**BCA-I (Sem-Ist)**

**B23-CAP-103 Logical Organization of Computer (Theory and Practical)**

**Lesson Plan (2025-26)**

**Month of July**

Number Systems: Binary, Octal, Hexadecimal etc. Conversions from one number system to another, BCD Number System.

**Month of August**

BCD Codes: Natural Binary Code, Weighted Code, Self Complimenting Code, Cyclic Code. Error Detecting and Correcting Codes. Character representations: ASCII, EBCDIC and Unicode. Number Representations: Integer numbers - sign-magnitude, 1’s &amp; 2’s complement representation. Real Numbers normalized floating point representations.

**Month of September**

Binary Arithmetic: Binary Addition, Binary Subtraction, Binary Multiplication, Binary Division using 1’s and 2’s Compliment representations, Addition and subtraction with BCD representations. Boolean Algebra: Boolean Algebra Postulates, basic Boolean Theorems, Boolean Expressions, Boolean Functions, Truth Tables, Canonical Representation of Boolean Expressions: SOP and POS, Simplification of Boolean Expressions using Boolean Postulates &amp; Theorems, Kaurnaugh-Maps (upto four variables), Handling Don’t Care conditions.

**Month of October**

Logic Gates: Basic Logic Gates – AND, OR, NOT, Universal Gates – NAND, NOR, Other Gates – XOR, XNOR etc. Their symbols, truth tables and Boolean expressions. Combinational Circuits: Design Procedures, Half Adder, Full Adder, Half Subtractor, Full Subtracor, Multiplexers, Demultiplexers, Decoder, Encoder, Comparators, Code Converters.

**Month of November**

Sequential Circuits: Basic Flip- Flops and their working. Synchronous and Asynchronous Flip –Flops, Triggering of Flip Flops, Clocked RS, D Type, JK, T type and Master-Slave Flip-Flops. State Table, State Diagram and State Equations. Flip-flops characteristics & Excitation Tables. Sequential Circuits: Designing registers –Serial-In Serial-Out (SISO), Serial-In Parallel-Out (SIPO), Parallel-In Serial-Out(PISO) Parallel-In Parallel-Out (PIPO) and shift registers.

**BCA-II (Sem-3rd)**

**B23-CAP-303 Data Base Technologies**

**Lesson Plan (2025-26)**

**Month of July**

Basic Concepts – Data, Information, Records, Files, Schema and Instance etc. Limitations of File Based Approach. Characteristics of Database Approach, Database Management System (DBMS),

**Month of August**

Components of DBMS Environment, DBMS Functions and Components, Database Interfaces, Advantages and Disadvantages of DBMS. Database Users: Data and Database Administrator, Role and Responsibilities of Database Administrator, Database Designers, Application Developers etc. Database System Architecture – 1-Tier, 2-Tier & Three Levels of Architecture, External, Conceptual and Internal Levels, Schemas, Mappings and Instances, Data Independence – Logical and Physical Data Independence.

**Month of September**

Data Models: Hierarchical, Network and Relational Data Models. Entity-Relationship Model: Entity, Entity Sets, Entity Type, Attributes: Type of Attributes, Keys, Integrity Constraints, Designing of ER Diagram, Symbolic Notations for Designing ER Diagram

**Month of October**

SQL: Meaning, Purpose and Need of SQL, Data Types, SQL Components: DDL, DML, DCL and DQL, Basic Queries, Join Operations and Sub-queries, Views, Specifying Indexes. Constraints and its Implementation in SQL. Relational Algebra: Basic Operations: Select, Project, Join, Union, Intersection, Difference, and Cartesian Product etc. Relational Calculus: Tuple Relational and Domain Relational Calculus. Relational Algebra Vs. Relational Calculus.

**Month of November**

Relational Model: Functional Dependency, Characteristics, Inference Rules for Functional Dependency, Types of Functional Dependency, Normalization: Benefits and Need of Normalization, Normal Forms Based on Primary Keys- (1NF, 2NF, 3NF, BCNF), Multi-valued Dependencies, 4 NF, Join dependencies, 5 NF, Domain Key Normal Form.

**B.Sc.-II (Sem-3rd)**

**Paper-I: Fundamentals of Database Systems**

**Lesson Plan (2025-26)**

**Month of July**

Introductory Concepts: Operating System, Functions and Characteristics, Historical Evolution of Operating Systems.

**Month of August**

Operating System Structure. Types of Operating System: Real time, Multiprogramming, Multiprocessing, Batch processing. Operating System Services, Operating System Interface, Service System Calls, System Programs. Process Management: Process Concepts, Operations on Processes, Process States and Process Control Block. Inter-Process Communication.

**Month of September**

CPU Scheduling: Scheduling Criteria, Levels of Scheduling, Scheduling Algorithms, Multiple Processor Scheduling, Algorithm Evaluation. Synchronization: Critical Section Problem, Semaphores, Classical Problem of Synchronization, Monitors. Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery.

**Month of October**

Memory Management Strategies: Memory Management of Single- User and Multiuser Operating System, Partitioning, Swapping, Contiguous Memory Allocation, Paging and Segmentation; Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Thrashing.

**Month of November**

Implementing File System: File System Structure, File System Implantation, file operations, Type of Files, Directory Implementation, Allocation Methods, and Free Space Management. Disk Scheduling algorithm- SSTF, Scan, C- Scan, Look, C-Look. SSD Management.

**B.Sc I (1st Sem)**

**Problem Solving through C**

**Course Code B23-CSE-101**

**Lesson Plan (2025-26)(Odd Semester)**

**Month of July**

Overview of C: History, Importance, Structure of C Program,Character Set, Constants and Variables, Identifiers and Keywords,Data Types, Assignment Statement, Symbolic Constant.

**Month of August**

Input/output: Formatted I/O Function-, Input Functions viz. scanf(),getch(), getche(), getchar(), gets(),output functions viz. printf(), putch(), putchar(), puts().Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression,

**Month of September**

Type Casting and Conversion. Decision making with if statement, ifelse statement, nested if statement, else-if ladder, switch and break statement, goto statement, Looping Statements: for, while, and dowhile loop, jumps in loops.Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions..

**Month of October**

Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate etc., Search for a Substring. User defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; difference between Structure and Union.

**Month of November**

Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays.

**BCA 3rd Sem**

**Java OOP Foundation**

**Course Code B23-CAP-301**

**Lesson Plan (2025-26)(Odd Semester)**

**Month of July**

Object Oriented Programming and Java Fundamentals: Structure of Java programs, Classes and Objects, Data types, Type Casting, Looping Constructs.

**Month of August**

Interfaces: Interface basics; Defining, implementing, and extending interfaces; Implementing multiple inheritance using interfaces Packages: Basics of packages, Creating and accessing packages, System packages, Creating user-defined packages

**Month of September**

Exception handling using the main keywords of exception handling: try, catch, throw, throws, and finally; Nested try, multiple catch statements, creating user-defined exceptions. File Handling Byte Stream, Character Stream, File I/O Basics, File Operations

**Month of October**

AWT and Event Handling: The AWT class hierarchy, Events, Event sources, Event classes, Event Listeners

**Month of November**

, Relationship between Event sources and Listeners, Delegation event model, Creating GUI

applications using AWT.

**BCA III(Vth Sem)**

**Back-end Developmen**

**Course Code B23-CAP-502**

**Lesson Plan (2025-26)(Odd Semester)**

**Month of August**

Introduction to back-end Development: Overview ofbackend, Client-server architecture, Introduction to web serversand databaseProgramming Languages and Tools: Introduction to server-side languages (e.g., Node.js), Syntax and semantics of chosenserver-side language

**Month of September**

Programming Languages: Version control with Git, Introduction to IDEs (Integrated Development Environments) of chosen language, Writing and executing basic server-side scripts Performance Optimization and Security: Caching strategies,Query optimization

**Month of October**

Database Management: Introduction to databases and DBMS (SQL and NoSQL), Designing a database schema, CRUD operations (Create, Read, Update, Delete), Connecting applications to a database

**Month of November**

Server-Side Frameworks: Overview of popular server-side frameworks (e.g., Express.js), Building a simple application using a framework. API Development: RESTful API concepts, Designing and

documenting APIs, Authentication and authorization basics Web security best practices (SQL injection, XSS, CSRF)

**BCA I**

**SESSION 2025-26**

**Foundations of Computer Science**

**B23-CAP-102**

**July**

Computer Fundamentals: Evolution of Computers through generations, Characteristics of Computers, Strengths and Limitations of Computers, Classification of Computers, Functional Components of a Computer System, Applications of computers in Various Fields.

**August:**

Types of Software: System software, Application software, Utility Software, Shareware, Freeware, Firmware, Free Software. Memory Systems: Concept of bit, byte, word, nibble, storage locations and addresses, measuring units of storage capacity, access time, concept of memory hierarchy. Primary Memory - RAM, ROM, PROM, EPROM. Secondary Memory - Types of storage devices, Magnetic Tape, Hard Disk, Optical Disk, Flash Memory.

**September:**

I/O Devices: I/O Ports of a Desk Top Computer, Device Controller,Device Driver. Input Devices: classification and use, keyboard,pointing devices - mouse, touch pad and track ball, joystick, magneticstripes, scanner, digital camera, and microphone Output Devices:speaker, monitor, printers: classification, laser, ink jet, dot-matrix. Plotter. Introduction to Operating System: Definition, Functions, Features of Operating System, Icon, Folder, File, Start Button, Task Bar, Status Buttons, Folders, Shortcuts, Recycle Bin, Desktop, My Computer, My Documents, Windows Explorer, Control Panel.

**October**:

The Internet: Introduction to networks and internet, history, Internet,Intranet &amp; Extranet, Working of Internet, Modes of Connecting to Internet. Electronic Mail: Introduction, advantages and disadvantages, User Ids, Passwords, e-mail addresses, message components, message composition, mailer features. Browsers and search engines.

**November**

Threats: Physical & non-physical threats, Viruses, worms, Trojans, Spyware, Keylogers, Rootkits, Adware, Cookies, Phishing, Hacking, Cracking. Computer Security Fundamentals: Confidentiality, Integrity, Authentication, Non-Repudiation, Security Mechanisms, Security Awareness, Security Policy, anti-virus software & Firewalls, backup & recovery

**B.SC III (PHYSICAL SCIENCE)**

**SESSION 2025-26**

**DATA STRUCTURE (MAJOR- CS)**

**August:**

Data Structure Definition, Data Type vs. Data Structure, Classification of Data Structures, Data Structure Operations, Applications of Data Structures. Algorithm Specifications: Performance Analysis and Measurement (Time and Space Analysis of Algorithms- Average, Best and Worst Case Analysis). Arrays: Introduction, Linear Arrays, Representation of Linear Array in Memory, Two Dimensional and Multidimensional Arrays, Sparse Matrix and its Representation, Operations on Array: Algorithm for Traversal, Selection, Insertion, Deletion and its implementation.

**September:**

String Handling: Storage of Strings, Operations on Strings viz., Length, Concatenation, Substring, Insertion, Deletion, Replacement, Pattern Matching Linked List: Introduction, Array vs. linked list, Representation of linked lists in Memory, Traversing a Linked List, Insertion, Deletion, Searching into a Linked list, Type of Linked List.

**October**:

Stack: Array Representation of Stack, Linked List Representation of Stack, Algorithms for Push and Pop, Application of Stack: Polish Notation, Postfix Evaluation Algorithms, Infix to Postfix Conversion, Infix to Prefix Conversion, Recursion. Introduction to Queues: Simple Queue, Double Ended Queue, Circular Queue, Priority Queue, Representation of Queues as Linked List and Array, Applications of Queue. Algorithm on Insertion and Deletion in Simple Queue and Circular Queue. Priority Queues.

**November**

Tree: Definitions and Concepts, Representation of Binary Tree, Binary Tree Traversal (Inorder, postorder, preorder), Binary Search Trees – Definition, Operations viz., searching, insertions and deletion; Searching and Sorting Techniques, Sorting Techniques: Bubble sort, Merge sort, Selection sort, Quick sort, Insertion Sort. Searching Techniques: Sequential Searching, Binary Searching.

**BCA III**

**SESSION 2025-26**

**Software Engineering**

**B23-CAP-501**

**August:**

Introduction: Program vs. Software, Software Engineering, Programming paradigms, Software Crisis – problem and causes, Phases in Software development: Requirement Analysis, Software Design, Coding, Testing, Maintenance, Software Development Process Models: Waterfall, Prototype, Evolutionary and Spiral models, Role of Metrics

.**September:**

Feasibility Study, Software Requirement Analysis and Specifications: SRS, Need for SRS, Characteristics of an SRS, Components of an SRS, Problem Analysis, Information gathering tools, Requirement specification, validation and metrics. Structured Analysis and Tools: Data Flow Diagram, Data Dictionary, Decision table, Decision trees, Structured English, Entity-Relationship diagrams

**October:**

Software Project Planning: Cost estimation: COCOMO model, Project scheduling, Staffing, and personnel planning, team structure, Software configuration management, Quality assurance plans, Project monitoring plans, Risk Management. Software Design: Design fundamentals, problem partitioning, and abstraction, design methodology, Cohesion & Coupling.

**November:**

Software testing strategies: unit testing, integration testing, Validation testing, System testing, Alpha and Beta testing. Software Maintenance: Type of maintenance, Management of Maintenance, Maintenance Process, maintenance characteristics.

**Lesson Plan**

**BCA 1st**

# Problem Solving through C B23-CAP-101

## Month of July/August

Unit-1: Overview of C: History, Importance, Structure of C Program, Character Set, Constants and Variables, Identifiers and Keywords, Data Types, Assignment Statement, Symbolic Constant. Input/output: Formatted I/O Function-, Input Functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(), putch(), putchar(), puts(). Practical’s associated with above mentioned topics.

## Month of September

Unit-2: Operators & Expression: Arithmetic, Relational, Logical, Bitwise, Unary, Assignment, Conditional Operators and Special Operators Operator Hierarchy; Arithmetic Expressions, Evaluation of Arithmetic Expression, Type Casting and Conversion. Decision making with if statement, ifelse statement, nested if statement, else-if ladder, switch and break statement, goto statement, Looping Statements: for, while, and dowhile loop, jumps in loops. Practical’s associated with above mentioned topics.

## Month of October

Unit-3: Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Functions: definition, prototype, function call, passing arguments to a function: call by value; call by reference, recursive functions. Strings: Declaration and Initialization, String I/O, Array of Strings, String Manipulation Functions: String Length, Copy, Compare, Concatenate etc., Search for a Substring. Practical’s associated with above mentioned topics.

## Month of November

Unit-4: Pointers in C: Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays. User defined data types: Structures - Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, Array of Structures; Unions - Union definition; difference between Structure and Union. Practical’s associated with above mentioned topics.

**Lesson Plan BCA3rd**

# Linux and Shell Programming

# B23-CAP-302

## Month of July/August

Unit-1:Introduction to Linux: Linux distributions, Overview of Linux operating system, Linux architecture, Features of Linux, Accessing Linux system, Starting and shutting down system, Logging in and Logging out, Comparison of Linux with other operating systems. Practical’s associated with above mentioned topics

## Month of September

Unit-2: Commands in Linux: General-Purpose commands, File oriented commands, directory oriented commands, Communication-oriented commands, process oriented commands, etc. Regular expressions & Filters in Linux: Simple filters viz. more, wc, diff, sort, uniq, grep;

Introducing regular expressions. Practical’s associated with above mentioned topics

## Month of October

Unit-3:Linux file system: Linux files, inodes and structure and file system, file system components, standard file system, file system types. Processes in Linux: Starting and Stopping Processes, Initialization Processes, Mechanism of process creation, Job control in linux using at, batch, cron & time. Practical’s associated with above mentioned topics

## Month of November

SUnit-4: Shell Programming: vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating & executing shell scripts in linux. Practical’s associated with above mentioned topics

**Lesson Plan BCA5th**

# Computer Network

## Month of July/August

Introduction to Data Communication and Computer Networks; Uses of Computer Networks; Types of Computer Networks and their Topologies; Network Hardware Components: Connectors, Transceivers, Repeaters, Hubs, Network Interface Cards and PC Cards, Bridges, Switches, Routers, Gateways; Network Software: Network Design issues and Protocols; Connection-Oriented and Connectionless Services; OSI Reference Model; Networking Models: Distributed Systems, Client/Server Model, Peer-to-Peer Model, Web-Based Model and Emerging File-Sharing Model;

## Month of September

Analog and Digital data and signals; Bandwidth and Data Rate, Capacity, Baud Rate; Transmission Impairment; Data Rate Limits; Guided Transmission Media; Wireless Transmission; Communication Satellites; Switching and Multiplexing; Modems and Modulation techniques; ADSL and Cable Modems;

## Month of October

Data Link Layer Design issues; Error Detection and Correction; Sliding Window Protocols: One-bit, Go Back N and Selective Repeat; Media Access Control: ALOHA, Slotted ALOHA, CSMA, Collision free protocols; Introduction to LAN technologies: Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet; Token Ring; Introduction to Wireless LANs and Bluetooth; VLANs

## Month of November

Routing Algorithms: Flooding, Shortest Path Routing, Distance Vector Routing; Link State Routing, Hierarchical Routing; Congestion Control; Traffic shaping; Choke packets; Load shedding; Elements of Transport Protocols; Network Security Issues: Security attacks; Encryption methods; Digital Signature; Digital Certificate

| **Department of Chemistry** | | | |
| --- | --- | --- | --- |
| **Class & Paper** | **Month** | **Topic** | **Planning** |
| **B.Sc. (Sem-I)** | **22nd July 2025- 14th August 2025** | **Structure and Bonding:** Localized and delocalized chemical bond, Vander Waal’s interactions, resonance: conditions, resonance effect and its applications, hyper conjugation, inductive effect, Electromeric effect & their comparison.  **Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. carbocations, carbanions, free radicals,⎯Reactive intermediates carbenes, (formation, structure & stability). |  |
| **16th August 2025- 31st August 2025** | **Atomic Structure:** Idea of de Broglie matter waves, Heinsenberg’s uncertainty principle, atomic orbitals, quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ2 , shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund’s multiplicity rules, Electronic configuration of elements, effective nuclear charge, Slater’s rules. |  |
| **September 2025** | **Periodic table and atomic properties:** Classification of periodic table into s, p, d, f blocks, atomic and ionic radii, ionisation energy, electron affinity and electronegativity definition, trend in periodic table (in s and p-block elements), Pauling , Mulliken, Allred Rachow and Mulliken Jaffe’s electronegativity scale, Sanderson’s electron density ratio. |  |
| **October 2025** | **Gaseous States:** Kinetic Molecular Theory of Gases, Maxwell’s distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behavior, Derivation of Van der Waal’s Equation of State, its application in the calculation of Boyle’s temperature (compression factor)  **Critical Phenomenon:** Critical temperature, critical pressure, critical volum. relationship between critical constants and Vander Waal’s constants. (derivation excluded) |
| **November 2025** | **Liquid States:** Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation.  **Solid State:** Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg’s law, a simple account of Laue method, rotating crystal method and powder pattern method. |  |
| **B. Sc. II (Sem-III)** | **22nd July 2025- 14th August 2025** | **Benzene and its derivatives:**  Nomenclature, Aromatic nucleus and side chain, Huckels’ rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel- Crafts reaction.  Energy profile diagrams. Activating, deactivating substituents and orientation.  **Alkyl halides:**  Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.  **Aryl halides**: Methods of formation: halogenation, Sandmeyer  reaction. addition mechanisms of nucleophilic aromatic substitution  reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides. |  |
| **16th August 2025-31st August 2025** | **Alkynes**  Nomenclature and its structure. Methods of formation: using  Calcium carbide, dehydrohalogenation, Kolbe’s electrolysis.  Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions, formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis. Acidity of alkynes.  **Stereochemistry of Organic Compounds**  Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (upto 2 asymmetric centres), diastereomers, threo and erythro, nomenclature, meso compounds, Relative and absolute configuration, sequence rules, R and S system of  nomenclature. Cis-Trans isomerism, E & Z system of nomenclature, Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds. Newman and Sawhorse  projection formulae. |  |
| **September 2025** | **Electrochemistry**-**I**: Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch’ s Law in calculation of conductance of weak electrolytes at infinite dilution (Numericals)  Concepts of pH and pKa, Buffer solution, Buffer action, Henderson-Hazel equation, Buffer mechanism of buffer action. |  |
| **October 2025** | **Electrochemistry**-**II:** Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (▲G, ▲H & K). Types of reversible electrodes-metal-metal ion, gas electrode, metal-insoluble salt-anion and redox electrodes. Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode |
| **November 2025** | **s and p**-**Block Elements:** Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon. |  |
| **B. Sc. III (Sem-V)** | **22nd July 2025- 14th August 2025** | **Organic Synthesis *via* Enolates**  Acidity of-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.  **Heterocyclic Compounds**  Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six- membered heterocycles. |  |
| **16th August 2025-31st August 2025** | **Co-ordination Compounds:** Werner’s theory of coordination compounds, EAN, chelates, nomenclature of coordination compounds, isomerism in coordination compounds  **Metal-Ligand Bonding in Transition Metal complexes:** valence bond theory, application and limitations, Elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes  **Magnetic properties of Transition metal complexes:** Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula, L-S coupling |  |
| **September 2025** | **Quantum Mechanics-I**: Black-body radiation, Plank’s radiation law,  Explanation of spectral distribution of black body radiation on the basis of classical mechanics and quantum mechanics. Heat capacity of solids, Need of quantum mechanics, postulates of quantum mechanics,quantum mechanical operator, Commutation relations, Hamiltonian operator, Role of operators to derive Schrodinger wave equation in determination of wave function & energy of a particle in one dimensional box. |  |
| **October 2025** | **Thermodynamics-II:** Third law of thermodynamics, Nernst Heat Theorem, Statement of concept of residual entropy, evaluation absolute entropy from heat capacity data. Gibbs function and Helmholtz Function as thermodynamic quantities. Criteria for thermodynamic equilibrium and spontaneity. Variation of G with P, V and T, Partial molar properties, concept of chemical potential (numerical included) |  |
| **November 2025** | **Phase Equilbria:** Statement and the meaning of term-phase component and degree of freedom. Thermodynamic derivation of Gibbs phase rule, Phase equillibria of one component system- water system, phase equlibria of two component system solid-liquid equillibria of two component system solid-liquid equillibria, simple eutectic Pb-Ag system. **Spectroscopy:** Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born oppenheimer approximation, Degrees of freedom.  **Rotational Spectrum:** Selection rules, Energy levels of rigid rotator (semi-classical principles), spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length and isotopic effect. |  |