PG & RESEARCH DEPARTMENT OF MATHEMATICS

PREAMBLE

UG : Course Profile, list of courses offered to the other departments & the syllabi of courses offered in the I, V VI semester (With effect from 2021-2024 batch onwards)

PROGRAMME PROFILE B.Sc. (MATHEMATICS)

PROGRAMME SPECIFIC OUTCOMES

PSO No. **Upon completion of these Courses the Students would have**

PSO-1 Become an individual academic excellence to face eligibility exams.

PSO-2 Acquired knowledge for higher studies.

PSO-3 Summarise the effective written communication of mathematical concepts.

PSO-4 Organize skills and knowledge that is translate information presented verbally into Mathematical form

PSO-5 Pursue a Higher Studies and become a software professional.

Semester	Part	Category	Course Code	Course Title	Previous course code	Contact Hours/ week	Credit Min/Max
I	I	Languages / AECC – II Tamil / Hindi/ French	UTAL107/ UTAL108/ UHIL102/ UFRL102	Basic Tamil-I/ Advanced Tamil-I/ Hindi-I / French-I	UTAL105/ UTAL106/ UHIL101/ UFRL101	5	3/4
	II	Communicative English/ AECC – I	UENL109/ UENL110	English for Communicative (Stream – I) / English for Communicative (Stream –II)		5	3/4
	III	Major Core (I) / DSC (I)	UMAM104	Differential Calculus	-	6	4
	III	Major Core (II)/ DSC (II)	UMAM108	Algebra and Trigonometry		6	4
	III	Allied – I (GE)	UMAA117	Mathematical Statistics - I	UMAA115	6	4
	III	PE	UPEM101	Professional English		6	4
	IV	Value Education (VE)				2	1
					TOTAL	**36**	**23/25**
II	I	Languages / AECC –II Tamil/ Hindi/ French	UTAL207/ UTAL208/ UHIL202/ UFRL202	Basic Tamil II/ Advanced Tamil-II/ Hindi-II / French-II	UTAL205/ UTAL206/ UHIL201/ UFRL201	5	3/4
	II	Communicative English / AECC – I	UENL209/ UENL210	English for Communicative (Stream – I) / English for Communicative (Stream –II)		5	3/4

II	III	Major Core III / DSC(III)	UMAM207	Vector Calculus		6	5
	III	Major Core IV /DSC(IV)	UMAM208	Analytical Geometry	UMAM105/ UMAM106	5	5
	III	Allied – II (GE)	UMAA207	Mathematical Statistics - II		6	4
	III	PE	UPEM201	Professional English II		6	4
	IV	Non Major Elective				3	2
	V	Extension Programme/ Physical Education				-	1/2
					TOTAL	**36**	**27/30**
III	I	Languages / AECC –II Tamil/ Hindi/ French	UTAL307/ UTAL308/ UHIL302/ UFRL302	Basic Tamil II/ Advanced Tamil-II/Hindi-II / French-II	UTAL305/ UTAL306/ UHIL301/ UFRL301	5	3/4
	II	Communicative English / AECC – I	UENL309/ UENL310	English for Communicative (Stream – I) / English for Communicative (Stream –II)		5	3/4
	III	Major Core V / DSC (V)_	UMAM308	Discrete Mathematics	UMAM206/ UMAM606	5	4
	III	Major Core VI/ DSC(VI)	UMAM309	Differential Equation	UMAM306/ UMAM302/ UMAM301	5	4
		Allied – III (GE)	UCSA304	Mathematical Programming using C	-	3	2
		Allied - III (GE) Practical	UCSR307	Mathematical Programming using C Practical	-	3	2
	IV	Online Course (NPTEL / SP)				3	1/2
		Value Education (VE)				2	1
					TOTAL	**31**	**20/23**
IV	I	Languages / AECC –II Tamil/ Hindi/ French	UTAL407/ UTAL408/ UHIL402/ UFRL402	Basic Tamil II/ Advanced Tamil-II/ Hindi-II / French-II	UTAL405/ UTAL406/ UHIL401/ UFRL401	5	3/4
	II	Communicative English / AECC – I	UENL409/ UENL410	English for Communicative (Stream –I) / English for Communicative (Stream –II)		5	3/4
	III	Major Core VII / DSC(VII)	UMAM407	Integral Transforms	UMAM405	4	4
	III	Major Core VIII / DSC (VIII)	UMAM408	Mechanics	UMAM406/ UMAM401	5	4
		Allied – IV (GE)	UPHA402	Electronics for Mathematics	-	3	2
		Allied – IV Practical	UPHR402	Electronics for Mathematics Practical	-	3	2
	IV	Soft Skill				2	1
		Non Major Elective				3	2
	V	Extension Programme/ Physical Education				-	-/2
					TOTAL	**30**	**21/25**
V	III	Major Core IX / DSC(IX)	UMAM507	Modern Algebra	UMAM501	6	5
		Major Core X / DSC(X)	UMAM514	Real Analysis I	UMAM508/ UMAM512	6	5
		Major Core XI / DSC(XI)	UMAM515	Numerical Methods	UMAM510	6	5

V	III	Major Elective	UMAO501	Graph Theory	UMAM205/ UMAM402	5	4
			UMAO502	Number Theory	UMAM506/ UMAM502		
		Major Core XII/ DSC (XII)	UMAP501/ UMAR511	Project/ R Programming	-	5	5
	IV	Value Education (VE)				2	1
					TOTAL	**30**	**25**
VI	III	Major Core XIII/ DSC (XII)	UMAM614	Linear Algebra	UMAM604/ UMAM610	6	5
		Major Core XIV/DSC (XIV)	UMAM615	Real Analysis II	UMAM607/ UMAM611	6	6
		Major Core XV/DSC(XV)	UMAM602	Complex Analysis	UMAM509	6	6
		Major Core XVI/ DSC(XVI)	UMAM613	Operations Research	UMAM603/ UMAM608	6	6
		Major Elective	UMAO607	Mathematical Modeling	UMAM404	5	4
			UMAO606	Mathematics for Construction Craft	--		
			UMAO607	Mathematics in SpaceScience	--		
		Comprehensive Viva	UMAM601			-	1
	IV	Soft Skill				2	1
	V	Extension Programme/ PhysicalEducation				-	-/2
					TOTAL	**31**	**29/31**
					GRAND TOTAL	**194**	**145/159**

COURSES OFFERED TO OTHER DEPARTMENTS-UG ALLIED

Class &Major	Semester	Category	Course Code	Course Title	Previous course code	Contact Hours/ week	Credit Min/ Max
I B Com & I BCom (CA)	I	Allied	UMAA112	Business Mathematics	-	6	4
I B.SC PHY			UMAA114	Allied Mathematics I	UMAA106	6	5
I BCA			UMAA110	Mathematical Methods I	-	6	4
I B.Sc (CS)			UMAA113	Statistical Methods	-	6	4
I B.Sc (CS)	II		UMAA218	Mathematics for computer Science	-	6	4
II BCA			UMAA216	Mathematical Methods II		6	4
I B.SC PHY			UMAA222	Allied Mathematics II	UMAA212	6	5
II B.Sc Chem	III	Allied	UMAA312	Allied Mathematics for Chemistry I	UMAA304	6	5
II B.Sc BIO			UMAA307	Bio-Statistics	UMAA305	6	4
II BBA/ II B.COM/ II B.COM CA			UMAA301	Business Statistics	UMAA211/ UMAA403/ UMAA107	6	4
II B.Sc Chem	IV		UMAA408	Allied Mathematics for Chemistry II	UMAA406	6	5
II BBA			UMAA410	Quantitative techniquesfor Business	UMAA505	6	4

NON-MAJOR ELECTIVE

Semester	Part	Category	Course Code	Course Title	Previous course code	Contact Hours/ week	Credit
II	IV	Non Major Elective	UMAR201	Statistics using Excel	-	3	2
			UMAE204	Basic Mathematics for Science	-	3	2
			UMAE202	Mathematics for Business and Decision Making	-	3	2
			UIDE302/ UMAE302	Numerical Methods using C++	-	3	2
			UMAE306	Operations Research for Managers	UMAE402	3	2
			UMAA501/ UMAE305	Statistical Data Analysis throughSPSS	-	3	2
			UMAE308	Mathematics for Competitive Exams	UMAE502	3	2
IV	IV	Non Major Elective	UMAE404	Mathematics for Career Development	-	3	2

EXTRA CREDIT EARNING PROVISION

Semester	Part	Category	Coursecode	Course Title	Contact Hours/ week	Credit	
						Min	Max
II	III	Self Study paper	UMAI201	Summer Internship	-	-	1
IV	III	Self Study paper	UMAI401	Summer Internship	-	-	1
VI	III	Self Study paper	UMAS601 UMAS602 UMAS603 UMAS604	Fourier Transforms Simulation Number Theory Project	2	-	2

MATHEMATICAL STATISTICS I
UMAA117

Semester : I   **Credit** : 4
Category : Allied   **Hours/Week** : 6
Class &Major : I B.Sc Mathematics   **Total Hours** : 78

Course Objectives:

CO No.	To enable the students
CO 1	Understand the concept of probability, conditional probability and its axiom discrete and continuous random variable and its properties.
CO 2	Recognise the Identify the basic concepts of Mathematical Statistics
CO 3	Evaluate expectation and variance and its relevant theorems.
CO 4	Analyse binomial distribution Poisson distribution and their properties
CO 5	Create the solution of Correlation and regression.

UNIT - I PROBABILITY   **15 Hours**

Concept of Sample Space - Events - Definition of Probability – Some theorems on Probability – Addition theorem of Probability - Conditional Probability - Multiplication theorem of Probability - Independence of Events.

UNIT- II RANDOM VARIABLE   **16 Hours**

Introduction – Distribution Function - Random Variables - Discrete and Continuous Random Variable.

UNIT - III MATHEMATICAL EXPECTATION AND MOMENT GENERATING FUNCTION   **15 Hours**

Expectation – Expected Value of Functions of a Random Variable – Properties of Expectation & Variance - Moment Generating Function - properties - Characteristic Function – Properties

UNIT - IV DISCRETE AND CONTINUOUS PROBABILITY FUNCTION   **16 Hours**

Discrete Uniform Distributions – Bernoulli Distribution – Binomial Distribution - Poisson Distribution – Normal Distribution

UNIT - V CORRELATION AND REGRESSION   **16 Hours**

Introduction of Correlation - Karl Pearson's Coefficient of Correlation - RankCorrelation - Linear Regression – Properties.

Text Book

- Gupta. S.C. & Kapoor. V.K. (2020), *Fundamentals of Mathematical Statistics.* Sultan & Sons. New Delhi.

Reference Books

- Hogg. R.V. & Craig. A.T. (2013). *Introduction to Mathematical Statistics*. Macmillan. New York.
- Mood. A.M. Graybill. F.A. & Boes. D.G. (2017). *Introduction to Theory of Statistics.* McGrawHill. New York.
- Gupta.S.P. (2021). *Statistical Methods.* Sultan Chand & Sons. New Delhi.
- Arora.S. Sumeet Arora (2010). *Comprehensive Statistical Methods*. S.Chand and CompanyLtd. New Delhi.

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Acquire a good knowledge of various Concepts of Probability.	K1
CO 2	Recognize discrete and continuous random variable	K2
CO 3	Compute expectation and variance and discuss relevant theorems.	K
CO 4	Explain normal distribution and its properties.	K4
CO 5	Evaluate Correlation and Regression	K5

MODERN ALGEBRA
UMAM507

Semester : V   **Credits : 5**
Category : Core IX / DSC (IX)   **Hours/Week : 6**
Class & Major : III B.Sc Mathematics   **Total Hours : 78**

Course Objectives

CO No.	To enable the students
CO 1	Understand the Algebraic structures such as Groups, Rings and Ideals
CO 2	Recognise the concept of subgroups and its classifications.
CO 3	Apply the permutation groups.
CO 4	Analyse ring and its special classes, quotient groups, Isomorphism and homomorphism.
CO 5	Solve the problems based on the Polynomial rings.

UNIT-I GROUP THEORY   15 Hours

Definition of a Group - Some Preliminary Lemmas- Subgroups.

UNIT-II NORMAL SUBGROUPS   15 Hours

A Counting Principle - Normal Subgroups and Quotient Groups - Homomorphism

UNIT-III AUTOMORPHISMS   **15 Hours**

    Automorphism - Cayley`s theorem - Permutation Groups

UNIT-IV RING   **18 Hours**

    Definition and examples of Ring – Some special classes of Rings – Integral Domain - Homomorphism of Rings - Ideals and Quotient Rings - More Ideals and Quotient Rings.

UNIT-V IDEALS   **15 Hours**

    The field of an integral domain – Euclidean ring – Polynomial Rings.

Text Books
- Herstein.I.N. (2013). *Topics in Algebra*. John Wiley & Sons Publishers. (2nd ed.,). Asia.

Reference Book
- Arumugam. S. Issac. A.T. (2015). *Modern Algebra*. Scitech Publications Pvt Ltd. India.
- John Fraleigh.B. (2013). *A first course in Abstract Algebra.* Addison Wesley publishing Co. (7th ed.,).
- Rotman. J.J. (2005). *A First Course in Abstract Algebra.* (3rd ed.,) Prentice.
- A. R. Vasishtha. (2015). *Modern Algebra.* Krishna Publication.

e- Resources
- http://matterhorn.dce.harvard.edu/engage/ui/index.html#/1999/01/82345

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Recognize groups and its classifications.	K1
CO 2	Classify the groups and normal subgroups	K2
CO 3	Use theorems to solve problems in Permutation groups.	K3
CO 4	Describe the concept of ideals, Maximal, prime ideals and homomorphism of rings	K4
CO 5	Write the abstract mathematical proofs in a clear and logical manner.	K5

REAL ANALYSIS I
UMAM514

Semester : V
Category : Core X / DSC (X)
Class & Major : III B.Sc Mathematics

Credits : 5
Hours/Week :6
Total Hours :78

Course Objectives:

CO No.	To enable the students
CO 1	Gain the Knowledge of Sequences and Series of real numbers.
CO 2	Understand the concept of Sequences and Series.
CO 3	Analyze the series of Real numbers.
CO 4	Illustrate the Metric Spaces and differentiate the sets and functions defined on it.
CO 5	Create the Continuous functions at a point on the real line.

UNIT- I SETS AND FUNCTIONS **15 Hours**

Sets & Elements – Operations on Sets - Functions – Real valued functions – Equivalence – Countability and Real numbers – Least Upper Bound.

UNIT- II SEQUENCE OF REAL NUMBERS **15 Hours**

Definition – Subsequence – Limit of a Sequence – Convergent Sequence – Divergent Sequence – Bounded Sequence – Monotone Sequence - Operations on Convergent Sequence - Operations on Divergent Sequence

UNIT-III SERIES OF REAL NUMBERS **16 Hours**

Limit Superior and Limit Inferior – Cauchy Sequence- Summability of sequences- Limit Superior and Limit Inferior for sequences of sets.

Series: Convergence and Divergence – Series with Non - negative terms – Alternating Series – Conditional Convergence and Absolute Convergence.

UNIT-IV LIMITS AND METRIC SPACES **16 Hours**

Rearrangement of series – Tests for Absolute Convergence – Series whose terms form a non increasing sequence – Summation by parts.
Limit of a function of the real line – Metric space – Limits in metric spaces.

UNIT- V CONTINUOUS FUNCTIONS ON METRIC SPACES **16 Hours**

Functions continuous at a point on the real line – Reformulation - Functions Continuous on a Metric Spaces – Open Sets – Closed Sets- Discontinuous functions in R^1.

Text Books

- Goldberg. R. (2020). *Methods of Real Analysis.* Oxford & IBH Publishing co. New Delhi.

Reference Books

- Tom Apostol. M. (2004). *Mathematical Analysis.* Addison –Wesley New York (4th ed.,).
- Malik.S.C. and Savita Arora. (2021). *Mathematical Analysis.* Wiley Eastern Limited NewDelhi.
- Sanjay Arora and BansiLal. (2012). *Introduction to Real Analysis.* Satya Prakashan. New Delhi.
- Walter Rudin. (2017). *Real and Complex Analysis.* (7th ed.), McGraw Hill Education. New York.

e- Resources

- http://nptel.ac.in/courses/122104017/

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Recall real valued function, sequence.	K1
CO 2	Recognize Convergent sequence and Divergence sequence, Bounded sequence, Monotone sequence and Cauchy sequence.	K2
CO 3	Analyze the series of Real numbers.	K3
CO 4	Explain limits, metric space and continuous function on a real line.	K4
CO 5	Examine open sets and closed sets	K5

NUMERICAL METHODS
UMAM515

Semester :V   **Credits** : 5
Category : Core XI / DSC (XI)   **Hours/Week : 6**
Class & Major : III B.Sc Mathematics   **Total Hours :78**
Course Objectives

CO No.	To enable the students
CO 1	Introduce the basic concepts of Algebraic and Transcendental Equations.
CO 2	Understand the concepts of interpolation for equal and unequal intervals.
CO 3	Analyse the numerical techniques of Differentiation and Integration.
CO 4	Apply the solution of linear system equations.
CO 5	Evaluate numerical solution to ordinary differential equations using direct Method.

UNIT- I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 15 Hours

Introduction – The Bisection Method – The Iteration Method –The method of False Position-Newton - Raphson Method.

UNIT- II INTERPOLATION **16 Hours**

Introduction – Errors in Polynomial Interpolation - Finite Differences - Newton's formula

for interpolation - Central Difference Interpolation formulae – Practical Interpolation-Interpolation with unevenly spaced points.

UNIT- III NUMERICAL DIFFERENTIATION AND INTEGRATION   16 Hours

Introduction - Numerical Differentiation - Maximum and Minimum Values of a tabulated function - Numerical Integration.

UNIT- IV SOLUTION OF LINEAR SYSTEM EQUATIONS   15 Hours

Introduction – Basic Definitions - Solution of Linear Systems: Direct Methods and Iterative Methods.

UNIT-V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
16Hours

Introduction – Solution by Taylor's series- Picard's Method of successive approximations -Euler's method- Runge-Kutta method- Predictor Corrector Methods.

Text Books
- Sastry, S.S. (2012). *Introductory Methods of Numerical Analysis*. Prentice Hall of India. (5 th edition). New Delhi.

References
- Grewal, B.S. and Grewal, J.S. (2016). *Numerical methods in Engineering and Science.* Khanna Publishers. (10th ed.,). India.
- Kandasamy, P. Thilagavathy, K. and Gunavathy, K. (2013). *Numerical Methods*. S.Chand & Company limited(5th Ed). New Delhi.
- Brian Bradie, (2007). *Friendly Introduction to Numerical Analysis.* Pearson Education. (1st ed.,). Asia.

e-Resources:
- http://textofvideo.nptel.iitm.ac.in/video.php?courseId=111101003&p=3
- http://textofvideo.nptel.iitm.ac.in/video.php?courseId=111101003&p=1
- http://textofvideo.nptel.iitm.ac.in/video.php?courseId=111101003&p=1
- http://textofvideo.nptel.iitm.ac.in/video.php?courseId=111101003&p=4
- http://freevideolectures.com/Course/3277/Numerical-methods-of-Ordinary-and- Partial-Differential-Equations.

Course Outcomes

CO No.	The student will be able to	Cognitive Level
CO 1	Understand numerical methods and how they are used to obtain approximate solutions.	K1
CO 2	Apply various interpolation methods.	K2
CO 3	Work out numerical differentiation and integration.	K3
CO 4	Analyse numerical methods to find out solution of algebraic equations using different methods	K4
CO 5	Solve Numerical Solutions and ordinary Differential Equations.	K5

GRAPH THEORY
UMAO501

Semester	: V		**Credit**	: 4
Category	: Major Elective		**Hours/Week**	: 5
Class & Major : III B.Sc Mathematics			**Total Hours**	: 65

Course Objectives

CO No.	To enable the students
CO 1	Introduce the notion of graph theory and its applications.
CO 2	Understand the connectedness and components.
CO 3	Connect the concepts of Hamiltonian graphs.
CO 4	Evaluate the concept of matching in bipartite graphs.
CO 5	Design the directed graph by colouring.

UNIT-I GRAPHS AND SUBGRAPHS 13 Hours

Introduction – The Konigsberg Bridge Problem- Graphs and Subgraphs: Definition and Examples - Degrees – Subgraphs – Isomorphism – Ramsey Numbers – Independent sets and coverings-Intersection Graphs and Line Graphs- Matrices - Operations on Graphs.

UNIT- II CONNECTEDNESS 13 Hours

Walks, Trails and Paths – Connectedness and Components – Blocks - Connectivity

UNIT - III EULERIAN , HAMILTONIAN GRAPHS AND TREES 13 Hours

Eulerian Graphs- Hamiltonian Graphs - Characterization of Trees - Centre of a Tree.

UNIT - IV MATCHING AND PLANARITY 13 Hours

Matchings- Matchings in Bipartite Graphs- Planarity: Introduction - Definition and Properties - Characterization of Planar Graphs-Thickness, Crossing and Outer Planarity.

UNIT - V COLOURABILITY AND DIRECTED GRAPHS 13 Hours

Chromatic Number and Chromatic Index- The Five Colour Theorem- Four Colour Problems- Chromatic Polynomials Directed Graphs: Introduction - Definitions and Basic Properties – Path and Connections-Digraphs and Matrices – Tournaments

Text Books

- Arumugam. S. and Ramachandran. S. (2015). *Invitation to Graph Theory*. SciTech Publications (India) Pvt. Ltd. Chennai.

References

- Narsingh Deo. (2016). Graph *Theory with applications to Engineering and Computer Science.* Prentice Hall of India.

- Gary Chartrand and Ping Zhang. (2017). *Introduction to Graph Theory*. Tata McGraw-Hill Edition.

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Understand the concepts of graph theory as an application of mathematics in information technology	K1
CO 2	Recall and relate connectivity.	K2
CO 3	Recognize the characteristics of Eulerian Graphs	K3
CO 4	Analyse Characterization of Planar graphs	K4
CO 5	Create special directed graphs and its properties for research purpose.	K5

NUMBER THEORY
UMAO502

Semester : V   **Credits** : 4

Category : Major Elective   **Hours/Week: 5**

Class &Major: III B.Sc Mathematics   **Total Hours : 65**

Course Objectives:

CO No.	To enable the students
CO 1	Acquire basic knowledge in Number theory.
CO 2	Understand the properties of various functions of Number Theory.
CO 3	Apply the concepts of Dirichlet Multiplication.
CO 4	Analyse the basic concepts of Euler Fermat Theorem.
CO 5	Formulate the Reciprocity Law.

UNIT- I THE FUNDAMENTAL THEOREM OF ARITHMETIC   **13 Hours**

Introduction – Divisibility - Greatest common divisor - Prime numbers – The fundamental theorem of arithmetic- The series of reciprocals of the primes – The Euclidean algorithm - The greatest common divisor of more than two numbers.

UNIT- II ARITHMETICAL FUNCTIONS   **13 Hours**

Introduction – The mobius function $\mu(n)$ – The Euler totient function $\phi(n)$ – A relation connecting ϕ and μ – A product formula for $\phi(n)$ – The Dirichlet product of arithmetical functions – Dirichlet inverses and the mobius inversion formula – The Mangoldt Function $\Lambda(n)$ - Multiplicative functions.

UNIT-III DIRICHLET MULTIPLICATIONS   **13 Hours**

Multiplicative functions and Dirichlet Multiplication -The inverse of a completely multiplicative function - Lioville''s function - The division function-Generalised convolutions - Formal power series - The bell series of an arithmetical functions - Bell series and Dirichlet multiplication. - Derivatives of arithmetical functions - The Selberg identity.

UNIT –IV CONGRUENCES   **13 Hours**

Congruences - Definition and basic properties of Congruences – Linear congruence - Reduced residue systems and The Euler-Fermat theorem - Polynomial Congruences modulo p Lagrange theorem - Application of Lagrange''s theorem - Simultaneous linear congruences - The Chinese remainder theorem - Applications of the Chinese remainder theorem.

UNIT-V QUADRATIC RESIDUES AND QUADRATIC RECIPROCITY LAW   13 Hours

Quadratic residues – Legendre's symbols and its properties- Evaluation of (-1/p) and (2/p) - Gauss lemma - The quadratic reciprocity law – Applications of the Reciprocity law-The Jacobi Symbol

Text Books

* Tom Apostol. M. (2013). *Introduction to Analytic Number Theory*. Springer-Verlag. New York.

Reference Books

* Neal Koblitz. (1994). *A Course in Number Theory and Cryptography.* Springer-Verlag. New York.
* John Stillwell. (2010). *Elements of Number Theory*. Springer – Verlag. New York.
* Ivan Niven Herbert Zuckerman. S. and Hugh Montgomery.L. (2008). *An Introduction to the Theory of numbers*. Wiley. (5th ed.,). India.

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Recall and relate number theory and its theorems.	K1
CO 2	Recognize the basic concepts of arithmetic functions.	K2
CO 3	Express the concept and results of Lioville''s function.	K3
CO 4	Apply numerical data to form Congruences about the integers	K4
CO 5	Construct Mathematical Proofs using Gauss Law	K5

LINEAR ALGEBRA

UMAM616

Semester	**: VI**	**Credits**	**: 5**
Category	**: Core XII / DSC (XII)**	**Hours/Week : 6**	
Class & Major : III B.Sc Mathematics		**Total Hours : 78**	

Course Objectives

CO No.	To enable the students
CO-1	Understand the concepts of Dual spaces.
CO-2	Describe the Concepts of Inner Product Spaces.
CO-3	Analyze Linear transformations.
CO-4	Compute Traces and Transpose.
CO-5	Formulate Normal Transformations.

UNIT-I VECTOR SPACES & DUAL SPACES   **13 Hours**

Elementary Basic Concepts – Linear Independence and bases- Dual Spaces.

UNIT-II INNER PRODUCT SPACES& DUAL SPACE   **13 Hours**

Inner Product Spaces - Modules.

UNIT-III LINEAR TRANSFORMATIONS   **13 Hours**

The Algebra of Linear Transformation - Characteristic Roots-Matrices.

UNIT-IV MATRIX OPERATIONS   **13 Hours**

Trace and Transpose – Determinants.

UNIT-V HERMITIAN-UNITARY & NORMAL TRANSFORMATIONS   **13 Hours**

Hermitian-Unitary & Normal Transformations

Text Book

- Herstein.I.N. (2013). *Topics in Algebra.* John Wiley & Sons.

Reference Books

- Kumaresan.S. (2000). *Linear Algebra A geometric Approach.* PHI Learning Private LimitedNew Delhi. (10th ed).
- Kenneth Hauffman. (2018). *Linear Algebra.* Person Education India (2nd edu.)
- John B. Fraleigh. (2003). *A first course in Abstract Algebra.* Addison Wesley publishing Co. (7th ed).

e-Resources

- http://nptel.ac.in/courses/111106051/
- https://www.khanacademy.org/math/linear-algebra

Course Outcomes:

CO No.	On completion of the course the student will be ableto	Bloom's Level
CO-1	Recall dual space and its properties	K1
CO-2	Recognize the concepts of inner product space.	K2
CO-3	Explain the concepts of linear transformation.	K3
CO-4	Evaluate and construct the matrix representing a linear transformation.	K4
CO-5	Construct the normal transformation.	K5 & K6

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course Code	Course Title	Component –III	Component -IV
I	III	UMAA117	Mathematical Statistics - I	Problem solving	Assignment
V	III	UMAM513	ModernAlgebra	Seminar	Assignment
V	III	UMAM514	Real Analysis I	Assignment	Seminar
V	III	UMAM515	Numerical Methods	Problem solving	Seminar
V	III	UMAO501	Graph Theory	Seminar	Prototyping
V	III	UMAO502	Number Theory	Problem solving	Seminar
VI	III	UMAM616	Linear Algebra	Assignment	Seminar

PG & RESEARCH DEPARTMENT OF MATHEMATICS

PREAMBLE

PG: Programme Profile and the Syllabi of Courses offered in the I and II Semester along with Evaluation Components III & IV (With Effect From 2021- 2023 Batch Onwards)

PROGRAMME PROFILE M.Sc. (MATHEMATICS)

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO No. **Upon completion of these Courses the Students would have**

PSO-1 Become an individual academic excellence in the discipline of Mathematics

PSO-2 Acquire knowledge for research program

PSO-3 Be an entrepreneur for training SET / NET examinations

PSO-4 Become a software Developer

PSO-5 Executing research projects for multidiscipline courses

Semester	Category	CourseCode	Course Title	Previous course code	Contact Hours/ Week	Credit Min/Max
I	Major Core I / DSC I	PMAM110	Abstract Algebra	PMAM107/ PMAM108/ PMAM109	6	4
	Major Core II/ DSC II	PMAM102	Real Analysis	-	6	4
	Major Core III / DSC III	PMAM103	Ordinary Differential Equations	-	6	4
	Major Core IV / DSC IV	PMAM105	Calculus Of Variations and Integral Equations	-	6	4
	Major Core V / DSC V	PMAM106/ PMAM407	Fuzzy Analysis	-	6	4
			TOTAL		**30**	**20**
II	Major Core VI/ DSCVI	PMAM211	Linear Algebra	PMAM209/ PMAM210	5	4
	Major Core VII / DSCVII	PMAM202	Measure and Integration	-	5	4
	Major Core VIII / DSCVIII	PMAM206	Partial DifferentialEquations	-	5	4
	Major Core IX / DSC IX	PMAM207	Classical Mechanics		5	4
	Major Core X / DSC X	PMAM208	Operations Research		5	4
	Non Major Elective				5	4
	Service Learning	PMAX201/ PMAX202	Mathematics for High School Students \ Elementary Mathematics for Higher Secondary Students		-	1
	Online Course	PONL201	NPTEL		-	1 /2
			TOTAL		**30**	**25 / 27**

III	Major Core XI / DSC XI	PMAM305	Complex Analysis	-	6	4
	Major Core XII / DSC XII	PMAM310	Fluid Dynamics	-	6	4
	Major Core XIII / DSC XIII	PMAM314	Topology	PMAM311	6	4
	Major Core XIV / DSC XIV	PRMC301	Research Methodology	-	5	4
	Major Core XV/ DSC XV	PMAI312	Number Theory and Cryptography	-	5	4
	Major Core XVI/ DSC XVI	PMAP401	Project	-	2	-
			TOTAL		**30**	**20**
IV	Major Core XVII / DSC XVII	PMAM405	Functional Analysis	-	6	5
	Major Core XVIII / DSC XVIII	PMAM409	Numerical Analysis	-	7	5
	Major Core XIX / DSC XIX	PMAM410	Probability theory	-	6	5
	Major Core XX / DSC XX	PMAM411	Differential Geometry	-	6	5
	Major Core XXI / DSC XXI	PMAP401	Project	-	4	5
			Library		1	-
			TOTAL		**30**	**25**
			GRAND TOTAL		**120**	**90/ 92**

PROGRAMMES OFFERED TO OTHER DEPARTMENTS – PG

Semester	Category	Course Code	Course Title	Contact Hours/ Week	Credit Min/ Max
II	Non MajorElective	PMAE201	LaTeX and MaTLab	3	4
	Practical		LaTeX and MaTLab	2	
	Non MajorElective	PMAE204	Operations Research	5	4
		PMAE202	NET/SET/Competitive Exam	5	5
		PMAE203	Discrete mathematics	5	4

EXTRA CREDIT EARNING PROVISION

Semester	Category	Course code	Course Title	Hours/ week	Credit Min /Max
III	Self-StudyPaper	PMAS301	Difference Equation	2	-/1
		PMAS302	Combinatorial Analysis	2	-/1

ABSTRACT ALGEBRA
PMAM110

Semester	**: I**	**Credits**	**: 5**
Category	**: Core I / DSC (I)**	**Hours/Week :**	**6**
Class & Major: I M.Sc Mathematics		**Total Hours**	**: 78**

Course Objectives:

CO No.	To enable the students
CO-1	Understand the concept of Sylow`s theorem, direct products.
CO-2	Analyze Finite abelian groups and modules
CO-3	Apply the polynomial rings over the rational fields.
CO-4	Evaluate the roots of the polynomials.
CO-5	Investigate the Galois theory.

UNIT-I SYLOW'S THEOREM   **16 Hours**

Another Counting principle- Sylow's theorem in 1st part of sylow's theorem 1st proof only, 2nd part of sylow's and 3rd part of sylow's theorem- Direct products.

UNIT-II FINITE ABELIAN GROUPS   **16 Hours**

Finite abelian groups - Modules.

UNIT-III FIELDS   **16 Hours**

Extension fields – Transcendence of e roots of polynomial.

UNIT-IV FIELDS (CONTINUATION)   **15 Hours**

Roots of Polynomials – More about roots.

UNIT-V FINITE FIELDS   **15 Hours**

Elements of Galois Theory – Solvability by radicals.

Text Book

- Herstein.N. (2013). *Topics in Algebra*. Wiley Eastern Limited. New Delhi.

Reference Books

- Bhattacharya P.B. Jain S.K. & Nagpaul S.R. (2012). *Basic Abstract Algebra.* Cambridge University press. New York.
- Jacobson.N & W.H. Freeman. (1980). *Basic Algebra. Vol. I & II.* Hindustan publishing Company. New Delhi.
- Malik D.S. Mordeson J.N. & Sen M.K. (2007). *Fundamental of Abstract Algebra*. Mc Graw Hill. New York.
- Artin.M. (2010). *Algebra.* Prentice Hall of India. New Delhi.

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Understand the concept of Sylow`s theorem, direct products.	K2
CO 2	Describe the properties of finite abelian groups and modules	K3
CO 3	Differentiate the polynomial rings over the rational fields and polynomial rings over the commutate rings.	K4
CO 4	Explain the concepts of roots of the polynomials.	K4
CO 5	Construct the solvability by radicals.	K5

LINEAR ALGEBRA
PMAM211

Semester	: II	**Credits**	: 5
Category	: Core VI / DSC (VI)	**Hours/Week**	: 6
Class & Major	: I M.Sc Mathematics	**Total Hours**	: 78

Course Objectives:

CO No.	To enable the students
CO-1	Understand the concepts of polynomials and Determinants.
CO-2	Describe the Elementary Canonical Forms.
CO-3	Use the Cyclic Decompositions.
CO-4	Analyse the Inner Product Spaces.
CO-5	Formulate Bilinear forms.

UNIT-I POLYNOMIALS AND DETERMINANTS   **16 Hours**

Algebras – The Algebras of Polynomials – Commutative Rings – Determinant Functions – Additional Properties of Determinants

UNIT-II ELEMENTARY CANONICAL FORMS   **16 Hours**

Characteristic Values – Annihilating Polynomials – Invariant Subspaces – Simultaneous Triangulation; Simultaneous Diagonalisation.

UNIT-III THE RATIONAL AND JORDAN FORMS   **16 Hours**

Cyclic Subspaces and Annihilators – Cyclic Decompositions and the Rational Form – The JordanForm – Computations of Invariant Factors – Semi-Simple Operators.

UNIT-IV OPERATIONS ON INNER PRODUCT SPACE   **15 Hours**

Form on Inner Product Spaces – Positive Forms – More on Forms – Spectral Theory – FurtherProperties of Normal Operations.

UNIT-V BILINEAR FORMS   **15 Hours**

        Bilinear Forms – Symmetric Bilinear Forms – Skew- Symmetric Bilinear Forms – Groups Preserving Bilinear Forms.

Reference Books

- Herstein.I.N.(2013). *Topics in Algebra.* John Wiley & Sons. (2nd ed.,).
- Kumaresan.S.(2000). *Linear Algebra A geometric Approach.* PHI Learning Private Limited New Delhi. (10th ed.,).
- John B. Fraleigh. (2003). *A first course in Abstract Algebra.* Addison Wesley publishing Co. (7th ed.,).

e- Resources

- http://nptel.ac.in/courses/111106051/
- https://www.khanacademy.org/math/linear-algebra

Course Outcomes:

CO No.	The student will be able to	Cognitive Level
CO 1	Recall the concepts of polynomials and Determinants.	K1
CO 2	Discuss the Elementary Canonical Forms.	K2
CO 3	Solve Annihilators	K3
CO 4	Analyse the Inner Product Spaces.	K4
CO 5	Design Symmetric Bilinear Forms	K4

III and IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course code	Course Title	Component III	Component IV
I	Major Core I / DSC I	PMAM110	Abstract Algebra	Assignment	Term Paper
II	Major Core VI / DSC VI	PMAM210	Linear Algebra	Assignment	Seminar