and determine orthogonality on vector spaces, including Gram–Schmidt orthogonalization to obtain orthonormal basis.

5. Find the adjoint, normal, unitary and orthogonal operators.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction				
2-5	Vector spaces and subspaces,	Books & Internet	Interactive lecture		Quizzes
6-9	null space and column space of a matrix,	Books & Internet	Interactive lecture, Problem solving session, PPT	.	Assignments.
10,11	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
12,13	linear transformations,	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
14,15	kernel and range,	Books & Internet	Interactive lecture, Problem solving session, PPT		
16,17	bases	Books & Internet	Interactive lecture, Problem solving session, PPT		Quizzes

18-20	linearly independent sets		Interactive lecture, Problem solving session, PPT		
21,22	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
23	coordinate systems,		Interactive lecture, Problem solving session, PPT		
24-28	dimension of a vector space.	Books & Internet	Interactive lecture, Problem solving session		
29,30	rank,	Books & Internet	Interactive lecture, Problem solving session		Quizzes
31	**Unit-test** 1				
32,33	change of basis	Books & Internet	Interactive lecture, Problem solving session		Quizzes
34,35	**Tutorial**	Books & Internet	Review session, problem solving practice, Interactive Discussion		Based on active participation
36,37	Eigenvectors and eigenvalues of a matrix,	Books & Internet	Interactive lecture, Problem solving session		Quizzes
38-39	the characteristic equation, ,	Books & Internet	Interactive lecture, Problem solving session		Assignments.

40,41	diagonalization,		Interactive lecture, Problem solving session		Quizzes
42-45	eigenvectors of a linear transformation	Books & Internet	Interactive lecture, Problem solving session		Quizzes
46,47	Tutorial	Books & Internet	Review session, problem solving practice, Interactive Discussion		Based on active participation
48,49	complex eigenvalues	Books & Internet	Interactive lecture, Problem solving session		Assignments.
50,51	Invariant subspaces	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
50	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
52-54	Cayley-Hamilton theorem	Books & Internet	Interactive lecture, Problem solving session		Quizzes
55,56	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
57	**Unit test-2**	Books & Internet	Review session, problem solving practice, Interactive Discussion		
58-60	Inner product, length	Books & Internet	Interactive lecture, Problem		Assignments.

			solving session		
61	orthogonality	Books & Internet	Interactive lecture, Problem solving session		Quizzes
62-65	orthogonal sets orthogonal projections	Books & Internet Books & Internet	Interactive lecture, Problem solving session		Quizzes
66,67	the Gram–Schmidt process,	Books & Internet	Interactive lecture, Problem solving session		Assignments.
68,69	Tutorial	Books & Internet	Review session, problem solving practice, Interactive Discussion		Based on active participation
70-73	inner product spaces	Books & Internet			Quizzes
74-76	Diagonalization of symmetric matrices	Books & Internet	Interactive lecture, Problem solving session		Quizzes
77,78	the Spectral Theorem	Books & Internet	Interactive lecture, Problem solving session		Assignments.
79,80	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
81	**Unit-test-3**	Books & Internet	Interactive lecture, Problem solving session		Quizzes
82-onwards	Revision and discussion on Work		Interactive lecture, Problem solving		Assignments.

	out question papers and solve problems arises by the students and discussion		session		

Signature of the Teacher   **Signature of the HoD**

Teaching Plan for the Session: 2022-23

Name of the Teacher: R. Kundu

Department: Mathematics   **Semester: V**

Paper Name: Number Theory   **Paper Code: MAT-HE-5016**

Learning Objectives:

1. Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc.
2. Know about number theoretic functions and modular arithmetic.
3. Solve linear, quadratic and system of linear congruence equations.

<u>**Syllabus:**</u>

Unit 1: Linear Diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem, Fermat's Little theorem, Wilson's theorem.

Unit 2: Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

Text Books:

1. David M. Burton, *Elementary Number Theory*, 6th Ed., Tata McGraw Hill, Indian reprint, 2007.
2. G. A. Jones and J. Mary Jones, *Elementary Number Theory*. Undergraduate Mathematics Series (SUMS). First Indian Print. 2005
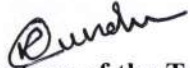
Reference Books:

1. Neville Robinns, *Beginning Number Theory,* 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007.
2. K. C. Chowdhury, *A First Course in Number Theory*, Asian Books Publications 2012.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Text books			
2 - 5	The division algorithm, GCD, the Euclidean algorithm	-do-	Interactive lectures, problem solving sessions		Quizzes
6 - 13	Prime numbers: definitions, theorems	-do-	-do-		
14 - 17	Prime counting functions	-do-	-do-	Coding in lab	
18 - 21	Fermat & Mersenne primes	-do-	-do-		Class Test
22	Goldbach conjecture	-do-	-do-		
23 - 29	Theory of congruences: Linear congruence.	-do-	-do-		

30, 31	Complete and reduced set of residues.	-do-	-do-		
32 - 36	The Chinese remainder theorem	-do-	-do-	Coding in lab	Class Test
37 - 42	Number theoretic functions: sum and number of divisors.	-do-	-do-		
43 - 50	Multiplicative functions, definition and properties of Dirichlet product.	-do-	-do-		
51 - 54	The Mobius inversion formula, the greatest integer function	-do-	-do-		Quizzes & Class Test
55 - 57	Euler's phi function.	-do-	-do-		
58 - 61	Euler's theorem.	-do-	-do-		
62 - 66	Properties of Euler's phi function.	-do-	-do-		
67 - 70	Fermat's little theorem and Wilson's theorem	-do-	-do-		Class Test

There will be tutorial classes every week.

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: M. S. Dutta

Department: Mathematics

Paper Name: Programming in C (including practical)

Semester: V

Paper Code: MAT-HE-5066

Learning Objectives:

1. Develop a fundamental understanding of programming concept.

2. Learn the basics of algorithmic problem solving.

3. Understand the syntax, semantics and features of C programming.

4. Apply mathematical concepts to solve computational problems.

5. Learn techniques for debugging and testing C programs.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books & Internet	Interactive lecture		
2-5	Variables, constants, reserved words	Books & Internet	Interactive lecture, PPT	Hands-on activities.	Quizzes
6-8	variable declaration, initialization, basic data types	Books & Internet	Interactive lecture, PPT	Hands-on activities.	Quizzes
9-11	operators and expression (arithmetic, relational, logical, assignment, conditional, increment and decrement)	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Assignments.
12-14	Practical class				
15,16	hierarchy of operations for arithmetic operators	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Quizzes
17-19	size of and comma operator, mixed mode operation	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in Lab	Assignments.
20,21	automatic (implicit) conversion, cast (explicit) conversion	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in Lab	Assignments.
22-24	Library functions, structure of a C program, input/output functions and statements.	Books & Internet	Interactive lecture	Hands-on activities, coding in Lab	
25-27	Practical class				

28	**Unit Test-I**				
29-31	if-else statement (including nested if-else statement)	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, coding in lab.	Quizzes
32-34	Switch statement, Loop control Structures (for and nested for, while and do-while)	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, coding in lab.	
35,36	Break, continue, go to statements, and exit function	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.
37-39	Practical class				
40	**Unit Test-II**				
41-44	One and Two dimensional array declaration	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in lab.	
45-47	accessing values in an array, initializing values in an array	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in lab.	Assignments.
48,49	sorting of numbers in an array	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Coding Assignment
50-52	Practical class			Coding Assignment to perform in lab	
53,54	addition and multiplication of matrices with the help of array	Books & Internet	Interactive lecture, PPT	Hands-on activities, coding in lab.	Based on active participation
55-57	Practical class				
58-60	function declaration, actual and formal arguments	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.
61-63	Practical Class				
64-66	function prototype, calling a function by value	Books & Internet	Interactive lecture	Hands-on activities, coding in lab.	Assignments.

67,68	Practical Class				
69,70	recursive function	Books & Internet	Interactive lecture, PPT		Assignments.
71-73	Practical Class				
74-77	Question paper discussion and solve problems asked by the students.				
78	**Unit Test-III**				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 - 23

Name of the Teacher: M. S. Dutta & R. Kundu

Department: Mathematics

Semester: III

Paper Name: Computer Algebra Systems & Related Software

Paper Code: MAT-SE-3014

Learning Objectives:

1. Use of software; Mathematica/MATLAB/Maxima/Maple, etc. as a calculator, for plotting functions and animations.
2. Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues and eigenvectors.
3. Understand the use of the statistical software **R** as calculator and learn to read and get data into **R**.
4. Learn the use of **R** in summary calculation, pictorial representation of data and exploring relationship between data.
5. Analyze, test, and interpret technical arguments on the basis of geometry.

Syllabus:

Unit 1: Computer Algebra System (CAS), Use of a CAS as a calculator, Computing and plotting functions in 2D, plotting functions of two variables using Plot 3 D and Contour Plot, plotting para metric curves surfaces, customizing plots, animating plots, producing tables of values, working with piecewise defined functions, Combining graphics.

Unit 2: Simple programming in a CAS, working with matrices, Performing Gauss elimination, operations (transpose, determinant, inverse), Minors and cofactors, working with large matrices, Solving system of linear equations, Rank and nullity of a matrix, Eigenvalue, eigen vector and diagonalization.

Text Books:

1. Bindner, Donald & Erickson, Martin. (2011). *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*. CRC Press, Taylor & Francis Group, LLC.
2. Torrence, Bruce F., & Torrence, Eve A. (2009). *The Student's Introduction to Mathematica*: *A Handbook for Precalculus, Calculus and Linear Algebra* (2nd ed.). Cambridge University Press.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course				
2 - 4	Computer algebra system, Use of CAS as calculator	Text books	Interactive lectures, Problem solving sessions		Quizzes
5, 6	Computing and plotting of functions in 2D, Plotting of functions of two variables using Plot3D and contour plot	-do-	-do-		
6 - 11	Practical	-do-	-do-	Computer Lab	
12, 13	Plotting parametric curve surfaces, customizing plots,	-do-	-do-		

	animating plots				
13 - 18	Practical	-do-	-do-	Computer Lab	Class Test
19, 20	Producing tables of values	-do-	-do-		
21	Working with piecewise defined functions	-do-	-do-		
22	Combined graphics	-do-	-do-		
23 - 27	Practical	-do-	-do-	Computer Lab	Class Test
28, 29	Simple programming in CAS	-do-	-do-		
30	Working with matrices	-do-	-do-		Quizzes & Class Test
31 - 34	Practical	-do-	-do-	Computer Lab	
35, 36	Performing Gauss elimination	-do-	-do-		
37	Operation in matrices (transpose, determinant, inverse)	-do-	-do-		
38 - 41	Practical	-do-	-do-	Computer Lab	Class Test
42	Minors & co-factors	-do-	-do-		
43 - 45	Practical	-do-	-do-	Computer Lab	
46	Working with large matrices	-do-	-do-		Class Test
55	Practical	-do-	-do-	Computer Lab	

	Solving system of linear equations, rank & nullity of a matrix	-do-	-do-		
56 - 60	Practical	-do-	-do-		Class Test
55	Eigenvalue, eigenvectors and diagonalization	-do-	-do-		
56 - 60	Practical	-do-	-do-		

There will be tutorial classes every week.

Signature of the Teacher   **Signature of the HoD**

Course Learning Outcomes:

The completion of the course will enable the students to:
i) Learn the significance of differentiability of complex functions leading to the understanding of Cauchy–Riemann equations.
ii) Learn some elementary functions and valuate the contour integrals.
iii) Understand the role of Cauchy–Goursat theorem and the Cauchy integral formula.
iv) Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

Course Outline & Suggested reading :

UNIT 1: Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. Limits, Limits involving the point at infinity, continuity.
UNIT 2: Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.
UNIT 3: Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals.
UNIT 4: Antiderivatives, proof of antiderivative theorem, Cauchy-Goursat theorem, Cauchy integral formula. Liouville's theorem and the fundamental theorem of algebra.

LAB WORK TO BE PERFORMED ON A COMPUTER
(MODELING OF THE FOLLOWING PROBLEMS USING MATLAB/ MATHEMATICA/ MAPLE ETC.)

1. Declaring a complex number and graphical representation. e.g. $Z1 = 3 + 4i$, $Z2 = 4 - 7i$
2. Program to discuss the algebra of complex numbers, e.g.,
   $Z1 = 3 + 4i$, $Z2 = 4 - 7i$, then find $Z1 + Z2$, $Z1 - Z2$, $Z1 * Z2$ and $Z1 / Z2$
3. To find conjugate, modulus and phase angle of an array of complex numbers. e.g.
   $Z = [2+ 3i, 4-2i, 6+11i, 2-5i]$
4. To compute the integral over a straight line path between the two specified end points.
   e. g., $\oint Sinz\, dz$, along the contour C which is a straight line path from $-1+ i$ to $2 - i$

5. To perform contour integration., e.g., (i) $\oint(z^2-2z+1)dz$ along the Contour C given by $x = y^2 +1; -2 \le y \le 2$.

(ii) $\oint(z^3+2z^2+1)dz$ along the contour C given by $x^2+y^2=1$, which can be

(iii) parameterized by $x = \cos(t)$, $y = \sin(t)$ for $0 \le y \le 2\pi$.

6. To plot the complex functions and analyze the graph. e.g., (i) $f(z) = z, iz, z^2, z^3, e^z$ and $(z^4-1)^{1/4}$,

7. To perform the Taylor series expansion of a given function $f(z)$ around a given point z. The number of terms that should be used in the Taylor series expansion is given for each function. Hence plot the magnitude of the function and magnitude of its Taylors series expansion, e.g.,

(i) $f(z) = \exp(z)$ around $z = 0$, $n = 40$ and

(ii) $f(z) = \exp(z^2)$ around $z = 0$, $n = 160$.

8. To determine how many terms should be used in the Taylor series expansion of a given function $f(z)$ around $z = 0$ for a specific value of z to get a percentage error of less than 5%. e.g., for $f(z) = \exp(z)$ around $z = 0$, execute and determine the number of necessary terms to get a percentage error of less than 5 % for the following values of z:

(i) $z = 30 + 30i$ (ii) $z = 10 + 103i$

9. To perform Laurents series expansion of a given function $f(z)$ around a given point z. e.g.,

(i) $f(z) = (\sin z - 1)/z^4$ around $z = 0$ (ii) $f(z) = \cot(z)/z^4$ around $z = 0$.

Text Book:

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications (Eighth Edition), McGraw – Hill International Edition, 2009.

Reference Book:

1. Joseph Bak and Donald J. Newman, *Complex analysis* (2nd Edition), Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

2. M.R. Speigel, Complex Variables, Schaum series,

Time Plan for the Course :

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks & Internet	Interactive lecture & PPT		
2-3	Properties of complex numbers	Reference Books	Interactive lecture & discussion		
4-5	regions in the complex plane	Textbooks & Internet	Interactive lecture & PPT		Assignments
6-7	functions of complex variable	Reference Books	Interactive lecture & PPT		Quizzes
8	Mappings	Textbooks	Interactive lecture & discussion		
9-10	Derivatives, differentiation formulas	Textbooks	Interactive lecture & discussion		Class Test
11-12	Cauchy-Riemann equations,	Textbooks	Interactive lecture & discussion		

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
13	Practical				
14	sufficient conditions for differentiability	Textbooks & Internet	Interactive lecture & PPT		
15-16	Limits, Limits involving the point at infinity	Textbooks & Internet	Interactive lecture & PPT		
17-18	Continuity	Reference Books	Interactive lecture & discussion		Class test
19	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
20	Unit Test -1				
21-23	Analytic functions, examples of analytic functions	Textbooks & Internet	Interactive lecture & PPT		
24	exponential function	Reference Books	Interactive lecture & PPT		
25	Logarithmic function	Reference Books	Interactive lecture & PPT		Quizzes
26	trigonometric function	Reference Books	Interactive lecture & discussion		Assignments
27	Practical				
28	derivatives of functions	Textbooks & Internet	Interactive lecture & discussion		
29	definite integrals of functions	Textbooks	Problem solving session		
30-31	Consequences of Lagrange's including Fermat's Little theorem				Class test
32	Tutorial Class	Textbooks	Problem solving session		Based on active participation
33	Unit Test II				
34-35	Contours	Textbooks	Interactive lecture & discussion		
36	Practical				

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
37-39	Contour integrals and its examples	Textbooks & Internet	Interactive lecture & PPT		Assignments
40-42	upper bounds for moduli of contour integrals	Reference Books	Interactive lecture & discussion		Quizzes
43	Tutorial Class	Textbooks	Problem solving session		Based on active participation
44	Practical				
45	Unit Test III				
46-47	Antiderivatives	Textbooks	Interactive lecture		
48	proof of antiderivative theorem	Textbooks & Internet	Interactive lecture & PPT		
49	Cauchy-Goursat theorem	Textbooks & Internet	Interactive lecture & PPT		Assignments
50	Practical				
51-52	Cauchy integral formula.	Textbooks & Internet	Interactive lecture & PPT		Assignments
53-54	Liouville's theorem	Textbooks & Internet	Interactive lecture & discussion		Quizzes
55	Practical				
56-57	fundamental theorem of algebra	Reference Books	Interactive lecture & discussion		Class Test
58	Tutorial Class	Textbooks	Problem solving session		Based on active participation
59	Practical Exam in Lab				
60	Unit Test III				
61-63	Solving previous Question papers and discussed	Library	Problem solving session		Based on active participation
64-Rest	Tutorial Class		Interactive discussion		Based on active participation

Signature of teacher

Signature of HOD

Nalbari College, Nalbari
Teaching Plan for the Session: 2022 - 23

Name of Teacher: Gautam Sarma
Department: Mathematics
Semester: III
Paper Name: Group Theory –I
Paper Code: MAT-HC- 3026

Objectives:

The objective of the course is to introduce the fundamental theory of groups and their homomorphisms. Symmetric groups and group of symmetries are also studied in detail. Fermat's Little theorem is studied as a consequence of the Lagrange's theorem on finite groups.

Course Learning Outcomes:

The course will enable the students to:

i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.

ii) Link the fundamental concepts of groups and symmetrical figures.

iii) Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.

iv) Explain the significance of the notion of cosets, normal subgroups and factor groups.

v) Learn about Lagrange's theorem and Fermat's Little theorem.

vi) Know about group homomorphisms and group isomorphisms.

Course Outline & suggested reading:

UNIT 1: Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.
UNIT 2: Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.
UNIT3: Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.

Textbook :

1. Gallian, Joseph. A. (2013). *Contemporary Abstract Algebra* (8th ed.). Cengage Learning India Private Limited, Delhi. Fourth impression, 2015.

Reference Books:
1. John B. Fraleigh, A First Course in Abstract Algebra, 7thEd., Pearson, 2002.
2. G. Santhanam, Algebra, Narosa Publishing House, 2017.
3. Joseph J. Rotman, An Introduction to the Theory of Groups, 4thEd., Springer Verlag, 1995.
4. David S. Dummit and Richard M. Foote, Abstract Algebra (2nd Edition), John Wiley and Sons (Asia) Pvt. Ltd, Singapore, 2003

Time Plan for the Course :

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks	Interactive lecture		
2	Symmetries of a square	Textbooks & Internet	Interactive lecture & PPT		
3	Dihedral groups	Textbooks & Internet	Interactive lecture & PPT		Assignments
4-5	Definition and examples of groups	Reference Books	Interactive lecture & discussion		Quizzes
6-7	permutation groups and quaternion groups	Reference Books	Interactive lecture & PPT		
8-9	elementary properties of groups	Textbooks & Internet	Interactive lecture & discussion		
10-11	Subgroups and examples of subgroups	Textbooks & Internet	Interactive lecture & PPT		Assignments
12	centralizer, normalizer with examples	Reference Books	Interactive lecture & PPT		Quizzes
13	center of a group with examples	Reference Books	Interactive lecture & PPT		
14	product of two subgroups	Reference Books	Interactive lecture & discussion		Class Test
15-16	Properties of cyclic groups	Textbooks & Internet	Interactive lecture & PPT		
17	classification of subgroups of cyclic groups	Textbooks & Internet	Interactive lecture & discussion		Assignments
18-20	Solving exercise problems	Textbooks	Problem solving session		Based on active participation
21	Unit Test I				
22-23	Cycle notation for permutations, properties of permutations	Textbooks & Internet	Interactive lecture & PPT		
24-25	even and odd permutations, alternating group	Textbooks & Internet	Interactive lecture & PPT		Assignments
26-27	properties of cosets	Reference Books	Interactive lecture & discussion		Quizzes

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
28	Lagrange's theorem	Textbooks & Internet	Interactive lecture & PPT		Assignments
29-31	Consequences of Lagrange's including Fermat's Little theorem	Textbooks & Internet	Interactive lecture & discussion		Quizzes
32-33	External direct product of a finite number of groups	Textbooks & Internet	Interactive lecture & PPT		
34	normal subgroups	Reference Books	Interactive lecture & discussion		
35	factor groups	Textbooks & Internet	Interactive lecture & PPT		Class Test
36	Cauchy's theorem for finite abelian groups	Reference Books	Interactive lecture & PPT		
37 – 39	Solving exercise problems	Textbooks	Problem solving session		Based on active participation
40	Unit Test II				
41	Group homomorphisms	Textbooks & Internet	Interactive lecture & PPT		
42-43	properties of homomorphisms	Textbooks & Internet	Interactive lecture & PPT		Assignments
44	Cayley's theorem	Reference Books	Interactive lecture & discussion		Quizzes
45-46	properties of isomorphisms	Textbooks & Internet	Interactive lecture & PPT		
47	First isomorphism theorem	Textbooks & Internet	Interactive lecture & discussion		
48	Second isomorphism theorem	Reference Books	Interactive lecture & discussion		Assignments
49	Third isomorphism theorem	Reference Books	Interactive lecture & discussion		Quizzes
50-52	Solving exercise problems	Textbooks	Problem solving session		Based on active participation
53	Unit Test III				
54-58	Solving previous Question papers and discussed	Library	Interactive discussion		Based on active participation
59-Rest	Tutorial Class		Interactive discussion		Based on active participation

Signature of teacher

Signature of HOD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 - 23

Name of the Teacher: P. Begum

Semester: III

Department: Mathematics
Paper Name: Analytical Geometry

Paper Code: MAT-HC-3026

Learning Objectives:

1. Transform coordinate systems, conic sections
2. Learn polar equation of a conic, tangent, normal and related properties
3. Have a rigorous understanding of the concept of three-dimensional coordinate systems
4. Understand geometrical properties of dot product, cross product of vectors.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction		Interactive lecture		
2,3	Transformation of coordinates,	Books & Internet	Interactive lecture, Problem solving session, PPT		Quizzes
4-7	Pair of straight lines	Books & Internet	Interactive lecture, Problem solving session, PPT	.	Assignments.
8	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
9,10	Parabola	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
11	parametric coordinates	Books & Internet	Interactive lecture, Problem solving		Quizzes
12,13	tangent and normal	Books & Internet	Interactive lecture, Problem solving		Quizzes
14-16	Ellipse and its conjugate diameters with properties	Books & Internet	Interactive lecture, Problem solving session		Quizzes
17	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
18,19	Hyperbola and its asymptotes	Books & Internet	Review session, problem solving practice,		Based on active

				Interactive Discussion		participation
20,21	General conics: tangent	Books & Internet	Interactive lecture, Problem solving session			Quizzes
22	condition of tangency	Books & Internet	Interactive lecture, Problem solving session			Assignments.
23-25	pole and polar	Books & Internet	Interactive lecture, Problem solving session			Quizzes
26	center of a conic	Books & Internet	Interactive lecture, Problem solving session			Assignments.
27	Tutorial		Review session, problem solving practice, Interactive Discussion			Based on active participation
28,29	equation of pair of tangents	Books & Internet	Interactive lecture, Problem solving session, PPT			Assignments.
30	Unit test-1					
30,31	reduction to standard forms	Books & Internet	Interactive lecture, Problem solving session			Quizzes
32,33	central conics,	Books & Internet				Assignments.
34,35	equation of the axes, and length of the axes	Interactive lecture, Problem solving				Quizzes
36	Tutorial	Books & Internet	Interactive lecture, Problem solving session			Assignments.
37,38	polar equation of a conic	Books & Internet	Interactive lecture, Problem solving session			Quizzes
39	Problem solving session	Books & Internet	Interactive lecture, Problem solving session			Assignments.
40,41	tangent and normal and properties	Books & Internet	Interactive lecture, Problem solving session			Quizzes
42	Problem solving session	Books & Internet	Interactive lecture, Problem solving session			Assignments.
43,44	Plane	Books & Internet	Interactive lecture, Problem solving session			Quizzes

45,46	Straight lines	Books & Internet	Interactive lecture, Problem solving session		Assignments.
47,48	Shortest distance.	Books & Internet	Interactive lecture, Problem solving session		Quizzes
49	Problem solving session	Books & Internet	Interactive lecture, Problem solving session		Quizzes
50	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
51,52	Sphere	Books & Internet	Interactive lecture, Problem solving session	.	Assignments.
53	Problem solving session	Books & Internet	Review session, problem solving practice, Interactive Discussion		Quizzes
54,55	Cone,	Books & Internet	Interactive lecture, Problem solving session		Quizzes
56	Problem solving session	Books & Internet	Interactive lecture, Problem solving session		Assignments.
57	**Unit-test -2**				
58,59	cylinder	Books & Internet	Interactive lecture, Problem solving session		Assignments.
60,61	Central conicoid	Books & Internet	Review session, problem solving practice, Interactive Discussion		Quizzes
62	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation

63,64	ellipsoid	Books & Internet	Interactive lecture, Problem solving session		Quizzes
65,66	hyperboloid of one and two sheets,	Books & Internet	Interactive lecture, Problem solving session		Assignments.
67,68	diametral planes	Books & Internet	Interactive lecture, Problem solving session		Quizzes
69,70	tangent lines	Books & Internet	Interactive lecture, Problem solving session		Quizzes
71,72	director sphere	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
73	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
74,75	polar plane	Books & Internet	Review session, problem solving practice, Interactive Discussion		Quizzes
76,77	section with a given center	Books & Internet			Quizzes
78,79	Problem solving	Interactive lecture, Problem solving			Assignments.
80	**Unit-test 3**				
81-onwards	Revision and discussion on Work Workout question papers and solve problems arises by the students and discussion				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 -23

Name of the Teacher: Mriganka Sekhar Dutta & R. Kundu

Department: Mathematics

Paper Name: Theory of Real functions

Semester: III

Paper Code: MAT-HC-3016

Learning Objectives:

1. To learn the concept of limit of a function.

2. To learn concept of continuity and uniform continuity of a function defined on interval.

3. Understand the geometrical properties of continuous functions on closed and bounded intervals.

4. To learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books & Internet	Interactive lecture		
2-4	Cluster point or limit point of a set	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Assignments.
5-7	limits of a function (ε-δ approach)	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
8-10	sequential criterion for limits, divergence criteria	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes
11,12	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
13-15	Limit theorems	Books & Internet	Interactive lecture, Problem solving session		Quizzes
16-18	one sided limits	Books & Internet	Interactive lecture, Problem solving session		Assignments.
19-21	infinite limits and limits at infinity	Books & Internet	Interactive lecture, Problem solving session		Assignments.
22-24	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation

25	Unit Test-I				
26-28	Continuous functions	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Quizzes
29-31	sequential criterion for continuity and discontinuity	Books & Internet	Interactive lecture, Problem solving session		
32-34	algebra of continuous functions	Books & Internet	Interactive lecture, Problem solving session		Assignments.
35,36	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
37-38	continuous functions on intervals	Books & Internet	Interactive lecture, Problem solving session		
39-41	maximum-minimum theorem, intermediate value theorem	Books & Internet	Interactive lecture, Problem solving session		Assignments.
42-44	location of roots theorem, preservation of intervals theorem	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes
45-47	uniform continuity, uniform continuity theorem	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Assignments.
48-50	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
51	Unit test-2				
52,53	Differentiability of a function at a point and in an interval	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	

54	Caratheodory's theorem	Books & Internet	Interactive lecture, Problem solving session		
55	chain rule	Books & Internet	Interactive lecture, Problem solving session		Assignments.
56	derivative of inverse function	Books & Internet	Interactive lecture, Problem solving session		Quizzes
57,58	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
59-62	Rolle's theorem, mean value theorem	Books & Internet	Interactive lecture, Problem solving session		Assignments.
63-65	Darboux's theorem, Cauchy mean value theorem	Books & Internet	Interactive lecture, Problem solving session		
66,67	L'Hospital's rules	Books & Internet	Interactive lecture, Problem solving session		Assignments.
68-70	Taylor's theorem and applications to inequalities	Books & Internet	Interactive lecture, Problem solving session		Quizzes
71-73	Taylor's series expansions of exponential and trigonometric functions, $\ln(1 + x)$, $1/(ax+b)$ and n (1+ x)	Books & Internet	Interactive lecture, Problem solving session		Quizzes
74	Tutorial class		Review session, problem solving practice,		Based on active participation

			Interactive Discussion		
75	Unit test-III				
76-80	Question paper discussion and solve problems asked by the students.				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari
Teaching Plan for the Session: 2022 - 23

Name of Teacher: Gautam Sarma
Department: Mathematics
Semester: I
Paper Name: Algebra
Paper Code: MAT-HC- 1026

Course Objectives:

The primary objective of this course is to introduce the basic tools of set theory, functions, induction principle, theory of equations, complex numbers, number theory, matrices and determinant understand their connection with the real-world problems.

Course Learning Out comes:

This course will enable the students to:

i) Employ DeMoivre's theorem in a number of applications to solve numerical problems.

ii) Learn about equivalent classes and cardinality of a set.

iii) Use modular arithmetic and basic properties of congruences.

iv) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.

v) Learn about the solution sets of linear systems using matrix method and Cramer's rule

Course Outline & Suggested readings :

UNIT-1: Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

UNIT-2: Statements and logic, statements with quantifier, compound statements, implications, proofs in Mathematics; Sets, operations on sets, family of sets, power sets, Cartesian product; Functions, one-one, onto functions and bijections, Composition of functions, Inverse of a function, Image and Inverse image of subsets

UNIT-3: Relation, Equivalence relations, Equivalence classes and partitions of a set, congruence modulo n in integers; Induction Principles, the well-ordering principle, greatest common divisor of integers.

UNIT 4: Systems of Linear Equations, row reduction and echelon forms, vector equations, the matrix equation Ax =b, solution sets of linear systems, linear independence, introduction to linear transformations, the matrix of a linear transformation; Matrix operations,inverse of a matrix, characterizations of invertible matrices;Determinants, Cramer's rule.

Textbooks :

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser,2006.

2. A Kumar, S. Kumaresan and B.K.Sarma, A Foundation Course in Mathematics,Narosa,2018.

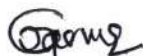3. David C. Lay, Linear Algebra and its Applications(3rdEdition), Pearson Education Asia, Indian

Reference Books:

1. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory (3rd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2005.

2. Gilbert Strang, Linear Algebra and its Applications, Thomson,2007.

Time Plan for the Course:

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks	Interactive lecture		
2	Polar representation of complex numbers with examples	Textbooks & Internet	Interactive lecture & PPT		
3	nth roots of unity	Textbooks & Internet	Interactive lecture & PPT		Assignments
4-5	De Moivre's theorem for rational indices	Reference Books	Interactive lecture & discussion		Quizzes
6-7	Applications of De Moivre's Theorem	Reference Books	Interactive lecture & PPT		Class test
8-9	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
10-11	Unit Test – 1				
12	Statements and logic, implications, proofs in Mathematics	Reference Books	Interactive lecture & PPT		
13	statements with quantifier, compound statements	Reference Books	Interactive lecture & PPT		Quizzes
14	Implications and proofs in Mathematics	Reference Books	Interactive lecture & discussion		Assignments
15-16	Sets, operations on sets.	Textbooks & Internet	Interactive lecture & PPT		
17	family of sets, power sets, Cartesian product	Textbooks & Internet	Interactive lecture & discussion		Class test
18-20	Tutorial Class	Textbooks	Problem solving session		Based on active participation
21	Functions, one-one, onto functions.	Textbooks	Interactive lecture & PPT		Assignments
22-23	Bijections and Composition of functions	Textbooks & Internet	Interactive lecture & PPT		Quizzes
24-25	Inverse of a function with examples	Textbooks & Internet	Interactive lecture & PPT		Assignments
26-27	Image and Inverse image of subsets	Reference Books	Interactive lecture & discussion		Class test
28	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
29	Unit Test – 2				

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
30-31	Relation and Equivalence relations	Textbooks & Internet	Interactive lecture & PPT		Assignments
32-33	Equivalence classes and partitions of a set	Reference Books	Interactive lecture & discussion		Quizzes
34	congruence modulo n in integers	Textbooks & Internet	Interactive lecture & PPT		Assignments
35	Induction Principles,	Reference Books	Interactive lecture & PPT		Quizzes
36 – 37	the well-ordering principle	Textbooks	Interactive lecture & discussion		
38	greatest common divisor of integers	Textbooks	Interactive lecture & discussion		Class Test
39	Tutorial Class	Textbooks	Problem Solving Session		Based on active participation
40	Unit Test – 3				
41-42	Systems of Linear Equations	Reference Books	Interactive lecture & discussion		
43-44	row reduction and echelon forms	Textbooks & Internet	Interactive lecture & PPT		Assignments
45-46	vector equations, the matrix equation Ax =b	Textbooks & Internet	Interactive lecture & discussion		Quizzes
47	solution sets of linear systems,	Reference Books	Interactive lecture & discussion		Assignments
48-49	linear independence, introduction to linear transformation	Reference Books	Interactive lecture & discussion		Quizzes
50-52	Matrix operations, inverse of a matrix	Textbooks	Interactive lecture		
53-54	characterizations of invertible matrices	Textbooks	Interactive lecture & PPT		Assignments
55-56	Determinants, Cramer's rule	Textbook	Interactive lecture & discussion		Class test
57	Tutorial Class	Textbooks	Problem solving session		Based on active participation
58	Unit Test III				
59-62	Solving previous Question papers and discussed	Library	Problem solving session		Based on active participation
63-Rest	Tutorial Class		Problem solving session		Based on active participation

Signature of teacher

Signature of HOD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 –23

Name of the Teacher: P. Begum

Department: Mathematics

Semester: I

Paper Name: Calculus

Paper Code: MAT-HG-1016/MAT-RC-1016

Learning Objectives:

1. Understand continuity and differentiability in terms of limits.
2. Describe asymptotic behavior in terms of limits involving infinity.
3. Use derivatives to explore the behavior of a given function, locating and classifying its extrema, and graphing the function.
4. Understand the importance of mean value theorems.

Syllabus:

Unit 1: Graphs of simple concrete functions such as polynomial, Trigonometric, Inverse trigonometric, Exponential and logarithmic functions

Unit 2: Limits and continuity of a function including approach, Properties of continuous functions including Intermediate value theorem.

Unit 3: Differentiability, Successive differentiation, Leibnitz theorem, Recursion formulae for higher derivatives.

Unit 4: Rolle's theorem, Lagrange's mean value theorem with geometrical interpretations and simple applications, Taylor's theorem, Taylor's series and Maclaurin's series, Maclaurin's series expansion of functions such as heir use in polynomial approximation and error estimation.

Unit 5: Functions of two or more variables, Graphs and level curves of functions of two variables, Partial differentiation up to second order.

Text Books:

1. Thomas, Jr. George B., Weir, Maurice D., & Hass, Joel (2014). *Thomas' Calculus* (13thed). Pearson Education, Delhi. Indian Reprint 2017.
2. Anton, Howard, Bivens, Irl, & Davis, Stephen (2013). *Calculus* (10th ed.). John Wiley & Sons Singapore Pvt. Ltd.
3. Shanti Narayan and P.K. Mittal, Differential Calculus, S. Chand, 2005.

Time Plan for the course:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course				
2 - 7	Graphs: Simple concrete functions, polynomials	Text books	Interactive lectures, problem solving sessions	Coding in lab	
8 - 14	Trigonometric, inverse trigonometric	-do-	-do-		
15 - 17	Exponential and logarithmic functions	-do-	-do-	Coding in lab	Quizzes
18 - 20	Differentiability	-do-	-do-	Coding in lab	
21, 22	Successive differentiation	-do-	-do-		Quizzes

23 - 27	Leibnitz theorem	-do-	-do-		Class Test
28 - 32	Recursion formulae for higher derivatives	-do-	-do-		
33 - 35	Rolle's theorem	-do-	-do-	Coding in lab	
36 - 39	Lagrange's mean value theorem: geometrical interpretation & application	-do-	-do-	Coding in lab	
40 - 44	Taylor's theorem	-do-	-do-		Class Test
45 - 47	Taylor's and Maclaurin's series	-do-	-do-		
48 - 54	Maclaurin's series expansion of functions such as their use in polynomial approximation and error estimation.	-do-	-do-		Quizzes & Class Test
55 - 58	Functions of two or more variables	-do-	-do-		Quizzes & Class Test
59 – 63	Graphs and level curves of functions of two variables	-do-	-do-	Coding in lab	
64 - 69	Partial differentiation up to second order.	-do-	-do-		Quizzes & Class Test

There will be tutorial classes every week.

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022 – 23

Name of the Teacher: M. S. Dutta

Department: Mathematics

Paper Name: Calculus (including practical)

Semester: I

Paper Code: MAT-HC-1016

Learning Objectives:

1. To learn first and second derivative tests for relative extremum and apply the knowledge in problems in business, economics and life sciences.

2. How to sketch curves in a plane using its mathematical properties in different coordinate systems.

3. Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.

4. Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books & Internet	Interactive lecture		
2-5	Higher order derivatives	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Assignments.
6-9	Leibnitz rule and its applications to problems of type $e^{(ax+b)} \sin x$, $e^{(ax+b)} \cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$	Books & Internet	Interactive lecture, Problem solving session, PPT		Assignments.
10,11	Practical class				
12-14	concavity and inflection points	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes
15,16	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
17-19	asymptotes	Books & Internet	Interactive lecture, Problem solving session		Quizzes
20,21	Practical class				
22-24	curve tracing in Cartesian coordinates	Books & Internet	Interactive lecture, Problem solving session		Assignments.
25-27	tracing in polar coordinates of standard curves	Books & Internet	Interactive lecture, Problem solving session		Assignments.
28,29	L'Hopital's rule	Books & Internet	Interactive lecture, Problem solving	Hands-on activities, curve tracing by coding	

			session	in lab.	
30-32	Applications of calculus in business, economics and life sciences. [				
33,34	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
35	Unit Test-I				
36-39	Reduction formulae, derivations and illustrations of reduction formulae of the type $\int((\sin x)^n dx$, $\int(\cos x)^n dx$, $\int(\tan x)^n dx$, $\int(\sec x)^n dx$, $\int(\log x) n$ dx, $\int(\sin x)^n (\cos x)^m dx$	Books & Internet	Interactive lecture, Problem solving session, PPT	Hands-on activities, curve tracing by coding in lab.	Quizzes
40-43	volumes by slicing, disks and washers methods	Books & Internet	Interactive lecture, Problem solving session		
44-46	volumes by cylindrical shells	Books & Internet	Interactive lecture, Problem solving session		Assignments.
47,48	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
49,50	parametric equations, parameterizing a curve	Books & Internet	Interactive lecture, Problem solving session		
51-53	arc length, arc length of parametric curves	Books & Internet	Interactive lecture, Problem solving session		Assignments.
54,55	Area of surface of revolution.	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	Quizzes

56	Unit Test-2				
57,58	Triple product	Books & Internet	Interactive lecture, Problem solving session	Hands-on activities, curve tracing by coding in lab.	
59-61	introduction to vector functions, operations with vector-valued functions	Books & Internet	Interactive lecture, Problem solving session		
62-64	limits and continuity of vector functions, differentiation and integration of vector functions	Books & Internet	Interactive lecture, Problem solving session		Assignments.
65-67	tangent and normal components of acceleration	Books & Internet	Interactive lecture, Problem solving session		Quizzes
68,69	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
70,71	modelling ballistics and planetary motion	Books & Internet	Interactive lecture, Problem solving session		Assignments.
72,73	Kepler's second law	Books & Internet	Interactive lecture, Problem solving session		
74,75	Practical class				
76	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation

77	Practical class				
78	Unit test-III				
79-81	Question paper discussion and solve problems asked by the students.				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher:

Department: Mathematics
Paper Name: Partial Differential Equations (including practical)

Semester: VI

Paper Code: MAT-HC-6026

Learning Objectives:

1. Formulate, classify and transform first order PDEs into canonical form.
2. Learn about method of characteristics and separation of variables to solve first order PDE's.
3. Classify and solve second order linear PDEs.
4. Learn about Cauchy problem for second order PDE and homogeneous and non-homogeneous wave equations.
5. Apply the method of separation of variables for solving many well-known second order PDEs.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to the course	Books &Internet	Lecture		
2-5	Classification	Books &Internet	Reading/Writing learning method		Quizzes
6-10	Construction of first order partial differential equations (PDE)	Books &Internet	Reading/Writing learning method		Assignments.
11,12					
13	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
14-20	Cauchy's problem for first order equations,	Books &Internet	Reading/Writing learning method		Quizzes
21-25	linear equations of the first order	Books &Internet	Reading/Writing learning method		Assignments.
28	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
29,30	Tutorial		Review session, problem solving practice, Interactive Discussion		Based on active participation
31	Unit test-1				
32-35	Integral surfaces passing through a given curve	Books &Internet	Reading/Writing learning method		Assignments.
36-40	Nonlinear partial differential equations of the first order	Books &Internet	Reading/Writing learning method		Assignments.

41	Practical			Hands-on activities, curve tracing by coding in lab	Quizzes
42-46	Cauchy's method of characteristics	Books &Internet	Reading/Writing learning method		Quizzes
47-51	Charpit's method	Books &Internet	Reading/Writing learning method		Assignments.
52,53	Tutorial	Books &Internet	Review session, problem solving practice, Interactive Discussion		Based on active participation
54	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
55-60	Solutions satisfying given conditions	Books &Internet	Reading/Writing learning method		Assignments.
61	Unit test-2				
62-65	Jacobi's method.	Books &Internet	Reading/Writing learning method& Visual Learning Method.	Hands-on activities by Coding in the lab	Quizzes
66	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
67,68	Tutorial				Based on active participation
69- 72	Canonical form of first order PDE	Books &Internet	Reading/Writing learning method& Visual Learning Method		Assignments.
73	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
75-79	Method of separation of variables for	Books &Internet	Reading/Writing learning method&		Assignments.

			Visual Learning Method		
80	Practical		Coding in the lab	Hands-on activities, curve tracing by coding in lab	Quizzes
81	Unit test-3				
82- on wards	Revision and discussion on Work out question papers and solve problems arises by the students and discussion				

Signature of the Teacher

Signature of the HoD

Nalbari College, Nalbari
Teaching Plan for the Session: 2022 - 23

Name of Teacher: Gautam Sarma
Department: Mathematics
Semester: VI
Paper Name: Group Theory II
Paper Code: MAT-HE- 6066
Course Objectives:
   The course will develop an in-depth understanding of one of the most important branch of the abstract algebra with applications to practical real-world problems. Classification of all finite abelian groups (up to isomorphism) can be done.

Course Learning Outcomes:
   The course shall enable students to:
i) Learn about automorphisms for constructing new groups from the given group.
ii) Learn about the fact that external direct product applies to data security and electric circuits.
iii) Understand fundamental theorem of finite abelian groups.
iv) Be familiar with group actions and conjugacy in Sn.
v) Understand Sylow's theorems and their applications.

Course outline & suggested reading :

Unit 1: Isomorphisms, automorphisms, inner automorphisms, Automorphisms groups; External direct products of groups and their properties; the group of units modulo n as an external direct product

Unit 2: Normal subgroups, factor groups and their applications, Internal direct products, of subgroups, Fundamental theorem of finite Abelian groups, isomorphism classes of finite abelian groups.

Unit 3: Conjugacy classes, the class equation, Conjugacy classes in the symmetric group Sn, p-groups, The Sylow's theorems and their applications.

Text Books :
1. Gallian, Joseph. A. (2013). *Contemporary Abstract Algebra* (8th ed.). Cengage Learning India Private Limited. Delhi. Fourth impression, 2015
2. Dummit, David S., & Foote, Richard M. (2016). *Abstract Algebra* (3rd ed.). Student Edition. Wiley India.

Reference Book:
1. Joseph J. Rotman, (1995). *An Introduction to The Theory of Groups* (4th ed.). Springer Verlag, New York.
2. John B. Fraleigh (2002), A First Course in Abstract Algebra, 7th Ed., Pearson.
3. G. Santhanam (2017), Algebra, Narosa Publishing House.

Time plan for the course :

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
1	Introduction	Textbooks	Interactive lecture		
2-4	Isomorphisms	Textbooks & Internet	Interactive lecture & PPT		
5-6	automorphisms,	Textbooks & Internet	Interactive lecture & PPT		Assignments
7	inner automorphisms,	Reference Books	Interactive lecture & discussion		Quizzes
8-10	Automorphisms groups	Reference Books	Interactive lecture & PPT		
11	External direct products of groups	Textbooks	Interactive lecture & discussion		
12-13	their properties	Textbooks	Interactive lecture & PPT		
14-15	group of units modulo n as an external direct product	Reference Books	Interactive lecture & PPT		Class test
16	Tutorial Class	Textbooks	Problem solving session		Based on active participation
17	Unit Test -1				
18-20	Normal Subgroups	Textbooks & Internet	Interactive lecture & PPT		
21-24	factor groups and their applications	Textbooks & Internet	Interactive lecture & discussion		
25-26	Internal direct products, of subgroups	Textbooks	Interactive lecture		Assignments
27-28	Fundamental theorem of finite Abelian groups.	Textbooks	Interactive lecture & PPT		Quizzes
29-30	isomorphism classes of finite abelian groups	Textbooks & Internet	Interactive lecture & PPT		Class test
31	Tutorial Class	Textbooks	Problem solving session		Based on active participation
32	Unit Test 2				
33-34	Conjugacy classes	Textbooks & Internet	Interactive lecture		
35	Tutorial Class	Textbooks	Problem solving session		Based on active participation

Sl No of Lectures	Topic/Subtopic	Learning Resources	Mode of Teaching &ICT tools	Experiential/Participating Learning Used	Mode of Assessment
36-38	the class equation	Textbooks & Internet	Interactive lecture & PPT		Assignments
39-41	Conjugacy classes in the symmetric group Sn	Reference Books	Interactive lecture & discussion		Quizzes
42-43	p-groups	Textbooks & Internet	Interactive lecture & PPT		
44-49	The Sylow's theorems,	Reference Books	Interactive lecture & PPT		
50-54	their applications	Textbooks	Interactive lecture & discussion		Class test
55	Tutorial Class	Textbooks	Problem solving session		Based on active participation
56	Unit Test -3				
57-62	Solving previous Question papers and discussed	Library	Problem Solving Session		Based on active participation
63-Rest	Tutorial Class		Interactive discussion		Based on active participation

Signature of teacher

Signature of HOD

Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: P. Begum

Department: Mathematics

Semester: VI

Paper Name: Numerical Analysis

Paper Code: MAT-RE-6016

Learning Objectives:

1. Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
2. Know about methods to solve system of linear equations, such as False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.
3. Interpolation techniques to compute the values for a tabulated function at points not in the table.
4. Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction	Books &Internet	Lecture		
2-5	Algorithms	Books &Internet	Reading/Writing learning method		Quizzes
6,7	Convergence	Books &Internet	Reading/Writing learning method		Assignments.
8	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
9,10	Tutorial class		Review session, problem solving		Based on active participation

			practice, Interactive Discussion		
11-15	Bisection method	Books &Internet	Reading/Writing learning method		Quizzes
16-18	False position method	Books &Internet	Reading/Writing learning method		Assignments.
19	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
20,21	Fixed point iteration method,		Reading/Writing learning method		Quizzes
22-24	Newton's method	Books &Internet	Reading/Writing learning method		Assignments.
25	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes.
25-28	Secant method	Books &Internet	Reading/Writing learning method		Assignments.
29	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
30-33	LU decomposition	Books &Internet	Reading/Writing learning method		Quizzes
34	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
35	Unit test-1				
36,37	Lagrange interpolation:,	Books &Internet	Reading/Writing learning method	Hands-on activities by Coding in the lab	Assignments.

38,39	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
40,41	Newton interpolation	Books &Internet	Reading/Writing learning method		Quizzes
42	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
43,44	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
45	linear and higher order				
46,47	finite difference operators.	Books &Internet	Reading/Writing learning method		Assignments.
48	Practical		Coding in the lab	Hands-on activities by Coding in the lab	
49	Problem solving				
50,51	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
52	Unit test-2				
53-55	Numerical differentiation	Books &Internet	Reading/Writing learning method& Visual Learning Method.		Quizzes
56,57	Forward difference.		Coding in the lab		Assignments

58,59	backward difference	Books &Internet	Reading/Writing learning method& Visual Learning Method	Hands-on activities by Coding in the lab	Assignments.
60,61	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
62	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
63	Problem solving				
64,65	central difference		Coding in the lab		Quizzes
66	Integration	Books &Internet	Reading/Writing learning method& Visual Learning Method		Assignments.
67,68	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
69	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes
70	trapezoidal rule				Quizzes
71-73	Simpson's rule		Reading/Writing learning method		Assignments
74,75	Tutorial class		Review session, problem solving practice, Interactive Discussion		Based on active participation
76	Practical		Coding in the lab	Hands-on activities by Coding in the lab	Quizzes

77-79	Euler's method				Assignments
80	Unit test-III				
81-onwards	Question paper discussion and problem solving				

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