Syllabus for
Technical Officer & Senior Technical Assistant
Posts
on contractual basis with consolidated remuneration

NATIONAL INSTITUTE OF ELECTRONICS AND INFORMATION TECHNOLOGY
ELECTRONICS NIKETAN BUILDING, CGO COMPLEX, LODHI ROAD, DELHI-110 003

Table of Contents

1. Computer Science

1.1 Basics of Information Technology Rational

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools of MS office; using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

DETAILED CONTENTS

1. Information Technology – its concept and scope
2. Computers for information storage, information seeking, information processing and information transmission
3. Elements of computer system, computer hardware and software; data – numeric data, alpha numeric data; contents of a program, processing
4. Computer organization, block diagram of a computer, CPU, memory
5. Input devices; keyboard, mouse etc; output devices; VDU and Printer, Scanner, Plotter
6. Electrical requirements, inter-connections between units, connectors and cables
7. Secondary storage; magnetic disks – tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
8. Exercises on file opening and closing; memory management; device management and input – output (I/O) management with respect of windows
9. Installation concept and precautions to be observed while installing the system and software
10. Introduction about Operating Systems such as MS-DOS and Windows
11. Special features, various commands of MS word and MS-Excel
12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like:e-mail and browsing
13. Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)
14. Basics of Networking – LAN,WAN, Topologies

1.2 Computer Fundamentals & Programming in C

Module I – Programming principles-algorithms. Flow charts, Truth tables, time and space complexity analysis of algorithms, Variable types, operators-precedence of evaluation.

Module II – control flow-If statement, If-Else and Else-If constructs, nested If statements, switch statements, looping, for loops, nested loops, While-do and Do-While loops; Break and Continue statements.

Module III – Functions: Arguments and local variables, declaration, return values, global variables; auto, static and register variables; recursive functions, structures and unions, typedef statement, data type conversions. Typecasting character strings, string functions, escape characters.

Module IV – Pointers: pointers and structures, pointers and functions, pointers and arrays, operations on pointers. Input and output character I/O, formatted I/O, print and scan functions, file I/O; fopen, fclose and feof functions; stdin, stdout and stderr.
Module V – The preprocessors: #define, #include, #if, #undef, etc., commandline arguments; dynamic memory allocation; sizeof operator. Elementary graphics; subroutines to draw geometrical shapes, functions to fill and shade images.

1.3 Operating System

Module I Operating System Objectives and functions-The Evolution of Operating Systems- Serial Processing-Simple batch Systems-Multi Programmed batch Systems-Time Sharing Systems.
Module II Overview of Operating Systems, Definition of Operating Systems, Types of Operating Systems, Importance of Operating Systems, Softness organization, Linking, loading and executing control program.
Module III Process Management Functions (Principles and Brief Concept), Job Scheduler, Process Scheduler, Process synchronization
Module IV CPU Scheduling - Scheduling Criteria-Scheduling algorithms – FCFS, SJF, Priority, RR, Multilevel, Feedback Queue - Process synchronization-The Critical Section Problem- Synchronization Hardware-Classical Problems of synchronization, File and Database System- File System-Functions of organization-Allocation and Free space management.
Module V Memory Management Function (Principles and Brief Concept), Introduction, Single Process System, Fixed Partition Memory, System Loading, Segmentation, Swapping, Simple Paging System
Module VI I/O Management Functions (Principles and Brief Concept), Dedicated Devices, Shared Devices, I/O Devices, Storage Devices, Buffering, Spotting, File Management

1.4 Digital Electronics

Module I Number Systems & Codes: Review of Binary, Octal and Hexadecimal representations of numbers and their conversion - Signed numbers - Floating point number representation - Binary arithmetic - Weighted and non-weighted binary codes, error detecting & correcting codes - Alphanumeric codes - BOOLEAN ALGEBRA: Introduction to Boolean Algebra - Theorems - AND, OR, NOT, NAND, NOR & EX-OR operations, truth tables - Boolean expressions - Universal building blocks
Module I Minimization Of Logic Functions: Sum of the products and Product of sums representations - Minimization of Boolean expressions using algebraic, K-map and Tabular methods, Minimization of multiple output functions - COMBINATIONAL LOGIC CIRCUITS: Analysis of logic schematics, Synthesis of combinational functions, Multiplexers, De- Multiplexers, code converters, decoders - Implementation of combinational functions using Multiplexers
Module III Arithmetic Circuits: Adder, carry lookahead adder, number complements, substraction using adders –signed number addition and subtraction – BCD adders - IC adders - FLIP-FLOP : Basic latch circuit, Debouncing of a switch, Flip-flops truth table and excitation table - Integrated circuit flip-flops - Latch timing conditions - Analysis of sequential circuits with latches, transition table, transition diagram and state table - Analysis of sequential circuit with feedback loops - Races in sequential circuits -

Module IV Counters: Asynchronous and synchronous counter design – down counter, general BCD counter, counter ICs, ring counter, digital clock - SHIFT REGISTERS: Serial in, serial/parallel out; Parallel in, Right/left serial shift registers - Shift counters, universal shift register - Application of shift registers in keyboard entry of decimal data -

1.5 Data Structures & Object Oriented Programming Using C++

Module I OOP Concepts: Introduction: Characteristics of OOP

C++ Fundamentals: C++ data types, Operators, Expressions, Type conversion, iostream library, Control statements, Functions: Prototype, Arguments passing, Return type, Default arguments, Inline functions, Function overloading

Classes: Classes and Objects, Defining classes, Creating objects, Defining member function, Static class members, Friend functions, Passing and returning objects to and from functions, Nesting of classes Constructors: Default constructors, Parameterized constructors, Constructor overloading, Constructors with default arguments, Copy constructors - Destructors,

Module II Pointers: Dynamic memory management, new and delete operators, Pointers to objects, Pointers to object members, Accessing members, this pointer, Operator overloading: Overloading unary and binary operators, Type conversion: Between objects and basic types and between objects of different classes,

Inheritance: Single Inheritance, Overriding base class members, Abstract classes, Constructors and destructors in derived classes, Multilevel inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual functions, Virtual base class, File processing: Opening and closing files, File pointers, Filestream functions, Creating and processing text and binary files

Module III Program Performance: Space complexity, Time complexity, Asymptotic notations, Contiguous data structures - Arrays: Structure of arrays, Representation of arrays, Operations on one dimensional arrays, Overloading operators for one-dimensional arrays, Polynomials using one-dimensional arrays, Multidimensional arrays, String representation and manipulation

Non Contiguous Data Structures: Lists: Representation and Traversing of linked list, Operations with linked list, Doubly linked list, Circular list, Header linked list, Sparse matrices: Array representation and Linked representation of Sparse matrices

Module IV Contiguous Data Structures: Stacks: Definition, Operation on stack, Implementation using arrays and linked lists, Evaluation of arithmetic expressions, Queues: Definition, Implementations using arrays and linked lists, Circular queue, Dequeues, Priority queues, Applications of queues

Trees and Graphs: Basic terminology, Binary trees, Properties of binary tree, Traversal application, Representation of binary trees, Sequential representation of binary trees, Linked representation of binary trees, BST: Definition, Insertion, Deletion, Traversal and Searching BST, Threaded binary tree, Heap tree: Insertion and deletion,

Module V Graphs: Representation of graphs, Graph search methods (BFS and DFS), Shortest path problems

Searching and Sorting: Searching: Linear search, Binary search, Comparison of different methods, Sorting: Insertion, Bubble, Selection, Quick, Heap, Merge sort methods, Comparisons, Hashing: Different hashing functions, Methods for collision handling

1.6 Data Communication

Introduction to Networking: Uses of Computer Networks, Network Hardware, ISO OSI Reference Model, Transmission Media - Magnetic Media, Twisted Pair, Coaxial Cable,

Fibre Optics, Wireless Transmission - Radio Transmission, Microwave Transmission, Satellites. PSTN
- Structure of Telephone System, Trunks and Multiplexing, Switching, Mobile Telephone System-GSM, CDMA

Methodology: Need for a modulation in communication systems. Concept of AM, FM, PM, PAM, FSK, PSK and PCM (no mathematical treatment) Concept of bandwidth, noise and channel capacity of different communication system such as radio, microwave, different types of electrical communication lines, optical fiber system and issues like line characteristics and impedance matching.

Data Communication Principles: Transmission of binary data, concept of simplex, half duplex and full duplex modes, two and four line systems. Byte level data communication, synchronous communication data transfer efficiency Synchronous communication, start-stop bits, data transfer efficiency, relative advantage and disadvantage with synchronous communication Frame level communication, data packets, address encoding and decoding of data packets, data encryption and decryption Serial and parallel data communication, comparison in terms of speed of data transfer Aasynchronous transmission, synchronous transmission.

Error Detecting: Source of errors in data communications, effects of errors, data error rate and its dependency on data transfer rates. Error detecting through parity bit, block parity to detect double errors and correct single error Characteristics of white noise and digital noise 79 4. Communicating Methods and Standards (8 hrs) One to one connections, multi drop lines, method of implementation, channel capacity Multiplexed lines, time division multiplexing and demultiplexing

Concept of Synchronization: Synchronization method, direct mode of communication, need for handshake mode of communication, handshake modes.

1.7 Database System Design and RDBMS

Module I Introduction: Purpose of database systems, View of data- Data abstraction, Instances and Schemas, data models. Database languages, Database administrator, database users, database architecture. The entity-relationship model- Entity sets, Relationship sets, Attributes. Constraints- Mapping cardinalities, Keys, ER diagrams, Weak entity sets, Strong entity sets.

Module II Relational Database Design: 1st, 2nd, 3rd, BCNF, 4th, 5th Normal forms.
Transactions - Properties (ACID), States, Concurrent executions. Concurrency control-lockbased protocols - Locks.

Module III Data Definition in SQL: Data types, creation, Insertion, viewing, updation, deletion of tables, modifying the structure of tables, renaming, dropping of tables. Data constraints- I/O constraints- Primary key, foreign key, Unique key constraints. Business rule constraints- Null, not null, check integrity constraints, Defining different constraints on table, ALTER TABLE Command.

Module IV Database Manipulation in SQL: Computations done on table data - Select command, Logical operators, Range searching, Pattern matching, Grouping data from tables in SQL, GROUP BY, HAVING clauses, Joins - Joining Multiple Tables, Joining a Table to itself. Views - Creation, Renaming the column of a view, destroys view. Granting and revoking permissions - Granting privileges, Object privileges, Revoking privileges.

Module V Program with SQL – data types – Using set and select commands-procedural flow-ifif/ else-while-goto-global variables - Security- Locks, types of locks, levels of locks. Cursorsworking with cursors- Error handling-developing stored procedures- create, alter and droppassing and returning data to stored procedures-using stored procedures within queries- building

user defined functions— creating and calling a scalar function-implementing triggers-creating triggers - multiple trigger interaction.

1.8 Multimedia

Introduction to multimedia: Hypertext, hypergraphics, animation, application in education and training, science and technology, kiosks, business and games

Multimedia Hardware: Multimedia PC configuration, features and specifications of sound and video interfaces, OCR, touch-screen, scanners, digital cameras, speakers, printers, plotters, optical disks and drives as CDROM and DVD. multimedia networks

Multimedia Files: Image and sound file formats, multimedia file formats, compression, standards and techniques, features of software to read and write such files.

Photo-shop: Photo-shop workshop, image editing tools, specifying and adjusting colors, using gradient tools, selection and move tools, transforming path drawing and editing tools, using channels, layers, filters and actions

Flash: Exploring interface, using selection and pen tools, working with drawing and painting tools, applying color, viewing and manipulating time line, time line/stage relationship, animating (frame-by-frame, tweening), guiding layers, importing and editing sound and video clips in flash, working with 3-D graphics

Director: Exploring interface: score editor, cast editor, toolbars, library, palette, inspector, menu bar, cast libraries, painting techniques, importing images, working with stage, sprites and score; using text, using sound, using digital video, creating behaviour, using behaviour inspector, basics of lingo.

1.9 Visual Programming

Unit I Introduction to visual Programming -Concept of event driven programming, introduction to VB.Net, The .Net Frame work and Common language runtime, Building VB. Net Application, VB IDE, forms, properties, events, VB language-console application and windows application, data type, declaring variable, scope of variable, operators and statements

Unit II Control Statements- if-then, if –then- else, else-if ladder, select case, choose, loop statements- do loops, for, while-The with statement, converting between data types, Handling dates and times Arrays-declaration and manipulation, Strings and String functions, procedures and functions

Unit III Windows Applications-forms, adding controls to forms, handling events, MsgBox, Input Box, multiple forms, handling mouse and Keyboard events, object oriented programming creating and using classes and objects, Handling Exceptions- on Error Goto

Unit IV Common controls- textbox, Rich textbox, label, command Button, option button, checkbox, frame, list box, combo box, scrollbar, picture box, image box, timer, Data control, OLE, file controls-properties and methods

Unit V Data Access with ADO. Net, accessing data with Server Explorer, Accessing Data with data Adaptors and Data sets, Creating a new data connection, creating and populating Data set, displaying data in Data Grid, selecting a data provider, Data accessing using Data adapter Control, Binding Data to Controls

1.10 Software Engineering

Module I Software - Characteristics, Classification, Myths, Crisis, Software Engineering: Definition , Comparison with other disciplines , Ethics & professional practice , Phases in

Software Engineering, Challenges, Software Process, Project, Product - Components of Software process , process framework, process assessment , Software Life Cycle Models, Selection criteria, Process change management , Quantitative process management

Module II Software Requirements – Definition, Types, Requirement Engineering process, Feasibility Study - Types of feasibilities , Process Requirements Elicitation - techniques, Requirements Analysis – Structured Analysis, Object Oriented Modelling, Other approaches, Requirements Specification – Structure of SRS, Requirements Validation , Requirements Management – A Case study

Module III Software Design – basic principles, concepts , Data design , Data Architectural design, Component level design , User Interface design , Pattern based Software design, Design Notations, Design Reviews – types, process, evaluating reviews, Software Design Documentation, A Case study, Software Coding – features, guidelines, Methodology, Programming practices, Verification techniques, documentation

Module IV Software Testing - basics, guidelines, characteristics, Test Plan – steps in development, Software testing strategies, V Model of Software testing, Levels of Software testing – Unit, Integration, System, Acceptance, Testing Techniques (basic idea of black box and white box testing), Object Oriented testing, Debugging, Software test report, Software Maintenance – basics, Legacy Systems, factors affecting maintenance, types of maintenance, Life cycle, Models, Techniques

Module V Software Planning and Scheduling – project planning, planning process, project plan, Project Scheduling – principles, techniques, Project staffing, Risk management, Software Quality – Concepts, Quality Assurance Activities, Software reviews, Evaluation, Capability Maturity Model , Software Reliability, Software Configuration Management process, Concept of Software Re Engineering – approaches, process models

1.11 Computer Graphics

Module I Overview of Graphic Systems – Display Devices – hard copy Devices – Interactive Input Devices – Display Processor – Graphic software – Output Primitives – Line Drawing Algorithms – Initialising Lines – Line command – fill areas – circle Generation Algorithms.

Module II Attributes of output primitives – line style – colour and Intensity – area filling algorithms – character Attributes – inquiry functions – bundled attributes – two dimensional transformations – basic and composite transformations – metric representations.

Module III Windowing and Clipping – Windowing concepts – Clipping Algorithms – Window to view port Transformations – segments – Interactive input methods – Physical input devices – logical classification of input devices – interactive picture construction techniques – input functions.

Module IV Three dimensional concepts – 3D Display Techniques – 3D representation – polygon and curved surface – 3D transformations.

Module V 3D viewing – projections – viewing transformation – Implementation of viewing operations – Hidden surface and Hidden Line removal – back free removal, depth buffer and scan line methods – shading.

2. Information Technology

2.1 Basics of Information Technology

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6. Electrical requirements, inter-connections between units, connectors and cables
7. Secondary storage; magnetic disks – tracks and sectors, optical disk (CD and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
8. Exercises on file opening and closing; memory management; device management and input – output (I/O) management with respect of windows
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10. Introduction about Operating Systems such as MS-DOS and Windows
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12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing
13. Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)
14. Basics of Networking – LAN,WAN, Topologies

2.2 Programming in C

Unit – I Programming principles: Algorithms, Flow charts. Computer Language: Classification. Program Concept: Source program, Compiling, Program execution, Object program. Measures of program performance. C- Language Fundamentals: Tokens, Fundamental data types, Precedence of evaluation.

Unit – II Flow of Control: Branching: If statement, If – else and Else – If constructs, nested if statements, switch statements. Looping: for loops, while and do-while loops, nested loops, break and continue statements.

Unit –III Arrays: Definition, One-dimensional arrays, Two-dimensional arrays, Initializing one and two dimensional arrays. Strings: Declaring and initializing strings, Reading and writing strings. Functions: Definition, Types of functions, Function prototyping, Arguments and return values, Nesting of functions, Recursive functions, String functions. Scope and Extent of Variables: Local and global variables, auto, static and register variables.

Unit – 1V Structures and Union: Definitions, Arrays of structures, Structures with in structures, Structures and functions, sizeof() operator. Pointers: Definition, Pointers and structures, Pointers and functions, Pointers and arrays, Operations on pointers.

2.3 Operating System

Unit – 1 Basic features of OS, I/O devices, Single user and multi-user OS, I/O utilities, Multitasking OS, Various parts of OS, Loading of OS, Boot strapping, Different types of OS, Shell, File system, Software tools, Program translation sequence, Compilers & interpreters, Linkers, Loaders, Assemblers, Fundamentals of DOS and Windows.

Unit – II Process concept, Process scheduling, Types of schedulers, Scheduling and performance criteria, Scheduling algorithms, Inter process communication and synchronization basic concepts, Mutual exclusion, Semaphores, Critical section, Dead locks

Unit –III Single process monitor, Multi-programming with fixed partitions and dynamic partitions, Paging, Hardware support for paging, Address translation by associative memory sharing system, Segmentation, Virtual memory, Demand paging with virtual memory management.

Unit – 1V File concept, Directories, Disk organization, Disk space management methods, Linked list, Bit map, Disk allocation methods, Contiguous allocation, Non-contiguous allocation, Disk scheduling, Different scheduling algorithms, File protection, Passwords access groups.

Unit – V Case Study (Unix) : Basic commands, Permissions, Piping, Directory management, The shell, Background process, File system, Terminals, Devises, Shell history, Vi editor, Basic operations., Mail, Shell programming, Simple Network Management Protocols, System calls, Sockets and IPC, System administration.

2.4 Digital Electronics

Module I Number Systems & Codes: Review of Binary, Octal and Hexadecimal representations of numbers and their conversion - Signed numbers - Floating point number representation - Binary arithmetic - Weighted and non-weighted binary codes, error detecting & correcting codes - Alphanumeric codes - BOOLEAN ALGEBRA: Introduction to Boolean Algebra - Theorems - AND, OR, NOT, NAND, NOR & EX-OR operations, truth tables - Boolean expressions - Universal building blocks

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Module IV Counters: Asynchronous and synchronous counter design – down counter, general BCD counter, counter ICs, ring counter, digital clock - SHIFT REGISTERS: Serial in, serial/parallel out; Parallel in, Right/left serial shift registers - Shift counters, universal shift register - Application of shift registers in keyboard entry of decimal data -

2.5 Data Structures & Algorithms

Unit – 1

Introduction: Elementary data organization, Data structures, Data structure operations, Algorithmic notation, Control structures, Complexity of algorithms, String processing, Structured approach in programming, Top-down design, Recursive procedures and algorithms.

Unit – II

Arrays, Records and Pointers: Linear arrays, Representation, Traversing, Inserting and deleting, sorting and searching, Binary search. Multidimensional arrays, Pointers, Records, Representation, Matrices, Sparse matrices, Sparse matrix operations

Unit –III

Linked Lists: Concept, Representation, Traversing, Inserting and deleting, Searching, Types of linked lists (circular, doubly circular doubly), garbage collection. Stacks and Queues: Definition, Fundamental operations on stacks, array representation, linked list representation, polish notation, Applications of stack, Concepts of queues, dequeues and priority queues.

Unit – 1V

Tress: Basic terminology, Binary tree representation, Traversing binary trees, Traversing algorithms using stack, Threads, Binary search tree, Operations; Heap: Storage representation and manipulation of binary trees, Huffman's algorithm, General trees. Graphs: Concept, Representation, Operations.

Unit – V

Sorting and Searching: Sorting types, Insertion sort, Selection sort, Merging, Merge sort, quick sort, radix sort, bubble sort, heap sort; Searching: Binary search and linear search comparison, Hashing.

2.6 Data Communication

Methodology: Need for a modulation in communication systems. Concept of AM, FM, PM, PAM, FSK, PSK and PCM (no mathematical treatment) Concept of bandwidth, noise and channel capacity of different communication system such as radio, microwave, different types of electrical communication lines, optical fiber system and issues like line characteristics and impedance matching.

Data Communication Principles: Transmission of binary data, concept of simplex, half duplex and full duplex modes, two and four line systems. Byte level data communication, synchronous communication data transfer efficiency Synchronous communication, start-stop bits, data transfer efficiency, relative advantage and disadvantage with synchronous communication Frame level communication, data packets, address encoding and decoding of data packets, data encryption and decryption Serial and parallel data communication, comparison in terms of speed of data transfer Aasynchronous transmission, synchronous transmission.

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Concept of Synchronization: Synchronization method, direct mode of communication, need for handshake mode of communication, handshake modes.

2.7 Object Oriented Programming & C++

Unit – 1

Object Oriented Paradigm: Evolution of programming paradigms, Structured verses object –oriented development, Elements of OOP, Objects, Classes, Multiple views of the same object, Encapsulation and data abstraction, Inheritance, Delegation, Polymorphism,

Message communication, Merits and demerits of OO methodology.

Unit – II

Stream based I/O, Comments, iostream library, Scope resolution operator, Variable declaration and definition, Runtime memory management. Data Types, Operators and Expressions. Control Flow, Arrays and Strings.

Unit –III Modular Programming with Functions: Function components, Passing data to functions, Function return data type, Library functions, Parameter passing, Return by reference, Parameter passing, inline function, Function overloading, Function Templates, Arrays and functions, Complete syntax of main(). Pointers and Runtime Binding. Classes and Objects.

Unit – 1V Object Initialization and cleanup: Constructors, Parameterized constructors, Destructor, Constructor overloading, Order of constructor and destructor, Dynamic initialization through constructors, Constructors with dynamic operations, Copy constructors, Nested classes. Dynamic Objects. Operator Overloading. Inheritance. Virtual Functions.

Unit – V

Generic Programming with Templates, Stream Computation with Files, Exception Handling, Standard Template Library, Object Oriented System Development.

2.8 Database System Design and RDBMS

Module I Introduction: Purpose of database systems, View of data- Data abstraction, Instances and Schemas, data models. Database languages, Database administrator, database users, database architecture. The entity-relationship model- Entity sets, Relationship sets, Attributes. Constraints- Mapping cardinalities, Keys, ER diagrams, Weak entity sets, Strong entity sets.

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Director: Exploring interface: score editor, cast editor, toolbars, library, palette, inspector, menu bar, cast libraries, painting techniques, importing images, working with stage, sprites and score; using text, using sound, using digital video, creating behaviour, using behaviour inspector, basics of lingo.

2.10 Web Programming using ASP.NET

Module I Overview of ASP.NET framework, Understanding ASP.NET Controls, Applications, Web servers, installation of IIS, Web forms, web form controls - server controls, client controls, web, forms & HTML, Adding controls to a web form, Buttons, Text Box, Labels, Checkbox, Radio Buttons, List Box, etc, Running a web Application, creating a multiform web project **Module II** Form Validation: Client side validation, server Side validation, Validation Controls: Required Field Comparison Range. Calendar, control, Ad rotator Control, Internet Explorer Control, State management- View state, Session state, Application state

Module III Architecture of ADO.NET, Connected and Disconnected Database, Create Connection using ADO.NET Object Model, Connection Class, Command Class,

Module IV DataAdapter Class, Dataset Class. Display data on, data bound Controls and Data Grid, Database Accessing on web applications: Data Binding concept with, web, creating data grid, Binding standard web server controls, Display data on web form using Data bound controls

3. Electronics

3.1 Semiconductor Devices

UNIT - I : Structure of Atom - Atomic Number - Valence Electrons - Bonding in Conductors - Insulators - Semiconductors - Energy Band Diagram of Conductors - Insulators - Semiconductors - Intrinsic Semiconductor - Extrinsic Semiconductor - P Type Semiconductor - N type Semiconductor - Carrier Life Time.

UNIT - II : Theory of PN Junction Diode - Energy Band Structure - Diode Current Equation - Diode Resistance - Depletion Capacitance - Diffusion Capacitance - Effect of Temperature – PN Junction Diode as a Rectifier - Zener Diode - Avalanche Break Down - Zener Break Down - Zener Diode as a Voltage Regulator.

UNIT - III : Operation of PNP & NPN Transistor - CB , CE , CC Configuration and Characteristics - Transistor as an Amplifier.

UNIT - IV : Construction - Operation - Output & Transfer Characteristics of P Channel & N Channel JFET - Characteristic Parameters of the JFET - Biasing the FET - Comparison of JFET & BJT - Comparison of P Channel & N Channel JFET - Applications of JFET - JFET as a Voltage Variable Resistor.

UNIT - V : Construction, Operation, Output & Transfer Characteristics of P Channel & N Channel Depletion MOSFET - Construction, Operation, Output & Transfer Characteristics P Channel & N Channel Enhancement MOSFET - Biasing the MOSFET - Comparison of P Channel MOSFET with N Channel MOSFET - Comparison of JFET with MOSFET – Handling Precautions for the MOSFET.

3.2 Applied Digital Electronics

UNIT I - NUMBER SYSTEMS : Binary Signals – Binary Number System – Decimal Number System - Octal Number System – Hexadecimal Number System – Conversion from One Number System to Another Number System - BCD – Gray code – Excess – 3 Code – ASCII code.

UNIT II - BOOLEAN ALGEBRA : Binary Addition, Subtraction, Multiplication & Division - 1's and 2's Complement Subtraction - 9's & 10's Complement Subtraction - Basic laws of Boolean Algebra - Duality Theorem – De Morgan's Theorem - Sum of Products – Product of Sum - Two Variable, Three Variable & Four Variable Karnaugh Maps.

UNIT III - COMBINATIONAL ELEMENTS : Logic Gates : AND, OR, NOT, EX-OR, EXNOR, NAND & NOR - Logic Gates using Discrete Components - NAND & NOR as Universal Gates - Half Adder and Full Adder – Half and Full Subtractor - Encoder - Decoder – Multiplexer - Demultiplexer - Implementation using 74147, 7442, 74153 & 74155 IC's.

UNIT IV - SEQUENTIAL ELEMENTS : Flip Flops : RS - Clocked RS - JK - Master Slave JK - D & T Flip Flops – Shift Registers : SIPO – SISO – PIPO – PISO – Shift Left – Shift Right - Ring counter – Twisted Ring Counter . Counters : Hexadecimal Up - Hexadecimal Down - Modulo Up - Modulo Down - UP/DOWN Counters - Implementation Using 7476, 7495, 7493 & 7490 IC's.

3.3 Electronic Components and Materials (ECM)

1. **Materials (32 hrs)**

1.1 Classification of materials Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure.

1.2 Conducting Materials

Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials.

1.3 Insulating Materials

Important relevant characteristics (electrical, mechanical and thermal) and applications of the following material: Mica, Glass, Copper, Sliver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish.

1.4 Magnetic Materials

Different Magnetic materials; (Dia, Para, Ferro) and their properties. Ferro magnetism, Domains, permeability, Hysteresis loop. Soft and hard magnetic materials, their examples and typical applications.

2. **Components**

2.1 Capacitors

a) Concept of capacitance and capacitors, units of capacitance, types of capacitors, constructional details and testing specifications

b) Capacity of parallel plate capacitors, spherical capacitors, cylindrical capacitor.

c) Energy stored in a capacitor.

d) Concept of di-electric and its effects on capacitance, di-electric constant, break down voltage.

e) Series and parallel combination of capacitor. Simple numerical problems of capacitor.

f) Charging and discharging of capacitor with different resistances in circuit, concept of current growth and decay, time constant in R-C circuits, simple problems.

2.2 Resistors:

Carbon film, metal film, carbon composition, wound and variable types (presets and potentiometers)

2.3 Transformer, inductors and RF coils: Methods of manufacture, testing, Need of shielding, application and trouble shooting

2.4 Surface Mounted Devices (SMDs): Constructional detail and specifications.

2.5 Connectors, Relays, switches and cables: Different types of connectors, relays, switches and cables, their symbols, construction and characteristics.

2.7 Semi Conductors and Integrated Circuits

• Basic characteristics of Semiconductor materials, testing of diodes, transistors, FETs and SCRs.

• Various processes in IC manufacturing. Hybrid IC technology.

• Superconductivity and piezoelectric ceramic transducer elements

3.4 Electronic Communication Systems

UNIT I - PROPAGATION OF RADIO WAVES : Introduction to EM waves – Reflection and refraction of radio waves at the surface of the earth – Ground wave propagation-Sky wave propagation – Space wave propagation – Structure of the Atmosphere – Critical frequency – Skip distance – Maximum Usable frequency (MUF) – Virtual height.

UNIT II - AM GENERATION & TRANSMISSION : Need for modulation – Amplitude modulation – Frequency Spectrum of the AM Wave - Modulation Index – Power relations in the AM Wave – AM generation – AM Transmitter. - Forms of Amplitude Modulation – Evolution of SSB – Balanced Modulator – Methods of SSB Generation – Vestigial side band Transmission.

UNIT III - FM GENERATION & TRANSMISSION : Frequency Modulation - Frequency Spectrum of the FM Wave – Modulation Index – Effect of Noise – Adjacent & Co-Channel

Interference – Wide Band & Narrow Band FM-FM Generation – Direct and Indirect methods - FM Transmitter – Pre-Emphasis.

UNIT IV -

AM & FM RECEPTION : AM Receiver – TRF Receiver – Super Heterodyne Receiver – Image Frequency Rejection – Frequency Changing & Tracking – Choice of IF – AM Detection – AGC – SSB Detection. FM Receiver – Amplitude Limiter – De-Emphasis – FM Detection – Balanced Slope Detector – Phase Discriminator – Ratio Detector.

UNIT V- PULSE MODULATION : PAM Modulation & Detection – PWM Modulation & Detection - PPM Modulation & Detection - Sampling Theorem – Quantization & Quantization Error – PCM Modulation & Detection - Companding - ASK – FSK – BPSK – QPSK – DPSK .

3.5 8085 Microprocessor & Interfacing

UNIT I - 8085 MICROPROCESSOR : Signals on 8085 – Architecture of 8085 – Demultiplexing the Bus - Generating Control Signals – Fetching, Decoding and Execution of an Instruction– Memory Mapping for a 8K Memory Chip.

UNIT II - INSTRUCTION SET : Data Transfer – Arithmetic – Logical – Branching – Machine Control Instructions - Stack & Stack Operations - Simple Programs.

UNIT III : Addressing Modes - Instruction Format - Memory Read Machine Cycle (MOV C,A & MVI A,32) - Memory Write Machine Cycle (MVI M, 48) - Timing Diagram of OUT & IN Instruction - Interrupt System of 8085.

UNIT - IV : Time Delay Program – Signals on 8255 – I/O Mode – BSR Mode – Interfacing With : Switches, LED'S - Single Seven Segment Display - EPROM (2764) - RWM (6264).

UNIT - V : Interfacing With : ADC 0809 - DAC 0800 – Stepper Motor – Matrix Keyboard – Multiple Seven Segment Display – LCD - Traffic Light Control.

3.6 Communication Engineering

1. **Introduction to Microwaves** Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, KU, KA, mm, SUB, mm)

2. **Microwave Devices** Basic concepts of thermoinic emission and vacuum tubes, Effects of interelectrode capacitance Lead Inductance and Transit time on the high frequency performance of conventional vacuum tubes, and steps to extend their high frequency operations. Construction, characteristics, operating principles and typical applications of the following devices (No mathematical treatment)

- Multi cavity klystron
- Reflex klystron
- Multi-cavity magnetron
- Traveling wave tube
- Gunn diode and
- Impatt diode

3. **Wave guides** Rectangular and circular wave guides and their applications. Mode of wave guide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation). Impossibility of TEM mode in a wave guide. Field configuration of TE10, TE20 and TM11 modes.

4. **Microwave Components** Constructional features, characteristics and application of tees, bends, matched termination, twists, detector, mount, slotted section, directional coupler, fixed and variable attenuator, isolator, circulator and duplex, coaxial to wave guide adapter.

5. **Microwave antennas** Structure characteristics and typical applications of Horn and Dish antennas

6. **Microwave Communication systems** a) Block diagram and working principles of microwave communication link. b) Troposcatter Communication: Troposphere and its properties, Tropospheric duct formation and propagation, troposcatter propagation.

7. **Radar Systems** Introduction to radar, its various applications, radar range equation (no derivation) and its applications. a) Block diagram and operating principles of basic pulse radar. Concepts of ambiguous range, radar area of cross-section and its dependence on frequency. b) Block diagram and operating principles of CW (Doppler) and FMCW radars, and their applications. c) Block diagram and operating principles of MTI radar. d) Radar display- PPI (06 hrs)

8. **Satellite Communications** (a) Basic idea of passive and active satellites. Meaning of the terms orbit , apogee, perigee b) Geostationary satellite and its need. Block diagram and explanation of a satellite communication link. Link losses etc. c) Transponders multiple access techniques, VSAT & its features

3.7 Consumer Electronics

1. **Audio System**

1.1 Microphones: construction, working principles and applications of microphones, their types viz: a) Carbon b) moving coil, c) velocity, d) crystal, e) condenser, e) cordless etc.

1.2 Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid range, multi - speaker system, baffles and enclosures.

1.3 Sound recording on magnetic tape, its principles, block diagram, and tape transport mechanism

1.4 Digital sound recording on tape and disc

1.5 CD system Hi-Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers.

2. **Television**

2.1 Monochrome TV Communication:

- Elements of TV communication system.
- Scanning
- its need for picture transmission.
- Need for synchronizing and blanking pulses.
- Progressive scanning
- Gross structure filters, interlaced scanning, resolution and band width requirement, tonal gradation.
- Composite Video signal (CVS) at the end of even and odd fields. equalizing pulses and their need
- Monochrome picture tube – construction and working, comparison of magnetic and electric deflection of beam
- Construction and working of camera tube: vidicon and plumbicon, Block diagram of TV camera and the transmitter chain.
- Block diagram of a TV receiver: function of each block and waveform at the input and output of each block.
- Frequency range of various VHF bands and channels used in India. Major specification of the CCIR.

2.2 Concept of positive and negative modulation VSB Transmission Turner
- Typical circuits of scanning and EHT stages of TV receiver, keyed AGC, function and location of brightness contrast V-hold, H-hold of centering control.
- Identification of faulty stage by analyzing the symptoms and basic idea of a few important faults and there remedies
2.3 Colour Schemes
- Introduction to PAL, NTSC, SECAM systems, advertisement and disadvantages block diagram of video camera and its explanation
- Construction and working principles of trinitran and PIL types of colour picture tubes.
- Concept of convergence, purity of beam shifting
- Block diagram of PAL TV receiver, explanation and working
3. **Colour TV**
- Primary colours, tristimulus values, trichromatic coefficients, concepts of additive and subtracting mixing of colours, concepts of luminance, Hue and Saturation, Representation of a colour in colour triangle, non spectral colour, visibility curve
- Compatibility of colour TV system with monochrome system. Block diagram of colour TV camera, Basic colour TV system
-NTSC, SECAM, and PAL their advantages and disadvantages.
- Construction and working principles of trinitron and PIL types of colour picture tubes. Concept of convergence, purity, beam shifting
- Need for luminance signal and band sharing by colour signals, subcarriers frequency, colour difference signal and its need, synchronous quadratic modulation and representation of a colour by a vector, burst signal and its need, chrominance signal.
- Block diagram of PAL TV receiver, explanation and working
4. **Cable Television** Block diagram and principles of working of cable TV and DTH, cable TV using internet
5. **VCR, VCD and DVD** Principle of video recording on magnetic tapes, block diagram of VCR, VHS tape transport mechanism.
6. **Video Camera** Study of VCD and DVD

3.8 Medical Electronics

UNIT I : Introduction to Human Physiology – Micro Electrodes – Skin Surface Electrodes –Needle Electrodes – Reference Electrodes - Digital Thermometer – Sphygmo Manometer - Electronic Stethoscope

UNIT II - RECORDERS AND METERS : ECG - EEG - EMG - Cardiac Stress Test Equipment – Cardio Topography - Electro Oculography - Electro Retinography – Poly Somnography - Spirometer - Blood Flow Meter - Vascular Doppler - Audiometer

UNIT III - OPERATION THEATRE EQUIPMENTS : Boyles Apparatus - Upper Endoscope - Lower Endoscope - ENT Endoscope - Laparoscope - Diathermy - Surgical Diathermy- Micro Wave Diathermy - Multipara Patient Monitor.

UNIT IV - INTENSIVE CARE EQUIPMENTS : Pulse Oximeter - Block Diagram & Sensor – Ventilator – Cardiac Monitor - ECG Holder - Defibrillator - Pace maker : Implantable and External Pacemakers - Infant Warmer - Infant Incubator - Baby Phototherapy – Nebulizer.
UNIT V - MODERN IMAGING SYSTEMS : Ultra Sound Scanner - Color Doppler Ultrasound - X-Ray Machine – C-Arm - CT Scan – MRI Scan – Angiography - LASER in Medical Applications . ELECTRICAL SAFETY OF MEDICAL INSTRUMENTS
: Radiation Safety - Physiological Affects Due to 50 Hertz Current Passage - Micro Shock - Macro Shock - Electrical Accidents in Hospitals - Devices to Protect Against Electrical Hazards
– SMPS in Medical Equipments.

3.9 Computer Architecture & Organisation.

1. Basic computer organisation & design Instruction lodes, indirect & direct address, computer registers, common bus system, computer instructions, timing control, instruction memory reference, Register reference & reference instructions. Interrupts, hard wire & microprogrammed control unit.
2. Central Processing Unit Introduction, general register organisation, control word, examples of microinstructions, stack organisation, register stack, reverse. Polish notation evaluation of anith expressions. Instruction formats, Addressing modes, 3 address instructions, 2 Address instructions. One address instructions, zero address instructions. Types of interrupts, compare RISC & CISC.
3. Computer Arithmetic Introduction, addition & subtraction, multiplication, & Division algorithms.
4. Register transfer & micro operations Register transfer language, arithmetic, logic & shift micro operation:
5. Input-output organisation Input-output interface, I bus, & interface4 module, I vs memory bus. Isolated Vs memory mapped I, Modes of data, transfer, first in first out buffer, priority interrupt, daisy chaining priority, parallel priority interrupt priority encoder, interrupt cycle, Direct memory access, DMA controller, DMA transfer.
6. Memory organisation Memory hierarchy, main memory, memory, address, map, RAM & ROM chips, memory connection to CPU, Anxillary memory, Associative memory, Read & write operation. Cache memory, Associative maping, Virtual memory, memory management hardware, memory segmentation

3.10 PC Hardware & Troubleshooting

UNIT - I : Motherboard Components - Support Circuits on Motherboard - Intel 845 Chipset -Physical Memory Organisation - Cache Memory - Shadow Memory - DDR - Common Memory Errors.
UNIT - II : BIOS - BIOS Functions - Battery - Motherboard Connectors – Motherboard Installation - Motherboard Troubleshooting - BIOS Beep Codes.
UNIT - III : KEYBOARD : Types - Organisation - Troubleshooting - Ergonomics - Mouse Types - Mouse Connection - Mouse Resolution - Mouse Installation - Mouse Troubleshooting.
UNIT - IV : Hard Disk - Form Factor - Storage Capacity - Disk Geometry - Interfacing – Logical Working & Structure of a Hard Disk - Installation, Formatting & Trouble shooting of a Hard Disk - Pen Drive - CD Drive Working & Installation - Types of DVD - CD & DVD Comparison & Troubleshooting.

UNIT - V : PRINTER : Types, Interface & Troubleshooting - Power Supply & Connectors - DVI Connector - Motherboard & Cabinet Form Factor - PC Assembly -
VIRUS : Types - Working - Symptoms - Antivirus.

3.11 Electronic Instrumentation

UNIT I - ELECTRO MECHANICAL INDICATING INSTRUMENTS : DC Ammeter - DC Voltmeter - Voltmeter Sensitivity - AC Voltmeter - Considerations in Analog Voltmeter – Series & Shunt Type Ohmmeter - Calibration of DC Instruments – Study of a Typical Digital Multimeter.

UNIT II - BRIDGES : Wheatstone Bridge - Balance Equation of General AC Bridges – Capacitance & Inductance Comparison Bridge - Maxwell – Hay - Schering - Wien - Kelvin & Kelvin's Double Bridge .

UNIT III : OSCILLOSCOPE : Block diagram - CRT - Vertical Deflection System - Delay line - Horizontal Deflection System - CRT screens & Graticules - Oscilloscope Probes - Measurement of Frequency, Amplitude & Phase - Lissajou's Patterns.

UNIT IV - SIGNAL GENERATION & SIGNAL ANALYSIS : Sample & Hold Circuit - Instrumentation Amplifier - Function Generator - Pulse Generator - Q Meter - Vector Impedance Meter - Wave Analyzer - Harmonic Distortion Analyzer .

UNIT V - TRANSDUCERS : Resistive Transducers – Inductive Transducers – Capacitive Transducers - Piezo Electric Transducer - Thermo Electric Transducers – Temperature Transducers – Microphones & Loud Speakers.

4. Mathematics

Linear Algebra: Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley-Hamilton Theroem, diagonalisation, Hermitian, Skew-Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, self-adjoint operators.

Complex Analysis: Analytic functions, conformal mappings, bilinear transformations; complex integration: Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle; Taylor and Laurent's series; residue theorem and applications for evaluating real integrals.

Real Analysis: Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima; Riemann integration, multiple integrals, line, surface and volume integrals, theorems of Green, Stokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness; Lebesgue measure, measurable functions; Lebesgue integral, Fatou's lemma, dominated convergence theorem.

Ordinary Differential Equations: First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions; Legendre and Bessel functions and their orthogonality.

Algebra: Normal subgroups and homomorphism theorems, automorphisms; Group actions, Sylow's theorems and their applications; Euclidean domains, Principle ideal domains and unique factorization domains. Prime ideals and maximal ideals in commutative rings; Fields, finite fields.

Functional Analysis: Banach spaces, Hahn-Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness; Hilbert spaces, orthonormal bases, Riesz representation theorem, bounded linear operators.

Numerical Analysis: Numerical solution of algebraic and transcendental equations: bisection, secant method, Newton-Raphson method, fixed point iteration; interpolation: error of polynomial interpolation, Lagrange, Newton interpolations; numerical differentiation; numerical integration: Trapezoidal and Simpson rules, Gauss Legendrequadrature, method of undetermined parameters;

least square polynomial approximation; numerical solution of systems of linear equations: direct methods (Gauss elimination, LU decomposition); iterative methods (Jacobi and Gauss-Seidel); matrix eigenvalue problems: power method, numerical solution of ordinary differential equations: initial value problems: Taylor series methods, Euler's method, Runge-Kutta methods.

Partial Differential Equations: Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification;

Cauchy, Dirichlet and Neumann problems; solutions of Laplace, wave and diffusion equations in two variables; Fourier series and Fourier transform and Laplace transform methods of solutions for the above equations.

Mechanics: Virtual work, Lagrange's equations for holonomic systems, Hamiltonian equations.

Topology: Basic concepts of topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn's Lemma.

Probability and Statistics: Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions, standard probability distributions and their properties, expectation, conditional expectation, moments; Weak and strong law of large numbers, central limit theorem; Sampling distributions, UMVU estimators, maximum likelihood estimators, Testing of hypotheses, standard parametric tests based on normal, X^2, t, F – distributions; Linear regression; Interval estimation.

Linear programming: Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution, simplex method, big-M and two phase methods; infeasible and unbounded LPP's, alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; Balanced and unbalanced transportation problems, u -u method for solving transportation problems; Hungarian method for solving assignment problems.

Calculus of Variation and Integral Equations: Variation problems with fixed boundaries; sufficient conditions for extremum, linear integral equations of Fredholm and Volterra type, their iterative solutions.

5. Physics (PH)

Mathematical Physics: Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors.

Classical Mechanics: Conservation laws; central forces, Kepler problem and planetary motion; collisions and scattering in laboratory and centre of mass frames; mechanics of system of particles; rigid body dynamics; moment of inertia tensor; noninertial frames and pseudo forces; variational principle; Lagrange's and Hamilton's formalisms; equation of motion, cyclic coordinates, Poisson bracket; periodic motion, small oscillations, normal modes; special theory of relativity – Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Electromagnetic Theory: Solution of electrostatic and magnetostatic problems includingboundary value problems;dielectrics andconductors; Biot-Savart's and Ampere's laws; Faraday's law; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.

Quantum Mechanics: Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.

Thermodynamics and Statistical Physics: Laws of thermodynamics; macrostates and microstates; phase space; probability ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck's distribution law; Bose-Einstein condensation; first and second order phase transitions, critical point.

Atomic and Molecular Physics: Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; Xray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR; lasers.

Solid State Physics: Elements of crystallography; diffraction methods for structure determination; bonding in solids; elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity.

Nuclear and Particle Physics: Nuclear radii and charge distributions, nuclear binding energy, Electric and magnetic moments; nuclear models, liquid drop model – semi-empirical mass formula, Fermi gas model of nucleus, nuclear shell model; nuclear force and two nucleon

problem; Alpha decay, Beta-decay, electromagnetic transitions in nuclei;Rutherford scattering,nuclear reactions, conservation laws; fission and fusion;particle accelerators and detectors; elementary particles, photons, baryons, mesons and leptons; quark model.
Electronics: Network analysis; semiconductor devices; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, negative feedback circuits ,**active filters and oscillators**; rectifier circuits, regulated power supplies; basic digital logic circuits, sequential circuits, flip-flops, counters, registers, A/D and D/A conversion.