NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)
Kumaracoil, Thuckalay

DEPARTMENT OF MATHEMATICS

M.Sc.MATHEMATHICS

CURRICULUM AND SYLLABI

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation : 2021

Curriculum and Syllabi

M.Sc. Programme

DEPARTMENT OF MATHEMATICS

M.Sc. MATHEMATICS

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Science and Humanities

Department of Mathematics

Vision of the Department

To prepare students to meet the challenges and opportunities facing them as they embark on careers as researchers, educators or members of a variety of fields.

Mission of the Department

- To produce Academic excellence in Mathematics by imparting Ethical motivation through updated curriculum, effective teaching learning process for the growth of science and technology.
- To inculcate Logical &Intuitive reasoning skills, co-curricular & extracurricular competence among students so as to meet societal expectations.

Description of the programme

The **Master of Science (M.Sc.) in Mathematics** is a two-year postgraduate degree program. This course equips students with the mathematical expertise required for both academic research and practical applications in various industries. It also provides an advanced understanding of mathematics, focusing on both theoretical and applied aspects of the subject. The curriculum is designed to enhance problem-solving, analytical reasoning, and research skills, preparing students for academic, research, and professional careers. The curriculum includes advanced-level topics from pure and applied mathematics. Students may choose elective courses or specializations based on their interests and career goals.

M.Sc. Mathematics program includes computational and practical components where students use software like MATLAB, LaTeX for numerical analysis, simulations, and modeling. Research-based projects in the final semesters allow students to explore a particular area of interest in-depth.

Eligibility: Bachelor's Degree: Candidates must hold a B.Sc. in Mathematics, or a related field (such as Statistics or Engineering), with a minimum required percentage from a recognized university.

Course Duration: Two Years (divided into four semesters).

Programme Educational Objectives - PEO	
PEO-01	Provide students with advanced mathematical and computational skills that prepare them to pursue higher studies, research and create a foundation of lifelong learning.
PEO-02	Have significant opportunities in various service domains at National levels like banking, insurance, government jobs, consultancy, teaching, defense and industry.
PEO-03	Achieve peer recognition as an individual or as a team member having specialized knowledge and expertise to investigate, formulate, analyze and implement on the problems of pure, applied and computational mathematics to compete at global level.
PEO-04	Possess strong leadership qualities to effectively navigate diverse circumstances by fostering an interdisciplinary and multidisciplinary learning environment, while maintaining a continuous learning mindset to acquire new skills and techniques for addressing challenges related to emerging technologies.
PEO-05	Inculcate value system while working in a team assigned with a important targets they will contribute through their critical thinking and mathematical competence holding the ethical values

Graduate Attributes-GA	
GA-1	**Advanced Scientific Knowledge and Specialization** Acquire in-depth knowledge and expertise in specific scientific disciplines, building upon foundational concepts to explore advanced theories, methodologies, and applications in the chosen field of study.
GA-2	**Research Methodology and Innovation** Demonstrate proficiency in designing, conducting, and interpreting complex research experiments, utilizing advanced research methodologies, tools, and technologies to contribute to scientific innovation and discovery.
GA-3	**Data-Driven Decision Making** Use sophisticated data analysis techniques, statistical tools, and computational models to solve complex scientific problems, make data-driven decisions, and predict outcomes in research and industry settings.
GA-4	**Critical Thinking and Problem-Solving** Develop advanced critical thinking and problem-solving skills, enabling the formulation of innovative solutions to theoretical and practical challenges in scientific research and application.
GA-5	**Interdisciplinary Collaboration and Leadership** Work effectively in interdisciplinary teams, integrating knowledge from various scientific domains to tackle complex, real-world problems, and demonstrate leadership in collaborative research and professional projects.
GA-6	**Environmental Stewardship and Sustainable Practices** Apply scientific principles to address environmental challenges, promote sustainability, and contribute to the development of environmentally responsible technologies and practices.
GA-7	**Ethics and Professional Integrity in Science** Uphold the highest standards of ethical conduct and professional integrity in scientific research, ensuring responsible data handling, experimentation, and reporting in accordance with global scientific standards.
GA-8	**Advanced Laboratory and Technological Skills** Master cutting-edge laboratory techniques, instrumentation, and scientific tools, utilizing them to conduct sophisticated experiments and research that contribute to scientific progress and innovation
GA-9	**Effective Communication of Scientific Ideas** Develop strong communication skills, capable of presenting complex scientific concepts, research findings, and technical information clearly and persuasively to both scientific and non-scientific audiences, including through publications and presentations.
GA-10	**Lifelong Learning and Professional Development** Embrace a commitment to lifelong learning, staying updated with the latest scientific advances, technologies, and best practices, and continuously developing skills to remain at the forefront of the scientific community.

Programme Outcome - PO	
PO-A	Solve intricate mathematical problems using the knowledge of pure and applied Mathematics.
PO-B	Acquaint with the recent advances in applied mathematical sciences such as numerical computations and mathematical modeling.
PO-C	Employ technology in solving and understanding mathematical problems.
P0-D	Capable of formulating and analyzing mathematical models of real life applications.
PO-E	To develop research intensity in the field of pure and applied Mathematics.

Mapping of Graduate Attributes and Programme Educational Objectives(PEO)

GAs / PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10
PEO-01	H	H	H	A	H	A	H	A	H	A
PEO-02	H	A	H	H	A	H	H	H	H	A
PEO-03	A	A	H	H	A	H	A	A	H	H
PE0-04	A	H	A	A	H	A	A	A	H	A
PEO-05	H	H	A	H	H	A	H	H	A	H

H- Highly Associated A- Associated Not – Not Associated

Mapping of Graduate Attributes and Programme Outcomes (PO)

GAs / PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10
PO-A	H	A	A	H	A	A	H	A	A	A
PO-B	H	H	H	A	H	A	H	A	H	A
PO-C	H	H	A	H	A	H	H	A	A	A
P0-D	A	A	H	H	H	H	A	H	A	H
PO-E	H	H	H	A	A	A	A	A	H	A

H- Highly Associated A- Associated Not – Not Associated

Mapping of Programme Educational OBJECTIVE(PEOs) and Programme Outcomes (POs)

PEO / PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-A	H	H	H	A	A
PO-B	H	H	A	H	H
PO-C	H	H	H	H	H
P0-D	H	A	H	A	H
PO-E	H	H	H	H	H

H- Highly Associated A- Associated Not – Not Associated

Duration of the programme: 2 Years/ 4 Semesters

Total credit : 90

CURRICULUM & SYLLABI

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3701	Group Theory	4	1	0	5
2.	MA3702	Analysis I	4	1	0	5
3.	MA3703	Differential Equations	3	1	0	4
4.	MA3704	Numerical Analysis	3	1	0	4
5.	XXXE1	Elective - I	3	1	0	4
TOTAL			**17**	**5**	**0**	**22**

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3705	Ring Theory	4	1	0	5
2.	MA3706	Analysis II	4	1	0	5
3.	MA3707	Mathematical Statistics	3	1	0	4
4.	MA3708	Partial Differential Equations	3	1	0	4
5.	XXXS1	Supportive Course-I	3	1	0	4
TOTAL			**17**	**5**	**0**	**22**

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3709	Linear Algebra	4	1	0	5
2.	MA3710	Complex Analysis	4	1	0	5
3.	MA3711	Topology	3	1	0	4
4.	XXXE2	Elective II	3	1	0	4
5.	XXXS2	Supportive Course-II	2	1	0	3
PRACTICAL						
6.	CS3771	Computer Fundamentals and C Programming Lab	0	2	2	3
TOTAL			**16**	**7**	**2**	**24**

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3712	Functional Analysis	4	1	0	5
2.	MA3713	Operations Research	3	1	0	4
3.	MA3714	Graph Theory	3	1	0	4
4.	XXXE3	Elective III	2	1	0	3
PRACTICAL						
5.	MA37P1	Project and Viva – Voce	0	0	12	6
TOTAL			**12**	**4**	**12**	**22**

Elective List

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA37S1	Statistical Methods	3	1	0	4
2.	MA37S2	Mathematics for Competitive Examinations	3	1	0	4
3.	CS37S1	Fundamentals of Computers	3	1	0	4
4.	CS37S2	PYTHON Programming	2	1	0	3

Open Elective List

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA37A1	Advanced Graph theory	3	1	0	4
2.	MA37A2	Calculus of Variations and Integral Equations	3	1	0	4
3.	MA37A3	Algebraic Number Theory	3	1	0	4
4.	MA37A4	Coding Theory	3	1	0	4
5.	MA37A5	Combinatorics	3	1	0	4
6.	MA37A6	Differential Geometry	3	1	0	4
7.	MA37A7	Fuzzy Mathematics	2	1	0	3
8.	MA37A8	Measure Theory and Integration	2	1	0	3
9.	MA37A9	Mechanics	3	1	0	4
10.	MA37B1	**Number Theory**	3	1	0	4
11.	MA37B2	Stochastic Processes	2	1	0	3

Syllabus Format

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3701	Group Theory	4	1	0	5
2.	MA3702	Analysis I	4	1	0	5
3.	MA3703	Differential Equations	3	1	0	4
4.	MA3704	Numerical Analysis	3	1	0	4
5.	XXXE1	Elective - I	3	1	0	4
TOTAL			**17**	**5**	**0**	**22**

MA3701	GROUP THEORY	L	T	P	C
		4	1	0	5

OBJECTIVE

To enable the students to comprehend the topics in algebra like groups, group actions. Also to develop computational skills in abstract algebra.

Course Outcome		Cognitive Skill
CO-01	Understand the concepts of Cyclic Groups and Permutation Groups and able to solve the related problems.	R,U,A,An,E,S
CO-02	Able to understand the concepts of isomorphisms and homomorphisms in groups and solve problems regarding them.	R,U,A,An,E,S
CO-03	Understand and apply the concepts of external and internal direct products, normal groups and factor groups in problem solving.	R,U,A,An,E,S
CO-04	Mastering the concepts on fundamental theorem of finitely generated abelian groups and apply them to form a table of groups of small order.	R,U,A,An,E,S
CO-05	Understand the concepts of Sylow's theorem and have increased ability of solving advanced counting problems in group theory.	R,U,A,An,E,S

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	L	M	M	S
CO-02	S	M	M	S	S
CO-03	S	M	M	S	S
CO-04	S	M	M	S	S
CO-05	S	S	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Cyclic Groups and Permutation Groups **15**

Cyclic Groups: Properties of Cyclic Groups- Classification of subgroups of cyclic groups. Permutation Groups: Definition and Notation- Cyclic Notation- Properties of Permutations.

Unit II: Isomorphisms, Cosets and Lagrange's Theorem **15**

Isomorphism: Motivation- Definition and Examples- Cayley's Theorem- Properties of Isomorphism- Automorphisms. Cosets and Lagrange's theorem: Properties of cosets- Lagrange's Theorem: Properties of Cosets- Lagrange's theorem.

Unit III: External Direct Products, Normal Subgroups and Factor Groups **15**

External Direct Products: - Definition and Examples- Properties of External Direct Products. Normal Subgroups and Factor Groups: Normal Subgroups-Applications of Factor Groups – Initial Direct Products.

Unit IV: Group Homomorphisms and Fundamental Theorem of Finite Abelian Groups **15**

Group Homomorphisms: - Definition and Examples- Properties of Homomorphism's. The first isomorphism Theorem - Fundamental Theorem of Finite Abelian Groups: The fundamental Theorem- The Isomorphism classes of Abelian Groups- The proof of fundamental Theorem.

Unit V: Sylow Theorems **15**

Sylow Theorems: Conjugacy Classes- The class Equation- The Sylow Theorems- Applications of Sylow Theorem.

TOTAL: 75 HOURS

Text Book

Contemporary Abstract Algebra (Seventh Edition) by Joseph A. Gallian, Brooks/Cole Cengage Learning (2010),

Unit 1: Chapter 4: pages 72-81 and Chapter 5 pages 95-106

Unit 2: Chapter 6: pages 122-133 and Chapter 7 pages 138-144

Unit 3: Chapter 8: pages 155-160 and Chapter 9 pages 178-192

Unit 4: Chapter 10: pages 200-203 and Chapter11 pages 218-225

Unit 5: Chapter 24: pages 403-414

MA3702	ANALYSIS I	L	T	P	C
		4	1	0	5

OBJECTIVE

To provide a strong foundation on the concepts in sequences and series and also enable the students to have a comprehensive idea about the underlying principles of derivatives, continuous functions.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Understand terms, definitions and theorems related to topology and limits and limit inferior/superior. Demonstrate knowledge and understanding of concepts such as connectedness and compactness.	R,U,A,An,E
CO-02	Recognize the converging sequence and diverging sequence . Know how to check if a sequence is converging or diverging.	R,U,A,An,E
CO-03	Comprehend the properties of Cauchy and Monotone sequences**.** Know and be able to apply convergence tests for sequences and series.	R,U,A,An,E
CO-04	Explain the notion of Continuity as related to functions. Students should be able to relate an intuitive notion of continuity to the mathematical definition of continuity and Uniform Continuity.	R,U,A,An,E
CO-05	Apply the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis and produce rigorous proofs of results that arise in the context of real analysis.	R,U,A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	S	M	S
CO-02	M	M	S	M	S
CO-03	S	M	M	S	S
CO-04	S	S	S	S	S
CO-05	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Basic Topology **15**

Finite, Countable and Uncountable sets – Metric Spaces – Compact sets – Perfect sets – Connected sets.

Unit II: Numerical Sequences **15**

Convergent Sequences – Subsequences – Cauchy Sequences – Upper and Lower Limits – Some Special Sequences.

Unit III: Numerical Series **15**

Series of Non-negative Terms – The Number e – The Root and Ratio Tests – Power Series – Summation by Parts – Absolute Convergence – Addition and Multiplication of Series – Rearrangements.

Unit IV: Continuity **15**

Limits of Functions – Continuous Functions – Continuity and Compactness –Continuity and Connectedness - Discontinuities – Monotonic Functions – Infinite Limits and Limits at Infinity.

Unit V: Differentiation **15**

The Derivative of a Real Function – Mean Value Theorems - The Continuity of Derivatives – L' Hospital's Rule – Derivatives of Higher Order – Taylor's Theorem –Differentiation of Vector-Valued Functions.

TOTAL: 75 HOURS

Text Book

Principles of Mathematical Analysis (Third edition) by Walter Rudin,

Chapters 2, 3, 4 and 5.

MA3703	DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVE

To help the students grasp problem solving techniques in power series solutions of second order ordinary differential equations with variable coefficients and some special functions of mathematical physics. To learn more about linear and non linear differential equations of first and second order in detail.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Understand the power series and special functions. Apply power series method to find the solution of first and second order differential equations. To find the Frobenius series solution of the Hyper geometric equations.	U, A ,An,E
CO-02	Know about Legendre polynomial and Bessel functions and their properties. Derive the Rodrigues formula from the Legendre polynomial and derive the Bessel function from the Bessel equation and to prove some results of the Legendre polynomial and Bessel functions.	U, A ,An,E
CO-03	Understand the simple critical point and to find the simple critical point of the non linear system. Prove the critical points are asymptotically stable and to find the asymptotically stable critical point of the equation of motion for the damped vibrations of a pendulum. Know the path of the autonomous system and construct the path of the autonomous system.	R, A ,An,E
CO-04	Evaluate the integrals and derivatives using Laplace transform. Apply the concepts of Convolution theorem to find the solution of differential equations and the integral equations.	U, A ,An,E
CO-05	Apply the Picard's method of successive approximations to find the exact solution of the initial value problems and prove the Picard's theorem. Know the Lipschitz condition and verify the Lipschitz condition for the functions.	U, A ,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	M	S
CO-02	S	M	M	M	S
CO-03	S	M	M	M	S
CO-04	S	M	S	S	S
CO-05	S	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Power Series Solutions and Special Functions **12**

Power Series Solutions : Series Solutions of First and Second Order Linear Equations. Regular Singular Points, Gauss's Hyper-Geometric Equation.

Unit II: Some Special Functions of Mathematical Physics **12**

Some Special Functions of Mathematical Physics: Legendre Polynomial, Bessel Functions. The Gamma Function and their Properties.

Unit III : Nonlinear Equations **12**

Nonlinear Equations: Simple Critical Points, Nonlinear Mechanics, Conservative Systems, Periodic Solutions, Closed path

Unit IV: Laplace Transforms **12**

Laplace Transforms: Application to Differential Equation, Derivatives and Integrals of Laplace Transforms, Convolution and Integral equation

Unit V: The Existence and Uniqueness of Solutions **12**

The Existence and Uniqueness of Solutions: The Method of Successive Approximations, Picard's Theorem, Systems. The Second order Linear Equation.

TOTAL: 60 HOURS

Text Book

Differential Equations with Applications and Historical Notes by George F. Simmons, 2nd Edition.

Sections 26 to 31, 44 to 47,50 to 52, 62 to 64, 68 to 70

MA3704	NUMERICAL ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVE

To provide the students an understanding of the basic principles of numerical methods and to apply them in solving algebraic equations and ordinary differential equations numerically. To enable the students for applying various difference operators in interpolation and numerical differentiation and integration.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Understand numerical techniques to find the root of transcendental and polynomial equations. Muller's methods to improve the rate of convergence. Also, compute the errors.	R,U,An
CO-02	Understand Numerical methods to solve a system of linear algebraic equations using Pivotal Strategy.	R,U,E
CO-03	Analyze the finite difference. Apply minimization results to the interpolation and least squares approximation of data and functions.	An,A,E
CO-04	To present various methods for doing numerical differentiation and integration. Also, present a general strategy for deriving such methods. Find solution errors and accuracy.	R, U ,A
CO-05	Construct a numerical method to solve ordinary differential equations in a single step and multistep methods.	S, E, U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	M	M	S
CO-02	S	S	S	S	S
CO-03	S	L	S	M	S
CO-04	S	M	M	S	S
CO-05	S	S	M	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Transcendental and Polynomial Equations **12**

The solution of nonlinear equations: A survey of iterative methods-Fixed point iteration- Muller's Method, Real roots-Complex roots Polynomial Equations using sturm's sequence.

Unit II: Linear Algebraic Equations **12**

The solution of linear systems by Gauss elimination- The pivoting strategy - Gauss Jordan, The triangular factorization. Gauss seidel iteration method.

Unit III: Interpolation and Approximation **12**

Taylor series interpolations - Gregory Newton forward and backward interpolation, The divided difference, Lagrange's interpolation. Least square approximation.

Unit IV: Differentiation and Integration **12**

Numerical differentiation- Newton forward and backward formula, Stirling's formula, Numerical Integration: Trapezoidal, Romberg's, Simpson's- Double integration.

Unit V: Ordinary Differential Equations **12**

Single step method: Euler's method, Modified Euler's method-Taylor series method - Runge Kutta method of fourth order. Multi step method: Adams Moulton method type I and II, Milne's predictor and corrector method.

TOTAL: 60 HOURS

Text Book

Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publishers, 2003, Fifth Edition. Chapters 2 to 6

SEMESTER – II

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3705	Ring Theory	4	1	0	5
2.	MA3706	Analysis II	4	1	0	5
3.	MA3707	Mathematical Statistics	3	1	0	4
4.	MA3708	Partial Differential Equations	3	1	0	4
5.	XXXS1	Supportive Course-I	3	1	0	4
TOTAL			**17**	**5**	**0**	**22**

MA3705	RING THEORY	L	T	P	C
		4	1	0	5

OBJECTIVE

To enable the students to comprehend the advanced topics in algebra like field extension, roots of polynomials, Galois Theory, finite fields, division rings and integral domains. Also to develop computational skills in abstract algebra.

Course Outcomes At the end of the course the students would be able to:		**Cognitive Skill**
CO-01	Understand the ring structures its examples and able to determine the properties of various integral domains.	U, A, An, E, S
CO-02	Understand the concept of ideals, factor rings and homomorphism of rings and able to do problems.	U, A, An, E, S
CO-03	Understand the concept of polynomial rings and able to do problems regarding factorization and reducibility.	U, A, An, E, S
CO-04	Understand the concept of divisibility in integral domains, unique factorization domains, Euclidean domains and vector spaces.	U, A, An, E, S
CO-05	Have a reasonable insight to the concepts in extension fields and finite fields.	U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	M	S
CO-03	S	S	S	M	S
CO-04	S	M	M	S	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Introduction to Rings and Integral Domains **15**

Definition and Examples- Properties of Rings-subrings. Definition and Examples-Fields-Characteristic of a Ring.

Unit II: Ideals, Factor Rings and Ring Homomorphism **15**

Ideals-Factor Rings-Prime Ideals and Maximal Ideals. Definition and Examples- Properties of Ring Homomorphism's- The field of Quotients.

Unit III: Polynomial Rings and Factorization of Polynomials **15**

Notation and Terminology-The Division Algorithm and Consequences. Reducibility Tests-Irreducibility Tests-Unique Factorization in Z[x].

Unit IV: Divisibility in Integral Domains and Vector Spaces **15**

Irreducible, Primes Unique Factorization Domains-Euclidean Domains. Definition and Examples-Subspaces-Linear Independence.

Unit V: Extension Fields and Finite Fields **15**

The fundamental Theorem of Field Theory-Splitting Fields-Zeros of Irreducible polynomial. Finite Fields- Subfields of a finite Field.

TOTAL: 75 HOURS

Text Book

Contemporary Abstract Algebra (Seventh Edition) by Joseph A. Gallian, Brooks/Cole Cengage Learning (2010),

Unit 1: Chapter 12: pages 237-241 and Chapter 13 pages 249-254

Unit 2: Chapter 14: pages 262-269 and Chapter 15 pages 280-286

Unit 3: Chapter 16: pages 293-300 and Chapter 17 pages 305-314

Unit 4: Chapter 18: pages 322-324, 328-334 and Chapter19 pages 345-348

Unit 5: Chapter 20: pages 354-366 and Chapter22 pages 382-388

MA3706	ANALYSIS II	L	T	P	C
		4	1	0	5

OBJECTIVE

To develop a firm footing in the concepts of sequences and series of function, Stone-Weierstrass theorem, Inverse function theorem and Stoke's theorem.

Course Outcome At the end of the course the students would be able to:		Cognitive Skill
CO-01	Able to understand about Definition and existence of Riemann Stieltjes integral and properties of the integral.	U,A,An,E
CO-02	Capable to understand about Pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weirstrass M-test,. Develop the ability to reflect on problems that are quite significant in the field of real analysis.	U,A,An,E
CO-03	Build-up the ability to estimate the values of the functions of several variables.	U,A,An,E
CO-04	Appreciate how abstract ideas and rigorous methods in mathematical analysis can be applied to important practical problems.	U,A,An,E
CO-05	Construct rigorous mathematical proofs of basic results in real analysis	U,A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	L	S	S	S
CO-02	S	M	S	S	S
CO-03	S	M	M	S	S
CO-04	S	M	S	S	S
CO-05	S	M	M	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: The Riemann-Stieltjes Integral **15**

Definition and Existence of the Integral- Properties of the Integral - Integration and Differentiation - Integration of Vector - Valued Functions-Rectifiable Curves.

Unit II: Sequence and Series of Functions **15**

Discussion of Main Problem - Uniform Convergence - Uniform Convergence and Continuity- Uniform Convergence and Integration.

Unit III: Equicontinuous **15**

Uniform Convergence and Differentiation- Equicontinuous Families of Functions-The Stone-Weierstrass Theorem.

Unit IV: Functions of Several Variables **15**

Linear Transformations - Differentiation-The Contraction Principle –The Inverse Function Theorem.

Unit V: Implicit Function **15**

The Implicit Function Theorem- Determinants - Derivatives of Higher Order – Differentiation of Integrals

TOTAL: 75 HOURS

Text Book

Principles of Mathematical Analysis (Third Edition) by Walter Rudin. Chapters 6, 7and 9 (except 9.30, 9.31 and 9.32) .

MA3707	MATHEMATICAL STATISTICS	L	T	P	C
		3	1	0	4

OBJECTIVE

To develop the ability of the students to understand more concepts in Statistics and to know more about various distributions.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Do some simple problems on probability, calculate conditional probabilities using Baye's theorem, identify discrete and continuous random variables, verify pmf and pdf , Transform discrete and continuous random variables, compute expectations and obtain probabilities using on Chebyshev's inequality.	R,U,A,An, E
CO-02	Do problems on two dimensional random variables, compute expectations, evaluate correlation coefficient and identify the independent random variables.	R,U,A,An, E
CO-03	Know the standard probability distributions, recognise the distribution from their mgf and identify the problems on the special distributions.	R,U,A,An, E
CO-04	Understand the limiting distribution of some probability distributions, evaluate the limiting distributions using mgf and apply central limit theorem.	R,U,A,An, E
CO-05	Construct confidence interval for unknown parameters, do problems on statistical hypothesis and understand the basic principles of statistical inferences	R,U,A,An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	M	S	S
CO-02	S	S	M	S	S
CO-03	S	S	M	S	S
CO-04	S	M	M	S	S
CO-05	S	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Probability and Distributions **12**

Introduction - Set Theory, The Probability Set Functions, Conditional Probability and Independence, Random Variables of the Discrete Type, Random Variables of the Continuous Type, Transformations, Expectation of a Random Variable, Moment Generating function and its Properties- Some Special Expectations, Important Inequalities.

Unit II: Multivariate Distributions **12**

Distributions of Two Random Variables- Expectation – Transformations: Bivariate Random Variables- Conditional Distributions and Expectations, The Correlation Coefficient, Independent Random Variables.

Unit III: Some Special Distributions **12**

The Binomial and Related Distributions, The Poisson Distribution, The Gamma, Chi-Square and Beta Distributions, The Normal Distribution - The t and F Distributions

Unit IV: Limiting Distributions **12**

Expectation - Convergence in Probability, Convergence in Distribution- Limiting Moment Generating Function Technique, The Central Limit Theorem,

Unit V: Some Elementary Statistical Inferences **12**

Sampling and Statistics -More on Confidence Intervals - Confidence Intervals for Differences in Means - Confidence Intervals for Differences in Proportions –Introduction to Hypothesis Testing

TOTAL: 60 HOURS

Text Book

Introduction to Mathematical Statistics(6^{th} Edition) by R.V.Hogg, A.T.Craig and Joseph W.Mckean, Pearson Education, Asia, Reprint 2013.

Chapter 1: Sections : 1.1 to 1.10.
Chapter 2: Sections: 2.1 to 2.5.
Chapter 3: Sections: 3.1 to 3.4 & 3.6
Chapter 4: Sections : 4.1 to 4.4.
Chapter 5: Sections: 5.1, 5.4, 5.5

MA3708	PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVE

To learn the elementary concepts and basic ideas involved in partial differential equations, solve linear second order PDEs using canonical variables for initial-value problems, separation of variables and boundary value problems and apply the partial differential equations in the physical problems such as wave equations and diffusion equations.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Understand the various types of methods and their limitations to solve the PDEs.	R,U,A,An,E,S
CO-02	Classify Second Order PDE and extract information from partial differential equations to interpret the reality.	R,U,A,An,E,S
CO-03	Understand and apply the Laplace, Poisson Equations and able to solve the problems.	R,U,A,An,E,S
CO-04	Understand and apply the Diffusion Equation and able to solve the problems.	R,U,A,An,E,S
CO-05	Apply the acquired knowledge of wave equation and to select the most appropriate method to solve the particular partial differential equation.	R,U,A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyse, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	S	S
CO-03	S	S	M	M	S
CO-04	S	S	M	M	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Partial Differential Equation of First Order **12**

Formation of Partial Differential Equation – Solution of Partial Differential Equation of First Order – Integral Surfaces Passing Through a Given Curve – The Cauchy Problem for First Order Equations – Surfaces Orthogonal to a Given System of Surfaces – First Order Non – linear equations – Compatible System of First Order Equations – Charpit's Method.

Unit II: Fundamental Concepts **12**

Classification of Second Order PDE – Canonical Forms –Linear Partial Differential Equations with Constant Coefficients – Homogeneous Linear PDE with Constant Coefficients.

Unit III: Elliptic Differential Equations **12**

Occurrence of the Laplace and Poisson Equations – Boundary Value Problems –Properties of Harmonic Functions – Separation of variables – Dirichlet Problem for Rectangle – Interior Dirichlet Problem for a Circle – Exterior Dirichlet Problem for a Circle.

Unit IV: Parabolic Differential Equations **12**

Occurrence of Diffusion Equation – Boundary Conditions – Elementary Solutions of Diffusion Equation - Dirac Delta Function – Separation of Variable Method Maximum-Minimum Principle and Consequences – Non-linear Equations (Models)

Unit V: Hyperbolic Differential Equations **12**

Occurrence of the Wave Equation – Derivation of One dimensional Wave Equation - Solution of One dimensional Wave Equation by Canonical Reduction – The Initial Value Problem: D' Alembert's Solution – Vibrating String – Variable Separable Solution – Forced Vibrations – Solution of Non-homogenous Equation – Boundary and Initial Value Problem for Two-dimensional Wave Equations

TOTAL: 60 HOURS

Text Book

Introduction to PARTIAL DIFFERENTIAL EQUATIONS, (Third Edition) by K. Sankara Rao, PHI Learning Private Limited, New Delhi – 110001, (2011).

Unit 1: Chapter 0: (Sections 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 0.10, and 0.11)

Unit 2: Chapter 1: (Sections 1.2, 1.3, 1.6, and 1.7)

Unit 3: Chapter 2: (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.8 and 2.9)

Unit 4: Chapter 3: (Sections 3.1, 3.2, 3.3. 3.4, 3.5, 3.8 and 3,9)

Unit 5: Chapter 4: (Sections 4.1, 4.2, 4.3. 4.4, 4.5, 4.6 and 4.7)

CS37S1	FUNDAMENTALS OF COMPUTERS	L	T	P	C
		3	1	0	4

OBJECTIVE

To facilitate students to

- Get good knowledge about different operating systems.
- Develop skills in preparing a document/worksheet/presentation/database.
- Acquire knowledge in the fundamental techniques of problem solving.
- Analyze the program and follow the programming style.
- Develop efficient programs in C

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Ability to understand and identify essential computer OS.	U
CO-02	Ability to process and store data effectively in MS-Office	A
CO-03	Ability to remember the fundamentals of Problem solving techniques.	R
CO-04	Ability to understand writing programming style in C.	U, An
CO-05	Ability to understand and remember programming and files in C.	A, An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	M	S	S	M	S
CO-02	S	S	S	M	S
CO-03	S	M	S	S	S
CO-04	S	M	S	M	S
CO-05	S	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Windows **12**

Using Windows – The Desktop – Point and Click Operations – Starting Up Applications – Windows and Menus – Keyboard Accelerators – Common Controls – Files, Folders and Disks – Online Help – Shutting Down – The Command Prompt – Using the Command Line – Command Prompt Choices –Introduction – The Excitement of Linux – Distribution and Support – Commands on Linux – Sources and Licenses.

Unit II: MS-Word, MS-Excel and MS-Power point **12**

Getting Comfortable in Word – Editing and Composing Documents – Formatting Documents – Presenting Information – Finalizing Documents. Creating and Editing Worksheets – Manipulating Numbers and Text– Manipulating Workbooks and Worksheets – Creating Charts and Graphics.

Designing and Creating Presentations – Creating On-Slide Content – Creating Office Graphics – Retrieving Data – Adding Animation and Multimedia – Finalizing and Presenting.

Unit III: Basics of C programming **12**

Introduction: Computer Architecture – Program development process – Structured and modular programming – Flowcharts – C Programming language – Program Development environments. Representing Data: Character Set – Keywords – Data Types – Constants – String Literals – Identifiers – Variables. Arithmetic Operators and Expressions: Operators – Expressions.

Unit IV: Branching and Looping Statements **12**

Conditional Control: If Statement – Logical Operator – The Switch Statement – Conditional expression operator.

Looping Control: The for Loop – while loop – do...while loop – Nested if – if else if – nested loop – loop interruption.

Arrays: Definition – Processing Array – One-dimensional array – Two dimensional Array – Multidimensional Arrays – Arrays and Strings.

Unit V: Functions, Pointers, Structures and File processing **12**

Function: Function call – User defined function – Program Structure – Method of Parameter passing – Passing Arrays to Function – Recursion. Pointers: Fundamentals – Pointer Declarations – Passing pointers to a Function – Pointers and One Dimensional Arrays – Dynamic Memory Allocation. Structures and Unions: Definition – Processing a Structure – Structures and Pointers – Passing Structures to Functions – Unions. Data Files: Opening and Closing a Data File – Reading and Writing a Data File – Processing a Data File

TOTAL: 60 HOURS

Text Books

1. Preston Gralla – "Windows Vista in a Nutshell – A Desktop Quick Reference" SPD O'Reilly, December 2006.
2. Ellen Siever, Aaron Weber, Stephen Figgins, Robert Love & Arnold Robbins – "Linux in a Nutshell – A Desktop Quick Reference" SPD O'Reilly, July 2005.
3. Beth Melton, Mark Dodge, Echo Swinford, Andrew Couch, Eric Legault, Ben M. Schorr&Ciprian Adrian Rusen – "Step by Step – Microsoft Office Professional 2013" PHI, 2014
4. Bichkar R. S. " Programming with C", University press, 2012.
5. Gottfried.B, "Programming with C", Mc-Graw Hill, 2005.

SEMESTER – III

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	MA3709	Linear Algebra	4	1	0	5
2.	MA3710	Complex Analysis	4	1	0	5
3.	MA3711	Topology	3	1	0	4
4.	XXXE2	Elective II	3	1	0	4
5	XXXS2	Supportive Course-II	2	1	0	3
PRACTICAL						
6	CS3771	Computer Fundamentals and C Programming Lab	0	2	2	3
TOTAL CREDITS			**16**	**7**	**2**	**24**

MA3709	LINEAR ALGEBRA	L	T	P	C
		4	1	0	5

OBJECTIVE

To enable the students to comprehend the advanced topics in linear algebra like systems of linear equations, the algebra of linear transformations, characteristic values, triangulation, diagonalization and decomposition. Also to develop computational skills in linear algebra.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Ability to understand the concepts of systems of linear equations and arrange them in reduced echelon matrices. Attaining the needed concept basis on vector spaces their subspaces, bases, dimension and computations concerning subspaces.	U, A, An, E, S
CO-02	Attaining the knowledge on the algebra of linear transformations, isomorphism of vector spaces, representations of linear transformations by matrices, linear functions and the transpose of a linear transformation.	U, A, An, E, S
CO-03	Understand the concepts of commutative rings, determinant functions, permutations and the uniqueness of determinants. Also attain the ability to compute the inverse of an invertible matrix using determinants.	U, A, An, E, S
CO-04	Understand and apply the concepts of characteristic values, annihilating polynomials and invariant subspaces in linear algebra problems.	U, A, An, E, S
CO-05	Develop the ability of solving problems on simultaneous triangulation and simultaneous diagonalization. Also attain the knowledge on direct sum decompositions, invariant direct sums and the primary decomposition theorem.	U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	S	S
CO-03	S	S	M	M	S
CO-04	S	S	M	M	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Linear Equations and Vector Spaces **15**

Systems of Linear Equations – Matrices and Elementary Row operations – Row - Reduced echelon Matrices – Matrix Multiplication – Invertible Matrices – Vector spaces – Subspaces – Bases and Dimension – Computations concerning Subspaces.

Unit II: Linear Transformations **15**

The Algebra of Linear Transformations – Isomorphism of vector spaces – Representations of Linear Transformations by Matrices - Linear Functionals - The Double Dual – The Transpose of a Linear Transformation.

Unit III: Determinants **15**

Commutative rings – Determinant functions – Permutations and the uniqueness of determinants – Classical Adjoint of a (Square) matrix – Inverse of an Invertible Matrix using Determinants.

Unit IV: Elementary Canonical Forms - I **15**

Characteristic values – Annihilating polynomials, Invariant subspaces.

Unit V: Elementary Canonical Forms – II **15**

Simultaneous Triangulation and Simultaneous Diagonalization – Direct-sum Decompositions - Invariant Direct sums – The Primary Decomposition Theorem.

TOTAL: 75 HOURS

Text Book

Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Private Limited, New Delhi :1975.

Chapters 1 to 3, Chapter 5 (5.1 to 5.4) and Chapter 6.

MA3710	COMPLEX ANALYSIS	L	T	P	C
		4	1	0	5

OBJECTIVE

To train the students to get essential knowledge in the theory of analytic function, complex integration and bilinear transformations in detail.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Do problems on Analytic Functions. Compute the Limits of the sequences. Distinguish Convergence and Uniform Convergence of Sequences & Series.	U, A, An, E, S
CO-02	Do problems on conformal mapping and cross ratio. Compute linear Transformation. Do problems on Complex integration.	U, A, An, E, S
CO-03	Compute the Index of a Point with Respect to a closed curve. Identify the problems based on Cauchy's Integral Formula. Distinguish the types of Singularities	U, A, An, E, S
CO-04	Compute the Residues. Do problems on Cauchy's Theorem.	U, A, An, E, S
CO-05	Solve Problems using Taylor Series and Laurent Series .Understand Harmonic function and Mean - Value Property.	U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	M	S
CO-03	S	S	M	M	S
CO-04	S	S	M	M	S
CO-05	S	S	M	M	S

S- S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Complex Functions **15**

Concept of Analytic Function – Limits and Continuity – Analytic Functions – Polynomials – Rational Functions – Elementary Theory of Power Series - Sequences - Series – Uniform Convergence – Power series – Abel's Limit Theorem.

Unit II: Analytic Functions as Mappings **15**

Conformality – Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping- Length and Arcs-Linear Transformations – The Linear Group – The Cross Ratio - Symmetry.

Unit III: Complex Integration **15**

Fundamental Theorems : Line Integrals – Rectifiable Arc – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk.

Cauchy's Integral Formula : The Index of a Point with Respect to a Closed Curve – The Integral Formula - Higher Derivatives.

Unit IV: Local Properties of Analytical Functions **15**

Removable Singularities – Taylor's Theorem – Zeros and Poles – The Local Mapping – The Maximum Principle.

The General Form of Cauchy's Theorem : Chains and Cycles - Simple Connectivity – Homology - The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem.

The Calculus of Residues : The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals.

Unit V: Harmonic Functions, Series and Product Developments **15**

Harmonic Functions : Definition and Basic Properties – The Mean - Value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle.

Series and Product Developments : Power Series Expansions - Weierstrass's Theorem – The Taylor Series – The Laurent Series.

TOTAL: 75 HOURS

Text Book

Complex Analysis (3rd Edition) by L.V. Ahlfors McGraw Hill ISE, 1981.

Unit I : Chapter 2: sections 1, 2.

Unit II : Chapter 3 : Sections 2, 3 (3.1 to 3.3 only) .

Unit III : Chapter 4: Sections 1, 2.

Unit IV : Chapter 4: Sections 3, 4 (4.1 to 4.5 only) and 5

Unit V : Chapter 4 : Section 6 , Chapter 5: Section 1.

MA3711	TOPOLOGY	L	T	P	C
		3	1	0	4

OBJECTIVE

To enable the students to distinguish spaces by means of simple topological invariants and to explain how to construct spaces by gluing and to prove that in certain cases that the result is homeomorphic to a standard space, also to construct simple examples of spaces with given properties.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Distinguish spaces according to their topologies. Construct order topology, product topology and subspace topology from sets and topologies. Identify the closed sets and limit points. Prove various properties and results on limit points and the closed sets.	U, A, An, E, S
CO-02	Distinguish functions which are continuous. Prove various properties and results on continuity, Product and quotient topology.	U, A, An, E, S
CO-03	Determine whether a space is connected. Identify the conditions which imply connectedness and compactness in a topological space. Give logical proofs to results in components and local connectedness.	U, A, An, E, S
CO-04	Understand the local compactness. Distinguish spaces according to the countability axioms. Provide logical proofs for established results in normal spaces	U, A, An, E, S
CO-05	Understand and apply the Urysohn lemma, The Tietze Extension theorem and the Tychonoff theorem	U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	M	S
CO-03	S	S	M	M	S
CO-04	S	S	M	M	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Topological Spaces **12**

Topological Spaces and Continuous Functions: Topological Spaces - Basis for a Topology – The Order Topology – The Product Topology on X×Y – The Subspace Topology - Closed Sets and Limit Points.

Unit II: Continuous Functions **12**

Continuous Functions – The Product Topology – The Quotient Topology.

Unit III: Connected Spaces **12**

Connectedness and Compactness: Connected Spaces, Components and Local Connectedness - Compact Spaces.

Unit IV: Compactness and Countability Axioms **12**

Local Compactness – Countability and Separation Axioms: The Countability Axioms – The Separation Axioms- Normal Spaces.

Unit V: Separation Axioms **12**

The Uryshon Lemma- The Tietze Extension Theorem - The Tychonoff Theorem: Tychonoff Theorem.

TOTAL: 60 HOURS

Text Book

Topology (2^{nd} Edition) by J. R. Munkres, Pearson Publishers, 2000

Sections 12 to 19, 22, 23, 25, 26, 29 to 33, 35, 37 and 38.

SEMESTER – IV

Sl. No	Course Code	Course Title	L	T	P	C
1.	MA3712	Functional Analysis	4	1	0	5
2.	MA3713	Operations Research	3	1	0	4
3.	MA3714	Graph Theory	3	1	0	4
4.	XXXE3	Elective III	2	1	0	3
PRACTICAL						
4.	MA37P1	Project and Viva – Voce	0	0	12	6
TOTAL			**12**	**4**	**12**	**22**
TOTAL: 22 +22 + 24 +22 = 90						

MA3712	FUNCTIONAL ANALYSIS	L	T	P	C
		4	1	0	5

OBJECTIVE

To enrich the knowledge of the students with the topics of functional analysis such as Banach Space, Hilbert Space and enable them to have comprehensive idea about the core principles of operators.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Understand the terminology of Banach spaces. Distinguish which normed spaces are Banach. Evaluate continuity of linear transformations.	U, A, An, E, S
CO-02	Understand the concepts of conjugate space and conjugate operators. Evaluate the conjugate space of given space. Finding conjugate of an operator.	U, A, An, E, S
CO-03	Analyzing which Banach space are Hilbert space. Constructing orthonormal set. Analyse whether the given set is orthonormal.	U, A, An, E, S
CO-04	Understand adjoint and self adjoint sets- Analysing whether an operator is normal or Unitary.	U, A, An, E, S
CO-05	Applying Finite dimensional spectral theory- Understandings spectrum concepts.	U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	M	S
CO-02	S	S	M	M	S
CO-03	S	S	M	M	S
CO-04	S	S	M	M	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Banach Spaces **15**

Banach spaces-The definition and some examples – Continuous linear transformation – The Hahn- Banach theorem.

Unit II: Operators on Banach Spaces **15**

Conjugate space N^* of normed linear space N – The natural imbedding of N in N^{**} - The open mapping theorem – The conjugate of an operator.

Unit III: Hilbert Spaces **15**

Hilbert spaces – The definition and some simple properties – Orthogonal complements – Orthonormal sets – The conjugate space H^*.

Unit IV: Operators on Hilbert Spaces **15**

Adjoint of an operator – Self-adjoint operators – Normal and Unitary operators – Projections.

Unit V: Spectral Theorem **15**

Finite-dimensional spectral theory – Determinants and the spectrum of an operator – The spectral theorem.

TOTAL:75 HOURS

Text Book

Introduction to Topology and Modern Analysis (2006) by G. F. Simmons, Tata Mc Graw-Hill Edition, 6^{th} Reprint Sections 46-59, 61 and 62.

MA3713	OPERATIONS RESEARCH	L	T	P	C
		3	1	0	4

OBJECTIVE

To enable the students to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively and also formulating mathematical models in decision theory, PERT, CPM, deterministic inventory systems, queues, replacement and maintenance problems.

Course Outcomes At the end of the course students should be able to		**Cognitive Skills**
CO-01	List the steps of the decision making process and describe the different types of decision making environments, making decisions under uncertainty, under risk, calculate EMV & EVPI and develop accurate and useful trees to analyse decision tree problems.	R,U,A,An, E,S
CO-02	Construct a network of the project, compute the critical path and the project completion time, compute the expected activity time using the activity time estimates such as optimistic, most likely and pessimistic, compute the probability of the project being completed by a specific time and understand the concept and the need for crashing.	R,U,A,An, E,S
CO-03	Describe the functions and the various costs of an inventory system, the rationale behind the EOQ models, calculate the order quantity that minimizes the TOTAL cost inventory, and analyze the implication of this model.	R,U,A,An, E,S
CO-04	Understand the nomenclature of queuing theory, identify the various queuing models and calculate the characteristics and performance measures of a queuing system.	R,U,A,An, E,S
CO-05	Recognise the necessity of replacement items and their terminologies, compute the time of replacement and average cost, apply individual and group replacement policy.	R,U,A,An, E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	M	S	S
CO-02	S	S	M	S	S
CO-03	S	S	M	S	S
CO-04	S	M	M	S	S
CO-05	S	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Decision Theory **12**

Steps in Decision Theory Approach - Decision Making Environments - Decision Making Under Conditions of Certainty- Decision Making Under Uncertainty - Decision Making Under Risk – Expected Value Criterion for Continuously Distributed Random Variables- Decision Trees.

Unit II: Project Management : PERT AND CPM **12**

Introduction-Phases of Project Management-Network-Numbering the Events-Measure of Activity-Frequency Distribution Curve for PERT- PERT - Computations-Probability of Meeting the Scheduled Dates-CPM Computations- Critical Path-Float-Cost Analysis-Project Cost-Crashing the Network.

Unit III: Inventory Models **12**

Necessity for Maintaining Inventory- Inventory Costs- Inventory Control Problem-Classification of Fixed Order Quantity Inventory Models- Inventory Models with Deterministic Demand-Model I (a) Demand Rate Uniform and Production Rate Infinite- Model I (b) Demand Rate Non-uniform and Production Rate Infinite- Model I (c) Demand Rate Uniform and Production Rate Finite- Model 2 (a) Demand Rate Uniform and Production Rate Infinite, Shortages Allowed- Model 2 (b) Demand Rate Uniform ,Production Rate Infinite, Shortages Allowed ,Time Interval Fixed- Model 2 (c) Demand Rate Uniform ,Production Rate Finite, Shortages Allowed.

Unit IV: Queueing Models **12**

Characteristic of Queuing Models-Waiting Time and Idle Time Costs-Transient and Steady States of the System-Single Channel Queuing Theory-Models for Arrival and Service times-Model:(M/M/1): (FCFS/∞); Model II. (M/M/1): (FCFS/N); Model III. (M/M/C): (FCFS/∞) ; Model IV- (M/M/C): (FCFS/N)

Unit V: Replacement Models **12**

Introduction- Replacement of Items Deteriorates with Time- Replacement of Items whose Maintenance and Repair Costs Increase with Time, Ignoring Changes in the Value of Money During the Period- Replacement of Items whose Maintenance Costs Increase with Time and Value of Money also Changes with Time- Replacement of Items that Fail Suddenly-Individual Replacement Policy – Group Replacement Policy- Miscellaneous Replacement Problems.

TOTAL: 60 HOURS

Text Book

Operations Research by Prem Kumar Gupta, D.S.Hira, Reprint (2001), S.Chand & Company Ltd., New Delhi.

Unit I : Chapter 9 : 9.1 – 9.10
Unit II : Chapter 14.1 - 14.9, 15.1- 15.7, 16.1-16.4, 17.1-17.2
Unit III : Chapter 12 : 12.1 – 12.5 ;
Unit IV : Chapter 10 : 10.1 - 10.7
Unit V : Chapter 11 : 11.1 - 11.5

MA3714	GRAPH THEORY	L	T	P	C
		3	1	0	4

OBJECTIVE

To study and develop the concepts of graphs, sub graphs, trees, connectivity, Euler tours, Hamilton cycles, matching, coloring of graphs, independent sets, cliques, vertex coloring and di graphs.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Understand the concept of graph theory, path, vertex degree and trees. To be able to find cut edge and cut vertices.	R,U, A, An, E, S
CO-02	Find Euler path, Euler tour Hamiltonian cycle and connectivity.	R,U, A, An, E, S
CO-03	Understand the concept of Matching and covering in bipartite graph. To able to find perfect matching.	R,U, A, An, E, S
CO-04	Apply the concept of independent sets, cliques etc.	R,U, A, An, E, S
CO-05	Understand the concept of Directed graph, Directed path and cycles. To be able to find Directed path and cycles	R,U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	M	S	S
CO-02	M	S	M	M	S
CO-03	S	M	S	M	S
CO-04	S	S	M	M	S
CO-05	M	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Graphs, Subgraphs and Trees **12**

Graphs and simple graphs - Graph isomorphism-Incidence and adjacency matrices – Subgraphs - Vertex degrees - Path and Connection cycles – Applications: The shortest path problem – Trees: Trees - Cut edges and bonds - Cut vertices-Cayley's formula.

Unit II: Euler tours and Hamilton cycles **12**

Connectivity – Blocks - Euler tours and Hamilton cycles: Euler tours – Hamilton cycles – Applications: The Chinese Postman Problem.

Unit III: Matchings and Edge colorings **12**

Matchings - Matching and coverings in bipartite graphs - Perfect matchings –. Edge colorings: Edge chromatic number - Vizing's theorem.

Unit IV: Independent sets and cliques **12**

Independent sets and cliques: Independent sets- Ramsey's theorem-Turan's theorem

Unit V: Directed Graphs **12**

Directed Graphs, Directed Paths and Directed Cycles.

TOTAL: 60 HOURS

Text Book

Graph Theory with Applications (5^{th} Print) by J.A.Bondy and U.S.R.Murty, Elsevier Science Publishing Co. Inc., USA, 1982.

Chapters 1 (except 1.9), 2 (except 2.5), 3 (except 3.3), 4 (except 4.4), 5 (except 5.5), 6, 7 (except 7.4 and 7.5) and 8.

LIST OF SUPPORTIVE COURSES

1.	MA37S1	Statistical Methods	3	1	0	4
2.	MA37S2	Mathematics for Competitive Examinations	3	1	0	4
3.	CS37S1	Fundamentals of Computers	3	1	0	4
4.	CS37S2	PYTHON Programming	2	1	0	3

MA37S1	**STATISTICAL METHODS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVE

To equip the students with different statistical techniques to summarize, analyse the data which are essential for decision making. Also to enable the students to solve statistical problems using computer packages like SPSS.

Course Outcomes At the end of the course the students would be able to:		**Cognitive Skills**
CO-01	Probability: Concept of random experiment- sample space, events, disjoint events- Definition of probability -Addition and Multiplication theorem, Conditional probability - simple problems.	R, U,A
CO-02	Introduction to Statistics – Classification, Frequency distribution: Discrete and Continuous frequency distribution. – Diagrammatic and Graphic representation: Bar diagram, Rectangle diagram and Pie diagram – Histograms- Frequency polygon, Advantages and limitations. Measures of Central Tendency - Dispersion – Standard deviation, Variance, Co-efficient of variation. - Applications of Binomial and Normal distributions .	R, U,A,An
CO-03	Correlation Analysis- Karl Pearson's correlation coefficient- Rank correlation- Regression lines.	R, U,A,An
CO-04	Definition-Type I and Type II errors – Null Hypothesis, Alternative Hypothesis- One tailed and two tailed tests- Large sample tests. Tests for mean and equality of means. Small sample tests: t -test for mean, equality of means, F test.	R, U,A,An
CO-05	Quality Control –Chance causes and Assignable causes - Control charts for variables – Control chart for Mean ($\overline{X}$) and Range (R). Control charts for Attributes, Proportion of defective (p chart), Number of defectives per Unit (c chart).	R, U,A,An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	S	S	S	M	S
CO-02	M	M	M	S	S
CO-03	M	S	S	S	S
CO-04	S	M	M	S	S
CO-05	S	S	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Probability **12**

Probability: Concept of random experiment- sample space, events, disjoint events- Definition of probability (frequency and axiomatic)-Addition and Multiplication theorem, Conditional probability - simple problems.

Unit II: Descriptive Statistics and Distributions **12**

Introduction to Statistics – Classification, Frequency distribution: Discrete and Continuous frequency distribution. – Diagrammatic and Graphic representation: Bar diagram, Rectangle diagram and Pie diagram – Histograms- Frequency polygon, Advantages and limitations. Measures of Central Tendency - Dispersion – Standard deviation, Variance, Co-efficient of variation. - Applications of Binomial and Normal distributions (Problems only).

Unit III: Correlation and Regression Lines **12**

Correlation Analysis- Karl Pearson's correlation coefficient- Rank correlation- Regression lines.

Unit IV: Testing of Hypothesis **12**

Definition-Type I and Type II errors – Null Hypothesis, Alternative Hypothesis- One tailed and two tailed tests- Large sample tests. Tests for mean and equality of means. Small sample tests: t - test for mean, equality of means, F test.

Unit V: Statistical Quality Control **12**

Quality Control –Chance causes and Assignable causes - Control charts for variables – Control chart for Mean ($\overline{X}$) and Range (R). Control charts for Attributes, Proportion of defective (p chart), Number of defectives per Unit (c chart).

TOTAL: 60 HOURS

REFERENCES

1. Statistical Methods (38th Edition) by Gupta.S.P , Sultan Chand &Sons, 2004.
2. Fundamentals of Statistics by Srivastava, S.C, Sangya Srivastava Anmol Publications Private Ltd., New Delhi, 2006.
3. Business Statistics in Practice (2nd Edition) by Bruce L. Bowcman, Richard T.O. Connell and Michael L. Hand, "McGraw – Hill, 2001.
4. Statistics for Management (7th Edition) by Richard I. Levin and David S , Prentice Hall of India, 2002.

MA37S2	MATHEMATICS FOR COMPETITIVE EXAMINATIONS	L	T	P	C
		3	1	0	4

OBJECTIVE

To build strong foundational mathematical skills commonly required for competitive exams, academic studies, and practical problem-solving in finance, business, and everyday life.

Course Outcome At the end of the course the students would be able to:		Cognitive Skill
CO-01	Understand the concepts of Ages, Percentages and can do problems on it.	U,A,An,E
CO-02	Ability to analyze, interpret and solve the problems on Profit , Loss, Ratio and Proportions.	U,A,An,E
CO-03	Understand the concept of simple interest and able to do problems on work and time.	U,A,An,E
CO-04	Understand and calculate compound interest, annuity, discount, true discount.	U,A,An,E
CO-05	Understand the concept of bankers discount and bankers gain. Also apply the knowledge of stock and share in real problems.	U,A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Unit I : Problems on Ages – Percentage.
Unit II: Profit and Loss – Ratio and Proportion.
Unit III: Time and Work – Simple Interest.
Unit IV: Compound Interest – Calendar.
Unit V: Stocks and Shares – Bankers' Discount.

TOTAL: 45 HOURS

Text Book

Quantitative Aptitude by R.S. Aggarwal (Reprint 2012), S. Chand and Company Ltd., NewDelhi. Chapters 8, 10 to 12, 15, 21, 22, 27, 29 and 31.

CS37S2	PYTHON programming	L	T	P	C
		2	1	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	To get knowledge about the fundamental concepts of the language	R,U
CO-02	Will be able to understand and apply Decision making and branching, Decision making and looping statements	U,A
CO-03	Will gain an idea for using arrays, Character arrays and strings	U,A
CO-04	Will be able to understand and apply user defined functions Structures	U. A
CO-05	Will be able to understand and apply files.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	M	S	S	M	S
CO-02	S	S	S	M	S
CO-03	S	M	S	S	S
CO-04	S	M	S	M	S
CO-05	S	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Introduction To Computing and Problem Solving **9**

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements

Unit II: Conditionals and Functions **9**

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If- Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

Unit III: Simple Data Structures in Python **10**

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List –List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets

UNIT IV: Strings, Dictionaries, Modules **10**

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built – In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested
Dictionaries Built – in Dictionary Function – Finding Key And Value in a Dictionary – Modules: Introduction – Module Loading and Execution – Packages – Making Your Own Module – The Python Standard Libraries.

UNIT V: File Handling and Exception Handling **7**

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

TOTAL: 45 HOURS

Text Books

1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers, 2016.
3. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.

REFERENCES

1. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
2. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.

LIST OF ELECTIVES

1.	MA37A1	Advanced Graph theory	3	1	0	4
2.	MA37A2	Calculus of Variations and Integral Equations	3	1	0	4
3.	MA37A3	Algebraic Number Theory	3	1	0	4
4.	MA37A4	Coding Theory	3	1	0	4
5.	MA37A5	Combinatorics	3	1	0	4
6.	MA37A6	Differential Geometry	3	1	0	4
7.	MA37A7	Fuzzy Mathematics	2	1	0	3
8.	MA37A8	Measure Theory and Integration	2	1	0	3
9.	MA37A9	Mechanics	3	1	0	4
10.	MA37B1	Number Theory	3	1	0	4
11.	MA37B2	Stochastic Processes	2	1	0	3

MA37A1	ADVANCED GRAPH THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES

- To motivate the students to do research in the field of Graph Theory.
- To introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields. To achieve this goal, the course introduces the main concepts such as Ramsey numbers, Perfect graphs and Eigenvalues.

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	Identify whether a graph has Hamiltonian cycles. Find the optimal Hamiltonian circuit for a graph using the brute force algorithm, the nearest neighbor algorithm, and the sorted edges algorithm. Identify a connected graph that is a spanning tree.	R,U,An
CO-02	Understand and create mathematical proof of perfect graph theorem. Able to know the concept of Chromatic number, Connectivity, Directed graphs. Study about imperfect graphs.	R,U,E
CO-03	Learn the concepts of Ramsey numbers and Ramsey theory. To study the partition of large structures and Pigeonhole principle. Able to write the proof of Ramsey's Theorem.	An,A,E
CO-04	To know the properties of Almost All Graphs. Understand the concept of Evaluation and graph Parameters, connectivity and cliques of graphs.	R, U ,A
CO-05	Able to find the Characteristic polynomial, Linear algebra of real symmetric Matrices, Eigenvalues and graph parameters, Eigenvalues of regular graphs.	S, E, U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	S	S
CO-02	S	S	M	S	S
CO-03	S	M	S	S	S
CO-04	M	S	M	M	S
CO-05	M	M	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I : Hamiltonian Cycles **12**

Necessary conditions, sufficient conditions, Cycles in directed graphs

Unit II: Perfect Graphs **12**

The perfect graph Theorem, Chordal graphs Revisited, other classes of perfect graphs, Imperfect graphs.

Unit III: Ramsey Theory **12**

The Pigeonhole principle revisited, Ramsey's Theorem, Ramsey Numbers, Graph Ramsey theory.

Unit IV: Random Graphs **12**

Existence and Expectation, Properties of Almost All Graphs, Threshold Functions, Evaluation and graph Parameters, connectivity, cliques.

Unit V: Eigenvalues of Graphs **12**

The Characteristic polynomial, Linear algebra of real symmetric Matrices, Eigenvalues and graph parameters, Eigenvalues of regular graphs.

TOTAL: 60 HOURS

Text Book

Introduction to Graph Theory, D.B. West, 2nd edition, Prentice Hall of India, 2005.

Unit I : Section 7.3

Unit II : Section 8.1

Unit III : Section 8.3

Unit IV : Section 8.5

Unit V : Section 8.6

MA37A2	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVE

To introduce the concepts of calculus of variation and its applications and also the various types of integral equations and the methods to solve such equations.

Course Outcomes		Cognitive Skill
At the end of the course the students would be able to:		
CO-01	Understand the concepts of variations and its properties. Use Euler's equation to solve various types of variational problems with fixed boundaries.	U, A,E
CO-02	Modify the Euler's formula for a class of curves with moving boundary points. Identify and solve Sturm-Liouville problems.	R,A,E
CO-03	Able to use and apply periodic boundary and unmixed boundary conditions and apply the green's function and problems.	An,A,E
CO-04	Able to solve Volterra and singular type integral equations and Fredholm first and second kind integral equations, reduce the differential equations to integral equations.	R,A,E ,S
CO-05	Understand the Fredholm theory and identify the Hilbert-Schmidt theorem, and solve the resolvent kernel problems.	U,An,A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	S	S
CO-02	S	S	M	S	S
CO-03	S	M	S	S	S
CO-04	M	S	M	M	S
CO-05	M	M	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Introduction to Calculus of Variations **12**

Maxima and Minima - The Simplest case-Illustrative examples - Natural boundary conditions and transition conditions – The variational notation-The more general case.

Unit II: Applications of Calculus of Variations **12**

Constraints and Lagrange multipliers-Variable end points - Sturm- Liouville problems-Hamilton's principle-Lagrange's equations

Unit III: Integral Equations **12**

Integral Equations: Introduction – Relations between differential and integral equations – The Green's function – Alternative definition of the Green's function.

Unit IV: Linear Integral Equations **12**

Linear equation in cause and effect: The influence function – Fredholm equations with separable kernels – Illustrative example.

Unit V: Integral Equations of Second Kind **12**

Hilbert – Schmidt theory – Iterative methods for solving equations of the second kind – Fredholm theory.

TOTAL: 60 HOURS

Text Book

Methods of Applied Mathematics (2^{nd} Edition) by Francis B. Hildebrand Dover Publications, Inc. New York, 2012.

Sections 2.1 to 2.11, 3.1 to 3.9 and 3.11

MA37A3	ALGEBRAIC NUMBER THEORY	L	T	P	C
		3	1	0	4

OBJECTIVE

To enable the students to compute norms and discriminants and to use them to determine the integer rings in algebraic number fields and also to assist the student to factorize ideals into prime ideals in algebraic number fields in straightforward examples.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Understand the basic concepts of Rings and fields, Factorization of polynomials, Field extensions, Symmetric polynomials, Free abelian groups.	R,U,A,An,E,S
CO-02	Recognise the concept of Algebraic numbers, Conjugates and discriminates, Algebraic integers, Integral bases, Norms and traces, Rings of integers.	R,U,A,An,E,S
CO-03	Describe the concepts and applications of Quadratic fields, Cyclotomic fields, Trivial factorizations, Factorization into irreducible	R,U,A,An,E,S
CO-04	Understand the concepts of Prime factorization, Euclidean domains, Euclidean quadratic fields, Consequences of unique factorization, The Ramanujan- Nagell theorem.	R,U,A,An,E,S
CO-05	Describe the concepts and applications of Ideals, Prime factorization of fields, The norm of an ideal, Nonunique factorization in cyclotomic fields.	R,U,A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	S	S	S	L	S
CO-02	S	M	S	L	S
CO-03	S	S	M	L	S
CO-04	S	S	M	L	S
CO-05	S	S	M	L	S

S - Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Algebraic Background **12**

Rings and fields-Factorization of polynomials-Field extensions-Symmetric polynomials-Free abelian groups.

Unit II: Algebraic Numbers **12**

Algebraic numbers-Conjugates and discriminates- Algebraic integers-Integral bases-Norms and traces-Rings of integers.

Unit III: Quadratic Cyclotomic Fields **12**

Quadratic fields- Cyclotomic fields. Factorization into irreducible: Trivial factorizations – Factorization into irreducible - Examples of non-unique factorization into irreducibles.

Unit IV: Factorization into Irreducibles **12**

Prime factorization-Euclidean domains-Euclidean quadratic fields-Consequences of unique factorization-The Ramanujan- Nagell theorem.

Unit V: Ideals: **12**

Prime factorization of fields-The norm of an ideal – Nonunique factorization in cyclotomic fields.

TOTAL:60 HOURS

Text Book

Algebraic Number Theory (2^{nd} Edition) by I. N. Stewart and D. O. Tall, Chapman and Hall, 1987. Chapters 1 to 5.

MA37A4	CODING THEORY	L	T	P	C
		3	1	0	4

OBJECTIVE

To make the students to have a thorough understanding of the theory and practice of error control coding techniques for digital data which are widely used in our everyday life. Topics covered in this syllabus include, linear codes, Hadamard codes, the binary Golay code, Bound on codes and the idempotent of a cycle code.

Course Outcomes At the end of the course the students would be able to:		**Cognitive Skill**
CO-01	Understand basic concept of Algebra, Krawtchouk polynomials, Combinatorial theory and Probability theory. Know about Shannon's Theorem and apply it to simple problems.	R,U, A, An, E
CO-02	Understand Block codes, Linear codes, Hamming codes, Majority logic decoding, Weight Enumerators and The Lee metric and apply decoding algorithm to simple problems.	R,U, A, An, E
CO-03	Know about some good codes, hadamard codes and generalizations, The binary Golay code, The ternary Golay code, Reed-Muller code and Kerdock codes. Construct codes from other codes.	R,U, A, An, E
CO-04	Study various bounds on codes like, The Gilbert bound and Upper bounds. Understand Cyclic codes Definitions, Generator matrix and Zeros of a cyclic code.	R,U, A, An, E
CO-05	Understand the idempotent of a cyclic code and study other representations of cyclic codes, BCH codes, Decoding BCH codes and Binary cyclic codes of length 2n (n odd).	R,U, A, An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	M	S
CO-02	S	M	M	M	S
CO-03	S	M	L	M	S
CO-04	S	M	S	M	S
CO-05	S	M	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Mathematical Background and Shannon's Theorem **12**

Algebra – Krawtchouk Polynomials - Combinatorial theory - Introduction - Shannon's Theorem.

Unit II: Linear Codes **12**

Block codes – Linear codes – Hamming codes - Majority logic decoding – Weight Enumerators – The Lee metric.

Unit III: Some Good Codes **12**

Hadamard codes and generalizations – The binary Golay code – The ternary Golay code- Constructing codes from other codes - Reed-Muller code – Kerdock codes..

Unit IV: Bound on Codes **12**

The Gilbert bound – Upper bounds – Cyclic codes: Definitions- Generator matrix and check polynomial – Zeros of a cyclic code.

Unit V: The Idempotent of a Cyclic Code **12**

Other Representations of cyclic codes – BCH codes – Decoding BCH codes- Binary cyclic codes of length 2n (n odd).

TOTAL:60 HOURS

Text Book

Introduction to Coding Theory (3rd Revised and Expanded Edition) by J. H. Van Lint, Springer Verlag NewYork Inc, 1982.

Chapters 1 (except 1.4)

2 (Sections 2.1 and 2.2 only)

3, 4, 5 (except 5.3), and

Chapter 6 (except 6.8, 6.9 and 6.11).

MA37A5	COMBINATORICS	L	T	P	C
		3	1	0	4

OBJECTIVE

To develop the calculating capacity by dealing with enumerating problems., Permutations and Combinations, Pigeonhole Principle,Ramsey Numbers, Generating Functions and Recurrence Relations.

Course Outcomes At the end of the course the students would be able to:		Cognitive Skill
CO-01	Able to compute permutations and combinations.	U,A,An,E
CO-02	Understand the concept of pigeon hole principle and Ramsey number and can do problems	U,A,An,E
CO-03	Capable of doing problems on Principle of inclusion and exclusion. Also understand the concept of Sterling numbers of the second kind, Derrangements and the Sieve of Eratosathenes and Euler phi function	U,A,An,E
CO-04	Understand the concept of generating functions and can do problems on it.	U,A,An,E
CO-05	Able to do problems on linear recurrence relations	U,A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	M	S	S
CO-02	S	S	M	M	S
CO-03	S	M	M	M	S
CO-04	S	S	M	S	S
CO-05	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Permutations and Combinations **12**

Two basic counting principles, Permutations, Circular permutations, Combinations,

The injection and bijection principles, Arrangements and selection with repetitions, Distribution problems.

Unit II: The Piegeonhole Principle and Ramsey Numbers **12**

Introduction, The piegeonhole principle, More examples, Ramsey type problems and Ramsey numbers, Bounds for Ramsey numbers.

Unit III: Principle of Inclusion and Exclusion **12**

Introduction, The principle, A generalization, Integer solutions and shortest routes Surjective mappings and Sterling numbers of the second kind, Derangements and a generalization, The Sieve of Eratosathenes and Euler phi function.

Unit IV: Generating Functions **12**

Ordinary generating functions, Some modelling problems, Partitions of integer, Exponential generating functions.

Unit V:Recurrence Relations **12**

Introduction, Two examples, Linear homogeneous recurrence relations, General linear recurrence relations, Two applications.

TOTAL:60 HOURS

Text Book

Principles and Techniques in Combinatorics by Chen Chuan -Chong, Koh Khee Meng, , World Scientific, Singapore, 1999.

Unit I : Chapter 1

Unit II : Chapter 3

Unit III : Chapter -4 Sections 4.1 to 4.7

Unit IV & Unit V : Chapter 5, 6 Sections 6.1 to 6.5

MA37A6	DIFFERENTIAL GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVE

To introduce the space curves and their intrinsic properties of a surface and geodesics and also to explore the non-intrinsic properties of surfaces..

Course Outcomes At the end of the course the students would be able to:		Cognitive Skill
CO-01	Understand the definition of space curve, Arc length , tangent , normal and binormal, curvature and torsion. To contact between curves and surfaces. Do the problems on tangent of the surface. involutes and evolutes of the curve. How to find Intrinsic equations, Fundamental Existence theorem for space curves and Helics.	R,U,A,E
CO-02	Remember the definition of a surface and compute the Surface of revolution, Helicoids, Metric, Direction coefficients , families of curves and Isometric correspondence. Easily study the Intrinsic properties.	R,U,A,E
CO-03	Obtain the Geodesics, Canonical geodesic equations and Normal property of geodesics. Know to prove Existence theorems and Geodesic parallels.	R,U,A,E
CO-04	Evaluate the Geodesics curvature , Gauss , Bonnet Theorem and Gaussian curvature. Also evaluate the surface of constant curvature.	R,U,A,E
CO-05	Know the second fundamental form , Principal curvature and the Lines of curvature. Also know about Developable and Developable associated with space curves on surface. Also Minimal surfaces and Ruled surfaces.	R,U,A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	S	M	M	M	S
CO-02	S	M	M	M	S
CO-03	S	M	M	M	S
CO-04	S	M	M	M	S
CO-05	S	M	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Space Curves **12**

Definition of a space curve - Arc length - tangent - normal and binomial - curvature and torsion - contact between curves and surfaces - tangent surface - involutes and evolutes - Intrinsic equations - Fundamental Existence Theorem for space curves - Helics.

Unit II :Intrinsic Properties of a Surface **12**

Definition of a surface - curves on a surface - Surface of revolution - Helicoids - Metric - Direction coefficients - families of curves - Isometric correspondence - Intrinsic properties.

Unit III:Geodesics I **12**

Geodesics - Canonical geodesic equations - Normal property of geodesics - Existence Theorems - Geodesic parallels

Unit IV: Geodesics II **12**

Geodesics curvature - Gauss - Bonnet Theorem - Gaussian curvature - surface of constant curvature.

Unit V: Non Intrinsic Properties of a Surface **12**

The second fundamental form - Principal curvature - Lines of curvature - Developable - Developable associated with space curves and with curves on surface - Minimal surfaces - Ruled surfaces.

TOTAL:60 HOURS

Text Book

An Introduction to Differential Geometry (17^{th} Impression) by T.J.Willmore, Oxford University Press, New Delhi 2002. (Indian Print).

Unit I : Chapter I : Sections 1 to 9

Unit II : Chapter II: Sections 1 to 9

Unit III : Chapter II: Sections 10 to 14

Unit IV : Chapter II: Sections 15 to 18

Unit V: Chapter III: Sections 1 to 8

MA37A7	FUZZY MATHEMATICS	L	T	P	C
		2	1	0	3

OBJECTIVE

To make the students to comprehend the fundamentals of Fuzzy set theory, Fuzzy relations, Fuzzy measures and Fuzzy algebra.

Course Outcomes		Cognitive Skill
CO-01	Learn basic concepts of fuzzy set and understand the membership function crisps set, fuzzy cardinality, and scalar cardinality.	R,U,L,A,
CO-02	Know about fuzzy relations and fuzzy matrices, invertible matrices, similarity of fuzzy relations, and asymptotic forms.	R,U,An
CO-03	Understand the fuzzy inverses, semi inverses and Pseudo similar fuzzy matrices.	R,U,E,S
CO-04	Able to know some elementary properties of union of two fuzzy subgroup, analyse fuzzy normal subgroup, fuzzy conjugate and fuzzy subgroup.	U,E,S
CO-05	Able to find the union of two fuzzy subrings and understand fuzzy homomorphism and fuzzy cosets.	R,U,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	L	S
CO-02	S	L	M	S	S
CO-03	S	M	M	L	S
CO-04	S	S	L	M	S
CO-05	S	M	L	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Fuzzy Sets **9**

The notion of Fuzzy sets, Basic concepts of Fuzzy sets, Operations on Fuzzy sets, Combinations of operations , fuzzy logic

Unit II: Fuzzy Relations and Matrices **9**

Fuzzy Relations - Fuzzy matrices- Invertible Matrices- Similarity relations-Asymptotic forms determinants- Fuzzy relation equations

Unit III: Inverses **9**

Regular Matrices- Semi-inverses -Minimum Norm g-inverses- Least Square g-inverses -Moore-Penrose inverse-Pseudo-similar Fuzzy matrices.

Unit IV: Fuzzy Subgroups **9**

Some elementary properties, union of two fuzzy subgroups, Fuzzy sub groups generated by a Fuzzy subset, Fuzzy normal subgroups, Fuzzy conjugate subgroups.

Unit V: Fuzzy Subrings **9**

Some elementary properties, union of two fuzzy subrings, Fuzzy subring generated by a fuzzy subset, Fuzzy ideal and homomorphisms, Fuzzy cosets.

TOTAL: 45 HOURS

Text Books

1. Fuzzy sets – Uncertainity and information by George J.Klir and Tina A.Folger, Prentice – Hall of India Pvt. (2006). Chapters: I, II
2. Fuzzy set theory and its applications – H.J.Zimmermann – Springer – Fourth Edition (2001). Chapter IV.
3. Fuzzy Algebra by Rajesh Kumar ,Volume 1, University of Delhi publication Division .Chapter 2 , Section 2.1,2.2,2.3
   Chapter 3 and Chapter 4 , Section 4.1,4.2.
4. Fuzzy Matrix Theory and Applications by Dr. AR. Meenakshi-MJP Publishers, Chennai– 2008. Chapters 1 (1.3) 2 &3.

MA37A8	MEASURE THEORY AND INTEGRATION	L	T	P	C
		2	1	0	3

OBJECTIVE

To understand the concept of Lebesgue measure, Measure space and integration with respect to a measure.

Course Outcomes At the end of the course students should be able to		Cognitive Skill
CO-01	Understand the concepts of Lebesgue measure, Outer measure and measurable function. Distinguish between measurable sets and Non measurable sets.	R, U, A, An, E, S
CO-02	Understand the construction of the Riemann integral and the Lebesgue integral from a finite measure. Attain the knowledge on the integral of a nonnegative function.	R, U, A, An, E, S
CO-03	Understand the concept of differentiation of monotone functions. Determine the functions which are of bounded variation. Understand and apply the concept of differentiation of an integral.	R, U, A, An, E, S
CO-04	Attain the ability to determine which spaces are Lp-spaces. Know the applications the Holder and Minkowski inequalities in various mathematical poof techniques.	R, U, A, An, E, S
CO-05	Determine the measurable functions and measurable sets in R^n. Understand the method for solving various problems on double integral of a step function.	R, U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	S	S	M	L	S
CO-02	S	S	M	L	S
CO-03	S	S	L	M	S
CO-04	S	S	L	L	S
CO-05	S	S	L	L	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Lebesgue Measure **9**

Introduction, Outer measure, Measurable sets and Lebesgue measure, A nonmeasurable set, Measurable functions.

Unit II: The Lebesgue Integral **9**

The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, The integral of a nonnegative function.

Unit III: Differentiation and Integration **9**

Differentiation of monotone functions, Functions of bounded variation, Differentiation of an integral.

Unit IV: L^p Spaces, Measure and Integration **9**

The L^p spaces, the Holder and Minkowski inequalities.

Unit V: Multiple Lebesgue Integrals **9**

Introduction, Step functions and their integrals, Upper functions and Lebesgue-integrable functions, Measurable functions and measurable sets in R^n, Fubini's reduction theorem for the double integral of a step function.

TOTAL: 45 HOURS

Text Books

1. Real Analysis by H.L. Royden, Prentice Hall of India, NewDelhi, 2004.

   Unit I Chapter 3: Sections 1 to 5.; Unit II Chapter 4: Sections 1 to 3.

   Unit III Chapter 5: Sections 1 to 3; Unit IV Chapter 6: Sections 1and 2

2. Contents and treatment as in the book "Mathematical Analysis" (2^{nd} Edition) by Tom M. Apostol, Narosa Publishing House, New Delhi. 1997.

   Unit V Chapter 15: Sections 1 to 5.

MA37A9	MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVE

To study and comprehend mechanical systems under generalized coordinate systems, virtual work, energy and momentum, and mechanics developed by Newton, Langrange, Hamilton Jacobi and also the theory of Relativity.

Course Outcomes At the end of the course the students would be able to:		Cognitive Skill
CO-01	Have understanding of fundamental concepts of Mechanical system and demonstrate knowledge in the Mechanical system of particles and motion of rigid body. Also learn to represent the Energy and Momentum.	R,U,A,An,E,S
CO-02	Should be able to use advanced concepts of mechanics theory, such as the Lagrange's equations to understand complex mechanical systems. Learn D-Alemberts principle and formulate Lagrange's equation of motion.	R,U,A,An,E,S
CO-03	Formulate Hamiltonian equation and understand its physical significance. Explain the applications of Hamilton's equations.	R,U,A,An,E,S
CO-04	Illustrate the Hamilton Jacobi equations and Hamilton Principle function, applications such as linear tri -atomic molecule, two carts connected with three springs, triple pendulum, and double pendulum.	R,U,A,An,E,S
CO-05	Describe and Apply the Canonical transform technique for functions. Explain the applications of, Canonical transformations, Poisson brackets, Invariance of Poisson bracket under canonical transformations – Principle of least action.	R,U,A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	S	M	S
CO-02	S	M	S	S	S
CO-03	S	S	M	S	S
CO-04	S	S	M	S	S
CO-05	S	S	M	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Mechanical Systems **12**

The Mechanical system - Generalised coordinates - Constraints - Virtual work - Energy and Momentum

Unit II: Lagrange's Equations **12**

Derivation of Lagrange's equations- Examples - Integrals of motion.

Unit III: Hamilton's Equations **12**

Hamilton's Principle - Hamilton's Equation - Other variational principle.

Unit IV: Hamilton - Jacobi Theory **12**

Hamilton Principle function - Hamilton-Jacobi Equation - Separability

Unit V: Canonical Transformation **12**

Differential forms and generating functions - Special Transformations - Lagrange and Poisson brackets.

TOTAL:60 HOURS

Text Book

Classical Dynamics by D. T. Greenwood, Prentice Hall of India, New Delhi, 1985.

Unit I	Chapter 1 : Sections 1.1 to 1.5
Unit II	Chapter 2 : Sections 2.1 to 2.3 (Omit Section 2.4)
Unit III	Chapter 4 : Sections 4.1 to 4.3 (Omit section 4.4)
Unit IV	Chapter 5 : Sections 5.1 to 5.3
Unit V	Chapter 6 : Sections 6.1, 6.2 and 6.3 (omit sections 6.4, 6.5 and 6.6)

MA37B1	NUMBER THEORY	L	T	P	C
		3	1	0	4

OBJECTIVE

To enable the students to know more about numbers, Bell series, the Mobius function, the Euler totient function and also the application to the distribution of lattice points visible from the origin.

Course Outcomes At the end of the course the students would be able to:		**Cognitive Skill**
CO-01	Understand the basic concepts of numbers, to define and describe different types of functions using theorems on different functions.	R, U, A, An, E, S
CO-02	Describe the concepts and applications of multiplicative functions, Dirichlet multiplicative on different kind of functions, and understand the derivatives of an arithmetical functions.	R, U, A, An, E, S
CO-03	Recognise the concept of big "O" notation and its application in various field of Euler Summation formula.	R, U, A, An, E, S
CO-04	Understand the basic concepts of congruences, residue classes, complete residue systems and linear congruences.	R, U, A, An, E, S
CO-05	Define quadratic residues, Legendre's symbol, Jacobi symbol and evaluate (-1|p), (2|p), (-1|P)& (2|P)	R, U, A, An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	S	S	M	S
CO-02	S	M	S	M	S
CO-03	S	S	M	M	S
CO-04	S	S	M	L	S
CO-05	S	S	M	L	S

S - Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Fundamental Theorem of Arithmetic and Arithmetical Functions **12**

Introduction, Divisibility, Greatest common divisor, Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes, The Euclidean algorithm, The GCD of more than two numbers, The Mobius function μ (n), The Euler totient function φ(n), A relation connecting φ and μ , A product formula for φ(n), The Dirichlet product of arithmetical functions, Dirichlet inverses and the Mobius inversion formula , The Mangoldt function $\wedge$(n).

Unit II: Dirichlet Multiplication and Generalized Convolution **12**

Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function. Liouville's function λ(n), The divisor functions σ_x(n), Generalized convolutions Formal power series, The Bell series of an arithmetical function, Bell series and Dirichlet multiplication , Derivatives of arithmetical functions, The Selberg identity.

Unit III: Averages of Arithmetic Functions **12**

Introduction , The big Oh notation. Asymptotic equality of functions, Euler's summation formula, Some elementary asymptotic formulas, the average order of d (n) , The average order of the divisor functions σ_n , The average order of φ(n).

Unit IV: Congruences **12**

Definition and basic properties of congruence's, Residue classes and complete residue systems, Linear congruence's, Reduced residue systems and the Euler-Fermat theorem, Polynomial congruence's modulo p, Langrange's theorem. Simultaneous linear congruence's, The Chinese remainder theorem.

Unit V: Quadratic residues and the Quadratic Reciprocity Law **12**

Quadratic residues, Legendre`s symbol and its properties, Evaluation of ( - 1| p) and (2 |p), Gauss` lemma, The quadratic reciprocity law, the Jacobi symbol.

TOTAL: 60 HOURS

Text Book

Introduction to Analytic Number Theory(3rd Edition) by T.M. Apostol, Narosa Edition, 1991.

Unit I Chapter 1: Sections 1.1 to 1.8 ; Chapter 2: Sections 2.1 to 2.8

Unit II Chapter 2: Sections 2.9 to 2.19

Unit III Chapter 3: Sections 3.1 - 3.7

Unit IV Chapter 5 : Sections 5.1 to 5.5 and 5.7.

Unit V Chapter 9: Sections 9.1 to 9.5 and 9.7

MA37B2	STOCHASTIC PROCESSES	L	T	P	C
		2	1	0	3

OBJECTIVE

To make the students to comprehend the idea of a stochastic process, and to show how simple probability and matrix theory can be used to build the Markov chain into a beautiful and useful piece of applied mathematics and also enable the students to understand renewal theory, which deals the processes which occasionally "begin all over again"

Course Outcomes At the end of the course students would be able to		**Cognitive Skill**
CO-01	To find the Generating Functions, the laplace transform of various functions, to solve the difference equations and the different operetions involved in Matrix Analysis	R, An, E
CO-02	Understand the definition for markov chain, describe a Markov chain and its transition matrix; Calculate the distribution of a Markov chain at a given time; Classify the states of a Markov chain; Describe a time-inhomogeneous Markov chain and its simple applications;	R, U, An, E
CO-03	Have a knowledge of Markov processes with a discrete state space, in particular a preparatory knowledge of Poisson process.	R, U, An, E
CO-04	Have a knowledge of Markov processes with a continuous state space, in particular a preparatory knowledge of Brownian Motion and the weiner process.	R, U, A, An, E
CO-05	Define renewal process in continuous time, be able to apply the renewal equation and to use Wald's equation in simple cases.	R, U, A, An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	M	S	S
CO-02	S	S	M	M	S
CO-03	S	M	M	M	S
CO-04	S	S	M	S	S
CO-05	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Generating Functions **9**

Laplace transform – Important properties of Laplace transforms – Difference equations – Differential Difference equations – Matrix Analysis.

Unit II: Markov Chains **9**

Definitions and Examples – Higher Transition Probabilities – Generalization of independent Bernoulli Trials- Sequence of chain dependent trials – Classification of States and Chains.

Unit III: Markov Processes with Discrete State Space **9**

Poisson Process and its Extensions – Poisson Process – Poisson Process and Related Distributions – Generalizations of Poisson.

Unit IV: Markov Processes with Continuous State Space **9**

Introduction –Brownian Motion – Wiener Process – Differential Equations for a Wiener Process.

Unit V: Renewal Process **9**

Renewal Processes in Continuous Time – Renewal Equation – Stopping Time: Wald's Equation.

TOTAL: 45 HOURS

Text Book

Stochastic Processes (3rd Edition) by J.Medhi, New Age International Publishers, 2009.

Unit 1	Chapter 1: Sections 1.1, 1.2 and Appendix A (pp: 447 – 475).
Unit 2	Chapter 2: Sections 2.1 to 2.4.
Unit 3	Chapter 3: Sections 3.1 and 3.2.
Unit 4	Chapter 4: Sections 4.1 to 4.3.
Unit 5	Chapter 6: Sections 6.1.5 to 6.4.2.

Practical

CS3771	**COMPUTER FUNDAMENTALS and C PROGRAMMING LAB**	**L**	**T**	**P**	**C**
		0	**2**	**2**	**3**

OBJECTIVES

The student should

- Understand the components of the Computer
- Perform system administration tasks
- Understand different Office Automation tools.
- Analyze the program and follow the programming style.
- Develop efficient programs in C

Course Outcomes At the end of the course students should be able to		**Cognitive Skill**
CO-01	To get a deep knowledge on Starting Up Applications, common controls, Command prompt choices.	U
CO-02	Able to understand comfortable editing and composing on Word documents, formatting Documents.	A
CO-03	Will be able to understand Worksheet creation, Manipulation of worksheets and workbooks.	An
CO-04	Will be able apply and evaluate decision making and branching, Decision making and looping statements in C programming	E
CO-05	Will be able apply and evaluate arrays, Character arrays and strings, functions Structures and Unions in C programming.	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO- C	PO-D	PO-E
CO-01	M	S	S	M	S
CO-02	M	S	S	M	S
CO-03	M	M	S	S	S
CO-04	S	M	S	M	S
CO-05	S	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

Unit I: Fundamentals of Computers and Operating Systems. 15

Evolution of computers – Organization of Modern Digital Computers – Single user Operating System – Multitasking OS – GUI.

Unit II: Office Automation 15

a. Word Processing
b. Data Base Management System
c. Spread Sheet Package
d. Presentation Software.

Unit III: Implementation in C 15

1. Input / output function
2. Control Functions
3. Functions
4. Arrays
5. Pointers
6. Structures and Unions
7. Files

TOTAL : 45 HOURS