P.G AND RESEARCH DEPARTMENT OF MATHEMATICS
NATIONAL COLLEGE (Autonomous)
Under Graduate and Post Graduate Programs structure and Syllabi
(For Candidates to be admitted from the academic year 2019 onwards)

Mathematics (from Greek máthēma, "knowledge, study, and learning") is the study of topics such as quantity (numbers), structure, space, and change. There is a range of views among mathematicians and philosophers as to the exact scope and definition of mathematics .Mathematicians seeks out patterns and uses them to formulate new conjectures. Mathematicians resolve the truth or falsity of conjectures by mathematical proof. When mathematical structures are good models of real phenomena, then mathematical reasoning can provide insight or predictions about nature. Through the use of abstraction and logic, mathematics developed from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity for as far back as written records exists. The research required to solve mathematical problems can take years or even centuries of sustained inquiry

Vision:

To be among the best mathematics departments in the country and to establish an international reputation as a centre for research and teaching in mathematics.

Mission:

- **To attract and retain academics of a high calibre on the Department's faculty.**
- **To seek out promising doctorates and to attract eminent researchers as long-term visitors to the Department.**
- **To attract motivated and talented students to the master's and Research programmes of the Department.**
- **To provide the best possible facilities for our faculty and students, particularly in the areas of computer facilities, library facilities and administrative support.**

History of the Department:

The Department of Mathematics, one of the oldest departments in the College, started offering Inter-mediate course in 1927. B.Sc. Mathematics was introduced in the year 1957 and Post Graduate Programme was started in the year 1960. The Department got recognition for guiding scholars for Ph.D degree in 1977 and for M.Phil Programme in 1980.

Careers in Mathematics

This is the golden age (as far as job opportunities are concerned) for Masters and Ph.D. degree holders in Mathematics. For those inclined towards a research career, many positions are available in research institutions and universities. For those who wish to pursue a teaching career, well-paying teaching positions are available in plenty in private engineering and Arts colleges. And for those who are willing to apply mathematics to practical problems, there has been a dramatic change in the job scene over the past few years in India. Many financial services companies, research labs of multinational companies and others are aggressively recruiting Indian mathematicians. The salaries offered are better than those offered to IT graduates. Students trained in pure mathematics are also actively recruited by these industries since almost all branches of mathematics are useful to them. Given the strength of the Department in both pure and applied mathematics, our students get a balanced and rigorous training in all aspects of mathematics. Therefore, our students are well placed to reap the benefits of the booming job market.

GRADUATE ATTRIBUTES:

a. Literacy (the acquisition of knowledge, skills and abilities)

1. Reading :

Reading engages, situates, and analyzes a text in order to comprehend and make meaning. Readers learn to understand how texts are culturally and historically situated, to interpret using a range of genres, and to appreciate that there are different ways to approach a text.

2. Written Communication:

Written communication is the use of writing to organize perspectives, knowledge, thoughts, ideas, and information and to present them in a clear and effective manner. Adept writers are able to negotiate different genres and situations.

3. Oral Communication:

Oral communication is the use of speech to express perspectives, knowledge, thoughts, ideas, and information in a clear and effective manner. It includes the capacity to listen and to comprehend orally-communicated information.

4. Information Literacies:

Information literacies include the ability to find and critically evaluate relevant information and its sources, and to synthesize the information with existing knowledge.

5. Scientific Literacy:

Scientific literacy entails an understanding of the scientific method, including the roles of experimentation, numeracy, and reproducibility, sufficient to make evidence-based conclusions and to participate in informed civic debate.

6. Technological Literacy:

Technological literacy includes an understanding of how technical innovation has influenced societies. Technological literacy involves openness to new technologies and processes, as well as the ability to critically evaluate their relevance and uses.

b. Intellectual and Practical Skills (the application of knowledge, skills and abilities)

1. Disciplinary Expertise:

Students achieve domain-specific knowledge and competence in their chosen areas of Study.

2. Critical Thinking:

Critical thinking is the ongoing practice of examining, analyzing, and reflecting on something before developing a position or conclusion.

3. Creative Thinking:

Creative thinking occurs when established approaches are re-imagined in order to arrive at a new way to represent or understand a subject. Creative thinking is characterized by a solid grasp of established practices within a field of study, by use of imagination and synthesis, and through initiative + risk-taking.

4. Inquiry and Ways of Knowing:

Inquiry is the process of posing questions while trying methodically to answer those questions. Questions arise in relation to past inquiry within a field of study, emerging issues, and individual curiosity. Ways of knowing can be historical, cultural, and disciplinary.

5. Historical Understanding:
Historical understanding is the capacity to see how texts, ideas, and events are informed by the past and situated in their own contexts. The ability to trace change or continuity over time extends to the historical basis of disciplines and knowledge, including how these relate to other social and cultural developments.

6. Safe and Ethical Practices Students will become aware of, and adhere to, safe and ethical practices in their areas of study or profession. Such practices could relate to work in a lab, a shop, or a classroom, and includes adherence to ethical standards in research involving human participants and ensuring that the safety, health, welfare, and rights of participants are adequately protected.

7. Collaboration:
Collaboration is the ability to work productively with others, especially within the context of an organization. Effective collaborators understand the processes by which organizations achieve their goals and apply skills and resources to achieve shared shared objectives.

8. Active Learning:
Active or deep learning occurs when individuals are able to understand how they learn and how to use appropriate learning strategies given the situation, including planning and re-evaluating their approach.

C. Civic Engagement (appreciating that knowledge, skills and abilities exist in contexts)

1. Indigenous Perspective:
An awareness of Aboriginal perspectives includes the different ways of knowing by which these perspectives enrich university life. Indigenous Perspective relates not only to the objective of exploring what Indigenous knowledge is but also to devising ways of integrating such knowledge into our learning.

2. Local Knowledge in a Global Context :
A world view informed by geography, sustainability, culture, history, and current events is an important facet of citizenship in an era of mass culture and communication.

3. Intercultural Perspective:
Intercultural perspectives comprise awareness and appreciation of different ways of knowing and being which encompass diverse peoples, cultures, and lifestyles.

4. Capacity to Engage in Respectful Relationships:
Respectful relationships involve trust, acceptance, inclusion, and emotional intelligence. Graduates of VIU have the capacity to develop meaningful relationships and demonstrate respectful and genuine interest in all people, particularly when interacting with others who have different abilities or backgrounds.

5. Foundations for Lifelong Learning:
Lifelong learners are self-motivated learners. They have the knowledge, skills, and attitude to engage in continuous learning; they are characterized by independence of thought, curiosity, and initiative. Lifelong learning is important for personal and professional development as well as for civic engagement.

6. Ethical Reasoning:
Ethical reasoning is the application of a moral framework to a given situation or issue.

7. Integrative Learning :
Integrative learning is the ability to make connections, synthesize and apply learning in new situations, and bridge theory and practice across disciplinary boundaries.

M.sc. Mathematics Degree Program

Eligibility:

- **Candidates for admission to the first year programme leading to the Degree of M.sc.Mathematics will be required to possess.**
- **A Pass in B.sc Mathematics.**

Aim:

This Programme is a high quality degree program that ensures that students will be able to integrate theory and practice, recognize the importance of abstraction an appreciate the value of efficient design created to meet clearly developed requirements.

Program Educational Objectives (PEOs)

1. **PEO1- run renowned Educational institutions to serve the society.**
2. **PEO2- have the ability to pursue interdepartmental research in Universities in India and abroad.**
3. **PEO3- have the caliber to work in foreign Universities.**
4. **PEO4- shine in higher level of administration like IAS, IPS officers in Nationalized Banks, LIC, and etc,.**

Programme Outcomes (POs):

1. **PO1-Graduates are prepared to be creators of new knowledge leading to innovation and entrepreneurship employable in various sectors such as private, government, and research organizations.**
2. **PO2-Graduates are trained to evolve new technologies in their own discipline.**
3. **PO3-Graduates are groomed to engage in lifelong learning process by exploring their knowledge independently.**

4. **PO4-Graduates are framed to design and conduct experiments /demos/create models to analyze and interpret data.**
5. **PO5-Graduates ought to have the ability of effectively communicating the findings of Biological sciences incorporating with existing knowledge.**

Programme Specific Outcomes (PSOs):

1. **PSO1-Analytic skills and Numerical Ability.**
2. **PSO2-Computational and Data Analysis skills.**
3. **PSO3-Aptitude skills that will help to take up research in pure and applied Mathematics.**
4. **PSO4-Reasoning skills required to learn advance mathematics.**
5. **PSO5-Probing attitude and a search for deeper knowledge in science.**
6. **PSO6-The relevance and applications of Mathematics in scientific phenomenon.**
7. **PSO-7Positive approach towards Higher Education in Mathematics.**
8. **PSO8-Employability Skills that will enable the students to explore career in Teaching and Research in Mathematics.**

NATIONAL COLLEGE(AUTONOMOUS), TIRUCHIRAPPALLI-1										
COURSE PATTERN FOR M.Sc. MATHEMATICS - 2019 ONWARDS										
SL. NO.	PART	CODE	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total Marks
I SEMESTER										
1	---		CORE I	LINEAR ALGEBRA	3	6	5	25	75	**100**
2	---		CORE II	REAL ANALYSIS - I	3	6	5	25	75	**100**
3	---		CORE III	ORDINARY DIFFERENTIAL EQUATIONS	3	6	5	25	75	**100**
4	---		CORE IV	NUMERICAL ANALYSIS	3	6	5	25	75	**100**
5	---		CBE I	CLASSICAL DYNAMICS	3	6	3	25	75	**100**
				TOTAL		**30**	**23**	**125**	**375**	**500**
SL. NO.	PART	CODE	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total Marks
II SEMESTER										
6	---		CORE V	ALGEBRA	3	6	5	25	75	**100**
7	---		CORE VI	REAL ANALYSIS - II	3	6	5	25	75	**100**
8	---		CORE VII	PARTIAL DIFFERENTIAL EQUATIONS	3	6	5	25	75	**100**
9	---		CORE VIII	INTEGRAL EQUATIONS AND CALCULUS OF VARIATIONS	3	6	5	25	75	**100**
10	---		CBE II	PROBABILITY AND STATISTICS	3	6	3	25	75	**100**
				TOTAL		**30**	**23**	**125**	**375**	**500**
SL. NO.	PART	CODE	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total Marks
III SEMESTER										
11	---		CORE IX	COMPLEX ANALYSIS	3	6	5	25	75	**100**
12	---		CORE X	MEASURE THEORY AND INTEGRATION	3	6	5	25	75	**100**
13	---		CORE XI	TOPOLOGY	3	6	5	25	75	**100**
14	---		CORE XII	STOCHASTIC PROCESSES	3	6	5	25	75	**100**
15	---		CBE III	APPLIED STATISTICS	3	6	3	25	75	**100**
				TOTAL		**30**	**23**	**125**	**375**	**500**
SL. NO.	PART	CODE	COURSE	COURSE TITLE	Exam Hrs.	Hrs.	Credits	Internal Exam	External Exam	Total Marks
IV SEMESTER										
16	---		CORE XIII	FUNCTIONAL ANALYSIS	3	6	5	25	75	**100**
17	---		CORE XIV	OPTIMIZATION TECHNIQUES	3	6	5	25	75	**100**

18	---		CORE XV	DIFFERENTIAL GEOMETRY	3	6	5	25	75	**100**
19	---		CBE IV	MATHEMATICAL MODELLING	3	6	3	25	75	**100**
20	---		PROJECT	PROJECT WORK		6	3	25	75	**100**
				TOTAL		**30**	**21**	**125**	**375**	**500**
				GRAND TOTAL		**120**	**90**	**500**	**1500**	**2000**

Choice Based Electives:

1.Classical Dynamics

2. Probability and Statistics.

3. Applied Statistics.

4. Mathematical Modelling.

5.Tensor Analysis and Spectral Theory of Relativity

6. Numerical Methods Using Mat lab.

7. Theory of Numbers.

8. Operator Theory.

9. Design and Analysis of algorithms.

10. Automata Theory.

11. Graph Theory.

12. Fuzzy Analysis.

LINEAR ALGEBRA P19MS1

semester : I | **Core Course: I**
Instruction Hours/Week: 6 | **Credit: 5**

Course Objectives:

1. Linear Algebra is ubiquitous in Mathematics and therefore a strong foundation has to be laid in studying the abstract algebraic concepts intertwining geometric ideas.

2. The fundamental notions of vector spaces viz linear dependence, basis and dimension and linear transformations on these spaces have to be studied thoroughly.

3. The students have to learn how the subject encompasses the isomorphic theory of matrices and comprehend the key ideas involved in the study of the structure theory of linear maps.

UNIT – I
Linear Equations: Row-Reduced echelon Matrices – Matrix Multiplication - Invertible Matrices.
Vector spaces: Vector spaces- Subspaces – Bases and Dimension – Coordinates – summary of row equivalence -Computations concerning Subspaces.

UNIT – II
Linear Transformations: The algebra of linear transformations – Isomorphism Representation of transformations by Matrices – Linear functionals – The Double Dual– The Transpose of a linear Transformation.

UNIT – III
Polynomials: Algebras - The algebra of polynomials – Lagrange Interpolation – Polynomial Ideals -The prime factorization of a polynomial.

UNIT – IV
Elementary Canonical Forms: Introduction - Characteristic values – Annihilating polynomials - Invariant subspaces -Simultaneous triangulation and simultaneous Diagonalization.

UNIT – V
Direct-sum Decompositions - Invariant Direct sums – The Primary Decomposition Theorem.
The Rational and Jordan Forms: Cyclic subspaces and annihilators – the Jordan form.

Text Book

Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice-Hall of India Private Limited, New Delhi 2014.

Unit I : Chapter 1: 1.4, 1.5, 1.6 & Chapter 2: 2.1 to 2.6
Unit II : Chapter 3: 3.1 to 3.7
Unit III : Chapter 4: 4.1 to 4.5
Unit IV : Chapter 6: 6.1 to 6.5
Unit V : Chapter 6: 6.6 to 6.8 & Chapter 7: 7.1 and 7.3

Reference(s)

[1] I.N.Herstein, Topics in Algebra, Wiley Eastern Limited, New Delhi

[2] N.Jacobson, Basic Algebra, Vols.I & II, Freeman, 1980 (also published by Hindustan Publishing Company)

Course Outcomes:

1. To give the students a thorough knowledge of the various aspects of Linear Transformations.

2. Understanding Relation between Matrices and Linear Transformation

3. Understanding Elementary operations

4. Polynomials of Matrices

5. To train the students in problem-solving as a preparatory to NET/SET

6. Advance concepts in Linear Algebra

7. Knowledge of Matrix theory

8. Techniques of Diaganalisation

REAL ANALYSIS – I P19MS2

Semester: I | **Core Course: II**
Instruction Hours/Week: 6 | **Credit: 5**

Course Objectives:

1. To learn the basic quantitative concepts of real analysis such as least upper bound property, convergence of sequences and continuity of functions.

2. To comprehend the qualitative aspects of real analysis in the setting of Metric spaces. The intrinsic geometric ideas in the basic notions of metric spaces viz., open sets, closed sets, limit points, cluster points, connectedness and compactness have to be brought out.

UNIT I
The real and complex number systems: ordered sets – fields – the real field – the extended real number system - the complex field – Euclidean spaces.

UNIT II
Basic Topology: finite, countable and uncountable sets – metric spaces – compact sets –perfect sets – connected sets.

UNIT III
Numerical sequences and series: convergent sequences – subsequences – Cauchy sequences – upper & lower limits – some special sequences – series – series of non-negative terms – the number – the root and ratio tests – power series.

UNIT IV
Continuity: limits of functions – continuous functions – continuity and compactness –continuity and connectedness – discontinuities.

UNIT V
Differentiation: The derivative of a real function – mean value theorems – the continuity of derivatives – L' Hospital's rule – derivatives of higher order.

TEXT BOOK

[1] Walter Rudin, Principles of Mathematical Analysis Third Edition, McGraw Hill,1976.

UNIT I : Chapter 1 – Sections 1.1 – 1.38
UNIT II : Chapter 2 – Sections 2.1 – 2.47
UNIT III : Chapter 3 – Sections 3.1 – 3.40
UNIT IV : Chapter 4 – Sections 4.1 – 4.27
UNIT V : Chapter 5 – Sections 5.1 – 5.15

REFERENCE(S)

[1] Simmons G.F, Topology and Modern Analysis, McGraw Hill Co. 1998.

[2] Apostol, Analysis Vol. II, Mac Millan 1976.

[3] A.T. White, Real Analysis : An Introduction, Addison Wesley Publishing Co.,Inc.1968.

Course Outcomes:

1. Construction of Real Numbers

2. Fundamentals of Pure Mathematics.

3. Inherit the knowledge of Set Theoretic approach.

4. Techniques in sequences

5. Sufficient conditions for convergence of series

6. Basic Knowledge of Topology

7. Properties of Real valued continuous functions

8. Fundamentals of Differentiable functions

ORDINARY DIFFERENTIAL EQUATIONS – P19MS3

Semester: I **Core Course: III**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. **Ordinary differential equations arise as a natural mathematical model of many physical situations and hence the concepts involved in solving them are rudiments and vital for the course. The main objective is to give elementary, thorough, systematic approach for the subject.**

2. **The existence and uniqueness of solutions for first order differential equations are studied in detail. Qualitative properties of solutions are carried out elaborately.**

UNIT – I
The general solution of the homogeneous equation – The use of one known solution to find another – The method of variation of parameters power Series solutions. A review of Power series – Series solutions of first order equations second order linear equations: Ordinary points.

UNIT – II
Regular Singular points- Gauss's hyper geometric equation – The point at infinity-Legendre Polynomials – Bessel functions – Properties of Legendre Polynomials and Bessel functions.

UNIT – III
Linear Systems of First Order Equations – Homogeneous Equations with Constant Coefficients – The Existence and Uniqueness of Solutions of Initial value problem for First Order Ordinary Differential Equations – The Method of Solutions of Successive Approximations and Picard's Theorem.

UNIT – IV
Oscillation Theory and Boundary value problems – Qualitative Properties of Solutions – Sturm comparison Theorems – Eigen values, Eigen functions and the vibrating string.

UNIT – V
Nonlinear equations: Autonomous Systems: the phase plane and its phenomena Types of critical points: Stability – critical points and stability for linear systems Stability by Liapunov's direct method – Simple critical points of nonlinear systems.

Text Book (s)

G.F.Simmons, Differential Equations with Applications and Historical Notes, TMH ,New Delhi, 1994.

Unit I : Chapter 3: Sections 15, 16,19 and Chapter 5: Sections 25 to 27.
Unit II : Chapter 5: Sections 28 to 31 and Chapter 6: Sections 32 to 35
Unit III : Chapter 7: Sections 37,38 and Chapter 11: Sections 55,56
Unit IV : Chapter 4: Sections 22 to 24
Unit V : Chapter 8: Sections 42 to 44.

Reference(s)

[1] W.T.Rcid, Ordinary Differential Equations, John Wilcy & Sons, New York, 1971.

[2] E.A.Coddington and N.Levinson, Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, New York, 1955.

Course Outcomes:

1. To study the method of solving Bessel's and Legendre differential equations.

2. To introduce the motion of stability of a solution of ODE.

3. To study the Boundary Value Problems.

4. Knowledge of oscillation theory and Boundary value problems.

5. To introduce existence and uniqueness theorems in Differential equations.

6. Problem solving techniques in Differential equations

7. Application of power series

8. Stability of Differential equations

NUMERICAL ANALYSIS – P19MS4

Semester: I **Core Course: IV**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To introduce the field of numerical analysis as the design and analysis of techniques to give approximate solutions to difficult problems.
2. The indispensable error analysis part has to be emphasized in the course.
3. Various numerical methods are used to solve algebraic equations and differential equations.

UNIT – I

Transcendental and polynomial equations: Muller method , Chebyshev method –Multipoint iteration method - Rate of convergence - Iteration methods. Polynomial equations: Birge-Vieta method, Bairstow's method, Graeffe's root squaring method only.

UNIT – II

System of Linear Algebraic equations and Eigen Value Problems: Decomposition method, Partition method - Error Analysis of direct and iteration methods – Finding eigen values and eigen vectors – Jacobi and Power methods.

UNIT – III

Interpolation and Approximation : Hermite Interpolations – Piecewise and Spline Interpolation – Bivariate Interpolation- Approximation – Least square approximation.

UNIT – IV

Differentiation and Integration: Numerical Differentiation - Optimum choice of Step length – Extrapolation methods – Partial Differentiation – Methods based on undetermined coefficients – Gauss-Legendre integration method and Lobatto, Radau,Gauss – Chebyshev integration methods only – Double integration.

UNIT – V

Ordinary differential equations: Introduction, Euler, Backward Euler, Mid-point, Taylor series method - Runge-Kutta methods – Stability analysis with single step methods only.

TEXT BOOK:

M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, III Edition, New Age International (P) Ltd Publishers,1993.

UNIT I Chapter 2 – 2.4(P 32- 34), 2.5, 2.6, 2.8
UNIT II Chapter 3 – 3.2(P 90-93, 95-99), 3.3, 3.4, 3.5
UNIT III Chapter 4 – 4.5 to 4.7, 4.9(upto P 199)
UNIT IV Chapter 5 – 5.2 to 5.5, 5.8(upto P 262) and 5.11
UNIT V Chapter 6 – 6.1,6.2, 6.3, 6.6(upto P 343).

REFERENCE(S)

1.C.F.Gerald and P.O.Wheatley , Applied Numerical Analysis, Fifth Edition, Addison Wesley, (1998).
2.Samuel D.Conte, Carl. De Boor, Elementary Numerical Analysis, Mc Graw Hill International Edition 1983.
3.M.KJain, Numerical Solutions of Differential Equations, Second Edition, New Age International (P) Ltd., 1983.

Course Outcomes:

1. To study the method of Transcendental and polynomial equations.
2. To introduce the System of Linear Algebraic equations.
3. To study the method of Interpolation and Approximation.
4. Knowledge of Differentiation and Integration through the numerical methods.
5. To introduce existence and uniqueness theorems in Differential equations.
6. Problem solving techniques in Numerical methods.
7. To Understand the method to solve the Differential equation through Numerical methods

CLASSICAL DYNAMICS – P19MS5E

Semester: I | **Core Based Elective: I**
Instruction Hours/Week: 6 | **Credit: 3**

Course Objectives:

1. To develop familiarity with the dynamical concepts of Newton, Lagrange and Hamilton.

2. To develop skills in formulating and solving physics problems.

UNIT – I

Introductory concepts: The mechanical system – Generalized Coordinates –constraints – virtual work – Energy and momentum.

UNIT – II

Lagrange’s equations: Derivation of Lagrange’s equation and examples – Integrals of the Motion .

UNIT – III

Special Applications of Lagrange’s Equations: Rayleigh’s dissipation function –impulsive motion – Gyroscopic systems – velocity dependent potentials.

UNIT – IV

Hamilton’s equations: Hamilton’s Principle – Hamilton’s equations – Other variational principles – phase space.

UNIT – V

Hamilton – Jacobi Theory: Hamilton’s Principal Function – The Hamilton – Jacobiequation – Separability.

Text Book (s)

Classical Dynamics, Donald T.Greenwood, PrenticeHall of India Pvt. Ltd., New Delhi-1985.

Unit I : Chapter 1: Sections 1.1 to 1.5
Unit II : Chapter 2: Sections 2.1 to 2.3
Unit III : Chapter 3: Sections 3.1 to 3.4
Unit IV : Chapter 4: Sections 4.1 to 4.4
Unit V : Chapter 5: Sections 5.1 to 5.3

Reference (s)

[1] Herbert Goldstein, classical Mechanics, (2nd edition), Narosa Publishing House, New Delhi.
[2] Narayan Chandra Rana & Prmod Sharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.

Course Outcomes:

1. To give a detailed knowledge about the mechanical system of particles.
2. To study the applications of Lagrange’s equations and Hamilton’s equations as well as the theory Of Hamilton-Jacobi Theory
3. Understanding Separable Theory.
4. Integrals of Motion.
5. Understanding the theory of Variational principles.
6. Hamilton Jacobi Theory
7. Applications into Practical problems
8. Abstract Physical concepts

ALGEBRA

Semester :II **SUBJECT CODE:P19MS6** **Core Course: V**

Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To learn the fundamental abstract algebraic structures namely groups and rings with rigor. The need for the abstract concepts is illustrated with numerous examples.
2. To comprehend how group action is effectively used in Sylow's theorems.
3. To study in detail the basic concepts of Rings such as Ring homomorphisms and Euclidean domains.

UNIT I

Group Theory:

A Counting Principle – Permutation Groups – Another Counting Principle – Sylow's theorem - Direct Products.

UNIT II

Ring Theory:

More Ideals and Quotient Rings – Polynomial Rings – Polynomials over the Rational Field –Polynomial Rings over commutative Rings.

UNIT III

Vector Spaces and Modules:

Dual Spaces - Inner Product Spaces – Modules.

UNIT IV

Fields:

Extension fields – Roots of Polynomials – More about Roots.

UNIT V

The Elements of Galois Theory – Finite Fields.

TEXT BOOK

I.N. Herstein, Topics in Algebra, Second Edition, Wiley Eastern Limited.

UNIT I : Chapter 2 – Sections 2.5, 2.10, 2.11, 2.12, and 2.13

UNIT II : Chapter 3 – Sections 3.5, 3.9, 3.10, 3.11

UNIT III : Chapter 4 – Sections 4.3, 4.4, 4.5

UNIT IV : Chapter 5 - Sections 5.1, 5.3, 5.5

UNIT V : Chapter 5 – Section 5.6, Chapter 7 – Section 7.1

REFERENCE BOOK(S)

[1] P.B. Bhattacharya. S.K. Jain and S.R. Nagpul, Second Edition, 2005, Cambridge University Press.

[2] Vijay, K. Khanna, and S.K. Bhambri, A Course in Abstract Algebra, Vikas Publishing House Pvt Limited, 1993.

[3] John, B. Fraleigh, A First Course in Abstract Algebra, Addison-Wesley Publishing company.

Course Outcomes:

1. To introduce the Algebraic Structures like Ring and Field
2. To study Polynomial Rings and its effect in Galois Theory
3. Properties of Finite Field
4. To give foundation in group theory
5. To train the students in problem-solving as a preparatory to NET/SET
6. Theoretic Background of Algebraic concepts
7. Problem solving techniques in algebra
8. Introduction to advance concepts in algebra

REAL ANALYSIS - II

Semester: II **SUBJECT CODE:P19MS7** **Core Course: VI**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To perceive and retain the basic idea of differential calculus is to approximate the given function by a first degree polynomial. To study the powerful tool of maxima-minima in calculus using mean value theorems.
2. To study the concept of convergence of sequences and series of functions and to introduce the theory of multivariable calculus

UNIT I

The Riemann – Stieltjes Integral: Definition and Existence of the integral – Properties of the integral – Integration and Differentiation – Integration of Vector valued functions – rectifiable curves.

UNIT II

Sequences and series of functions: uniform convergence - uniform convergence and continuity - uniform convergence and integration - uniform convergence and differentiation – Equicontinuous families of functions – The Stone -Weierstrass Theorem.

UNIT III

Some Special Functions: Power series – The Exponential and Logarithmic Functions – The Trigonometric functions – The algebraic completeness of the complex field – Fourier series – The Gamma function.

UNIT IV

Functions of Several variables: Linear Transformations – Differentiation – The Contraction Principle – The inverse function theorem.

UNIT V

Functions of Several variables continued: The implicit function theorem – The rank Theorem – Determinants – Derivatives of Higher order – differentiation of integrals

TEXT BOOK

Walter Rudin, Principles of Mathematical Analysis Third Edition, McGraw Hill, 1976.

UNIT I **:** Chapter 6– Sections 6.1 – 6.27
UNIT II **:** Chapter 7– Sections 7.1– 7.33
UNIT III **:** Chapter 8– Sections 8.1 – 8.22
UNIT IV **:** Chapter 9– Sections 9.1 – 9.25
UNIT V **:** Chapter 9 – Sections 9.26 – 9.43

REFERENCE(S)

[1] Simmons G.F, Topology and Modern Analysis, McGraw Hill Co. 1998.
[2] Apostol, Analysis Vol. II, Mac Millan 1976.A.T. White, Real Analysis: An Introduction, Addison Wesley Publishing Co., Inc.1968.

Course Outcomes:

1. Knowledge of Riemann integrals and its properties

2. Give knowledge for any advanced learning in Pure Mathematics.

3. Convergence of a sequences and series of functions

4. Basics of special functions

5. To train the students in problem-solving as a preparatory to NET/SET

6. Multivariate analysis

PARTIAL DIFFERENTIAL EQUATIONS

Semester: II **SUBJECT CODE:P19MS8** **Core Course: VII**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. The problem arising in physical phenomena widely involve partial differential equations (PDEs). The main objective is to equip students to classify partial differential equations and solve linear Partial Differential equations using different methods

2. To give a detailed study of Heat equation, Wave equation and Laplace equation.

UNIT – I
First order P.D.E.- Curves and Surfaces – Genesis of First Order P.D.E. – Classification of Integrals – Linear Equations of the first order – Pfaffian Differential Equations – Compatible systems – Charpit's Method – Jocobi's Method.

UNIT – II
Integral Surfaces Through a given Curve – Quasi – Linear Equations – Non-Linear First order P.D.E.

UNIT – III
Second order P.D.E: Genesis of second order P.D.E. – Classification of Second order P.D.E. One – Dimensional Wave equation – vibrations of an infinite string – Vibrations of semi-infinite string – Vibrations of a String of Finite Length (Method of separationof variables)

UNIT – IV
Laplace's Equation: Boundary value Problems – Maximum and Minimum Principles –The Cauchry Problem – The Dirichlet problem for the Upper Half Plane – The NeumannProblem for the Upper Half Plane – The Dirichlet Interior Problem for a circle – TheDirichlet Exterior for a circle – The Neumann Problem for a circle – The DirichletProblem for a Rectangle – Harnack's Theorem – Laplace's Equation – Green's Function.

UNIT – V
Heat Conduction problem – Heat Conduction – Infinite Rod case - Heat Conduction finite Rod case – Duhamel's Principle – Wave Equation – Heat Conduction Equation.

Text Book(S)

T. Amarnath ,An Elementary course in Partial Differential Equations, Narosa Publishing house Pvt.Ltd. Second Edition Fourth Reprint 2009.

Unit – I – Chapter 1: Sections 1.1 to 1.8
Unit – II – Chapter 1: Sections 1.9 to 1.11.
Unit – III – Chapter 2: Sections 2.1 to 2.3.5(omit section 2.3.4.)
Unit – IV – Chapter 2: Sections 2.4 to 2.4.11
Unit – V – Chapter 2: Sections 2.5 to 2.6.2.

REFERENCE(S)

1. I..c.Evans, Partial Differential Equations, Graduate Studies in Mathematics, Vol 19 AMS, 1998.

2. I.N.Snedden, Elements of Partial Differential Equations.

3. F.John , P.Prasad, , Partial Differential Equations.

Course Outcomes:

1. Understanding the origin of partial differential equations

2. Understanding nonlinear partial differential equations

3. Understanding the Integral surfaces passing through a given curve.

4. Understanding different methods of solving the Problems .

5. Applying higher order equations in physics

6. Analyzing Linear Hyperbolic equations

7. Understanding Laplace equations and its applications.

INTEGRAL EQUATIONS AND CALCULUS OF VARIATIONS

Semester: II **SUBJECT CODE: P19MS9** **Core Course: VIII**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To obtain thorough analysis of various aspects of calculus of variations.
2. To acquire the knowledge of solving problems in the fields of mechanics and mathematical physics.

UNIT – I

Linear Integral Equations – Definition- Regularity conditions – special kind of kernels – Eigen values and eigen functions – Convolution Integral – The inner and scalar product Of two functions.

Integral equations with seperable Kernels: Reduction to a system Examples – Fred Holm alternative – examples – an approximate method.

UNIT – II

Method of successive approximation: Iterative scheme – examples- Volterra Integral equation – examples – some results about the resolvent kernel.

UNIT – III

Classical Fred Holm Theory: The method of solution of Fredholm – Fredholm's first theorem – Examples- Fredholm's second theorem (statement Only) – Fredholm's third theorem (Statement Only). **Applications to ordinary Differential Equations:** Initial value problems-Boundary value problems-Examples. **singular integral equations:** Abel integral equation-Examples.

UNIT – IV

Calculus of variation – Maxima and Minima – The simplest case – Natural boundary Conditions and transition conditions. The Variational notation.

UNIT – V

The more general case with illustrative equations – Constraints and Lagrange's multipliers – Variables end points – Sturm – Liouville Problems.

Text Book(S)

[1] Ram.P.Kanwal-Linear Integral Equations Theory and Practise, Academic Press 1971.

[2] F.B.Hildebrand, Mehtods of Applied Mathematics II ed. PHI, ND 1972.

Unit – I – Chapter 1: section 1.1 to 1.6. [1], Chapter 2: section 2.1 to 2.5.[1]
Unit – II – Chapter 3: section 3.1 to 3.5. [1]
Unit – III – Chapter 4: section 4.1 to 4.5 [1], Chapter 5: section 5.1 to 5.3[1],
Chapter 8: section 8.1, 8.2[1]
Unit – IV – Chapter 2: Section 2.1 to 2.4[2],
Unit –V- Chapter 2: Section 2.5 to 2.9[2]

REFERENCE(S)

[1] S.J.Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
[2] I.N.Snedden, Mixed Boundary value Problems in Potential Theory, North Holland,1966.

Course Outcomes:

1. Be able to understand variational methods for solving differential equations.
2. Be able to analyse variational problems with moving boundaries.
3. Know different integrals equations and methods of solving them.
4. Be able to understand boundary value problems to solve the integral equations.
5. To understand the Fredholm integral theorem
6. To know the concepts of Maxima and minima ,Natural boundary conditions
7. To understand the concept of Sturm – Liouville Problems

PROBABILITY AND STATISTICS WITH QUEUEING THEORY

Semester: II **SUBJECT CODE: P19MS10E** **Core Based Elective: II**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1. To provide mathematical foundation for statistics
2. To study the discrete and continuous random variables, statistical parameters on probability distributions and central limit theorems.

UNIT – I
Probability: Axioms of probability –Conditional probability – Baye's theorem –One dimensional Random variables – Probability mass function – Probability density function- Properties.

UNIT – II
Distributions: Geometric, Hyper Geometric, Negative Binomial, Uniform, exponential, Gamma and weibull distributions –Moment generating functions - Properties .

UNIT – III
Two dimensional random variables – Joint distribution – Marginal and Conditional distributions – Functions of random variables – Central limit theorem.

UNIT – IV
Queueing theory: Characteristics of a queueing model –(M/M/1):(∞/FIFO) ;(M/M/S):(∞/FIFO); (M/M/1):(K/FIFO); (M/M/S):(K/FIFO)- Problems.

UNIT – V
Advanced Queue model- Non-Markovian Queueing Model((M/G/1):(∞/GD)- Pollaczek- Khintchine formula – Special cases.

TEXT BOOK

T.Veerarajan "Probability, Statistics and Random Process with Queuing theory and Queuing Networks"- ,Fourth edition - McGraw Hill Education.

Unit I : Chapter 1 – sec 1.1- 1.25, Chapter 2 - sec 2.1- 2.23
UNIT II : Chapter 4 – sec 4.48 - 4.62(MGF only for the related distribution)
Chapter 5 – sec 5.9-5.12 5.36 - 5.43, 5.54 - 5.68,
UNITIII : Chapter 2 - sec 2.23 - 2.46 , Chapter 3 – sec 3.1 - 3.27,Chapter 4 – sec 4.73 - 4.79
UNITIV: Chapter 8 – sec 8.1 – 8.59
UNIT V : Chapter 9 – sec 9.3- 9.14

REFERENCE(S)

[1] Kishore S. Trivedi, "Probability & Statistics with Reliability, Queueing and Computer Applications", Prentice Hall of India, 1999.

Course Outcomes:

1. Understanding the basic concepts in Probability
2. Understanding the Concepts of continuous Distribution.
3. Understanding the Moment Generating Concepts for continuous Distributions
4. Understanding Concepts of two dimensional random variable.
5. Understanding the concepts Transformation of random variables.
6. Understanding concepts of central limit theorem
7. Understanding the basic concepts of Queue-model.

COMPLEX ANALYSIS – P19MS11

Semester: III **Core Course: IX**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To give a careful treatment of argument and logarithms and winding numbers

2. To introduce analytic functions which are locally a power series and to study the profound Cauchy theory which says analytic functions are complex differentiable (holomorphic) functions on an open set.

3. To emphasize that the subject is a amalgamation of ideas from analysis, geometry and topology

UNIT – I
Fundamental theorems: Line Integrals- Rectifiable Arcs –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 – II
Local properties of Analytical Functions : Removable Singularities – Taylor's Theorem -Zeros and Poles - The Local Mapping - The Maximum Principle.

UNIT – III
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-Locally Exact Differentials – Multiply Connected Regions.
The Calculus of residues: The Residue Theorem- The Argument Principle-Evaluation of Definite Integrals.

UNIT – IV
Harmonic Functions and: Definition and Basic Properties-The Mean value Property-Poisson's Formula-Schwarz's Theorem-The Reflection Principle .**Power series expansions:** Weierstrass's Theorem-The Taylor Series-The Laurent Series.

UNIT – V
Partial fractions and factorization: Partial fractions – Infinite products - Canonical products – The Gamma function. **Entire Functions:** Jensen's formula - Hadamard's theorem.

Text Book(s)

Lars.V.Ahlfors,Complex Analysis McGraw Hill Company,Third Edition 1979

Unit I : Chapter 4: 1.1-1.5, 2.1 – 2.3
Unit II : Chapter 4: 3.1,3.2,3.3,3.4
Unit III : Chapter 4: 4.1-4.7,5.1-5.3
Unit IV : Chapter 4: 6.1-6.5 and Chapter 5: 1.1-1.3
Unit V : Chapter 5: 2.1 to 2.4 :3.1, 3.2

Reference(s)

[1] Serge Lang, Complex Analysis,Addisn Wesley, 1977

[2] S.Ponnisamy, Foundations of Complecx Analysis, Narosa Publishing House, New Delhi 1997.

[3] V.Karunakaran, Complex Analysis

Course Outcomes:

1. To be familiar with Cauchy's Integral Formula to apply Contour Integration.

2. To learn the various intrinsic concepts and the theory of Complex Analysis.

3. To study the concept of Analyticity, Complex Integration..

4. To be familiar with the concept of Complex Integration so as to apply Cauchy's Theorem.

5. Knowledge of Infinite Products

6. Knowledge of Residues

7. Advance concepts in complex analysis

8. Knowledge of Harmonic functions

MEASURE THEORY AND INTEGRATION – P19MS12

Semester : III | **Core Course: X**
Instruction Hours/Week: 6 | **Credit: 5**

Course Objectives:

1. To provide a concrete setting of Lebesgue measure and Lebesgue integral via the classical concepts of Jordan measure and the Riemann integration.

2. To give an expert and thorough study on abstract measuresa and the modern integation theory including the standard convergence theorems.

3. To introduce product measure and study the Fubini's theorem.

UNIT – I
Measure on Real line: Lebesgue outer measure – Measurable sets – Regularity-Measurable functions – Borel and Lebesgue measurability.

UNIT – II
Integration of Functions of Real variable: Integration of non-negative functions – TheGeneral Integral – Integration of series – Riemann and Lebesgue integrals.

UNIT – III
Abstract Measure spaces: Measures and outer measures – Extension of a measure –uniqueness of the extension-Completion of a Measure - Measure spaces – Integration with respect to a measure.

UNIT – IV
Convergence: Convergence in Measure – Almost uniform convergence-Signed measures and their derivatives - Signed Measures and the Hahn Decomposition – The Jordan Decomposition.

UNIT – V
Measure and Integration in a Product Space: Measurability in a product space – The product Measure and Fubini's Theorem.

Text Book(s)

G.De Barra , Measure Theory and Integration, New age international (P) Limited,First Edition Reprint-2010.

Unit I : Chapter II: Sections 2.1 to 2.5
Unit II : Chapter III: Sections 3.1 to 3.4
Unit III : Chapter V: Sections 5.1 to 5.6
Unit IV : Chapter VII: Sections 7.1 and 7.2,Chapter VIII: Sections 8.1 and 8.2
Unit V : Chapter X: Sections 10.1 and 10.2

Reference(s)

[1] Measure and Integration, by M.E.Munroe, Addison – Wesley publishing company,Second Edition, 1971.

[2] P.K.Jain, V.P.Gupta, Lebesgue Measure and integration, New Age International Pvt Limited Publishers, New Delhi,1986. (Reprint 2000)

[3] Richard L.Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc.1977.

[4] Inder, K.Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.

Course Outcomes:

1. To generalize the concept of integration using measures.

2. To develop the concept of analysis in abstract situations.

3. To learn measure theory

4. To understand the concepts of measurable function

5. To connect integral of derivative with differentiation of an integral.

6. Advance concepts in measure theory

7. Knowledge of decomposition theorems

8. Knowledge of Absolute continuity

TOPOLOGY – P19MS13

Semester : III | **Core Course: XI**
Instruction Hours/Week: 6 | **Credit: 5**

Course Objectives:

1. To introduce the notion of topological spaces and to characterize the properties of convergence, continuity of functions, compactness and connectedness of the spaces. Emphasize is to bring out the intrinsic geometric ideas in the concepts.

2. To lay strong foundation on obtaining weak topology induced by maps and to study product topology as a special case.

3. To study in depth the ingenious idea of the construction of the continuous real valued functions on normal spaces.

UNIT – I
TOPOLOGICAL SPACES: Topological spaces-Basis for a topology – The order topology – The product topology on X x Y – The subspace topology – closed sets and limit points.

UNIT – II
CONTINUOUS FUNCTIONS: Continuous functions – the product topology – The metric Topology-The metric topology (Continued)

UNIT – III
CONNECTEDNESS and COMPACTNESS : Connected spaces – connected subspaces of the real line - Compact spaces – Compact subspaces of the Real line – Limit point Compactness – Local Compactness.

UNIT – IV
COUNTABILITY AND SEPARATION AXIOMS: The countability Axioms – The separation Axioms – Normal spaces.

UNIT – V
The Urysohn Lemma- The Urysohn metrization Theorem - The Tietz extension Theorem-The Tychonoff Theorem.

Text Book(S)

James R. Munkres, Topology , Pearson Education Pvt. Ltd.,New Delhi,Second Edition,9th Indian Reprint -2005.

Unit I : Chapter 2: Sections 12 to 17.
Unit II : Chapter 2: Sections 18 to 21
Unit III : Chapter 3: Sections 23,24, 26 to 29(Omit Section 25)
Unit IV : Chapter 4: Sections 30 to 32.
Unit V : Chapter 4: Sections 33 to 35.Chapter 5: Sections 37

REFERENCE(S)

[1] J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.

[2] George F.Simmons, Introduction to Topology and Modern Analysis, McGraw HillBook Co., 1963.

[3] J.L.Kelly, General Topology, Van Nostrand, Reinhold Co., New York.

[4] L.Steen and J.Seeback, Counter examples in Topology, Holt, Rinehart and Winston,New York, 1970.

Course Outcomes:

1. Understanding metric spaces as a motivation to topology

2. Continuous functions and their properties in topological spaces

3. Understanding Basis as a collection of basic open sets

4. Understand compactness and connectedness in topological spaces

5. Understand separation axioms.

6. Problem solving techniques in topology

7. Advance concepts in topology

8. Sufficient conditions for metrizability of a topological space

STOCHASTIC PROCESSES – P19MS14E

Semester : III **Core Course: XII**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. To motivatestochastic processes and in particular Markov chains are the ones which are widely used as mathematical models of systems and phenomena that appear to vary in a random manner.

2. To study Markov chains, Markov processes with discrete and continuous state space, renewal processes in continuous time and Morkovian queuing models.

Unit I

Stochastic Processes : Some notions – Specification of Stochastic processes – Stationary processes - Markov chains – Definitions and examples – Higher Transition probabilities– Generalization of Independent Bernouli trails – Sequence of chain – Dependent trains.

Unit II

Markov chains: Classification of states and chains – determination of higher transition probabilities – stability of a Markov system – Reducible chains – Markov chains with continuous state space.

Unit III

Markov processes with Discrete state space: Poisson processes and their extensions – Poisson process and related distribution – Generalization of Poisson process – Birth and Death process – Markov system – Reducible chains – Markov chains with continuous state space.

Unit IV

Renewal processes and theory: Renewal processes - Renewal processes in continuous time - Renewal equation .

Unit V

Stopping Time Wald's Edition:

Stopping time – Wald's Edition – Renewal theorem-Elementary Renewal theorem – Application of Renewal theorem (Black well's and Smith's)

Text Book

J.Medhi, Stochastic Processes, Howard M. Taylor – Second Edition.

Unit I : Chapter 2 - Sec 2.1 to 2.3, Chapter 3 - Sec 3.1 to 3.3.
Unit II : Chapter 3 - Sec 3.4 to 3.6, 3.8,3.9 and 3.11.
Unit III : Chapter 4 - Sec 4.1 to 4.5.
Unit IV : Chapter 6 – sec 6.1 - 6.3
Unit V : Chapter 6- sec 6.4., 6.5, 6.5.1, 6.5.2 & 6.5.4.

REFERENCE(S)

[1] Sameul Korlin, Howard M. Taylor, A first course in stochastic processes, II Edn.

[2] Narayan Bhat, Elements of Applied Stochastic processes,

[3] Srinivasan and Metha, Stochastic processes, N.V. Prabhu, Macmillan (NY), Stochastic Processes.

Course Outcomes:

1. To understand the stochastic models for many real life probabilistic situations.

2. To learn the well known models like birth-death processs.

3. To learn the transition probabilities and its classifications.

4. To understand the random walk associated with real life situation to solve.

5. To learn the renewal theory and to know the method of problem solving .

6. Applications into real life problems

APPLIED STATISTICS – P19MS15E

Semester: III **Core Based Elective : III**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1. To introduce the concepts involved in basic statistics and learn them with plenty of demonstrating examples

2.To emphasize the correct statistical tools required to analyze and understand the results based on them.

UNIT I :
STATISTICAL QUALITY CONTROL: Introduction –Process & Product Control-Control Charts-Control Limits – Tools of S.Q.C –Control chart for attributes- Control chart for number of defects per unit (C-Charts).

UNIT II :
TIME SERIES ANALYSIS (Excluding the moving average mathematical treatment): Introduction-Components of Time series-Analysis of Time Series-Measurement of Trend –Measurement of Seasonal Fluctuations.

UNIT III :
INDEX NUMBERS: Introduction-Problems involved in the construction of index numbers-The criteria of a good index number-Classification of index numbers.

UNIT IV :
DEMAND ANALYSIS: Introduction-Price elasticity of demand- Partial elasticities of demand –Types of Data required for estimating elasticities-Engel's law and Engel's curve- Pareto's law of income Distribution-Utility function.

UNIT V :
ANALYSIS OF VARIANCE: Introduction- One-way classification – Two-way classification- Analysis of Two-way classified data with M-observations per cell.

TEXT BOOK (S) :

S. C GUPTA AND V.K. KAPOOR FUNDAMENTALS OF APPLIED STATISTICS, SULTAN CHAND & SONS – THIRD EDITION,

UNIT I : Chapter I - Sections 1.0 to 1.7
UNIT II : Chapter II - Sections 2.1 to 2.5
UNIT III : Chapter III - Sections 3.1 to 3.4
UNIT IV : Chapter IV - Section 4.1 to 4.7
UNIT V : Chapter V - Section 5.1 to 5.4

REFERENCE BOOK[s]:

1.D.R. Caze – APPLIED STATISTICS – Principle and examples
2.B.N. Ashana – APPLIED STATISTICS

Course Outcomes:

1.To Know the basic concepts of control charts and their applications.

2.To study the concepts of time-series analysis

3. Understanding the concepts involved in index numbers

4.Understanding the concepts of demand analysis and their related methods

5. Analyzing the Engel's curve and pareto's Law for income distribution.

6. To Analyse the Analysis of Variance

7.Understanding the concepts of Analysis of one-way and two-way classification

FUNCTIONAL ANALYSIS

Semester : IV **SUBJECT CODE:…………………….** **Core Course: XIII**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1. The idea behind the course is to emphasize very basic results which are needed for analysts and to give typical applications.

2. To study normed linear spaces, four pillars of functional analysis, weak topologies and duality, Hilbert space theory and algebra of bounded linear operators.

UNIT – I
Banach Spaces : The definition and some examples – Continuous linear transformations – The Hahn – Banach theorem – The natural imbedding of N in N** **-** The open mapping theorem – The conjugate of an operator.

UNIT – II
Hilbert Spaces : The definition and some simple properties – Orthogonal complements –Orthonormal sets – The conjugate space H* **-** The adjoint of an operator – Self-adjoint operators – Normal and Unitary operators – Projections.

UNIT – III
Finite-Dimensional Spectral Theory : Matrices – Determinants and the spectrum of an operator – The Spectral theorem – A survey of the situation.

UNIT – IV
General Preliminaries on Banach Algebras : Definition and some examples – Regular and singular elements – Topological divisors of zero – The spectrum – The formula for the
Spectral radius – The radical and semi simplicity.

UNIT – V
The Structure of Commutative Banach Algebras : The Gelfand mapping – Applications of the formula $r(x) = \lim \|x^n\|^{1/n}$- Involutions in Banach Algebras – The Gelfand –Neumark theorem.

TEXT BOOK (S)

G.F. Simmons ,Introduction to Topology and Modern Analysis, , Tata McGraw- Hill Publishing Company Limited, 2004.

UNIT I : Chapter 9 (46-51)
UNIT II : Chapter 10(52-59)
UNIT III : Chapter 11(60-63)
UNIT IV : Chapter 12(64-69)
UNIT V : Chapter 13(70-73)

REFERENCE (S) :

[1] Walter Rudin, Functional Analysis, TMH Edition, 1974. [2] B.V. Limaye, Functional Analysis, Wiley Eastern Limited, Bombay, Second Print, 1985.

[3] K. Yosida, Functional Analysis, Springer – Verlag, 1974.

[4] Laurent Schwarz, Functional Analysis, Courant Institute of Mathematical Sciences,New York University, 1964.

Course Outcomes:

1. To introduce the concept of Functional Analysis

2. To study Hahn Banach Theorem and its applications.

3. Knowledge of Banach spaces.

4. To introduce Inner Product Spaces.

5. To understand the operator theory in Hilbert Spaces.

7. Infinite dimensional spaces

8. Knowledge of operators

OPTIMIZATION TECHNIQUES

Semester: IV **SUBJECT CODE:……………………** **Core Course: XIV**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1.To provide the insights into structures and processors that operations research can offer and the enormous practical utility of its various techniques.

2. To explain the concepts and simultaneously to develop an understanding of problem solving methods based upon model formulation, solution procedures and analysis.

UnitI:
Games and Strategies: Introduction-Two-person Zero-Sum Games-The Maximin-Minimax Principle-Games without saddle points-Mixed strategies-Graphical Solution of 2xn and mx2 Games-Dominance Property.

Unit II:
Dynamic Programming: Introduction-The Recursive Equation Approach-Characteristics of Dynamic Programming-Dynamic Programming Algorithm-Solution of Discrete DynamicProgrammingProblem-Some Applications-Solution of Linear Programming Problem by Dynamic Programming.

Unit III:
Non-Linear Programming: Introduction-Formulating a Non-Linear Programming Problem-General Non-Linear Programming Problem – Constrained Optimization with equality constraints- Constrained Optimization with inequality constraints – Saddle Point Problems – Saddle Points and Non-Linear Programming Problem.

Unit IV:
Integer Programming Problem: Introduction- Gomory's all - Integer Programming Problem method-Construction of Gomory's Constraints-Fractional Cut Method -All Integer- Fractional Cut Method – Mixed Integer - Branch and Bound Method-Applications Integer Programming Problem.

Unit V:
Replacement Models: Replacement of Equipment that deteriorates gradually- Replacement of Equipment that fails suddenly- Group Replacement

TEXT BOOK(S)

Kanti Swarp,P.K.Gupta,Man-Mohan, Operations Research,Sultan Chand & Sons Educational Publishers New Delhi, 12th Revised Edition,1991.

UNIT-I – Chapter 17: Sections 17.1 to17.7
UNIT –II - Chapter 13: Sections 13.1 to 13.7
UNIT-III - Chapter24: Sections 24.1 to 24.7
UNIT –IV - Chapter 7: Sections 7.1 to 7.7
UNIT – V - Chapter 18: Sections 18.1, 18.2, 18.3, 18.4

REFERENCE(S):

[1] Problems in O.R by D.S.Hira & P.K.Gupta.

[2] Prem Kumar Gupta and D.S.Hira,Operations Research:An Introduction,S.Chand and Co.,Ltd. New Delhi.

[3] S.S.Rao,Optimization Theory and Applications,Wiley Eastern Limited,New Delhi.

Course Outcomes:

1. To understand the theory behind optimization techniques.

2. To introduce the Game theory and its Strategies.

3. To study the Dynamic programming for Problem solving.

4. Analyzing the methods of non-linear programming.

5. Understanding the concepts of integer programming problem

6. Understanding the concepts of replacement models

7. To highlight some of the applications of optimization techniques.

8. Applications into real life problem

DIFFERENTIAL GEOMETRY

Semester: IV **SUBJECT CODE:…………………….** **Core Course: XV**
Instruction Hours/Week: 6 **Credit: 5**

Course Objectives:

1.To introduce the geometry of n-dimensional oriented surfaces on Euclidean spaces using calculus of vector fields as a tool.

2. To study geodesics, parallel transport, curvature and convexity of surfaces.

Unit I

Introductory remarks about Space Curves- Definitions- Arc length -Tangent, normal and binormal – curvature and torsion of a given curve – contact between curves and surfaces –.

Unit II

Tangent surface, involutes and evolutes- intrinsic equations, Fundamental Existence theorem for space curves – Helics Intrinsic properties of a surface: Definition of a surface – curves on a surface – surface of revolution – Helicoids –.

Unit III

Metric – Direction coefficients – families of curves – Isometric correspondence – Intrinsic Properties – Geodesics.

Unit IV

Canonical Geodesic equation – Normal property of Geodesics – (Existence theorem) – Geodesics Parallels – Geodesics curvature - Gauss Bonnet Theorem – Gaussian Curvature.

Unit V

Non intrinsic properties of a surface: The second fundamental form – Principal curvature - Lines of curvature – Developable -Developables associated with space curves- Developable associated with curves on surface – Minimal surfaces – Ruled surfaces.

Text Book(S)

T.J. Wilmore, An Introduction to Differential Geometry, Oxford University press, (17th Impression) New Delhi 2002. (Indian Print).

Unit I	**:** Chapter I: Sections 1to 6.
Unit II	**:** Chapter I: Section 7 to 9.Chapter 2: Sec 1 to 4
Unit III	**:** Chapter II: Section 5 to 10.
Unit IV	**:** Chapter II: Section 11 to 17.
Unit V	**:** Chapter III: Section 1 to 8.

REFERENCE(S)

[1] Struik, D.T.Lectures on classical Differential Geometry, Addison – Wesley, Mass. 1950.

[2] Kobayashi S. and Nomizu.K. Foundations of Differential Geometry, InterScience publishers, 1963.

[3] Wihelm Klingenberg : A Course in Differential Geometry. Graduate Texts in Mathematics, Springer Verlag, 1978.

[4] J.A.Thorpe Elementary topics in Differential Geometry, Under- Graduate Texts in Mathematics, Springer Verlag, 1979.

Course Outcomes:

1. To explain the various intrinsic concepts of Differential Geometry.

2. To understand the theory of Differential Geometry.

3. To introduce difference surfaces and their uses.

4. To study Euler's theorem in Differential Geometry.

5. To appreciate the application of the Gauss equation

6. Applications into real life problems

MATHEMATICAL MODELLING

Semester : IV **SUBJECT CODE:…………………….** **Core Based Elective : IV**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1.To introduce the concepts of mathematical modelling .

2. To give a wide range view of applications of mathematics in science and technology.

UNIT I :
Mathematical Modelling:Need ,Techniques Classification and Simple Illustration:
Introduction: Need, Techniques, Classifications and Characteristics of Mathematical Modeling – Mathematical Modeling through Geometry, Algebra, Trigonometry and Calculus-Limitations of Mathematical Modelling

UNIT II :
Mathematical Modeling through Ordinary Differential Equations of First order : Mathematical modelling through differential equations Linear Growth and Decay Models – Non – Linear Growth and Decay models – Compartment models –Mathematical Modelling in Population Dynamics- Mathematical Modelling in Epidemics through system.

UNIT III :
Mathematical Modeling through Ordinary Differential Equations of Second Order:
Planetary motions – Circular motion and motion of Satellites – Mathematical Modeling through Ordinary Differential Equations of Second Order motion –Electrical Circuits – Phillip's Stabilization model for a Closed Economy – The Catenary – A Curve of Pursuit.

UNIT IV :
Mathematical modeling through Difference Equations : Simple models – Basic theory of linear difference equations with constant coefficients – Economics and Finance –Population Dynamics and Genetics – Probability theory.

UNIT V :
Mathematical modeling through graphs : Problems that can be modeled through graphs – directed graphs – Signed graphs – weighted digraphs – un oriented graphs.

TEXT BOOK :

J.N. Kapur, Mathematical Modeling, New Age International (P) Limited,Publishers, 1998.

UNIT I : Chapter 1 – Section 1.1 to 1.9
UNIT II : Chapter 2 – Section 2.1 to 2.4,Chapter 3 – Section 3.1, 3.2
UNIT III : Chapter 4 – Section 4.1 to 4.4
UNIT IV : Chapter 5 – Section 5.1 to 5.6
UNIT V : Chapter 7 – Section 7.1 to 7.5

REFERENCE:

J.N. Kapur, Mathematical Models in Biology and Medicine, Affiliated East – West Press Pvt Limited, New Delhi, 1981.

Course Outcomes:

1. To explain the various intrinsic concepts of Mathematical modelling .

2. To understand the theory of mathematical modeling through ordinary differential equations.

3. To understand the mathematical modelling concepts through difference equations.

4. To understand the mathematical modelling concepts through Graph theory .

5. Applications into real life problems.

THEORY OF NUMBERS

Semester : **SUBJECT CODE:……………………Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1 .Number theory is one of the classical branches of Mathematics. In this course, the basic concepts such as divisibility, primes, congruences and solutions in congruences are introduced in detail. Emphasize is made on the concepts which turn out to be concrete examples which motivate the abstract ideas in the algebra course.

2. Quadratic Residues, Mobius inversion Formula and the Diophantine equations and their solutions have to be introduced.

UNIT I
Introduction – Divisibility – Primes – The Binomial Theorem – Congruences
Euler's totient - Fermat's, Euler's and Wilson's Theorems – Solutions of congruences – The Chinese Remainder theorem.

UNIT II
Prime power Moduli – Primitive roots and Power Residues – Number theory from an Algebraic Viewpoint – Groups, rings and fields.

UNIT III
Quadratic Residues – Quadratic Reciprocity – The Jacobi Symbol – Binary Quadratic Forms – Equivalence and Reduction of Binary Quadratic Forms – sum of two squares.

UNIT IV
Greatest integer Function – Arithmetic Functions – The Mobius Inversion Formula Recurrence Functions – Combinatorial number theory

UNIT V
Diophantine Equations – The equation ax+by = c – Simultaneous Linear Diophantine Equations – Pythagorean Triangles – Assorted examples

TEXT BOOK(S)
[1] Ivan Niven, Herbert S, Zuckerman and Hugh L, Montgomery, An Introduction to the Theory of Numbers, Fifth edn., John Wiley & Sons Inc, 2004.

UNIT I- Chapter 1 and Chapter 2 : Sections 2.1 to 2.3
UNIT II- Chapter 2 : Sections 2.6 to 2.11
UNIT III- Chapter 3: Sections 3.1 to 3.6
UNIT IV- Chapter 4
UNIT V- Chapter 5: Sections 5.1 to 5.4

REFERENCE(S) :

[1] Gareth A. Jones and J. Mary Jones, Elementary Number Theory, Springer Verlag, Indian Reprint, 2005.
[2] David M. Burton, Elementary Number Theory, 6th edition, McGraw Hill, 2007.
[3] George Andrews, Theory of Numbers, Saunders, 1971.

Course Outcomes:

1. Understand and work numerous problems on concepts of divisibility and primes

2. Gain expertise in Euler's totient, Fermat's, Euler's and Wilson's Theorems and work on applications illustrating them.

3.Solve congruences as application of Chinese remainder Theorem

4. Understand number theory from algebraic point of view there by improving their sense of abstraction.

5. Describe power residues and multiplicative groups.

6. Discuss Quadratic residue and Jacobi symbol and work on sum of two squares problems.

7.Attained mastery in the fundamentals of greatest Course Outcomesinteger function and recurrence functions and attacking combinatorial problems using them.

8. Solve simple simultaneous linear Diophantine equations.

OPERATOR THEORY

Semester : **SUBJECT CODE:…………………….Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1. The idea behind the second course on functional analysis is to emphasize very basic results which are left out in the first course and are important for analysts who apply these tools.

2. To study compact operators, spectral theory of Banach space operators and Hilbert space operators, Banach algebras and Gelfand Naimark theorem.

UNIT I
Compact Operators: Characterizations – Some Properties.

UNIT II
Spectral Results for Banach Space Operators – Spectrum – Eigen spectrum – Resolvent set – Riesz - Schauder Theory

UNIT III
Operators on Hilbert Spaces –Adjoint – Self Adjoint – Normal – Unitary – Opertors – Numerical range – Hilbert-Schmidt operators.

UNIT IV
Spectral Results for Hilbert space Operators- Normal and Self Adjoint Operators- Spectral Representations

UNIT V
Banach Algebras – Regular and Singular elements – Spectrum – Gelfand mapping – Gelfand-Neumark Theorem

TEXT BOOKS

[1] M.Thamban Nair, Functional Analysis: A first course, Prentice Hall of India, New Delhi, 2002..
[2] G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill International Ed. 1963.

UNIT – I -Chapter 9 from [1]
UNIT – II -Chapter 10 from [1]
UNIT – III -Chapter 11 from [1]
UNIT – IV - Chapters 12 and 13 from [1]
UNIT – V -Chapters 12 and 13 from [2]

Reference(s)

1.B.V. Limaye, Functional Analysis, Wiley Eastern Limited, Bombay, Second Print, 1985.

2. K. Yosida, Functional Analysis, Springer-Verlag, 1974.

3. E. Kreyszig, Introductory Functional Analysis with applications, John Wiley, 1978.

Course Outcomes:

1. **Revise the important four pillars of functional analysis namely Hahn- Banach theorem, Open mapping theorem, Closed graph theorem, Uniform boundedness principles.**
2. **Find dual spaces and their representations and tabulate them.**
3. **Gain mastery in compact operators and spectral results on these operators**
4. **Get a working knowledge on algebra of bounded linear operators on Normed linear spaces.**
5. **Compute eigen spectrum, approximate eigen spectrum and spectrum of various operators and study their interconnections.**
6. **Study in detail the spectral properties of Hilbert space operators.**
7. **Understand spectral theory of compact self adjoint operators**
8. **Learn Gelfand mapping and Gelfand Naimark theorem**

GRAPH THEORY

Semester : SUBJECT CODE:…………………….Core Based elective:
Instruction Hours/Week: 6 Credit: 5

Course Objectives:

1. To Study the basic Concepts of Graph Theory.

2. To study the Graph Colouring and Planarity.

Unit-I:
Basic Results: Basic Concepts - Subgraphs - Degrees of Vertices - Paths and Connectedness-Operations on Graphs - Directed Graphs: Basic Concepts - Tournaments.

Unit-II: **Connectivity**
Vertex Cuts and Edge Cuts - Connectivity and Edge - Connectivity, Trees:Definitions, characterization and Simple Properties - Counting the Numberof Spanning Trees - Cayley's Formula. (Chapter III: 3.1, 3.2, Chapter IV: 4.1,4.3.1 to 4.4) Counting the Number of Spanning Trees - Cayley's Formula.

Unit-III: **Independent Sets and Matchings**
Vertex Independent Sets and Vertex Coverings - Edge Independent Sets -Matchings and Factors - Eulerian Graphs - Hamiltonian Graphs.

Unit-IV: **Graph Colourings**
Vertex Colouring - Critical Graphs - Triangle - Free Graphs - Edge Colourings of Graphs - Chromatic Polynomials.

Unit-V: **Planarity**
Planar and Nonplanar Graphs - Euler Formula and its Consequences - K5 and K3,3 are Nonplanar Graphs - Dual of a Plane Graph - The Four-Colour Theorem and the Heawood Five-Colour Theorem-Kuratowski's Theorem.

Textbook
1. R. Balakrishnan, K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.
References
1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.
2. F. Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969.

UNIT – I -(Chapter I: 1.1 to 1.4, 1.7, Chapter II: 2.1, 2.2)
UNIT – II - (Chapter III: 3.1, 3.2, Chapter IV: 4.1, 4.3.1 to 4.4)
UNIT – III -(Chapter V:5.1 to 5.4, Chapter VI: 6.1, 6.2)
UNIT – IV - (Chapter VII: 7.1 to 7.4, 7.7)
UNIT – V -(Chapter VIII: 8.1 to 8.6)

Reference(s)

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.

2. F. Harary, Graph Theory, Addison - Wesley, Reading, Mass., 1969.16 17

Course Outcomes:

1. To study the concepts of Connectivity and vertex and edge connectivity and its applications
2. To introduce the concept of colouring and its implication in planar graphs
3. To introduce the notion of Eulerian and Hamiltonian graphs
4. To give a rigorous introduction to the basic concepts of Graph Theory.
5. To give applications of Graph Theory in other disciplines
6. Applications to real life problems
7. Introduction to advance topics in graph theory
8. Algorithms in graph theory

DESIGN AND ANALYSIS OF ALGORITHMS

Semester : **SUBJECT CODE:…………………….Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1. To Study the Basis of the Algorithm

2. To Understand Concepts of Interpolations and Algebraic Problems

Unit-I:
Algorithms: Introduction- Algorithm - Algorithm specification: Pseudocode Conventions, Recursive algorithms - Performance analysis: Space Complexity, Time Complexity, Asymptotic Notation, Practical Complexities.

Unit-II:
Data structures and Queues: Arrays – ordered lists- Representation of Arrays-Stack and Queues –Fundamentals-Evaluation of Expressions.

Unit-III:
Linked lists and trees: Linked Lists - Singly Linked Lists- Linked Stacks and Queues-More on Linked Lists-Simple algorithms of Doubly Linked Lists (insertion and deletion only).Trees-Binary Trees- Binary Tree Representations- Binary Tree Traversal.

Unit-IV:
Search and Sort:Divide and conquer - General method - Binary search - Finding the maximum and minimum in a set of items - Merge sort - Quick sort - Selection sort. Basic Traversal and Search Techniques for graphs: Breadth First Search – Depth First Search.

Unit-V:
Interpolations: Backtracking - The 8-Queens problem - Algebraic problems - The general method - Evaluation and interpolation - Horner's rule - Lagrange interpolation - Newtonian interpolation.

Textbooks:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer algorithms, Galgotia Publications Pvt. Ltd., 2004.(Units: I, IV, V)

2. Ellis Horowitz, Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, 1981.(Units: II, III)

UNIT – I -(Sections: 1.1, 1.2,1.3.1 to 1.3.4)
UNIT – II - (Sections: 2.2,2.4,3.1,3.3)
UNIT – III -(Sections: 4.1,4.2,4.5,4.8,5.2,5.3,5.4).
UNIT – IV - (Sections: 3.1 to 3.5,6.2)
UNIT – V -(Sections: 7.1,7.2,9.1,9.2)

Reference(s)

1. A.V. Aho, J.E.Hopcroft, J.D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley Publ. Comp., 1974.

2. Seymour E.Goodman and S.T. Hedetniemi, Introduction to the design and analysis of algorithms, McGraw Hill International Edition, 2002

Course Outcomes:

1. To impart the students the knowledge of design and analysis of algorithms

2. To give tha basis for the core of computer science.

3. To give importance to finding the complexity (order) of algorithms.

4. To learn the linked lists and trees

5. To understand the searching and sorting methods.

6. Techniques in search and sort method.

AUTOMATA THEORY

semester : SUBJECT CODE:…………………….Core Based elective:
Instruction Hours/Week: 6 Credit: 3

Course Objectives:

1.To Study the Automation Techniques.

2.To study the BasicParsing Techniques.

Unit-I:
Finite Automata and Regular expressions Definitions and examples - Deterministic and Nondeterministic finite Automata - Finite Automata with moves.

Unit-II:
Context free grammar Regular expressions and their relationship with automation - Grammar - Ambiguous and unambiguous grammars - Derivation trees – Chomsky Normal form.

Unit-III:
Pushdown Automaton Pushdown Automaton - Definition and examples - Relation with Context free languages.

Unit-IV:
Finite Automata and lexical analysis Role of a lexical analyzer - Minimizing the number of states of a DFA - Implementation of a lexical analyzer.

Unit-V:
Basic parsing techniques Parsers - Bottom up Parsers - Shift reduce - operator precedence - Top down Parsers - Recursive descent - Predictive parsers.

Textbooks

1. John E. Hopcroft and Jeffrey D. Ullman, Introduction to Automata theory, Languages and Computations, Narosa Publishing House, Chennai, 2000.

2. A.V. Aho and Jeffrey D. Ullman, Principles of Compiler Design, Narosa Publishing House, Chennai, 2002.

UNIT – I (Book 1, Ch. 2: Sec. 2.1-2.4)
UNIT – II - (Book 1, Ch. 2, Sec. 2.5, Ch.4, Sec.4.1-4.3, 4.5,)
UNIT – III - (Book 1, Ch.5: Sec.5.2, 5.3)
UNIT – IV - (Book 2, Ch.3: Sec.3.1-3.8)
UNIT – V - (Book 2, Ch.5: Sec. 5.1-5.5)

Reference(s)

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall, 1997.

2. A.V. Aho, Monica S. Lam, R. Sethi, J.D. Ullman, Compilers: Principles, Techniques, and Tools, Second Edition, Addison-Wesley, 2007.54 55

Course Outcomes:

1. To make the students understand the nuances of Automata and Grammar.

2. To make them understand the applications of these techniques in computer.

3. To study context free grammar.

4. To learn finite automata and lexical analysis.

5. To understand basic parsing techniques.

6. Basic Knowledge of parsing Techniques.

FUZZY ANALYSIS

semester : **SUBJECT CODE:……………………. Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1.To Study the Fuzzy sets and Fuzzy Logic.

2.To Understand the concept of Fuzzy Techniques.

Unit-I
Crisp sets and fuzzy sets - basic concept of fuzzy set - fuzzy logic - operations on fuzzy sets - general discussion fuzzy complements.

Unit-II
Fuzzy union - fuzzy intersection - combinations operations.

Unit-III
Fuzzy relations and fuzzy graphs - fuzzy relation on sets and fuzzy sets - composition of fuzzy relations - properties of the min-max composition - fuzzy graphs - special fuzzy relations.

Unit-IV
Fuzzy measures - general discussion - belief and plausibility measures - probability measures - possibility and necessity measures.

Unit-V
Fuzzy decision making - individual decision making - fuzzy ranking methods - fuzzy linear programming.

Textbooks

1. George J.Klir, Tina.AFolger, Fuzzy sets, uncertainty and information, Prentice Hall of India Pvt Ltd, New Delhi, 2008.

2. H.J. Zimmermann, Fuzzy set theory and its applications, Second Edition, Springer New Delhi, 2006.

3. George J. Klir and Bo Yuan, Fuzzy sets and fuzzy logic theory and applications, Prentice-Hall of India private limited, New Delhi, 1995.

UNIT – I Book 1: chapter 1- 1.4, 1.6 & chapter 2-2.1 & 2.2.
UNIT – II - Book 1: chapter 2 - 2.3, 2.4, 2.5.
UNIT – III - Book 2: chapter 6 - 6.1, 6.1.1, 6.1.2, 6.2, 6.3.
UNIT – IV Book 1: chapter 4 - 4.1, 4.2, 4.3, 4.4.
UNIT – V - Book 3: chapter 4 - 4.1, 4.2, 4.3, and 4.4.

Reference

1. Timothy J. Ross, Fuzzy logic with Engineering Applications, McGraw-Hill, Inc. New Delhi, 2000.

Course Outcomes:

. To make the students understand the nuances of Fuzzy Analysis.

2. To make them understand the applications of these techniques in real life problems

3. Knowledge of Fuzzy operations

4. Knowledge of fuzzy union and intersection

5. Fuzzy measures and probability measures

6. Fuzzy graphs and Fuzzy relations

NUMERICAL METHODS USING MATLAB

semester : **SUBJECT CODE:…………………….** **Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1.To Study the Basics of MATLAB.

2. To Solve the Equations using MATLAB algorithms.

Unit-I:
Basics of MATLAB - Matrix functions Basics, windows, Variables, File types, Matrices and Vectors, Matrix manipulation, Matrix and Array Operations, Arithmetic operations, Relational operations, Logical operations, Elementary math functions, Matrix functions, Manipulating character strings, Array Operations, Vectorization.

Unit-II:
Built-in functions Inline functions, Anonymous functions, Built-in functions, Complex Arithmetic, Solving linear systems, Eigen Values and Vectors, Calculus.

Unit-III:
Graphics Basic 2-D Plots, Specialized 2-D plots, 3-D Plots, 3-D Surface Graphics.

Unit-IV:
MATLAB Algorithms and Programs The Solution of Non-linear Equations f(x) = 0 : Bracketing Methods for Locating a Root Newton-Raphson and Secant Methods, The Solution of Linear Systems AX = Â : Gaussian elimination and Pivoting, Iteration for Nonlinear Systems: Seidel and Newton's Methods (Optional). (Algorithms and Programs only,No derivations and Theorems)

Unit-V: :
MATLAB Algorithms and Programs
Curve Fitting : Least-squares Line, Numerical Integration : Composite Trapezoidal and Simpson's Rule, Solution of Differential Equations : Euler's Method - Taylor Series Method - Runge-Kutta Methods - Predictor-Corrector Methods (Algorithms and Programs only, No derivations and Theorems)

Textbook

1. Rudra Pratap, Getting started with MATLAB 7, Oxford University Press,2008.

2. John H. Mathews and Kurds D. Fink, Numerical Methods using MATLAB, Third Edition, Prentice Hall, Upper Saddle River, NJ, 1999.

UNIT – IV : (Chapter 2.2, 2.4, 3.4, 3.7)
UNIT – V - (Chapter 5.1, 7.2, 9.2, 9.4, 9.5, 9.6)

References

1. Brain R Hunt, Ronald L Lipsman, Jonathan M Rosenberg, A Guide to MATLAB for Beginners and Experienced Users, Cambridge University Press, 2003.

2. C. Woodford and C. Phillips, Numerical Methods with Worked Examples, Matlab Edition, Springer, Netherlands, 2012.

Course Outcomes:

1. To introduce the Mathematical software MATLAB for high-performance numerical computations and visualization.

2. To learn MATLAB built-in functions provided to solve all type of scientific problems.

3. Drawing 2D and 3D Plots

4. Solving Matrix Problems

5. Solving Linear systems

6. Solving Differential equations

TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY

Semester : **SUBJECT CODE:…………………….** **Core Based elective:**
Instruction Hours/Week: 6 **Credit: 3**

Course Objectives:

1. To develop familiarity of Algebras of Tensors.

2. To develop skills in Metric Tensor.

UNIT I

Invariance Transformations of coordinates and its properties Transformation by invariance - Transformation by covariance and contra variance - Covariance and contra variance - Tensor and Tensor character of their laws - Algebras of tensors - Quotient tensors - Symmetric and skew symmetric tensors - Relative tensors.

UNIT II

Metric Tensor - The fundamental and associated tensors - Christoffel's symbols - Transformations of Christoffel's symbols- Covariant Differentiation of Tensors - Formulas for covariant Differentiation- Ricci Theorem - Riemann -Christoffel Tensor and their properties.

Unit III

Einstein Tensor - Riemannian and Euclidean Spaces (Existence Theorem) – The e-systems and the generalized Kronecker deltas - Application of the e-systems

UNIT IV

Special Theory of Relativity: Galilean Transformation - Maxwell's equations - The ether Theory — The Principle of Relativity Relativistic Kinamatics : Lorentz Transformation equations – Events and simultaneity - Example Einstein Train - Time dilation – Longitudinal Contraction - Invariant Interval - Proper time and Proper distance — World line – Example - twin paradox - addition of velocities - Relativistic Doppler effect.

UNIT V

Relativistic Dynamics: Momentum - energy – Momentum energy four vector - Force - Conservation of Energy - Mass and energy - Example - inelastic collision - Principle of equivalence - Lagrangian and Hamiltonian formulations. Accelerated Systems : Rocket with constant acceleration - example - Rocket with constant thrust.

TEXT BOOK(S)

[1] I.S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, New York, 1964
[2] D. Greenwood, Classical Dynamics, Prentice Hall of India, NewDelhi, 1985

UNIT I -Chapter 2 : Sections 18 to 28 of [1]
UNIT II -Chapter 2 : Sections 2910 37 of [1]
UNIT III -Chapter 2 : Section 38 to 41 o [1]
UNIT IV -Chapter 7 : Sections 7.1 and 7.2 of [2]
UNIT V- Chapter 7 : Sections 7.3 and 7.4 of [2]

REFERENCE(S)

[1] J.L. Synge and A.Schild, Tensor Calculus, Toronto, 1949.

[2] A,S. Eddington, The Mathematical Theory of Relativity, Cambridge University Press, 1930.

[3] P.G. Bergman, An introduction to Theory of Relativity, New york, 1942,

[4] G.E. Weatherburn, Riemannian Geometry and Tensor Calculus, Cambridge,1938.

Course Outcomes:

1.To Study Covariance and the Tensor.

2.To Understand the concept of Formulas of covariant Differentiation.

3. To Understand the Einstein Tensor and Euclidean Spaces.

4. To Understand the Special Theory of Relativity.

5. To Study the Lagrangian and Hamiltonian formulations.