NOTIFICATION (Advt No. 1/2018)

Syllabus (Paper III)

Post Code - 302

Area: Instrumentation

COMPUTER PROGRAMMING AND APPLICATION

1. OVERVIEW OF PROGRAMMING: Steps in program development, problem identification, task analysis, flowcharting, program coding, testing, debugging etc. Programming language classification: machine language, assembly language, third generation language, fourth generation language, assemblers, compilers, interpreters. Programming techniques: top-down design, bottom-up design, modular design and structured programming.
2. C LANGUAGE PROGRAMMING: An overview of C language, history of C language. The structure of a C program, data types, char, int, float, double, void. Constants: integer constants, character constants, floating constants, logical constants, string constants. Variables: integer variables, real variables, character variables, floating variables, logical variables, string variables. Declaration: scope of variables, local variables and global variables. Modifiers: signed, unsigned, long, and short. Storage class specifiers: extern, auto, static, register.
3. EXPRESSIONS, OPERATIONS AND ASSIGNMENT: Operators: arithmetic operators, increment and decrement operators, modulo division operator, relational operators, logical operators, bitwise operators, the ? operators, the comma as an operator, the precedence of operators. Expressions: definition, type conversion in expressions, type casting. Assignment statements: general form, type conversion in assignments, variable initialisation.
4. CONTROL STATEMENTS: The ‘if’ statement, general form, nested if, the if-else-if ladder, the ? as an alternative to if. Switch statement, general form, nested switch statements. For, while, do-while, break, continue, exit() function. Goto and label declarations.
5. CONSOLE I/O: Unformatted console I/O functions, getchar(), putchar(), gets, puts(). Formatted console I/O, sprintf(), scanf().
6. ARRAYS, FUNCTIONS & POINTERS

7. Introduction to Operating System: Concept of resource management, single user and multi user OS, Various popular OS (DOS, Windows, Unix/ Linux), elementary commands.
8. Introduction to Internet: Fundamentals of networking – need of network topology, concept of LAN, WAN, MAN, network devices – NIC, hub, bridge, switch, repeaters, gateway, modem, transmission media. Internet services, concept of global net, different browsers, search engine.
9. MS – Office: Various products, their introduction and uses.

ANALOG ELECTRONICS

1. SEMICONDUCTOR DEVICES: Current carriers in semiconductors, P-type and N-type materials, P-N junction, biasing, characteristic curve, zener diode, Special semiconductor devices – tunnel diode, backward diode, varactor and PIN diode, their construction, operation and applications. Opto-electro devices: LDR, LED, photo diode, photo voltaic cell, solar cells, their construction, operation and applications. Bipolar transistor: Construction and schematic representation of PNP and NPN transistors, different types of biasing system, bias stabilisation, analysis of CE, CB & CC configuration, their I/P & O/P characteristics, transistor rating and specifications.
2. RECTIFIER CIRCUITS: Half wave and full wave rectifier, ripple factor, rectification efficiency, Peak Inverse Voltage, Filtering and voltage regulation: Capacitor filter, induction filter, 'T' filter, 'H' fil

   Zener voltage regulator.
3. AMPLIFIERS: Concept of Amplification, classification criteria of amplifiers and their classifications, Class A, B, C and AB amplifiers, Amplifiers coupling – RC coupled, transformer coupled, direct coupled and tuned coupled amplifiers and their comparison with reference to frequency response, Power amplifiers, push-pull amplifiers.
4. FEEDBACK AMPLIFIERS: Concept of feedback, positive and negative feedback. Their comparison with reference to gain, distortion noise, bandwidth, phase shift, input/output resistance and stability.
5. OSCILLATORS: Concept of oscillation, condition for oscillation, Barkhausen criterion, different types of oscillators, their expression for oscillating frequency and their comparison. (R-C shift oscillator, Hearty Oscillator, Crystal Oscillator).UJT relaxation oscillator – its operation & uses.
6. FIELD EFFECT TRANSISTOR (FET): Classification of FET: Construction, operation & characteristics of JFET & MOSFET. FET biasing techniques. Comparison of FET and BJT.

7. DIFFERENTIAL AMPLIFIER: Basic principles of differential amplifier – inverting & non-inverting input; single/ double ended input/output operation: difference and common mode gain: Common Mode Rejection Rate (CMRR). Circuit diagram of differential amplifier using BJT or FET, its operation.
8. OPERATIONAL AMPLIFIER: Differential Amplifier as its building block, other circuitry required, idea Op-Amp characteristics. Applications of Op-Amp-inverting amplifier, voltage follower, multiplier, summer, integrator, differentiator etc. The 741 Op-Amp IC-characteristics, pin-out diagram.
9. DC VOLTAGE REGULATOR: Transistorized linear regulator circuits – Series regulator, shunt regulator. IC Regulators.
10. WAVE SHAPING CIRCUITS: High-pass and Low-pass circuits – operation with different inputs, integrator, differentiator. Clipping and clamping circuits – their operations, clipping at different levels.
11. PULSE CIRCUITS: Concept of step pulse, rectangular pulse and their characteristics study. Concept of electronic switch – switching diode transistor as switch, their characteristics studies. Multivibrators – operation of Bi-stable, Schmitt Trigger, Mono-stable and A-stable multi-vibrators and their waveforms.
12. SWEEP CIRCUIT: Concept of sweep, difference between voltage and current time base generators. Operation of miller sweep and bootstrap circuits, synchronisation, applications.
13. UNI-JUNCTION TRANSISTOR (UJT): Construction, operation & characteristics of UJT.

DIGITAL ELECTRONICS

1. NUMBER SYSTEM: Understanding number system, binary, octal decimal, hexadecimal number systems and their conversion. Representation of binary number system. Signed and unsigned number system, 1's complement and 2's complement, number multiplication, division, subtraction and addition of binary numbers. Different coding systems i.e. binary code, BCD code, Excess-3 code, Gray code, ASCII code and Parity code.
2. LOGICAL GATES: Concept of logical gates, definition and truth table of OR, AND, NOT, NOR, NAND, X-OR, X-NOR gates. Universal logic gates, tri-state gates, buffers. Logic families: RTL, DTL, TTL, ECL and CMOS, their comparison.
3. BOOLEAN ALGEBRA: Principles of Boolean Algebra, definition of Boolean constant, variables and function, the rule of Boolean Algebra. De-Morgan's theorem, analysis of the operation of logical gates, realisation of Boolean expression logic gates. Simplification of compound Boolean expression, Algebraic and K-Map method of simplification, don't care condition. Arithmetic circuits – Half Adder, Full Adder, Half Subtractor, and Full Subtractor.

4. FLIP – FLOPS: Flip – Flops, Latch, R-S, J-K, T, D flip flops, clocked flip-flop, Master Slave J-K flip-flop.
5. REGISTERS & COUNTERS: Shift Register, serial in serial out (SISO), serial in parallel out (SIPO), parallel in series out (PISO), parallel in parallel out (PIPO). Counters: Synchronous, asynchronous counter, Ring counter, Up/Down counter.
6. COMBINATIONAL DIGITAL SYSTEMS: Binary Adders, Digital Comparator, parity checker/ generator. Decoder/ Demultiplexer, data Selector/ Multiplexer, Encoder. BCD to Segment Decoder.

7. CONVERTER CIRCUITRY: Digital to Analog converters and Analog to Digital converters.
8. MEMORY DEVICES: Introduction, classification & characteristics of memories. ROM architecture, types and applications. RAM – static, dynamic. Magnetic memories: Magnetic Tape, Disk, Hard Disk, Floppy Disk, Optical Disks (CDs). Introduction to PLA, PAL, GALs, FPLA.

MICROPROCESSORS AND MICROCONTROLLERS

1.0 INTRODUCTION: An overview of Micro-computer System, Block diagram of digital computer. Organization of Micro-computer, Computer languages – machine language, assembly language, high-level language.

2.0 MICROPROCESSOR ARCHITECTURE: Architecture of a typical 8-bit microprocessor, Intel 8085 microprocessors, study of functional units, functions of various control signals. Memory – Memory organization, memory map, buffer, timing diagram.

3.0 INTERFACING I/O DEVICES: Basic interfacing concepts, interfacing input/ output devices. I/O addressing schemes – I/O mapped I/O and memory mapped I/O techniques.

4.0 PROGRAMMING 8085 MICROPROCESSOR: Programming model, instruction classification, instruction format etc.

5.0 INTERFACING PERIPHERAL I/Os: Interfacing of peripheral chips with 8085: Programmable Peripheral Interface (Intel 8255), Programmable Communication Interface (Intel 8251), Programmable Interval Timer (Intel 8253 and 8254), Programmable Keyboard / Display Controller (Intel 8279), Direct Memory Access (Intel 8257).

6.0 MICROPROCESSOR APPLICATION: Stepper motor interface, A/D and D/A converter chips and their interface, Concepts of interfacing microprocessor to high power devices. Serial and parallel bus standards – RS 232 C, IEEE 488 Centronics parallel interface standards.

7.0 MICROCONTROLLERS: Introduction, comparison with microprocessors. Study of microcontroller (MCS 51 family) – Architecture, instruction set, addressing modes and its programming.