Andhra Pradesh State Council of Higher Education

Programme: B.Sc., Honours in APPLIED MATHEMATICS: MAJOR

w.e.f AY 2023-24

COURSE STRUCTURE

Year	Semester	paper	Title	Hr/ week	Credits
I	I	1	**ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES**	5	4
		2	ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES	5	4
	II	3	DIFFERENTIAL EQUATIONS	5	4
		4	REAL ANALYSIS	5	4
II	III	5	SOLID GEOMETRY	5	4
		6	ABSTRACT ALGEBRA	5	4
		7	MATHEMATICAL APPLICATIONS IN DATA ANALYTIC METHODS	5	4
		8	RING THEORY & MATRICES	5	4
	IV	9	OPTIMIZATION TECHNIQUES	5	4
		10	MATHEMATICAL TECHNIQUES IN ACCOUNTING	5	4
		11	VECTOR CALCULUS	5	4
III	V	12	LAPLACE TRANSFORMS	5	4
		13	INTEGRAL TRANSFORMS	5	4
		14	A) MATHEMATICAL APPLICATIONS IN BUSINESS ENTERPRISES OR B) LINEAR ALGEBRA	5	4
		15	A) DISCRETE MATHEMATICS OR B) NUMERICAL ANALYSIS	5	4
	VI		INTERNSHIP		
IV	VII	16	FLUID DYNAMICS	5	4
		17	CRYPTOGRAPHY	5	4

		18	CODING THEORY	5	4
	VIII	19	GRAPH THEORY	5	4
		20	MATHEMATICAL MODELING	5	4
		21	CLASSICAL MECHANICS	5	4

COURSE 1 **SEMESTER-I**

ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Hours: 5hrs/week Credits: 4

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in

these areas, enabling them to apply scientific principles to real-world situations.

Learning outcomes:

1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations

3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical

principles can be used to explain and predict phenomena in different contexts.

5 To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.

UNIT I: ESSENTIALS OF MATHEMATICS: 9hrs

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus- Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems Statistical Measures: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS: 9hrs

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: : 9hrs

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY: 9hrs

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations & Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.

2. Elementary Trigonometry by H.S.Hall and S.R.Knight

3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd. 4.Basic Statistics by B.L.Agarwal, New age international Publishers

5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman

6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker

7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.

8. Physics for Technology and Engineering" by John Bird

9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

UNIT I: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms.

They will plot the complex numbers on the complex plane and identify their properties 2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a dataset containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyze the central tendencies and distribution of the data.

UNIT II: ESSENTIALS OF PHYSICS:

1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results.

After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

UNIT III: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

.4: Mathematical Modeling

Present students with real-world problems that require mathematical modeling and analysis.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of
2. your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.

COURSE 2 **SEMESTER-I**

Title of the Course

ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

Hours: 5 hrs/week Credits: 4

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Learning outcomes:

1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.

2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.

3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.

3. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.

4. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.

5 Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics.Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..

UNIT I: ADVANCES IN BASICS MATHEMATICS 9hrs

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

UNIT II: ADVANCES IN PHYSICS: 9hrs

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY: 9hrs

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY 9hrs

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine,

Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics,

Application of medical physics: Radiation Therapy, Nuclear medicine

Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science 9hrs

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill

8. "Medical Physics: Imaging" by James G. Webster

9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas

10. Nano materials and applications by M.N.Borah

11. Environmental Chemistry by Anil.K.D.E.

12. Digital Logic Design by Morris Mano

13. Data Communication & Networking by Bahrouz Forouzan.

STUDENT ACTIVITIES

UNIT I: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications, such as analyzing rates of change or optimizing functions.

3: Integration Exploration

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or

integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

UNIT II: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency,

sustainability, materials design, biomedical applications, or technological advancements.

2: Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

UNIT III: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme- substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

They will discuss the accuracy and limitations of their model, propose improvements, and

interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

UNIT V: Advanced Applications of computer Science

1. Students must be able to convert numbers from other number system to binary number systems

2. Identify the networking media used for your college network

3. Identify all the networking devices used in your college premises.

II Semester

Course 3: Differential Equations

Credits: 4

Course objectives:

The central objective of differential equations are important for many physical system, one can subject to suitable idealization, formulate a differential equations that describes how the system changes in time, understanding the solutions of differential equation isthen of paramount interest.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Will be able to explain to the concept of differential equations.
2. Will be able to solve first order ordinary differential equations.
3. To find orthogonal trajectories.
4. Solve exact differential equations.
5. Convert separable in homogeneous to exact Solve exact differential equations by integrating factors.
6. Solve Bernoulli's differential equations.
7. Solve homogeneous linear differential equations with constant coefficients.
8. Use the method of variation of parameters to find the solution of higher order differential equations.
9. Solve the Cauchy's Euler equation.

UNIT – I - Differential Equations of first order and first degree :

Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; IntegratingFactors Equations Reducible To Exact Equations by Integrating Factors:

1. 1/Mx+Ny
2. 1/Mx-Ny

***UNIT – II* - Orthogonal Trajectories.**

Cartesian co-ordinates self orthogonal Family of curves. Orthogonal trajectories : polar co-ordinates.

Differential Equations of first order but not of the first degree :

Equations solvable for *p*; Clairaut's Equation.

UNIT – III -, Higher order linear differential equations-I :

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.

General Solution of f(D)y=0

General Solution of f(D)y=Q when Q is a function of x.

P.I. of f(D)y = Q when Q= be^{ax}

P.I. of f(D)y = Q when Q is b sin ax or b cos ax.

UNIT – IV- Higher order linear differential equations-II :

Solution of the non-homogeneous linear differential equations with constant coefficients. P.I. of f(D)y = Q when$Q= bx^k$

P.I. of f(D)y = Q when Q= be^{ax} V P.I. of f(D)y = Q when Q= xV

P.I. of f(D)y = Q when Q=x^m V

UNIT –V - Higher order linear differential equations-III :

Method of variation of parameters (without non constant coefficient equations) ; The Cauchy-Euler Equation ;Legender's Equations.

Prescribed Text Book :

1. A text book of mathematics for BA/BSc Vol 1 by N. Krishna Murthy & others, published by S. Chand & Company,New Delhi.

Reference Books :

1. Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Learning Pvt. Ltd.New Delhi-Second edition.
2. Ordinary and Partial Differential Equations Raisinghania, published by S. Chand & Company, New Delhi.
3. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-universities press.
4. Telugu Academy Text Book for Differential Equations.
5. I-B.Sc A text Book of a Mathematics Deepthi Publications.

II Semester

***Course 4:*Real Analysis**

Credits: 4

Course objectives:

Real Analysis, this course is designed to provide fundamental concepts of analysis, theory of functions of a real variable,differentiation and integration of real functions as well as some mean value theorems and Riemann integrable concepts.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Define and recognize the basic properties of the field of real numbers, series and sequences.
2. Improve and outline the logical thinking.
3. Recognize the series of real numbers and convergences.
4. Define and recognize the real functions of limits and continuity.
5. Define and recognize the differentiability of real functions and its related theorems.

UNIT – I : REAL NUMBERS :

The algebraic and order properties of R, Absolute value and Real line, Completeness property of R, Applications ofsupreme property; intervals. No. Question is to be set from this portion.

Real Sequences: Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergentsequence, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit and the Bolzano-weierstrass theorem – (Cauchy Sequences – Cauchey's general principle of convergence theorem). No.

Question is to be set from this portion.

Series : Introduction to series, convergence of series of Non-Negative Terms.

1. P-test 2. Cauchey's nth root test or Root Test.

3. D'-Alemberts' Test or Ratio Test

UNIT – II : LIMITS AND CONTINUITY :

Limits : Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept,Infinite Limits. Limits at infinity. No. Question is to be set from this portion. ***Continuous functions :*** Continuous functions, Combinations of continuous functions, Continuous Functions on intervals.

UNIT – III : DIFFERENTIATION :

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning ofthe Derivative, Problems on Differentiation.

UNIT – IV : MEAN VALUE THEORMS :

Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchhy's Mean value TheoremStatement and their Applications.

UNIT – V : RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions. Necessary and sufficient condition for R– integrability, Properties of Integrable functions, Continuous Functions R-Integral, Monotonic Function R-Intigrable constant function R-Intergrable

- Fundamental theorem of integral calculus.

Prescribed Text Book :

1. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, Published by S. Chand & Company Pvt. Ltd., NewDelhi.

Reference Books :

1. Real Analysis by Rabert & Bartely and .D.R. Sherbart, Published by John Wiley**.**

2. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisingkania Published by S.Chand & Company Pvt. Ltd., New Delhi.
3. Telugu Academy Text Book for Real Analysis.
4. I-B.Sc A text Book of a Mathematics Deepthi Publications.

III SEMESTER

Course 5: SOLID GEOMETRY

Credits: 4

Course objectives:

Studying solid geometry provides the students with many foundational skills and helps them to build their logicalthinking skills, deductive reasoning, analytical reasoning and problem solving skills.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Will be able to direction cosines and direction rations.
2. Identify Plane, system of planes and pair of planes.
3. Identify right line, coplanar lines and shortest distance.
4. Knowledge related to concept of sphere and cylinder.

UNIT – I : The Plane :

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Distance between parallel planes, System of Planes. Planes bisecting theangles between two Planes. Pair of Planes.

UNIT – II : The Line :

Equation of a line; Angle between a line and a plane; The condition for a line to lie in a plane, Image of a point in a plane,Image of point in a line coplanar Lines

Shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines.

UNIT – III : Sphere-I :

Definition and equation of the sphere; the sphere through four given points; Plane sections of a sphere; Intersection of two spheres;Equation of a circle; great circle, small circle; Intersection of a sphere and a line.

UNIT – IV : Sphere -II:

Equation of Tangent plane; Angle of intersection of two spheres; Orthogonal spheres; Radical plane; Coaxial system ofspheres; Limiting Points.

UNIT – V : Cylinder :

Definition of a cylinder, Equation to the cylinder, Enveloping cylinder, right circular cylinders equation of the right circularcylinder.

Prescribed Text Book :

1. V. Krishna Murthy & Others "A text book of Mathematics for BA/B.Sc Vol 1, Published by S. Chand & Company, NewDelhi.

Reference Books :

1. Scope as in Analytical Solid Geometry by Shanti Narayan and P.K. Mittal Published by S. Chand & Company Ltd.Seventeenth Edition.

Sections :- 2.4, 2.5, 2.6, 2.7, 2.8, 3.1 to 3.7, 6.1 to 6.9, 7.1 to 7.4, 7.6 to 7.8.

2. P.K. Jain and Khaleel Ahmed, "A text Book of Analytical Geometry of Three Dimensions", Wiley Eastern Ltd., 1999.

3. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam,

K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.

4. Telugu Academy Text Book for Solid Geometry.

5. I-B.Sc A text Book of a Mathematics Deepthi Publications.

III Semester

Course 6: ABSTRACT ALGEBRA

Credits: 4

Course objectives:

The main aim of the course is to introduce the basic concepts of group theory structure and logical thinking in derivations ofvarious properties.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Understand and use the properties of group axioms.
2. Understand and use the properties of cosets and permutations.
3. Understand the concept of homomorphism .
4. In over all critical thinking, research and communication from group theory.

UNIT – 1 : GROUPS : -

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite andInfinite groups – examples – order of a group. Composition tables with examples.

UNIT – 2 : SUBGROUPS : -

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition – examples-criterionfor a complex to be a subgroups.

Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

UNIT –3 : NORMAL SUBGROUPS : -

Cosets Definition – properties of Cosets statements only – Index of a subgroups of a finite groups– Lagrange's TheoremStatement and Proof.

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to bea normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group – simple group

UNIT – 4 : HOMOMORPHISM : -

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism –aultomorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

UNIT – 5 : PERMUTATIONS : -

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition –even and odd permutations.

Cayley's Theorem .

Prescribed Text Book :

1. A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, Published by S.Chand & Company,New Delhi.

Reference Books :

1. Abstract Algebra, by J.B. Fraleigh, Published by Narosa Publishing house.
2. Modern Algebra by M.L. Khanna.
3. Telugu Academy Text Book for Abstract Algebra.
4. I-B.Sc A text Book of a Mathematics Deepthi Publications.

III Semester

Course 7: MATHEMATICAL APPLICATIONS IN DATA ANALYTIC METHODS

Credits: 4

Course Objectives:

The main objective of this course is to provide students with the foundations of mathematical applications in dataanalytic methods used in various applications in engineering and science like disease modeling, climate prediction and computer networks etc.

Course Outcomes:

After successful completion of this course, the student will be able to;

1. For estimation we use finite differences and curve fitting.
2. Knowledge related to concept of correlations.
3. Knowledge related to concept of curve fitting.
4. Knowledge of correlation, regression analysis, regression diagnostics.
5. Knowledge related to concept of regressions.

UNIT – I :

CORRELATION : Introduction, Meaning of Correlation, Types of correlation ,probable error, Karl- Pearson'scoefficient of correlation for individual series, Spearman's Rank correlation for individual series .

UNIT –II :

REGRESSION : Introduction, definition, difference between correlation and regression, Simple linear regression,properties of regression coefficients, Regression equation x on y, Regression equation yon x, Simple Problems applications in business.

UNIT-III :

CURVE FITTING : Scatter diagram Method of least squares, fitting of a straight line to find trend values by themethod of straight line trend.

UNIT – IV :

FINITE DIFFERENCES AND INTERPOLATION : Forward Differences - Backward differences. Newton's forwardinterpolation formula - Newton's backward interpolation formula and their applications.

UNIT-V :

APPLICATIONS OF NUMERICAL INTEGRATION:
Trapezoidal Rule, Simpson's 1\3 rd Rule, Simpson's 3\8th Rule.

Prescribed Text Book:

1. Statistical Methods – Dr. S.P. Gupta – Chand & Sons.
2. Quantitative Techniques by C. Sathyadevi – S. Chand.
3. Fundamentals of Mathematical Statistics – S.C. Gupta & V.K. Kapoor

REFERENCE BOOKS :

1. Statistical Methods – Snedecor G.W. & Cochran W.G. Oxford & + DII.
2. Elements of Statistics – Mode. E.B. - Prentice Hall.
3. Fundamentals of Statistics – Goon Gupta & Das Gupta.

III Semester

Course 8: RING THEORY AND MATRICES

Credits: 4

Course Objectives:

To motivate the students to gain knowledge to know the fundamental concepts in Ring theory such as concepts ofideals, integral domains and fields. Understanding the concept of matrix notations. Understanding rank of the matrix, solutions of linear equations and characteristics roots.

Course Outcomes :

After successful completion of this course, the student will be able to;

1. Understanding the concepts of fields, division ring and integral domain.
2. Understanding the concepts of ideals and characteristics of rings and homomorphism of rings.
3. Finally used in lots of communication, media from encoding data to CD to telecommunication to transmechines tosatellites and probs.
4. Define the term matrix.
5. Demonstrate and understanding of how to translate a linear equations into amatrix notation.
6. Applications of Clayey-Hamilton theorem.

UNIT – I : Rings-I :-

Definition of Ring and basic properties, Boolean Rings, Zero Divisors of Ring - Cancellation laws in a Rings - Integral DomainDivision Ring – Fields Examples.

UNIT –II : Rings-II :-

Characteristic of Ring – Characteristic of an Integral Domain – Characteristic of Field Characteristic of Boo Loan Ring.

Sub Ring Definition – Sub ring test – Union and Intersection of sub rings . Excluding ideals,Principal prime and maximal Ideals.

UNIT –III : Rings-III :-

Definition of Homomorphism – Homorphic Image – Elementary Properties of Homomorphism –Kernel of a Homomorphism –Fundamental theorem of Homomorhphism.

UNIT – IV: Matrix-I :-

Rank of a Matrix – Elementary operations – Normal form of a matrix Echelon from of a Matrix - Solutions of Linear EquationsSystem of homogenous Linear equations – System of non Homogenous Linear Equations method of consistency.

UNIT – V : Matrix-II :-

Characteristic Roots, Characteristic Values & Vectors of square Matrix, Cayley – Hamilton Theorem.

Prescribed Text books:

1. Abstract Algebra by J. Fralieh, Published by Narosa Publishing house.
2. A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.

Reference Books :-

1. Rings and Linear Algebra by Pundir & Pundir, Published by Pragathi Prakashan.
2. Matrices by Shanti Narayana, published by S.Chand Publications.

IV Semester

Course 9: OPTIMIZATION TECHNIQUES

Credits: 4

Course Objective:

The central objective of optimization is ―to do thing best under the given circumstances‖. This general concept has great many applications, for instance, in data analysis, engineering system design, inventory control, man power and resourceallocation and building capabilities in the students for analyzing different situations in the industrial/business scenario.

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Recall the theoretical foundations of various issues related to linear programming modelling to formulate real-worldproblems as a LP model
2. Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision onvariables so as to optimize the objective function.
3. Identify appropriate optimization method to solve complex problems involved in various industries.
4. Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.
5. Find the appropriate algorithm for allocation of resources to optimize the process of assignment.
6. Explain the theoretical workings of sequencing techniques for effective scheduling of jobs on machine.

UNIT-I:

Introduction to Operations Research, Definition of OR, Applications of OR, Limitations of OR, Linear programmingproblem (LPP), Introduction, Mathematical formulation of the LPP, Applications and Limitation of LPP.

UNIT-II:

Linear Programming Problem – Solution of LPP Using Graphical Method and Simplex Method (□ inequality only).

UNIT-III:

Transportation problem: Mathematical formulation, IBFS of transportation problem using north-west corner rule, least-cost rule and Vogel’s approximation method, Simple problems.

UNIT-IV:

Assignment problem, definition, mathematical formulation of assignment problem, solution of assignment problem usingHungarian algorithm, unbalanced assignment problem, simple problems, Difference between Assignment and transportation Problem.

UNIT-V:

Introduction – Definition – Terminology and Notations
Principal Assumptions,Problems with n Jobs through Two Machines

Problems with n Jobs through Three Machines

Prescribed Text Book:

Operations Research (2nd Edition) by S.Kalavathi, Vikas Publications Towers Pvt. Ltd.

Scope:

UNIT-I: 1.1, 1.2, 1.3, 1.5, 1.6, 1.7

UNIT-II: 2.1, 2.2, 2.2.1, 2.2.2, 3.1, 3.1.1, 4.1, 4.2, 4.3

UNIT-III: 8.1, 8.2, 8.3, 8.4.1, 8.4.2, 8.4.3
UNIT-IV: 9.1, 9.2, 9.2.1, 9.2.2, 9.3, 9.4

UNIT-V: 12.1, 12.2, 12.2.1, 12.2.2, 12.3, 12.4

Reference books:

1. Operations Research by Kanthiswaroop, P.K.Gupta, Manmohan by Sultan Chand & Sons
2. Operations Research by SD. Sharma, Published by Kedhar Nath ram Nath – Meerut.

IV Semester

Course 10: MATHEMATICAL TECHNIQUES IN ACCOUNTING

Credits: 4

Course Objective:

Accounting is a process of identifying the events of financial nature , recording them in the journal, classifying in their respective accounts and summarizing them in profit and loss account and balance sheet and communicating results to users of suchinformation,viz, owner, government, creditor ,investors, etc.

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Identify and interpret accounting information to inform users and make decisions.
2. Apply critical thinking skills by identifying and analyzing accounting issues using relevant accounting frameworks.

Unit-I – Introduction to Accounting

Need for Accounting – Definition – Objectives, Advantages – Book keeping and Accounting–Accounting concepts and conventions - Accounting Cycle - Classification of Accounts and its rules - Double Entry Book-keeping - Journalization - Posting to Ledgers, Balancing of ledger Accounts (problems).

Unit –II: Subsidiary Books:

Types of Subsidiary Books - Cash Book, Three-column Cash Book- Petty cash Book (Problems).

Unit-III: Trail Balance with Mathematical Concepts :

Preparation of Trail balance –Methods of Trail balance (Simple Problems).

UNIT-IV: MATHEMATICAL APPLICATIONS IN MARGINAL COSTING AND BREAK EVEN ANALYSIS:-

Marginal Costing –features-Merits-Demerits-Applications of Marginal Costing – profit planning – Evaluation of Performance-fixing selling price – break even point(BEP)units –BEP(Rs) -Pv Ratio-margin of safety.(simple problems).

UNIT-V: MATHEMATICAL APPLICATIONS IN RATIO ANALYSIS

Meaning - Advantages and Limitation of Ratio Analysis –Profitability Ratios- Gross Profit Ratio (GPR) – Net ProfitRatio (NPR) – Operating profit Ratio -Turnover Ratios- Stock Turn Over Ratio – Debtor turn over- Creditor Turn Over-Debtor and Creditor Velocities fixed Assets Turn over – Working Capital-turn over ratio (Simple Problems Only).

Prescribed Books

1. S.P. Jain & K.L Narang, Accountancy-I, Kalyani Publishers
2. Sharma & sashi Gupta , Kalyani Publishers Co.

Reference Books

1. T.S.Reddy & A. Murthy, Financial Accounting , Margham Publications
2. R L Gupta & V. K Gupta, Principles and Practice of Accounting, Sultan Chand & Sons
3. Tulasian, Accountancy -I, Tata McGraw Hill Co.
4. V.K.Goyal, Financial Accounting, Excel Books
5. K. Arunjothi, Fundamentals of Accounting; Maruthi Publications

IV Semester

Course 11: VECTOR CALCULUS

Credits: 4

Course Objective:

Vector calculus plays an important role in differential geometry and in study of partial differential equations. It is used extensively in physics and engineering, especially in the description of electromagnetic fields ,gravitational fields and fluid flow.**Course Outcomes:**

After successful completion of this course, the student will be able to;

1. We study the calculus of vector fields.
2. Will be able to discuss line integrals and surface integrals also volume integrals.
3. It motivates the study of vector differtiation and integration in two and three dimensional spaces.

UNIT – I : Vector Differentiation – I :-

Vector Function of Scalar Variable continuity of a vector function partial differentiation scalar point Faction vector pointfaction – Gradient of a scalar point Function – Unit normal – Directional Derivative at a Point – Angle between two surfaces.

UNIT – II : Vector Differentiation – II :-

Vector differential Operator – Scalar Differential Operator – Divergence of a vector – Solenoidal vector – Laplacianoperator – curl of a vector – Ir rotational Vector – Vector identities.

UNIT – III : Vector Integration - I :-

Definition – Integration of a vector – simple problems – smooth curve – Line integral – Tangential Integral – circulationProblems on line Integral. Surface Integral – Flux Problems on Surface Integral.

UNIT – IV : Vector Integration - II :-

Volume Integrals – Gauss Divergence Theorem statement and proof – Applications of Gauss Divergence theorem.

UNIT – V : Vector Integration - III :-

Green's Theorem in a plane Statement and proof –
Application of Green's Theorem.Statement and Proof of
Stoke Theorem – Application of stoke Theorem.

Prescribed Text books:

A text Book of B.Sc., Mathematics by B.V.S.S.Sarma and others, published by

S. Chand & Company Pvt. Ltd., New Delhi.

Reference Books :-

1. Vector Calculus by Santhi Narayana, Published by S. Chand & Company Pvt. Ltd., New Delhi.
2. Vector Calculus by R. Gupta, Published by Laxmi Publications.
3. Vector Calculus by P.C. Matthews, Published by Springer Verlag publicattions.

V Semester

Course 12: LAPLACE TRANSFORMS

Credits: 4

Course Objective:

The objective of this course is to familiarize the student with Laplace transforms and inverse Laplace transformsand their applications. Apply Laplace transforms to solve differential equations.

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Find the Laplace transforms of derivatives, integral and periodic functions.
2. Will be able to solve initial value problems for linear differential equations.

UNIT – 1: Laplace Transform I : -

Definition of - Integral Transform – Laplace Transform Linearity, Property, Piecewise continuous Functions, Existenceof Laplace Transform, Functions of Exponential order, and of Class A. Linear property, First Shifting Theorem.

UNIT – 2: Laplace Transform II : -

Second Shifting Theorem, Change of Scale Property, Laplace Transform of the derivative of f(t), Initial Value theoremand Final Value theorem.

UNIT – 3: Laplace Transform III : -

Laplace Transform of Integrals – Multiplication by t, Multiplication by tn – Division by t. Laplace transform of BesselFunction Only.

UNIT –4: Inverse Laplace Transform I : -

Definition of Inverse Laplace Transform. Linearity, Property, First Shifting Theorem, Second Shifting Theorem, Changeof Scale property, use of partial fractions, Examples.

UNIT –5: Inverse Laplace Transform II : -

Inverse Laplace transforms of Derivatives–Inverse Laplace Transforms of Integrals – Multiplication by Powers of „P'–Division by powers of „P'– Convolution Definition – Convolution Theorem – proof and Applications.

Prescribed Text Books :-

Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Reference Books :-

1. Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.
3. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
4. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd.,New Delhi.

V Semester

Course 13: INTEGRAL TRANSFORMS

Credits: 4

Course Objective:

The objective of this course is to familiarize the student with applications of integral transforms and Fouriertransforms and their applications.

Course Outcomes:

After successful completion of this course, the student will be able to;

1. Understanding and regarding different kind of integral transforms.
2. Understand Fourier transform and its properties and will be able to solve the examples based on it.

UNIT – 1- Application of Laplace Transform to solutions of Differential Equations : -

Solutions of ordinary Differential Equations.

Solutions of Differential Equations with constants co-efficient.

UNIT – 2 -Application of Laplace Transform : -

Solutions of partial Differential Equations.

UNIT – 3- Application of Laplace Transforms to Integral Equations : -

Definitions : Integral Equations-Abel's, Integral Equation-Integral Equation of Convolution Type, Integro DifferentialEquations. Application of L.T. to Integral Equations.

UNIT –4 -Fourier Transforms-I : -

Definition of Fourier Transform – Fourier's in Transform – Fourier cosine Transform – Linear Property of Fourier Transform – Change of Scale Property for Fourier Transform – sine Transform and cosine transform shifting property –modulation theorem.

UNIT – 5- Fourier Transform-II : -

Convolution Definition – Convolution Theorem for Fourier transform – parseval's Indentify – Relationship betweenFourier and Laplace transforms – problems related to Integral Equations.

Prescribed Text Books :-

Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.

Reference Books :-

1. Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.

3. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
4. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd.,New Delhi.

V Semester

Course 14A: MATHEMATICAL APPLICATIONS IN BUSINESS ENTERPRISES

Credits: 4

Course Objective:

Business maths helps in assessing the financial performance of the business. It helps in estimating the incomes and expenditure along with the risk analysis. It improves decision making about such as costs, raw materials, marketing etc.**Course Outcomes:**

After successful completion of this course, the student will be able to;

1. To apply different quantitative models in solving business problems.
2. Describe mathematical relations and functions used in business settings.
3. Mathematical concept and terminology involved in derivatives and basic arithmetic operations on matrices.

Unit-I – Introduction of Business Organization

Concepts of Business, Trade , Industry and Commerce – Features of Business -Trade Classification - Aidsto Trade –Industry – Classification – Relationship of Trade, Industry and Commerce.

Unit II- Business Functions and Entrepreneurship with Mathematical Concepts

Meaning of Entrepreneurship – Characteristics of a good entrepreneur - Types – Functions ofEntrepreneurship. Functions ofBusiness and their relationship - Factors influencing the choice of suitable form of organization

Unit –III – Mathematical Applications in business Organization

Sole Proprietorship – Meaning – Characteristics – Advantages and Disadvantages – Partnership - Meaning – Characteristics- Kinds of partners – Advantages and Disadvantages – Partnership Deed – Hindu-undivided Family –Cooperative Societies.

UNIT – IV :

Applications of Determinants to Economic and Business problemsApplications of Matrices to Economic and Business problems

UNIT-V :

Mathematical applications to find linear trend
Linear trend, find trend values by the method of straight line trend in Business problemsMarginal product and Marginal cost.

Prescribed Text Book:

1. Applications of mathematics for commerce and economics By P.N.Arora and P.C.Bagga Willey Eastern Limited.
2. R.K.Sharma and Shashi K Gupta, Business Organization - Kalyani Publications.

Reference Books:

1. C.D.Balaji and G. Prasad, Business Organization - Margham Publications, Chennai.
2. C.B.Guptha, Industrial Organization and Management, Sultan Chand.
3. Y.K.Bushan, Business organization and Management, Sultan Chand.
4. Sherlekar, Business Organization and Management, Himalaya Publications.

V Semester

Course 14 B: LINER ALGEBRA

Credits: 4

Course objectives:

The main aim of the course is to introduce the basic concepts of linear algebra and logical thinking in derivations of variousproperties. It develop the definitions ,concepts and theories associated to linear algebra.

Course outcomes:

After successful completion of this course, the student will be able to;

1. Understand and use the properties of group axioms.
2. Understand and use the properties of basis and dimensions of vector spaces.
3. Understand the concept of rank and nullity in vectors .
4. In over all critical thinking, research and communication from inner produt space

UNIT – I : Vector Spaces-I :

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

UNIT –II : Vector Spaces-II :

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space,Dimension of a subspace, Quotient space and Dimension of Quotient space.

UNIT –III : Linear Transformations :

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Rangeand null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

UNIT –IV : (Inner product space-I) :

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle inInequality, Parallelogram law.

UNIT –V : (Inner product space-II) :

Orthogonal and Ortho normal Vectors, Orthogonal and Ortho normal Sets of Inner product Space, Phythagoras theorem, The Diagonals are perpendicular in a rhombus, orthogonal set of non-zero vectors is linearly independent, Ortho normal set of vectors is liner independent, Gram-schmidth Orthogonalisation process, Bessel's Inequality and parseval's Identity.

Reference Books :

1. Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut-250002.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition), New Delhi.
3. Linear Algebra by Stephen H. Friedberg et al published by Prentice Hall of India Pvt. Ltd. 4th Edition 2007.

V Semester

Course 15 A: DISCRETE MATHEMATICS

Credits: 4

Course Objectives:

1. To study the mathematical structures that are countable or distinct and separable.
2. To learn sets, functions, logic,calculus and analysis.
3. To study the Algebraic systems such as Lattices ,Boolean Algebra and Boolean functions
4. To introduce basic concepts of graph theory

Course Outcomes :

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

1. learn the applications of graph theory in other subjects.
2. understand representations of different problems by means of graphs.
3. learn the relation between bipartite graphs and odd cycles.
4. learn the concepts of forest, binary trees, eccentricity of a vertex and radius ofconnectedgraphs.
5. learn the importance of multi graphs in other subjects like physics and chemistry.
6. learn different characterizations of modular and distributive lattices.

UNIT- I:

Basic Ideas, History, Initial Concepts, Summary, Connectivity , Elementary Results, Structure Basedon Connectivity .

UNIT –II :

Normal Forms-Disjunctive-Conjunctive Principal Disjunctive, Principal Conjunctive Normal Forms –Ordering and Uniqueness of Normal Forms. The theory of Inference for the statement Calculus-Rules of inferences – Consistency of Premises-Automatic Theorem proving.

UNIT – III:

The predicate calculus-Inference Theory of the Predicate Calculus(Sections 1.5 and 1.6 ofChapter 1)

UNIT – IV:

Lattices and Boolean Functions: Lattices as partially Ordered sets-Lattices as Algebraic Systems

–Boolean Algebra-Boolean Functions- Minimization. (Sections 4.1 ,4.2,4.3 and 4.4 of Chapter 4)

UNIT-V:

Finite – State Machines-Basic Concepts of Graph Theory –Basic Definitions-Paths-Reach ability,and Connectedness-Matrix Representation of Graphs-Trees (Section 4.6 of Chapter 4 andSection

5.1 of Chapter)

TEXT BOOK

Scope and Standard as in the book " **Discrete Mathematical Structures With Applications To Computer Science"** by Tremblay, J.P&Manohar, R- Published by McGraw-Hill InternationalEdition -1987 Edition

References :

1. Discrete Mathematics & Graph Theory by BhavanariSatyanarana& KunchamSyam Prasad, PHIPublications, New Delhi, Second Edition, 2014.
2. Mathematical Foundation of Computer Science, by Bhavanari Satyanarayana, T.V. Pradeep Kumar, SK. Mohiddin Shaw, BS Publications, Hyderabad.2016.

V Semester

Course 15 B: NUMERICAL ANALYSIS

Credits: 4

Course Objectives:

1. To provide suitable and effective methods called Numerical Methods, for obtainingapproximate representative numerical results of the problems
2. To make the students familiarize with the ways of solving complicatedmathematical problems numerically.

Course Outcomes: At the end of the course students will be able to

1. Solve Algebraic and Transcendental polynomial equations.
2. Learn how to apply the Numerical method for various Mathematicaloperations and tasks.
3. Understand Interpolation, Differentiation, Integration, the solution ofDifferential Equation
4. Analyse and evaluate the accuracy of common Numerical methods.

UNIT-I:

Solutions of Algebraic and Transcendental Equations: Introduction - Bisection method – Methodof Falseposition - Newton Raphson –method solutions of non linear equations – Method of iteration.

UNIT-II:

Interpolation And Approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Finite Difference Operators - Interpolating Polynomials using finite differences- Gregory- Newton forward difference interpolation- Backward difference interpolation - Spline interpolation – cubic splines.

UNIT-III:

Direct methods – matrix inversion method -Gauss Elimination Method - Gauss – Jordan Method– eigen value problems –Iterative Methods

UNIT-IV: Numerical solutions of ODEs :

Taylor's series –Picard's method– Euler method - Modified Euler – method-Runge-Kutta methods-Predictor- CorrectorMethods: Adams- Moulton And Milne's Method

UNIT-V : Numerical Methods of PDE:

Finite difference approximations to derivatives –Laplace's equation: Jacobi's method, Gauss-Seidel method,Successive over-Relaxation method,

Text Book:

Scope and standard as in chapters 2,3,5,6 and 7 of "**Introductory methods for Numerical AnalysisbyS.S.Sastry fourth edition**".

Reference Book:

1. An Introduction to Numerical Analysis by Kendall E. Atkinson.
2. Information Technology and Numerical methods fot Atul Kahate
3. Theory and problems in Numerical Methods with programs in C and C++.
4. Numerical Methods and computing by Ward Cheney and David Kincaid
5. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K.Jain,New Age International (p) Limited, Publishers, 5^{th} Edition

VII Semester

Course 16: **FLUID DYNAMICS**

Credits: 4

Course Objectives:

describe the physical properties of a fluid. calculate the pressure distribution for incompressible fluids. calculate the hydrostatic pressure and force on plane and curved surfaces. demonstrate the application point of hydrostatic forces on plane and curved surfaces.

Course Outcomes

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

1: understand the equation of continuity and general analysis of fluid motion.
2: understand the equation of motion of a fluid, Bernoulli's equation and circulation theorem.3: understand the two dimensional fluid flows and their properties.
4: understand the various deformations and equation of compatibility.

5: understand the properties of the stress, Mohr's Diagram and certain examples of stress.

UNIT-I

Kinematics of fluids, real and ideal fluids, velocity of fluid at a point, streamlines and path lines, elocity potential, velocity vector, local and particle rates of change, equation of continuity, Acceleration of fluid, conditions at a rigid boundary, General analysis of fluid motion (Chapter 2 of Text book 1)

UNIT-II:

Equation of motion of a fluid, pressure at a point in a fluid at rest and in a moving fluid, conditions at a boundary of two in viscid immiscible fluids, Euler's equations of motion, Bernoulli's equation. Discussion of the case of steady motion under conservative body forces, Vortex motion, Kelvin's circulation theorem. Some further aspects of vortex motion (Chapter3(excluding sections 3.8 to 3.11) of Text book 1).

Unit-III:

Some two - dimensional flows: Meaning of two - dimensional flow, use of cylindrical polar coordinates, the stream function, the complex potential for two – dimensional, irrotational, incompressible flow, complex potential for standard two – dimensional flows, some worked examples, two - dimensional image systems. The Milne- Thomson circle theorem, the theorem of Blasius (Chapter 5(excluding sections 5.10 to 5.12) of

Text book 1).

Unit -IV:

Analysis of strain: Deformation, affine deformation, infinitesimal affine deformation, geometrical interpretation of the components of strain, strain quadric of Cauchy, principal directions, invariants, general infinitesimal deformation, Examples of strain, equations of compatibility, finite deformations. (Chapter 1 of Text book 2)

Unit-V:

Analysis of stress, body and surface forces, stress tensor, equations of equilibrium, transformation of coordinates, stress quadric of Cauchy, Mohr's diagram, examples of stress(Chapter 2 of Text book2)

Text books:

1. Text book of Fluid Dynamics by F.Chorlton, CBS publishers and distributors, New Delhi.
2. Mathematical theory of Elasticity, by I.S.SOKOLNIKOFF 2 nd edition; Tata McGrawHill-New Delhi

Reference Book :

S.W. Yuan, Foundations of Fluid Mechanics, Prentice Hall

VII Semester

Course 17: CRYPTOGRAPHY

Credits: 4

Course Objectives :

1. Apply the fundamental concepts of cryptography
2. Describe the difference between symmetric and asymmetric cryptography
3. Define the basic requirements for cryptography
4. Identify processes to support secure protocols
5. Describe the process for implementing cryptographic systems
6. Define key management concepts.
7. Define Public Key Infrastructure
8. Identify processes for key administration and validation
9. Describe the implementation of secure protocols

Course Outcomes:

After successful completion this course, the student will be able to

1. understand Divisibility and Euclidean algorithm and congruence
2. understand about Enciphering matrices
3. understand finite fields and quadratic residues
4. understand the idea of public key cryptography understand pseudo-primes and Fermat'sfactorization

UNIT-I:ELEMENTARY NUMBER THEORY:-

Time Estimates for doing arithmetic - Divisibility and Euclidean algorithm – Congruence- Applications to factoring.(Chapter-I of the Text Book)

UNIT-II:CRYPTOGRAPHY:-

Some simple crypto systems - Enciphering matrices (Chapter-III of the Text Book)

UNIT-III:FINITE FIELDS AND QUADRATIC RESIDUES:-

Finite fields - Quadratic residues and Reciprocity (Chapter-II of the Text Book)

UNIT-IV:PUBLIC KEY CRYPTOGRAPHY:-

The idea of public key cryptography - RSA - Discrete log - Knapsack

UNIT-V:PRIMALITY AND FACTORING:-

Pseudo primes - The rho method - Fermat factorization and factor bases - The Continued fraction method - The quadratic sieve method.(Chapter-V of the Text Book)

Text Book:

Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York,2002, Second Edition.

Reference Books:

1. Niven and Zuckermann, An Introduction to Theory of Numbers (Edn. 3), Wiley EasternLtd., New Delhi, 1976.
2. David M.Burton, Elementary Number Theory, Wm C.Brown Publishers, Dubuque, Iowa,1989.
3. K.Ireland and M.Rosen, A Classical Introduction to Modern Number Theory, Springer Verlag, 1972.

VII Semester

Course 18: CODING THEORY

Credits: 4

Course Objectives:

This is a first-level graduate course on coding theory, which will introduce students to some of the classical methods in coding theory. While mathematical background on linear algebra and probability is assumed, coverage of necessary background on finite fields is included as part of the course. Through concrete examples of code construction, where simple, yet powerful mathematical tools are put to use, the course is expected to improve students' insights into the mathematical foundations.

Course Outcomes : Upon successful completion of this course, students are expected to:

1. Use algebraic techniques to construct efficient codes
2. Identify the parameters of a given code the quality of a given code.
3. State and prove the limits on achievable code performance

UNIT-I:

Basics of Coding Theory, Finite Fields, Linear Codes, Generator and Parity Check Matrices, Maximum Likelihood Decoding and Shannon's Noisy Channel Coding Theorem

UNIT-II:

Some Interesting Codes and Their Properties Repetition Codes, Hamming Codes
Cyclic Codes: Reed-Solomon Codes, BCH Codes, Quadratic Residue Codes
Binary and Ternary Golay Codes

UNIT-III:

Weight Enumerators and the MacWilliams Theorem
Self-Dual Codes and Gleason's Theorem. Counting and classifying self-dual codes

UNIT-IV:

Bounds on Codes- The Gilbert-Varshamov Bound, Hamming and Griesmer Bounds Orthogonal Polynomials and the Linear Programming Bound

Lloyd's Theorem and the Existence of Perfect Codes

UNIT-V:

Codes and Designs- The Assmus-Mattson Theorem

Connections between Lattices and Codes, Practical Coding Theory
Codes on Graphs, LDPC Codes, Iterative Decoding

Textbooks

There will be no official textbook, but there are two that I like quite a lot that cover mostofthe material.

1. MacWilliams, F. J. and Sloane, N. J. A. The theory of error-correcting codes. North- Holland Mathematical Library, Vol. 16. North-Holland Publishing Co., New York, 1977.
2. van Lint, J. H. Introduction to coding theory, Third edition. Graduate Texts in Math- ematics, 86. Springer-Verlag, Berlin, 1999.

Rererences :

1. Huffman, W. C. and Pless, V. Fundamentals of error-correcting codes. Cambridge University Press, Cambridge, 2003.
2. MacKay, D. Information theory: inference and learning algorithms. Cambridge Uni-versity Press, New York, 2003.
3. Walker, J. Codes and curves, Student Mathematical Library, 7. IAS/Park City Mathe- matical Subseries. American Mathematical Society, Providence; Institute for Advanced Study, Princeton, 2000.
4. Cameron, P. J. and van Lint, J. H. Designs, graphs, codes and their links. London Mathematical Society Students Texts, 22. Cambridge University Press, Cambridge, 1991.

VIII Semester
Course 19: GRAPH THEORY

Credits: 4

Course Objectives:

1. To introduce the fundamental concepts of graph theory
2. To Study the properties of Trees and Connectivity.
3. To explain Eulerian graphs and Hamiltonian graphs
4. To apply graph theory in diversified fields such as Electrical Engineeringcomputers science and communication networks etc

Course Outcomes :

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

1. Be familiar with the definitions and basic theory of graphs;;
2. Be able to implement standard algorithms of graph theory
3. Be able to prove simple results in graph theory.
4. Identify trees and obtain spanning trees of graphs.
5. Find Euler and Hamiltonian paths and circuits in a graph

UNIT –I :

Graphs &Subgraphs: Graphs and simple Graphs-Isomorphism-Incidence and adjacency Matrices-Sub graphs-Vertex Degrees-Paths ad connection –Cyle's- Shortest path-Problem-Sperner's Lemma

UNIT – II:

Trees: Trees-Edges and Bonds-Cut vertices, Cayley's Formula –Applications-Connected problem

UNIT – III:

Connectivity-Connectivity–Blocks-Application Construction of Reliable communications Networks.

UNIT-IV:

Euler Tours and Hamiltonian Cycles: Euler Tours – Hamilton cycles Application – Chinese Postman Problem –Travelling Salesman Problem .

UNIT V:

Matching and Augmenting paths; The marriage problem; The personnel assignment problem; The optimal Assignment problem Scope and standard as in chapters 1 to 4 " Graph Theory with application" J.A. Bondy and U.S.R. Murthy, M.C. Millan Press

Rererences :

1. Discrete Mathematics & Graph Theory, by Satyanarayana Bhavanari, K.SyamPrasad, PHI Pvt Ltd, New Delhi Second Edition,2014
2. Mathematical Foundation of Computer Science by Satyanarayana Bhavanari, T. V. Pradeep Kumar, Sk. Mohiddin Shaw, BS Publications, Hyderabad,2016.
3. Graph Theory with applications to Engineering and Computer Science –Narsingh Deo

4. First look at Graph Theory- John Clark Derek Allaw Holton.
5. Introduction to Graph Theory- Robin . J. Wilson
6. Introduction to Graph Theory- Douglas B. West
7. Graph theory with applications to engineering and computer science byNarsing Deo, PHI
8. Discrete mathematics for computer scientists and Mathematics byJ.L.Mott, A.Kandel and T.P.Baker, Prentice Hall of India

VIII Semester

Course 20: MATHEMATICAL MODELLING

Credits: 4

Course Objectives:

The main objective of this course is to provide an introduction to modelling and simulation nd how to model, solve and interpret real life problems using different Mathematical perspectives.

Course Outcomes:

After successful completion of the course, students will be able to understand concept of modelling and simulation construct mathematical models of real world problems

solve the mathematical models using mathematical techniques

UNIT –I

Mathematical modeling through ordinary differential equations of first order .

UNIT-II

Mathematical Modeling through system of ordinary differential equations of first order

UNIT: III

Mathematical Modeling through ordinary differential equations of second order

UNIT IV :

Mathematical Modeling through difference equations : Basic Theory of Linear Difference Equations with constant coefficients- Mathematical Modeling through difference equations in Economics and Finance- Mathematical Modeling through difference Equations in Population Dynamics and Genetics.

UNIT-V:

Mathematical Modeling Through partial Differential Equations : mass-Balance Equations Momentum Balance Equations.

Scope and standard as in Chapter 2, Chapter 3, Chapter 4, sections 5.2 to 5.4 Chapters 5 and Sections 6.2 and 6.3 of Chapters 6 in " Mathematical Modelling" by J.N. Kapur, Wiley Eastern Limited(1988)

References : 1. Mathematical Modeling –Applications, Issues and analysis – by Vimal K Mishra, ANE Book Publishers –New Delhi

2. Mathematical Modeling by Meerscharet M. Elsevier India Pvt Ltd.

VIII Semester

Course 21: CLASSICAL MECHANICS

Credits: 4

Course Objectives:

i. This course is intended to provide a treatment of basic knowledge in mechanics usedin deriving a range of important results and problems related to rigid bodies.

ii. The objective is to provide the student the classical mechanics approach to solve amechanical problem.

iii. To enable the students to acquire knowledge of Mechanics. Also to understand the concepts of Lagrange's Equation and Hamiltonian Principle.

Course Outcomes:

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

1. identify the basic concepts of mechanics and also learn applications of Lagrangianformulation.
2. Understand derivation of Lagrange's equations from Hamilton's principle and advantages of variational principle formulation
3. Understand the simplistic approach to canonical transformations,
4. Understand Poisson and Lagrange brackets and their invariance and the Hamilton JacobiEquations for Hamilton's principal function
5. Understand special theory of relativity, Lorentz transformation and contractions andLorentz transformations

Unit-I

Lagrangian Formulation:

Mechanics of a particle, mechanics of a system of particles, constraints, generalized coordinates generalized velocity, generalized force and potential. D'Alembert's principle and Lagrange's equations, some applications of Lagrangian formulation (scope and treatment as in Art.1.1 to 1.4 and Art 1.6 of Text book.1).

Unit-II

Hamilton's principle to non-holonomic systems

Hamilton's principle, derivation of Lagrange's equations from Hamilton's principle, extension of Hamilton's principle to non-holonomic systems, advantages of variational principle formulation, conservation theorems and symmetry properties (scope and treatment as in Art 2.1 and 2.3 to 2.6 of Text book.1).

Unit-III

Hamiltonian formulation:

Legendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorems, derivation of Hamilton's equations from a vibrational principle, the principle of least action, the equation of canonical transformation, examples of canonical transformation, the Harmonic Oscillator, the simplistic approach to canonical transformations (scope and treatment as in Art.8.1,8.2,8.5, 8.6 and 9.1 to 9.4 of Text book.1).

Unit-IV

Canonical transformations:

Poisson and Lagrange brackets and their invariance under canonical transformation. Jacobi'sidentity; Poisson's Theorem. Equations of motion infinitesimal canonical transformation in the Poisson bracket formulation. Hamilton Jacobi Equations for Hamilton's principal function, The harmonic oscillator problem as an example of the Hamilton – Jacobi method, the Hamilton – Jacobi equation for Hamilton's characteristic function (scope and treatment asin Art 9.5, 9.6, 10.1, 10.2 and 10.3 of Text book.1)

Unit-V

Lorentz transformation equations:

New concept of space and Time, postulates of special theory of relativity, Lorentz transformation equations, Lorentz contraction, Time dilation, simultaneity, Relativistic formulae for composition of velocities and accelerations, proper time, Lorentz transformations form a group (scope and treatment as in chapters 1 and 2 of Text book.2).

Text books:

Classical mechanics by H.Goldstein, 2nd edition, Narosa Publishing House. Relevant topics from Special relativity by W.Rindler, Oliver & Boyd, 1960.

Reference Book :

J.C. Upadhyaya, Classical Mechanics, Himalaya Publishing House.