PROGRAMME: THREE-YEAR

B.Sc - Mathematics, Physics, Computer Science

SYLLABUS & REGULATIONS

(with effect from the batch admitted in the academic year 2026-27)

CHOICE BASED CREDIT SYSTEM (CBCS) Regulations-2016

Dr B.R. Ambedkar Open University

Eluru - Andhra Pradesh, India

www.drbraouap.org

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PROGRAMME: Three-Year B.Sc

(with effect from the batch admitted in the academic year 2026-27)

CHOICE BASED CREDIT SYSTEM (CBCS) Regulations-2016

B.Sc - Mathematics, Physics, Computer Science

EMESTER – I

Sl.No.	Course	Name of the Subject	Total Marks	Mid Sem	Sem End	Teaching Hours	Credits
1.	First Language	English	100	25	75	4	3
2.	Second Language	Telugu	100	25	75	4	3
3.	Skill Skills		50	---	50	2	2
4.	Skill Development Courses		50	---	50	2	2
5.	1M	Differential Equations	100	25	75	5	4
6.	1P	Mechanics, Waves and Oscillations	100	25	75	5	4
7.	1CS	Problem Solving in 'C'	100	25	75	5	4
		Total	**600**	**125**	**475**	**27**	**22**

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – II

Sl.No.	Course	Name of the Subject	Total Marks	Mid Sem	Sem End	Teaching Hours	Credits
1.	First Language	English	100	25	75	4	3
2.	Second Language	Telugu	100	25	75	4	3
3.	Skill Skills		50	---	50	2	2
4.	Skill Development Courses -1		50	---	50	2	2
	Skill Development Courses -2		50	---	50	2	2
5.	2M	Three Dimensional Analytical Solid Geometry	100	25	75	5	4
6.	2P	Wave Optics	100	25	75	5	4
7.	2CS	Data Structures using C	100	25	75	5	4
		Total	**650**	**125**	**525**	**29**	**24**

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B.Sc - Mathematics, Physics, Computer Science

SEMESTER – III

Sl.No.	Course	Name of the Subject	Total Marks	Mid Sem	Sem End	Teaching Hours	Credits
1.	First Language	English	100	25	75	4	3
2.	Second Language	Telugu	100	25	75	4	3
3.	Skill Skills - 1		50	---	50	2	2
	Skill Skills - 2		50	---	50	2	2
4.	Skill Development Courses		50	---	50	2	2
5.	3M	Abstract Algebra and Real Analysis	100	25	75	5	4
6.	3P	Electricity, Magnetism and Electronics	100	25	75	5	4
7.	3CS	Database Management Systems	100	25	75	5	4
		Total	**650**	**125**	**525**	**29**	**24**

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – IV

Sl.No.	Course	Name of the Subject	Total Marks	Mid Sem	Sem End	Teaching Hours	Credits
1.	4M1	Linear Programming	100	25	75	5	4
2.	4M2	Mathematics - **Elective**	100	25	75	5	4
3.	4P1	Modern Physics	100	25	75	5	4
4.	4P2	Physics - **Elective**	100	25	75	5	4
5.	4CS1	JAVA Programming	100	25	75	5	4
6.	4CS2	CS-**Elective**	100	25	75	5	4
		Total	**600**	**150**	**450**	**30**	**24**

Dr B.R. Ambedkar Open University

Eluru - Andhra Pradesh, India

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – I

Paper 1M: Differential Equations

Course Outcomes:

At the end of this course, the student will be able to

1. convert separable and homogeneous equations to exact differential equations by using integrating factors.
2. solve higher-order linear differential equations.
3. understand the concept and apply appropriate methods for solving differential equations.
4. get awareness and skills to apply the differential equations in various fields.

UNIT – I (12 Hours)

Differential Equations of first order and first degree :

Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors; Change of Variables.

UNIT – II (12 Hours)

Orthogonal Trajectories

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

Equations solvable for *p*; Equations solvable for *y*; Equations solvable for *x*; Equations that do not contain.x (or y); Equations of the first degree in *x* and *y* – Clairaut's Equation.

UNIT – III (12 Hours)

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. $\frac{1}{f(D)}$ is Expressed as partial fractions.

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 cosax.

UNIT – IV (12 Hours)

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 = $e^{ax}V$

P.I. of f(D)y = Q when Q = xV

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

UNIT –V (12 Hours)

Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

Text Book :

Differential Equations and Their Applications by ZafarAhsan, published by Prentice-Hall of India Learning Pvt. Ltd.New Delhi-Second edition.

Reference Books :

1. A text book of Mathematics for B.A/B.Sc, Vol 1, by N. Krishna Murthy & others, published by S.Chand& Company, New Delhi.
2. Ordinary and Partial Differential Equations by Dr. M.D,Raisinghania, published by S. Chand & Company, New Delhi.
3. Differential Equations with applications and programs – S. BalachandraRao& HR Anuradha-Universities Press.
4. Differential Equations -SrinivasVangala&Madhu Rajesh, published by Spectrum University Press

PAPER - IP:Mechanics, Waves and Oscillations

Course Outcomes

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

Understand the Newton's laws of motion and the law of conservation of linear momentum and its application to rocket motion, the concepts of concepts of impact parameter, scattering cross section and Distinguish between elastic and inelastic collisions.

Formulate the rotational kinematic relations, learn the working principle of gyroscope and its applications and explain the precessional motion of a freely rotating symmetric top.

Analyse the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.

State the postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.

Understand the phenomena of simple harmonic motion and the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.

State the laws of transverse vibrations in a stretched string and their verification using a sonometer and learn the formation of harmonics and overtones in a stretched string.

Acquire knowledge on Ultrasonic waves, their production and detection and their applications in different fields.

Unit-I: Mechanics of Particles

Mechanics of Particles

Review of Newton's Laws of Motion, Conservation of linear momentum, Collisions, Elastic and inelastic collisions, Collisions in one and two dimension, Rocket propulsion, Impact parameter, Scattering cross-section, Rutherford scattering (No derivation-Qualitative ideas only)

Mechanics of Rigid body

Rigid body, Rotational kinematic relations, Rotational kinetic energy and moment of inertia, Angular momentum, Torque, Relation between torque and angular momentum, Conservation of angular momentum, Illustrations, Gyroscopic motion (No derivation - Qualitative ideas only), Precession of the equinoxes.

Unit-II: Central forces

Central force-Definition& examples, General Characteristics of Central forces, Conservative nature of central forces, Planetary motion-Kepler's laws (Statements & Explanation), Deduction of Newton's law of gravitation from Kepler's law, Geostationary Satellite Motion, Uses of communication satellites, Basic idea of Global Positioning System (GPS) and their applications.

Unit-III: Relativistic Mechanics

Inertial and Non-inertial reference frames-Galilean relativity; Special theory of relativity-Statements of the two basic postulates- (Elementary treatment and application only) Lorentz transformation equations (No derivations); length contraction; time dilation; addition of velocities; Einstein's mass - energy equation

Unit-IV: Undamped, Damped and Forced Oscillations

Simple harmonic motion, Characteristics of SHM, Equation of motion and solution, Combination of Simple harmonic motions along a line and perpendicular to each other-Lissajous figures& uses, Damped vibrations: Explanation and examples, Distinction between damped and undamped vibrations, Forced vibrations: Explanation and examples, Resonance, examples – Sharp resonance and Flat resonance, Sharpness of resonance, Q-factor, Volume Resonator- Determination of frequency of a given tuning fork.

Unit-V: Wave Motion

Progressive waves-Equation of a progressive wave, Velocity of transverse waves in elastic media, Standing waves, overtones and harmonics, Sonometer-Verification of laws of transverse vibrations in a stretched string, Phenomenon of beats (qualitative ideas only).

Ultrasonics

Ultrasonics, properties, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, Applications of ultrasonic waves.

REFERENCE BOOKS:

- B. Sc. Physics, Vol.1, Telugu Academy, Hyderabad
- Fundamentals of Physics Vol. I - Resnick, Halliday, Krane ,Wiley India 2007
- College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya PublishingHouse.
- University Physics-FW Sears, MW Zemansky& HD Young,Narosa Publications, Delhi
- Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003.
- Waves and Oscillations. N. Subramanyam and Brijlal, VikasPulications.
- Unified Physics - Waves and Oscillations, Jai PrakashNath&Co.Ltd.
- Waves & Oscillations. S.Badami, V. Balasubramanian and K.R.Reddy, Orient Longman.
- The Physics of Waves and Oscillations, N.K.Bajaj, Tata McGraw Hill
- Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004

PAPER - 1CS:Problem Solving in 'C'

Outcomes

Upon successful completion of the course, a student will be able to:

1. Understand the evolution and functionality of a Digital Computer.
2. Apply logical skills to analyse a given problem.
3. Develop an algorithm for solving a given problem.
4. Understand 'C' language constructs like Iterative statements, Array processing, Pointers, etc.
5. Apply 'C' language constructs to the algorithms to write a 'C' language program.

Unit-I

General Fundamentals: Introduction to computers: Block diagram of a computer, characteristics and limitations of computers, applications of computers, types of computers, computer generations.

Introduction to Algorithms and Programming Languages: Algorithm - Key features of Algorithms, Flow Charts, Programming Languages - Generations of Programming Languages - Structured Programming Language- Design and Implementation of Correct, Efficient and Maintainable Programs.

Unit-II

Introduction to C: Introduction - Structure of C Program - Writing the first C Program - File used in C Program - Compiling and Executing C Programs - Using Comments - Keywords - Identifiers - Basic Data Types in C - Variables - Constants - I/O Statements in C - Operators in C - Programming Examples.

Decision Control and Looping Statements: Introduction to Decision Control Statements - Conditional Branching Statements - Iterative Statements - Nested Loops - Break and Continue Statement - Goto Statement

Unit-III

Arrays: Introduction - Declaration of Arrays - Accessing elements of the Array - Storing Values in Array - Operations on Arrays - one dimensional, two dimensional and multi dimensional arrays, character handling and strings.

Unit-IV

Functions: Introduction - using functions - Function declaration/ prototype - Function definition - function call - return statement - Passing parameters - Scope of variables - Storage Classes - Recursive functions.

Structure, Union, and Enumerated Data Types: Introduction - Nested Structures - Arrays of Structures - Structures and Functions - Union - Arrays of Unions Variables - Unions inside Structures - Enumerated Data Types.

Unit-V

Pointers: Understanding Computer Memory - Introduction to Pointers - declaring Pointer Variables - Pointer Expressions and Pointer Arithmetic - Null Pointers - Passing Arguments to Functions using Pointer - Pointer and Arrays - Memory Allocation in C Programs - Memory Usage - Dynamic Memory Allocation - Drawbacks of Pointers

Files: Introduction to Files - Using Files in C - Reading Data from Files - Writing Data to Files - Detecting the End-of-file - Error Handling during File Operations - Accepting Command Line Arguments.

REFERENCE BOOKS:

1. Programming for Problem Solving in 'C' by Dr. P. Santosh Kumar Patra, Amaravathi Publishers

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – II

Paper 2M :Three Dimensional Analytical Solid Geometry

Course Outcomes:

At the end of this course, the student will be able to

1.get the knowledge of planes.

2. basic idea of lines, sphere and cones.

3. understand the properties of planes, lines, sphere and cones.

4.express the problems geometrically and then to get the solution.

UNIT – I (12 Hours)

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, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

UNIT – II (12 hrs)

The Line :

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

UNIT – III (12 hrs)

The Sphere :

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;

UNIT – IV (12 hrs)

The Sphere and Cones :

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified from of the equation of two spheres.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone;

UNIT – V (12 hrs)

Cones :

Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

Text Book :

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand &Company Ltd. 7th Edition.

Reference Books :

1. A text book of Mathematics for BA/B.ScVol 1, by V Krishna Murthy & Others, published by S. Chand & Company, New Delhi.
2. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by 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. Solid Geometry by B.RamaBhupal Reddy, Published by Spectrum University Press.

Paper 2P: - Wave Optics

Unit-I: Aberrations

Introduction - monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet.Removal of chromatic aberration of a separated doublet.Achromatism for two lenses (i)in contact and (ii) separated by a distance.

Unit-II: Interference of Light

Principle of superposition - coherence-temporal coherence and spatial coherence-conditions for interference of light. Interference by division of wave front: Fresnel's biprism-determination of wavelength of light. Determination of thickness of a transparent material using Biprism, change of phase on reflection, Lloyd's mirror experiment. Interference by division of amplitude: Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (cosine law) colors of thin films- Non-reflecting films, Interference by a plane parallel illuminated by a point source-Interference by a film with two non-parallel reflecting surfaces (Wedge shaped film). Determination of diameter of wire, Newton's rings in reflected light with and without contact between lens and glass plate, Newtons's rings in transmitted light (Haidinger Fringes)-Determination of wavelength of monochromatic light using Newton's rings and Michelson Interferometer. Types of fringes-Determination of wavelength of monochromatic light, Difference in wavelength of Sodium D1, D2 lines and thickness of a thin transparent plate.

Unit-III: Diffraction of Light

Introduction, distinction between Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction – Diffraction due to single slit and Circular aperture-Limit of Resoultion-Fraunhoffer diffraction due to double slit-Fraunhoffer diffraction pattern with N slits (diffraction grating). Resolving power of grating, Determination of wavelength of light in normal and oblique incidence methods using and minimum deviation methods using diffraction grating.

Fresnel's Diffraction: Fresnel's half period zones-area of the half period zones-zone plate-comparison of zone plate with convex lens-phase reversal zone plate, diffraction at a straight edge-difference between interference and diffraction.

Unit-IV: Polarisation of Light

Polarized light: Methods of polarization polarization by reflection, refraction, double refraction, selective absorption scattering of light-Brewster's law-Mauls law-Nicol prism polarizer and analyzer-Refraction of plane wave incident on negative and positive crystals (Huygen's explanation)-Quarter wave plate, Half wave plate-optical activity, determination of specific rotation by Laurent's half shade polarimeter-Babinet's compensator - idea of elliptical and circular polarization

Unit-V: Lasers and Holography

Lasers: Introduction, spontaneous emission, stimulated emission. Population Inversion, Laser principle-Einstein coefficients-Types of lasers-He-Ne laser, Ruby laser- Applications of lasers.

Holography: Basic principle of holography-Gabor hologram and its limitations, Applications of holography.

Unit-6: Fiber Optics

Introduction- optical fibers, different types of fibers, Step and graded index fibers, rays and modes in an optical fiber, fiber material, principles of fiber communication (qualitative treatment only), advantages of fiber optic communication.

Paper 2CS:Data Structures using C

Learning outcomes of Course

Upon successful completion of the course, a student will be able to:

1. Understand available Data Structures for data storage and processing.
2. ComprehendData Structure and their real-time applications - Stack, Queue, Linked List, Trees and Graph.
3. Choose a suitable Data Structures for an application.
4. Develop ability to implement different Sorting and Search methods.
5. Have knowledge onData Structures basic operations like insert, delete, search,update and traversal.
6. Design and develop programs using various data structures.
7. Implement the applications of algorithms for sorting, pattern matching etc.

Unit-I

Introduction to Data Structures: Introduction to the Theory of Data Structures, Data Representation, Abstract Data Types, Data Types, Primitive Data Types, Data Structure and Structured Type, Atomic Type, Difference between Abstract Data Types, Data Types, and Data Structures, Refinement Stages

Principles of Programming and Analysis of Algorithms: Software Engineering, Program Design, Algorithms, Different Approaches to Designing an Algorithm, Complexity, Big 'O' Notation, Algorithm Analysis, Structured Approach to Programming, Recursion, Tips and Techniques for Writing Programs in 'C'

Unit-II

Arrays: Introduction to Linear and Non- Linear Data Structures, One- Dimensional Arrays, Array Operations, Two- Dimensional arrays, Multidimensional Arrays, Pointers and Arrays, an Overview of Pointers

Linked Lists: Introduction to Lists and Linked Lists, Dynamic Memory Allocation, Basic Linked List Operations, Doubly Linked List, Circular Linked List, Atomic Linked List, Linked List in Arrays, Linked List versus Arrays

Unit-III

Stacks: Introduction to Stacks, Stack as an Abstract Data Type, Representation of Stacks through Arrays, Representation of Stacks through Linked Lists, Applications of Stacks, Stacks and Recursion.

Queues: Introduction, Queue as an Abstract data Type, Representation of Queues, Circular Queues, Double Ended Queues- Deques, Priority Queues, Application of Queues

UnitIV

Binary Trees: Introduction to Non- Linear Data Structures, Introduction Binary Trees, Types of Trees, Basic Definition of Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Operations on a Binary Search Tree, Binary Tree Traversal, Counting Number of Binary Trees, Applications of Binary Tree

Unit-V

Searching and sorting: Sorting - An Introduction, Bubble Sort, Insertion Sort, Merge Sort, Searching - An Introduction, Linear or Sequential Search, Binary Search, Indexed Sequential Search

Graphs: Introduction to Graphs, Terms Associated with Graphs, Sequential Representation of Graphs, Linked Representation of Graphs, Traversal of Graphs, Spanning Trees, Shortest Path, Application of Graphs.

REFERENCE BOOKS:

1. Data Structures using C by Dr. P. Santosh Kumar Patra, S International Publisher, Hyd

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – III

Paper 3M : Abstract Algebra and Real Analysis

UNIT - I

GROUPS : Binary operations-Definitions and properties, Groups-Definition and elementary properties, Finite groups and group composition tables, Subgroups and cyclic subgroups. Permutations-Functions and permutations ,groups of permutations, cycles and cyclic notation, even and odd permutations, The alternating groups. Cyclic groups - Elementary properties ,The classification of cyclic groups , sub groups of finite cyclic groups. Isomorphism - Definition and elementary properties, Cayley's theorem, Groups of cosets, Applications, Normal subgroups - Factor groups , Criteria for the existence of a coset group, Inner automorphisms and normal subgroups, factor groups and simple groups, Homomorphism- Definition and elementary properties, The fundamental theorem of homomorphisms, applications.

UNIT - II

RINGS: Definition and basic properties, Fields, Integral domains, divisors of zero and Cancellation laws, Integral domains, The characteristic of a ring, some non – commutative rings, Examples, Matrices over a field, The real quaternions ,Homomorphism of Rings - Definition and elementary properties, Maximal and Prime ideals, Prime fields. Rings of Polynomials – Polynomials in an indeterminate form, The evaluation of homomorphism.

UNIT – III

REAL NUMBERS: The Completeness Properties of R, Applications of the Supremum Property.

Sequences and Series - Sequences and their limits, limit theorems, Monotonic Sequences, Sub-sequences and the Bolzano-Weirstrass theorem,The Cauchy's Criterion, Properly divergent sequences, Introduction to series, Absolute convergence, test for absolute convergence, test for non-absolute convergence.

Continuous Functions-continuous functions, combinations of continuous functions, continuous functions on intervals, Uniform continuity.

UNIT – IV

DIFFERENTIATION AND INTEGRATION: The derivative, The mean value theorems, L'Hospital Rule, Taylor's Theorem.Riemann integration - Riemann integral, Riemann integrable functions, Fundamental theorem.

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Paper 3P: Electricity, Magnetism and Electronics

Unit – I **23 hrs**

1. Electrostatics (10 periods)

Gauss law and its applications-Uniformly charged sphere, charged cylindrical conductor and an infinite conducting sheet of charge. Deduction of Coulmb's law from Gauss law Mechanical force on a charged conductor Electric potential Potential due to a charged spherical conductor, , electric field strength from the electric dipole and an infinite line of charge. Potential of a uniformly charged circular disc.

2. Dielectrics (5 periods)

An atomic view of dielectrics, potential energy of a dipole in an electric field. Polarization and charge density, Gauss's law for dielectric medium Relation between D,E, and P. Dielectric constant, susceptibility and relation between them.Boundary conditions at the dielectric surface. Electric fields in cavities of a dielectric-needle shaped cavity and disc shaped cavity.

3. Capacitance (8 periods)

Capacitance of concentric spheres and cylindrical condenser, capacitance of parallel plate condenser with and without dielectric. Electric energy stored in a charged condenser – force between plates of condenser, construction and working of attracted disc electrometer, measurement of dielectric constant and potential difference.

Unit – II

1. Magnetostatics (6 periods)

Magnetic shell potential due to magnetic shell field due to magnetic shell equivalent of electric circuit and magnetic shell Magnetic induction (B) and field (H) permeability and susceptibility Hysteresis loop.

2. Moving charge in Electric and Magnetic Field (8 periods)

Hall effect, cyclotron, synchrocyclotron and synchrotron force on a current carrying conductor placed in a magnetic field, force and torque on a current loop, BiotSavart's law and calculation of B due to long straight wire, a circular current loop and solenoid.

3. Electromagnetic Induction (10 periods)

Faraday's law Lenz's law expression for induced emf time varying magnetic fields Betatron Ballistic galvanometer theory damping correction self and mutual inductance, coefficient of coupling, calculation of self inductance of a long solenoid toroid energy stored in magnetic field transformer Construction, working, energy losses and efficiency.

Unit – III

1. Varying and Alternating Currents (10 periods)

Growth and decay of currents in LR, CR and LCR circuits Critical damping. Alternating current relation between current and voltage in pure R,C and L-vector diagrams Power in ac circuits. LCR series and parallel resonant circuit Q-factor. AC & DC motors-single phase, three phase (basics only).

2. Maxwell's Equations and Electromagnetic Waves (10 periods)

A review of basic laws of electricity and magnetism displacement current Maxwell's equations in differential form Maxwell's wave equation, plane electromagnetic waves Transverse nature of electromagnetic waves, Poynting theorem, production of electromagnetic waves (Hertz experiment)

Unit – IV

1. Basic Electronics (15 periods)

Formation of electron energy bands in solids, classification of solids in terms of forbidden energy gap. Intrinsic and extrinsic semiconductors, Fermi level, continuity equation p-n junction diode, Zener diode characteristics and its application as voltage regulator. Half wave and full wave rectifiers and filters, ripple factor (quantitative) p n p and n p n transistors, current components in transistors, CB,CE and CC configurations transistor hybrid parameters determination of hybrid parameters from transistor characteristics transistor as an amplifier concept of negative feed back and positive feed backBarkhausen criterion, RC coupled amplifier and phase shift oscillator (qualitative).

2. Digital Principles (8 periods)

Binary number system, converting Binary to Decimal and vice versa.Binary addition and subtraction (1's and 2's complement methods).Hexadecimal number system.Conversion from Binary to Hexadecimal – vice versa and Decimal to Hexadecimal vice versa.

Logic Gates: OR,AND,NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive OR gate, De Morgan's Laws statement and proof, Half and Full adders. Parallel adder circuits.

NOTE: Problems should be solved from every chapter of all units.

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Paper 3CS: Database Management Systems

Course Objective:

Design & develop database for large volumes & varieties of data with optimized dataprocessing techniques.

Course Outcomes

On completing the subject, students will be able to:

1. Design and model of data in database.
2. Store, Retrieve data in database.

UNIT I

Overview of Database Management System: Introduction, file-based system, Drawbacksof file-Based System ,Data and information, Database, Database management System,Objectives of DBMS, Evaluation of Database management System, Classification ofDatabase Management System, DBMS Approach, advantages of DBMS, data models,Components and Interfaces of Database Management System. Database Architecture,Situations where DBMS is not Necessary.

UNIT II

Entity-Relationship Model: Introduction, the building blocks of an entity relationshipdiagram, classification of entity sets, attribute classification, relationship degree, relationshipclassification, reducing ER diagram to tables, enhanced entity-relationship model (EERmodel), generalization and specialization, IS A relationship and attribute inheritance,multiple inheritance, constraints on specialization and generalization, aggregation andcomposition, entity clusters, connection types, advantages of ER modelling.

UNIT III

Relational Model: Introduction, CODD Rules, relational data model, concept of key,relational integrity, relational algebra, relational algebra operations, advantages of relationalalgebra, limitations of relational algebra, relational calculus, tuple relational calculus, domainrelational Calculus (DRC). QBE

UNIT IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL,Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation,Aggregate functions, Data Manipulation Language, Table Modification Commands, TableTruncation, Imposition of Constraints, Join Operation, Set Operation,View, Sub Query, Embedded SQL,

UNIT V

PL/SQL: Introduction, Shortcoming in SQL, Structure of PL/SQL, PL/SQL LanguageElements, Data Types, Operators Precedence, Control Structure, Steps to Create aPL/SQL, Program, Iterative Control, Cursors, Steps to create a Cursors, Procedure,Function, Packages, Exceptions Handling, Database Triggers, Types of Triggers.

Reference Books

1. "Database System Concepts" by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill, 2010, 9780073523323
2. "Database Management Systems" by Raghu Ramakrishnan, McGrawhill, 2002,
3. Database Management Systems by Dr. P. Santosh Kumar Patra, Spectrum Techno Press
4. Fundamentals of Relational Database Management Systems by S. Sumathi, S. Esakkirajan, Springer Publications
5. "An Introduction to Database Systems" by Bipin C Desai
6. "Principles of Database Systems" by J. D. Ullman
7. "Fundamentals of Database Systems" by R. Elmasri and S. Navathe

B.Sc - Mathematics, Physics, Computer Science

SEMESTER – IV

Paper 4M1: Linear Programming

Unit-1

Linear Programming Problem: Convex Set, Extreme Points of convex set,Convex combination, Convex hull, Convex polyhedron, Fundamental theorem of linear programming, Definition, Formulation of linear programming (LPP), Graphical solution of linear programming problems, General formulation of Lp problems, Standard form and matrix form of LP problems.

Unit-2

Simplex Method: Introduction, Definitions and notations, Computational procedure of simplex algorithm, Simple way for simplex computations, Artificial variables, Two-phase method, Alternative method of two –phase simplex method, Big-M method, Degeneracy in LPP and method to solve to resolve degeneracy, Alternative solutions, Unbounded solutions, Non-existing feasible solutions, Solutions of simultaneous equations by simplex method

Unit-3

Duality in Linear Programming and Dual Simplex Method: Introduction**,**Definition of Dual problems, General rules for converting any primal into its Dual ,Relation between the solution of primal and Dual problem, Initial Solution for Dual Simplex Method, Dual Simplex Method.

Unit-4

Assignment Problems: Introduction, Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Method for solving Assignment problem, Unbalanced assignment problem,The traveling salesman problem, Formulation of travelling salesman problem as an Assignment problem and Solution procedure

Unit-5

Transportation Problems

Mathematical formulation of Transportation problem,TabularRepresentation,Definitions, Special structure of the solution, North-west corner rule, Lowest cost entry method, Vogel's approximation method, Optimality in transportation Problem,Degeneracy in transportation problems Resolution of degeneracy, Unbalanced transportation problem, Generalized transportation problem.

Paper 4P1: Modern Physics

Unit – I **25 hrs**

Atomic Spectra: Introduction Drawbacks of Bohr's atomic model Sommerfeld's elliptical orbits relativistic correction (no derivation). Stern &Gerlach experiment Vector atom model and quantum numbers associated with it. L-S and j-j coupling schemes. Spectral terms, selection rules, intensity rules.Spectra of alkali atoms, doublet fine structure. Alkaline earth spectra, singlet and triplet fine structure. Zeeman Effect, Paschen-Back Effect and Stark Effect (basic idea).

Molecular Spectroscopy: Types of molecular spectra, pure rotational energies and spectrum of diatomic molecule, determination of internuclear distance. Vibrational energies and spectrum of diatomic molecule. Raman effect, Classical theory of Raman effect. Experimental arrangement for Raman effect and its applications.

Unit – II **25 hrs**

Quantum Mechanics

Inadequacy of classical Physics: (Discussion only): Spectral radiation Planck's law. Photoelectric effect Einstien's photoelectric equation. Compton's effect (quantitative) experimental verification. Stability of an atom Bohr's atomic theory.Limitations of old quantum theory.

Matter Waves:de Broglie's hypothesis wavelength of matter waves, properties of matter waves. Phase and group velocities. Davisson and Germer experiment. Double slit experiment. Standing de Brogile waves of electron in Bohr orbits.

Uncertainty Principle: Heisenberg's uncertainty principle for position and momentum (x and p_X), Energy and time (E and t). Gamma ray microscope. Diffraction by a single slit. Position of electron in a Bohr orbit.Particle in a box.Complementary principle of Bohr.

Schrodinger Wave Equation: Schrodinger time independent and time dependent wave equations. Wave function properties Significance.Basic postulates of quantum mechanics. Operators, eigen functions and eigen values, expectation values. Application of Schrodinger wave equation to particle in one and three dimensional boxes, potential step and potential barrier.

Unit – III **15 hrs**

Nuclear Physics

Nuclear Structure: Basic properties of nucleus size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment. Binding energy of nucleus, deuteron binding energy, p-p and n-p scattering (concepts), nuclear forces. Nuclear models liquid drop model, shell model.

Alpha and Beta Decays: Range of alpha particles, Geiger Nuttal law. Gammow's theory of alpha decay.Geiger Nuttal law from Gammow's theory.Beta spectrum neutrino hypothesis, Fermi's theory of b-decay (qualitative).

Nuclear Reactions: Types of nuclear reactions, channels, nuclear reaction kinematics. Compound nucleus, direct reactions (concepts).

Nuclear Detectors : GM counter, proportional counter, scintillation counter, Wilson cloud chamber and solid state detector.

Unit – IV **25 hrs**

Solid State Physics

Crystal Structure: Crystalline nature of matter. Cystal lattice, Unit Cell, Elements of symmetry.Crystal systems, Bravais lattices.Miller indices. Simple crystal structures (S.C., BCC, CsCl, FCC, NaCl diamond and Zinc Blends)

X-ray Diffraction: Diffraction of X –rays by crystals, Bragg's law, Experimental techniques - Laue's method and powder method.

Nanomaterials: Introduction, nanoparticles, metal nanoclusters, semiconductor nanoparticles, carbon clusters, carbon nanotubes, quantum nanostructuresnanodot, nanowire and quantum well. Fabrication of quantum nanostructures.

Bonding in Crystals: Types of bonding in crystals characteristics of crystals with different bindings. Lattice energy of ionic crystals determination of Medelung constant for NaCl crystal, calculation of Born coefficient and repulsive exponent. Born Haber cycle.

Magnetism: Magnetic properties of dia, para and ferromagnetic materials. Langevin's theory of paramagnetism.Weiss' theory of ferromagnetism –Concepts of magnetic domains, antiferromagnetism and ferrimagnetism ferrites and their applications.

Super Conductivity

Basic experimental facts zero resistance, effect of magnetic field, Meissner effect, persistent current, Isotope effect Thermodynamic properties, specific heat, entropy. Type I and Type II superconductors.

Elements of BCS theory-Cooper pairs.Applications. High temperature superconductors (general information)

NOTE: Problems should be solved from every chapter of all units.

Paper 4CS1: JAVA Programming

Unit-1

Introduction to OOP, Procedural Programming Language and Object Oriented Language, principles of OOP, Applications of OOP, History of JAVA, JAVA features, JVM, program Structure. Variables, Primitive Data Types, Identifiers, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control.Classes and Objects, Class declaration, Creating Objects, Methods, Method Overloading.

Unit-II

Constructor, Overloading, Garbage Collector, Importance of Static Keyword and this keywords, Examples, Arrays, Command Line Arguments, Nested Classes.

Inheritance & Polymorphism: Basic concepts of Inheritance, Member access, forms of inheritance-specialization, specification, construction, extenssion, limitation, combination, benefits of inheritance, Relationship, Creating Multilevel Hierarchy, super uses, using final with Inheritance, Polymorphism, Runtime polymorphism, pure polymorphism, method overriding, abstract classes & Methods, Object class

Packages: Defining a Package, PATH, CLASSPATH, Difference between PATH and CLASS PATH, Access protection, importing packages.

Unit-III

Interfaces: Defining an interface, implementing interfaces, Nested interfaces, variables in interfaces and extending interfaces, Multiple inheritances of interfaces, Difference between Abstract class & Interfaces.

Exception handling: Fundamentals of exception handing, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception sub classes.

Multithreading: Thread Introduction, Differences between thread-based multitasking and process-based multitasking, Thread life cycle, creating threads using Thread class and Runnable Interface, Thread Priorities, synchronizing threads, inter thread communication.

Unit-IV

Files: Reading data from files and writing data to files, Random Access File

Applet: Applet class, Applet structure, Applet life cycle, Sample Applet programs. Event handling: Event delegation model, Sources of event, Event Listeners, Adapter classes, Inner classes.

Reference Books

1. Complete ReferenceJava Programmingwith OOPs Concepts by Dr. P. Santosh Kumar Patra, Surneni International Book Publishers, Hyd