DEPARTMENT OF MATHEMATICS

M.Sc. (MATHEMATICS)

(Students admitted during 2020-2021 Onwards)

(Under CBCS with Outcome Based Education (OBE) Pattern)

SYLLABUS

I & II SEMESTER

GOBI ARTS & SCIENCE COLLEGE

(Govt. Aided Autonomous Co-educational Institution, Affiliated to
Bharathiar University, Coimbatore, Accredited with 'A' Grade by NAAC (4th cycle)
and Recognised as a STAR College by DBT, Government of India)

KARATTADIPALAYAM POST,

GOBICHETTIPALAYAM - 638453

ERODE DISTRICT.

GOBI ARTS & SCIENCE COLLEGE (Autonomous)

Vision

Social and Economic upliftment of the people of this area through value based quality Education.

Mission

Committed to serve the society with humility and trust, devoid of exploitation; to impart value based higher education, particularly to the socially and economically deprived sections of this area; to make students of this institution worthy citizens of our glorious motherland.

DEPARTMENT OF MATHEMATICS

Vision

To strengthen the mental calculations, approximations, predictions, estimation of results and Mathematical problems to meet the challenge open to them.

Mission

- To Achieve innovation in teaching, learning and research to realize goals of higher education.
- To improve the perspective of students on mathematics as per modern requirements.
- To empower the learners in achieving their professional goals related to mathematics through invited talks and workshops.

GOBI ARTS & SCIENCE COLLEGE (AUTONOMOUS): GOBICHETTIPALAYAM

SCHEME OF EXAMINATIONS - M.Sc. (MATHEMATICS) (20 BATCH)

No.	Course Code	Course	Total Hours	Hrs/ Exam	Maximum Marks		Total Marks	Credits
					CIA	EOS		
		SEMESTER - I						
1	19P3MA01	LINEAR ALGEBRA	90	3	40	60	100	5.0
2	19P3MA02	REAL ANALYSIS	90	3	40	60	100	5.0
3	19P3MA03	ORDINARY DIFFERENTIAL EQUATIONS	90	3	40	60	100	5.0
4	19P3MA04	FUZZY SETS AND THEIR APPLICATIONS	90	3	40	60	100	4.0
5	19P3MA05	NUMBER THEORY	90	3	40	60	100	4.0
		SEMESTER – II						
6	19P3MA06	ALGEBRA	90	3	40	60	100	5.0
7	19P3MA07	COMPLEX ANALYSIS	90	3	40	60	100	5.0
8	19P3MA08	DIFFERENTIAL GEOMETRY	90	3	40	60	100	5.0
9	19P3MA09	PARTIAL DIFFERENTIAL EQUATIONS	90	3	40	60	100	5.0
10	19P3MA10	OBJECT ORIENTED PROGRAMMING WITH C++	60	3	40	60	100	3.0
11	19P3MAP1	PROGRAMMING LAB (C++)	30	3	40	60	100	1.0
		SEMESTER - III						
12	19P3MA11	TOPOLOGY	90	3	40	60	100	5.0
13	19P3MA12	FUNCTIONAL ANALYSIS	90	3	40	60	100	5.0
14	19P3MA13	FLUID DYNAMICS	90	3	40	60	100	3.0
15	19P3MA14	PYTHON PROGRAMMING	60	3	40	60	100	2.0
16	19P3MAP2	PROGRAMMING LAB (PYTHON PROGRAMMING)	30	3	40	60	100	1.0
17		SUPPORTIVE PAPER :	90	3	40	60	100	4.0
		SEMESTER - IV						
18	19P3MA15	CONTROL THEORY	90	3	40	60	100	5.0
19	19P3MA16	MECHANICS	90	3	40	60	100	5.0
20	20P3MA17	MATHEMATICAL STATISTICS	90	3	40	60	100	5.0
21	19P3MA18	MATHEMATICAL METHODS	90	3	40	60	100	4.0
22	19P3MA19	GRAPH THEORY	90	3	40	60	100	4.0

TOTAL CREDITS: 90

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

I. END OF SEMESTER (EOS) EXAMINATIONS

1. Theory: 60 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	10 × 1 = 10	MCQ	60
K2	B (Either or Pattern)	5 × 4 = 20	Short answers	
K3 & K4	C (Answer 3 out of 5)	3 × 10 = 30	Descriptive/Detailed	

2. Practical Examinations: 60 Marks

Knowledge Level	Section		Total
	Practical	Record work	
K3	50	10	60
K4			
K5			

II. CONTINUOUS INTERNAL ASSESSMENT (CIA):

1. Test – I & II: 30 Marks (Theory)

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	10 × 1 = 10	MCQ	30
K2	B (Answer 2 out of 3)	2 × 5 = 10	Short answers	
K3 & K4	C (Answer 1 out of 2)	1 × 10 = 10	Descriptive/Detailed	

2. Test –III: (Model Exam)

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	10 × 1 = 10	MCQ	60 Marks converted to 40 Marks
K2	B (Either or Pattern)	5 × 4 = 20	Short answers	
K3 & K4	C (Answer 3 out of 5)	3 × 10 = 30	Descriptive/Detailed	

3. Practical Internal Assessment: 40 Marks

Knowledge Level	Components		Calculation	Lab Performance	Total
K3, K4, K5	Test 1	30	$\frac{\text{Test 1 + Test 2}}{2}$	10	40
	Test 2	30			

Components of Continuous Internal Assessment (CIA)

Components		Calculation	CIA Total
Test 1 & Test 2	30	$30 + 40 + 30 = \frac{100 \times 40}{100} = 40$	40
Test 3	40		
Assignment+ Seminar+ Quiz / GD / Poster Presentation / Book Review / Field Visit Report	10+10+10 = 30		

Programme Specific Objectives

The students will be able to do, on successful completion of programme,

1. Post graduates use this course as a training ground to develop their knowledge, positive attitude, skills which will enable them to become good Mathematician.

2. Learn about research and development efforts which can enhance their own work and make them to solve the problems in Maths.

3. Make connection with other problem and theories with their fundamental knowledge of Mathematician.

4. To Use technology as significance aid in Mathematics learning.

Programme Specific Outcomes (PSO)

PSO1: Become competent in different fields of Mathematics.

PSO2: Able to read independently real mathematical literature of various types including survey articles, journals and online sources.

PSO3: Have opportunity of employment in teaching and many industries such as biomedical, research, communication and system analyst.

PSO4: Qualify lectureship and fellowship exams approved by CSIR NET and SET.

PSO5: Learn and apply in real life situations aiming service to society.

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA01	Course Title:	Batch:	2019
Total Hours:	90	Linear algebra	Semester:	I
			Credits:	5.0

Course Objective

The course aims

- Work with matrices and learn to solve systems of linear equations.
- Recognize the concepts of the terms span, linear independence and dependence, basis and dimension and apply the concepts of various vector spaces and subspaces.
- Compute eigen vectors and eigen values.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K3, K4	CO1	Determine whether or not particular subsets of a vector space are subspaces
K2, K3	CO2	Identify and construct linear transformations of a matrix
K2	CO3	Find the characteristic equation , eigen values and corresponding eigen Vectors of a given matrix
K4	CO4	Determine the given matrix is diagonalizable
K4	CO5	Demonstrate competence with the basic ideas of linear algebra including matrix operations, basis, invertibility, polynomials and minimal polynomials.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Vector spaces:** Introduction - Vector spaces - subspaces - Linear dependence and independence - Bases and dimensions.	**18**
II	**Linear transformations and matrices:** Linear transformations - Null spaces and Ranges - The matrix representation of a linear transformation. Invertibility and isomorphism.	**18**
III	**Elementary matrix operations and systems of linear equations:** Elementary matrix operations and elementary matrices - The rank of a matrix and matrix inverse - System of linear equations - Theoretical aspects.	**18**
IV	**Diagonalization:** Eigen values and Eigen vectors - Diagonalizability.	**18**
V	**Diagonalization:** Invariant subspaces and the Cayley - Hamilton theorem -Canonical forms: The Jordan canonical form I -The minimal polynomial.	**18**

Text Book:

Stephen H. Friedberg, Arnold J .Insel, Lawrence E. Spence, Linear Algebra, Fourth Edition, PHI Learning private Ltd, New Delhi, 2010.

Unit I - Chapter 1: 1.1-1.3, 1.5, 1.6

Unit II - Chapter 2: 2.1, 2.2 & 2.4

Unit III- Chapter 3: 3.1-3.3

Unit IV- Chapter 5: 5.1, 5.2

Unit V - Chapter 5: 5.4

Chapter 7: 7.1, 7.3

Reference Books:

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Private Ltd, New Delhi, 2005.
2. Seymour Lipschutz and Marc Lipson, Schaum's Outlines "Linear Algebra", Third Edition, Mc Graw Hill Education, 2017.

E-references:

1. http://ocw.mit.edu/courses/mathematics
2. http://www.khanacademy.org/math/linear-algebra
3. http://jasonmorton.gjthub.io/LinearAlgebra

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	L	S	M
CO2	L	S	L	S	S
CO3	M	S	M	L	S
CO4	L	M	L	S	M
CO5	S	S	M	M	L

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA02	Course Title:	Batch:	2019
Total Hours:	90	Real Analysis	Semester:	I
			Credits:	5.0

Course Objective

The course aims

- To acquire knowledge of basic topological properties in the field of real numbers and to expose the concept of convergence, continuity of sequence and series of functions.
- To equip adequate understanding of differentiability of real functions, transformations of vector valued functions and related theorems.
- To construct simple mathematical proofs and possess the ability to verify them.
- To apply abstract ideas and rigorous methods in mathematical analysis to practical problems in various fields.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Describe fundamental properties of the real number systems and familiar with basic proof techniques.
K2	CO2	Understanding limits and their uses in sequences, series, differentiation and integration.
K3	CO3	Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis and interconnected to various fields in science, in general.
K4	CO4	Evaluate the Riemann integrability of a bounded function and prove theorems related to linear transformations.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	[Recall basic concepts and definitions] The Riemann – Stieltjes Integral – Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of vector valued functions – Rectifiable Curves.	**18**
II	Sequences and Series of Functions – Discussion of main Problem – Uniform convergence – Uniform convergence and Continuity – Uniform convergence and Integration – Uniform convergence and Differentiation – Equi-Continuous families of functions – The Stone Weierstrass's theorem.	**18**
III	Some special functions - Power series – The Exponential and Logarithmic functions – The trigonometric functions – The algebraic Completeness of the complex field – Fourier series – The gamma function.	**18**

IV	Functions of several variable – Linear transformations – Differentiation – The contraction principle – The inverse function theorem.	**18**
V	Functions of several variable – The implicit function theorem – The rank theorem – Determinants – Derivative of Higher order – Differentiation of integral.	**18**

Text Book:

1. Walter Rudin, *Principles of mathematical Analysis,* Third edition, Reprint – 2016, McGraw Hill Education (India) pvt. Ltd., New Delhi.

   Unit – I : Chapter 6

   Unit – II : Chapter 7

   Unit – III : Chapter 8

   Unit – IV : Chapter 9 – Sections 9.1 – 9.25

   Unit – V : Chapter 9 – Sections 9.26 – 9.43

Reference Books:

1. T.M. Apostol, Mathematical Analysis, Narosa Publ. House, New Delhi, 1985.
2. H.L.Royden, Real Analysis, Macmillian Publn.Co.Inc.4th Edition, New York, 1993.
3. V.Ganapathy Iyer, Mathematical Analysis, Tata McGraw Hill, New Delhi, 1970.

E-reference:

1. https://onlinecourses.nptel.ac.in/

Mapping with Programme Specific Outcomes

PSO / C0	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	-	-	-
CO2	H	S	M	-	-
CO3	M	M	S	L	-
CO4	L	M	M	M	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA03	Course Title:	Batch:	2019
Total Hours:	90	Ordinary Differential Equations	Semester:	I
			Credits:	5.0

Course Objective

The course aims

- To give the students an awareness of the system to linear differential equations.
- To enable the students to use the methods to find the solutions of systems and Boundary Value Problems.
- To apply the results, learn to analyze the oscillations of second order equations and discuss the stability of linear and non-linear systems.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2	**CO1**	Obtain Systems of linear differential equations and identify the uniqueness of solutions.
K2	**CO2**	Determine the Existence and uniqueness of solutions.
K3	**CO3**	Create the Sturm –Liouville problem and the Green's function and Apply on Boundary Value Problems.
K4	**CO4**	Analyze on the Oscillations of second order equations.
K5	**CO5**	Develop the Stability of linear and Non-linear systems.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Systems of linear differential equations** Systems of first order equations – Model for Arms completion between two nations – Existence and uniqueness theorem - Fundamental matrix – Non-homogeneous linear systems – Linear systems with coefficients – Linear systems with periodic coefficients.	**18**
II	**Existence and uniqueness of solutions** Preliminaries – Successive approximations – Picard's theorem – Continuation and dependence on initial conditions – Existence and uniqueness of solutions of systems – Fixed point method.	**18**
III	**Boundary value problems** Sturm –Liouville problem – Green's function – Applications of Boundary Value Problems – Pecard's theorem.	**18**
IV	**Oscillations of second order equations** Fundamental results – Sturm's comparison theorem – Elementary linear oscillations – Comparison theorem of Hille-Wintner – Oscillations of $X''+a(t)X=0.$	**18**

V	**Stability of linear and Non-linear systems** Elementary critical points – System of equations with constant coefficients – Linear equation with constant coefficients – ***Lyapunov stability**** – Stability of Quasi – linear systems – second order linear differential equations.	**18**

<***- Self study***>

Text Book:

1. **Text book of Ordinary Differential Equations** by S.G Deo, V.Laksmikantan and V.Raghavendra, Tata McGraw Hill publishing company limited (Second edition), New Delhi.

Reference Books:

1. Theory of Ordinary Differential Equations by Coddington E.A, Levinson.N, - Tata McGraw Hill publishing company limited (First edition), New Delhi.
2. Ordinary Differential Equations and Stability theory by Sanchez D.A, - W.H.Free man and Co, (First edition).
3. Ordinary Differential Equations principles and applications by Nandhakumaran, A.K.Datti, P.S.Raju, K.George, - Cambridge University press, (First edition).

E-references:

1. https://mathworld.wolfram.com/Ordinary Differential Equation.html
2. http://www.math.psu.edu/tseng/class/math25/Notes-2nd%20order%20ODE%20pt1.pdf
3. http://www.khanacademy.org/math/differential-equations/first-order-differential-equations

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	L	M	M	M
CO2	L	M	M	M	H
CO3	L	M	M	H	S
CO4	M	M	S	S	S
CO5	M	S	S	S	S

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA04	Course Title:	Batch:	2019
Total Hours:	90	Fuzzy Sets and their Applications	Semester:	I
			Credits:	4.0

Course Objective

The course aims

- To study basic concepts and representations of Fuzzy Sets.
- To study Operations on Fuzzy Sets.
- To study fuzzy relations and their compositions.
- To study the concepts of Fuzzy Logic and Approximate Reasoning.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1, K2	**CO1**	Develop a grand paradigm shift from classical sets to fuzzy sets.
K2, K3	**CO2**	Describe various operations on fuzzy sets and apply the combinations of operations to solve problems.
K3	**CO3**	Demonstrate various measures of fuzziness and apply algebraic operations to fuzzy numbers.
K4	**CO4**	Analyze fuzzy relations and various properties of the Min-Max Composition.
K4, K5	**CO5**	Acquire sufficient skills in linguistic variables and fuzzy languages.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	From Classical Sets to Fuzzy Sets: Introduction – ***Crisp Sets: An overview***** – Fuzzy Sets: Basic Types – Fuzzy sets: Basic concepts – characteristics and significance of the paradigm shift. Fuzzy Sets versus Crisp Sets: Additional properties of α-cuts – Representations of Fuzzy Sets.	**18**
II	Operations on Fuzzy Sets: Types of operations – Fuzzy Complements – Fuzzy Intersections: t-Norms – Fuzzy Unions: t-conorms – Combinations of operations.	**18**
III	Fuzzy Measures and Measures of Fuzziness: Fuzzy measures – Measures of Fuzziness – The Extension principle and Applications: The Extension Principle – Operations for Type 2 Fuzzy Sets – Algebraic Operations with fuzzy Numbers – Special Extended Operations – Extended Operations for LR – Representation of fuzzy sets.	**18**
IV	Fuzzy Relations and Fuzzy Graphs: ***Fuzzy Relations on sets and Fuzzy Sets***** – Compositions of Fuzzy Relations – Properties of the Min-Max Composition – Fuzzy Graphs – Special Fuzzy Relations.	**18**
V	Applications of Fuzzy Set Theory: Fuzzy Logic and Approximate Reasoning – Linguistic Variables – Fuzzy Logic – Classical Logics Revisited – Linguistic Truth Tables – Approximate and Plausible Reasoning – Fuzzy Languages.	**18**

<* - Self Study>

Text Books:

1. For Units I & II – George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic: theory and Applications", PHI Learning Private Limited, New Delhi (2012).
2. For Units III, IV & V – H.J. Zimmermann, "Fuzzy Set Theory and its Applications", Springer Private Limited, 4th Edition (2006).

Unit I : Chapter 1 (1.1 – 1.5)
Chapter 2 (2.1, 2.2)
Unit II : Chapter 3 (3.1 – 3.5)
Unit III : Chapter 4 (4.1, 4.2)
Chapter 5 (5.1 – 5.3.2)
Unit IV : Chapter 6 (6.1 – 6.3)
Unit V : Chapter 9 (9.1 – 9.4)

Reference Books:

1. George J. Klir, Tina Folger A., "Fuzzy Sets, Uncertainty and information", Prentice – Hall of India Private Limited, 2006.
2. A.K. Bhargava, "Fuzzy Set Theory, Fuzzy Logic and their Applications", published by S. Chand Pvt Limited, (2013).
3. K.Pundir and R. Pundir, "Fuzzy Sets and their Applications", published by A. Pragati edition, (2012).
4. H.J. Zimmermann, "Fuzzy Sets, Decision Making and Expert Systems", Kluwer, Boston, 1987.

E-references:

1. https://onlinecourses.nptel.ac.in
2. https://www. tutorialspoint.com/fuzzy_logic

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	S	L	S
CO2	M	S	S	M	S
CO3	S	H	H	M	S
CO4	S	S	H	L	H
CO5	S	H	S	M	M

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA05	Course Title:	Batch:	2019
Total Hours:	90	Number Theory	Semester:	I
			Credits:	4.0

Course Objective

The course aims

- To give Introduction to Elementary Number Theory.
- To show how certain number theorems can be applied within Cryptography.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Understand the concepts of divisibility and primes.
K1, K2	CO2	Understand the concepts of congruences & solving problems.
K4	CO3	Analyze and solve problems using power residues & Quadratic residues.
K3, K5	CO4	Apply quadratic reciprocity Law to solve problems.
K4	CO5	Analyze the concepts of Number Theory functions.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Divisibility: Introduction, Divisibility, Primes.	**18**
II	Congruences: Solutions of congruences, Congruences of Degree 1, The functions $\varphi(n)$ congruences of Higher Degree, Prime power Moduli, Prime Modulus.	**18**
III	Congruences of Degree 2, prime Modulus, Power Residues, Number Theory from an Algebraic view point, Multiplicative Groups, Rings and Fields, Quadratic Residues.	**18**
IV	Quadratic Reciprocity: Quadratic Reciprocity – The Jocabi symbol – Greatest Integer function.	**18**
V	Some functions of Number Theory: Arithmetic functions – The Moebius Inversion formula – The Multiplication of Arithmetic function – Recurrence functions.	**18**

Text Book:

Herberts Zuchermam, Ivan Niran, An Introduction to theory of Numbers.

Unit-I

Chapter: I – Sections: 1.1-1.3

Unit-II

Chapter: II – Sections: 2.1-2.7

Unit-III

Chapter: II – Sections: 2.8-2.11

Chapter: III – Section: 3.1

Unit-IV

Chapter: III – sections: 3.2, 3.3

Chapter: IV – Section: 4.1

Unit-V

Chapter: IV – sections: 4.2-4.5

- Question paper setters are asked to confine to the above **text books** only.

Reference Books:

1. Apostol T.M., Introduction to Analytic number Theory, Springer Verlag, 1976.
2. George E. Andrews, Number Theory, Hindustan publishing Corporation, New Delhi, 1989.
3. Kennath, Rosan, Elementary Number Theory and Its Application, Addison Wesley Publishing Company, 1968.

E-references:

1. https:// freevideolectures.com/course/3027/cryptography-and-network-security/.
2. https://www.khanacademy.org/computing/computer-science/cryptography/modarithmetica/ congruence-modulo.
3. https://ocw.mit.edu/courses/mathematics/18-785-number Theory-i-fall-2017/Lecture-notes/MIT 18_785F17_4c27.pdf.

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	S
CO2	M	S	M	S	M
CO3	M	S	S	M	S
CO4	S	M	M	S	S
CO5	S	M	S	M	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA06	Course Title:	Batch:	2019
Total Hours:	90	Algebra	Semester:	II
			Credits:	5.0

Course Objective

The course aims

- To provide deep knowledge about various algebraic structures.
- To present the relationships between abstract algebraic structures with familiar numbers systems.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Realizesome advances of the theory of groups, extension fields, Galois theory.
K2	CO2	Understanding automorphism of a group, class equation of a group and the structure of finite Abelian groups.
K3	CO3	Apply Sylow's Theorem to study the properties of groups to find the conjugacy classes in symmetric groups using class equation.
K4	CO4	Examine the degree of extension fields and degree of the splitting field of the polynomial. Testing the irreducibility of a polynomial.
K5	CO5	Investigate the structure of two isomorphic algebraic structures like groups, rings, fields.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Groups and Sub Groups – Introduction and Examples – Binary Operations – Groups – Sub Groups – Cyclic Groups.	18
II	Groups of permutations – Orbits, Cycles, and the Alternating Groups – Cosets and the Theorem of Lagrange – Direct Products and Finitely Generated Abelian Groups.	18
III	Homomorphism - Factor Groups – Isomorphism Theorems – Sylow Theorems – Rings and Fields – Integral Domains - Fermat's and Euler's Theorem.	18
IV	The field of Quotients of an Integral Domain – Rings of Polynomials - Factorization of Polynomials over a Fields – Homomorphisms – Ideals and Factor rings – Prime and Maximal ideals.	18
V	Algebraic Extensions – Unique Factorization Domain – Euclidean Domain – Splitting Field – Separable Extension - Galois Theory.	18

Text Book:

John. B. Fraleigh, **A First Course in Abstract Algebra**, 7th Edition, Addison-Wesley, New Delhi, 2003.

Unit-I: Sections: 1 to 6 (Except 3)
Unit-II: Sections: 8 to 11
Unit-III: Sections: 13, 14, 18-20, 34 and 36
Unit-IV: Sections: 21 to 23, 26 and 27
Unit-V: Sections: 29, 31, 45, 46, 50-53.

Reference Books:

1. P.B. Bhattacharya, S.K. Jain & S.R. Nagpaul, **Basic Abstract Algebra**, Cambridge University Press, USA, 1986.
2. Charles Lanski, **Concepts in Abstract Algebra**, American Mathematical Society, USA, 2010.
3. M. Artin, **Algebra**, Prentice-Hall of India, New Delhi, 1991.
4. D.S. Dummit & R.M. Foot, **Abstract Algebra**, John Wiley, New York, 1999.

E-references:

1. https://onlinecourses.nptel.ac.in/noc18 ma15/
2. https://onlinecourses.nptel.ac.in/noc18 ma16/

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	L	L
CO2	S	H	H	L	L
CO3	S	S	H	M	M
CO4	S	S	H	H	H
CO5	S	H	H	S	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA07	Course Title:	Batch:	2019
Total Hours:	90	Complex Analysis	Semester:	II
			Credits:	5.0

Course Objective

The course aims

- To study the local properties of analytic functions and conformal mappings.
- To learn the concepts of complex integration and singularities.
- To study the series and product developments and conformal mapping of polygons.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Understand the concepts of analytic functions and complex integration.
K1, K2	CO2	Understand Residues, Singularities and Evaluation of definite integrals.
K4	CO3	Determine series and product development, partial fractions & factorization.
K3	CO4	Apply Cauchy's theorem, Taylor's theorem, Riemann mapping theorem for analytic functions.
K4	CO5	Analyze periodic functions and Weierstram theorem.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Concepts of Analytic function – Limits & continuity, Analytic functions – Sequences, series, Uniform convergence, Power series, Abel's limit theorem – Polynomials – Rational functions – Exponential, trigonometric functions, Periodicity, Analytic functions in regions, Conformal mapping. Complex integration – Line integrals as functions for arcs – Cauchy's theorem for rectangle, Discs, index of a point w. r. to a closed curve.	18
II	Zeros and Singularities, Residue theorem, Argument Principle, Evaluation of definite integrals.	18
III	Series and product developments – Wierstrass theorem – Hurwitz theorem – Taylor series – Laurent series – partial functions and factorizations – Mittag Leffler's theorem, infinite product, canonical product.	18
IV	The Riemann Mapping theorem – statement and proof – Boundary Behaviour, Analytic Arc, Conformal mapping of polygons – Behaviour at an angle – Schwarz Christoffel formula – Mapping on a Rectangle.	18
V	Elliptic functions – Simply periodic functions – Doubly periodic functions – The Weierstrass theory.	18

Text Book:

Complex Analysis by Ahlfors, McGraw Hill.

Unit-1

Chapter: 2 – sections 1.1 to 3.3
Chapter: 3 – sections 2.2 to 2.3
Chapter: 4 – sections 2.1 to 2.3

Unit-2

Chapter: 4 – sections 3.1, 3.2, 3.3, 3.4, 5.1, 5.2, 5.3

Unit-3

Chapter: 5 – sections 1.1 to 2.3

Unit-4

Chapter: 6 – sections 1.1 to 2.4

Unit-5

Chapter: 7 – sections 1.1 to 3.4

- Question paper setters are asked to confine to the above **text books** only.

Reference Books:

1. Foundations of complex Analysis by Ponnusamy, Narosa publishing house, 2002.
2. Real and complex Analysis by, w. Rudin, Megraw Hill international Editions 3rd Editing, 1987.

E-references:

1. https:// www.khanacademy.org/math/Linear-Algebra/matrix-transfurmations/linear-transformations.
2. https://freebookcentre.net/maths-books-download/introduction-to complex Analysis.html
3. https://www.nptel.ac.in/courses//11103070/

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	S
CO2	M	S	M	S	S
CO3	M	S	M	M	S
CO4	S	M	S	M	S
CO5	S	M	M	M	S

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA08	Course Title:	Batch:	2019
Total Hours:	90	Differential Geometry	Semester:	II
			Credits:	5.0

Course Objective

The course aims

- To study basic concepts of space curve theory.
- To study basic concepts of surface theory.
- To study the concepts of geodesics.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Develop arguments in the geometric description of curves and surfaces in order to establish basic properties of geodesics.
K2,K5	CO2	Understand the normal curvature of a surface, its connection with the first and second fundamental form and Euler's theorem.
K3	CO3	Compute the curvature and torsion of space curve.
K4	CO4	Learn about the curvilinear coordinates in space and to have some knowledge in Gauss and Codazzi Equations and its applications.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Curves: Analytic representation – Arc length, tangent – Osculating plane – Curvature – Torsion – Formulas of Frenet. Chapter 1: Sections 1-1 – 1-6.	18
II	Curves: Contact – Naturals Equations – Helices – General solution of the natural equations – Evolutes and involutes. Chapter 1: Sections 1-7 – 1-11.	18
III	Elementary theory of surfaces: Analytic representation – First fundamental form – Normal, tangent plane – Developable surfaces. Chapter 2: Sections 2-1 – 2-4.	18
IV	Elementary theory of surfaces: Second fundamental form. Meusnier's theorem – Euler's theorem – Dupin's indicatrix. The fundamental Equations: The equations of Gauss-Weingarten – The theorem of Gauss and the equations of Codazzi. Chapter 2: Sections 2-5 – 2-7 Chapter 3: Sections 3-2 and 3-3.	18
V	The fundamental Equations: Curvilinear coordinates in space – Some applications of the Gauss and the Codazzi equations – The fundamental theorem of surface theory. Geometry on a surface: Geodesic (tangential) curvature – Geodesics. Chapter 3: Sections 3-4 – 3-6 Chapter 4: Sections 4-1 and 4-2.	18

Text Book:

Dirk J. Struik, "Lectures on Classical Differential Geometry", Addison- Wesley Publishing company Inc., Second Edition, 1961.

Reference Books:

1. Mittal and Agarwal, "Differential Geometry", Krishna Prakashan Mandir, Twenty fifth Edition, 1997.
2. Willmore.T.J, "An introduction to Differential Geometry", Oxford University Press Publications.

E-reference:

1. http://search.barnesandnoble.com

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	M
CO2	H	H	M	H	H
CO3	M	M	M	H	S
CO4	H	M	L	M	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA09	Course Title:	Batch:	2019
Total Hours:	90	Partial Differential Equations	Semester:	II
			Credits:	5.0

Course Objective

The course aims

- To know about the basic concepts of Partial differential equations.
- To develop the mathematical skills in the subject.
- To enable the students to understand the application of PDE in science.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2	CO1	To understand the mathematical models and classification of second order equations
K3	CO2	To study Cauchy problem, separation of variable techniques and boundary value problems
K4	CO3	Know about the Dirichlet, Neumann problems for a circle, rectangle, annulus.
K5	CO4	Understand construction of Green's function and its application to boundary value problems.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Mathematical Models:** The Vibrating String -The Vibrating Membrane--Waves in an Elastic Medium--Conduction of Heat in Solids--The Gravitational Potential. (Chapter 2: 2.2 to 2.6) **Classification of Second-order Equations:** Second-order Equations in Two Independent Variables--Canonical Forms--Equations with Constant Coefficients--General Solution. (Chapter 3: 3.1 to 3.4)	**18**
II	**The Cauchy Problem:** The Cauchy problem -- Cauchy-Kowalewsky theorem. Hadamard Example--The Cauchy problem for Homogeneous Wave Equation--Initial-boundary Value Problem--The Cauchy Problem for Nonhomogeneous Wave Equation--Riemann's method. (Chapter 4: 4.1 to 4.6)	**18**
III	**The Method of Separation of Variables:** The Vibrating String Problem-Existence and Uniqueness of Solution of the Vibrating String Problem--The Heat Conduction Problem-Existence and Uniqueness of Solution of the Heat Conduction Problem--The Laplace and Beam Equations-Nonhomogeneous Problems--Exercises. (Chapter 6: 6.2 to 6.7)	**18**
IV	**Boundary Value Problems:** Boundary Value Problems--Maximum and Minimum Principles--Uniqueness and	**18**

	Stability Theorems--Dirichlet Problem for a Circle--Dirichlet problem for a Circular Annulus—Neumann Problem for a Circle--Dirichlet Problem for a Rectangle--Dirichlet Problem involving Poisson Equation--Neumann Problem for a Rectangle--exercises. (Chapter 8: 8.1 to 8.9)	
V	**Green's Functions:** The Delta Function--Green's Function--Method of Green's Function--Dirichlet Problem for the Laplace Operator--Dirichlet Problem for the Helmholtz Operator--Method of Images--Eigenfunction Method--Higher Dimensional Problems--Neumann Problem. (Chapter 10: 10.1 to 10.9)	**18**

Text Book:

Partial Differential Equations of Mathematical Physics By Tyn Myint-U.

Reference Books:

1. Partial Differential Equations of Mathematical physics and Integral equations by Ronald B.Guenther and John W.Lee (Dover publications Inc.)
2. Introduction to Partial Differential Equations by K.Sankara Rao (PHI Learning pvt. Ltd, New Delhi – 110 001 (2011).
3. Partial Differential Equations for Scientists and Engineers, Stanley J.Farlow (Dover publications Inc.)

E-references:

1. https://www.elsevier.com/books/Mathematical physics...partial-differential-equation/..
2. https://www.cncpress.com>Mathematics>Mathematics for physics

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	M
CO2	S	S	M	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S

S - Strong; **H** - High; **M** - Medium; **L** – Low

Programme Code:	M.Sc.	Programme Title:	Mathematics	
Course Code:	19P3MA10	Course Title:	Batch:	2019
Total Hours:	60	Object Oriented Programming with C++	Semester:	II
			Credits:	3.0

Course Objective

The course aims

- To give the students an awareness of the object oriented programming.
- To enable the students to write the c++ programs using classes, functions and interfaces.
- To make applications using c++ programs.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2, K3	CO1	Understand and apply the c++ structure, tokens, expressions, control structures and functions.
K3	CO2	Ability to declare various prototyping and arrays of objects.
K3, K4	CO3	Create constructors, distracters, over loading operators and strings.
K4	CO4	Analyze inheritance, pointers, virtual functions and polymorphism.
K4, K5	CO5	Deliberate files and templates. Create, design and develop quality programs in c++.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	Principles of OOP. Basic concepts of OOP. Benefits and applications of OOP. C++ structure – Tokens, Expressions and control structures. Tokens – Keywords – Identifiers and Constants – Basic data types – User defined data types – Derived data types – Declaration and dynamic initialization of Variables – Operators in c++ - Expressions and their Types – Operator Overloading – Control structures.	12
II	Functions, Classes and Objects. Function prototyping – call by reference – return by reference – Inline functions – Function overloading – Friend and Virtual functions – Specifying a class – Member functions – Private member functions - Arrays within a class – Static member functions - Memory allocation for Objects – arrays of objects – Const member functions – Pointers to Members.	12
III	Constructors, Destructors and operator overloading: Constructors – Parameterized – Constructors – Copy constructor – Dynamic constructors – Destructors – Operator overloading – Overloading binary operators – Manipulation of strings using operators – Rules for overloading operators.	12

IV	Inheritance, Pointers, Virtual Functions and Polymorphism: Derived classes - Single and multiple Inheritance - Hierarchical and hybrid Inheritance - Virtual base Classes – Abstract classes – pointers to objects – pointers to derived classes – Virtual functions.	**12**
V	Files, Templates and object oriented Systems development : Files: Classes for file stream operations – Opening and closing a file – Detecting end of file – Error handling during file operations –Templates: Class templates – Function templates – Member function templates - Object oriented Systems development: Procedure oriented paradigms – Object oriented paradigm – Object oriented design and analysis.	**12**

Text Book:

Object Oriented Programming with c++ **by E.Balagurusamy, Tata McGraw Hill publishing company limited, New Delhi.**

Reference Books:

1. Programming with c++ by D.Ravichandran, -Tata McGraw Hill publishing company limited, NewDelhi.
2. Object Oriented Programming with c++ by S.S.Vinod Chandra, New age.
3. Object Oriented Programming with c++ by Sourav Sahay, Oxford University press.

E-references:

1. https://books.Google.co.in
2. https://www.pdfdrive.com
3. https://www.math.psu.edu
4. http://www.khanacademy.org
5. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-096-introduction-to-c-january-iap-2011/lecture | notes/

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	H	H
CO2	H	H	H	S	S
CO3	M	H	H	S	S
CO4	M	M	H	H	S
CO5	M	S	S	S	S

S - Strong; **H** - High; **M** - Medium; **L** – Low

Question Paper Pattern - P.G. Courses

(Common for Major and Supportive Papers)

For EOS Examinations: 60 Marks

The Question Paper is to be divided into THREE Sections.

Section-A Carries 10 Marks, Section-B Carries 20 Marks and Section-C Carries 30 Marks.

Section-A Contains 10 Multiple Choice Questions. (10 x 1 = 10)

Two Questions from each unit. (Q. No: 1 to 10)

Section-B Contains 5 Either or Choice Questions. (5 x 4 = 20)

Each Question carries 4 Marks. Both (a) and (b) from the same unit.

Q. No.: 11 (a) or (b) to 15(a) or (b)

Section-C Contains 5 Questions, out of which 3 Questions are to be answered. (3 x 10 = 30)

Each Question carries 10 Marks. One Question from each unit. Q. No.: 16 to 20

For CIA Examinations: 40 Marks

CIA Test I and II Question Paper Pattern: (30 Marks)

Section-A: 10 Multiple Choice Questions. (10 x 1 = 10)

Section-B: Two Questions out of Three. (2 x 5 = 10)

Section-C: One Question out of Two. (1 x 10 = 10)

Components of Continuous Internal Assessment (CIA)

Components		Calculation	CIA Total
Test 1 & Test 2	30	$30 + 40 + 30 = \frac{100 \times 40}{100} = 40$	40
Test 3 (Model Exam)	40		
Assignment + Seminar + Quiz / GD / Poster Presentation / Book Review / Field Visit Report	10+10+10 = 30		