SAVITRIBAI PHULE PUNEUNIVERSITY
[Formerly University of Pune]
DEPARTMENT OF ELECTRONICS & INSTRUMENTATION SCIENCE,
Syllabus for M.Sc. Electronic-Science Entrance Examination, June 2026

Section A: General Aptitude (20%)
Aptitude, Reasoning, Ratios and Proportions, Area and Volume, Surds and Indices, Progressions, Series, Problems on Ages, Sets, Permutations, Combinations, Probability, height, distance and time, basics of geometry, Encoding and decoding, Blood Relation problems, Missing element in a sequence, logical reasoning.

Section B:9
Unit I: Mathematical Methods for Electronics and C Programming (10%)
Complex Numbers and its operations, Scalers and Vectors, vector operations, Divergence, gradient and Curl, Matrix and Operations, Solution of System of linear equations, Function types and examples Dirac Delta Function, Unit Impulse Function, Limit and Continuity, Differentiation and Integration, Applications of Definite Integral, Differential Equations and its solutions.
Type of Programming Languages, Identifiers in C, Variables and Data Types, Constants, Standard Input Output functions, Expressions and Arithmetic Operators, Relational and Logical Operators, Bitwise Operator, If statement, If-else statement, Else-if statement, , Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue, Special Cases, Introduction and Writing Functions, Scope of Variables, Storage Classes, Pass by Value and reference, Recursion, Array and Array operations, String and String operations, Pointers, File Operations using C.

Unit II: Analog Electronics (10%)
Diodes, diode equation, Graphical/Load line analysis, Diode models- Ideal, Piecewise linear AC, Other diode types, Zener diodes, Diode applications, Peak sample, power rectifier, clamps, regulator, Bipolar transistors-Definitions, V-I characteristics, breakdown, Common- emitter large signal model, graphical analysis, Common-collector, Common-emitter, Applications: current source, DC power supply regulator, Bipolar transistors, Transistor biasing, Hybrid-pi equivalent circuit, High-frequency hybrid-pi, H-parameters, Common- emitter amplifier, AC load line, Common-collector (emitter-follower) amplifier, Junction field-effect transistors, Operation, Background and V-I characteristics: JFET, FET switch, chopper, MUX, Low frequency incremental model, Biasing, JFET current source, Two- transistor amplifiers, Differential emitter-coupled pair, Current mirror, Complementary emitter-follower (Class B, AB), Amplifier classes, Power amplifiers, Operational amplifiers, Overview, Basic linear op-amp circuits, Inverting, non-inverting, addition, subtraction, AC amplifiers, inverting, and non-inverting, Cascading; Ideal impedances, I-V conv, V-I conv, difference amp, instrument amp, Integrator, differentiator, Lossy integrator,. Negative feedback, Operational amplifiers, Limitations, Effect of finite open-loop gain, Differential and common mode input voltage limits, Common-mode rejection ration, Input resistance, Input bias current, input offset current, Non-zero output resistance, Frequency response, gain- bandwidth product, Output voltage swing, saturation, Output current limit, Compensation, Slew rate, Offset voltage and drift, Op-amp selection considerations, Operational amplifiers, Non-linear op-amp circuits, Precision ½ wave rectifier, log and antilog amps, Comparator, Schmitt-trigger, Schmitt-trigger oscillator [Astable multivibrator]e. 555 IC timer

Unit III: Digital Electronics (10%)
TTL Logic, CMOS logic, fan in, fan out, propagation delay, noise margin, combinational circuits, Logic gates based on TTL , AND, OR,NOR,EXOR,NAND, mathematical circuit Adder, Subtractor, half adder, half subtractor, full adder, full subtractor, comparator, parity generator, odd parity, even parity, number systems, binary, decimal, hexadecimal, octal systems, sequential circuits, shift registers, counters, memory cells, flip flops, multiplexer, demultiplexers, Analog to digital converter, digital to analog converter.

Unit IV: Microcontrollers (10%)
Introduction to 8051 Microcontroller, Architectural block diagram of microcontroller, functions of each block, microcontroller features, functional pin diagram and pin description, Application of microcontroller. Classification of instructions, the syntax of instructions, instruction cycle, machine cycle, instruction set, addressing modes, and Types of instruction (Data transfer instruction, Arithmetic instruction, logical instruction, Boolean Instruction, Program branching instructions). Special function registers, Timer and counter, interrupts in the microcontroller, a priority of interrupts, stack pointer, stack memory and stack operations.
Memories, Latches, shift registers, Ram, NVRAM, ROM, PROM, UVPROM, EEPROM, FLASH, SRAM, DRAM, serial EEPROMS, Serial RAM.
Integrated Development Environment, Compiler, Debugger, Interfacing of ADC (Analog to Digital Converter) and DAC (Digital to analog converter), communication protocols (UART, USART, I2C, SPI, USB, CAN). Basics of Motor, Working Principle of DC and Stepper motor, Interfacing of DC motor and Stepper motor, PWM, Speed control of DC motor using PWM, interfacing of LCD display, sensors, and actuators.

Unit V: Semiconductor and Power Electronics (10%)
Moore's Law, P-N junction fundamentals, diffusion current, drift current, junction capacitance, light emitting diode, varactor diode, Schottky diode, tunnel diode, PIN diode, photodiode, Zener diode, solar cell, n-p-n/p-n-p transistor basics, operating point, amplification using BJT, power devices fundamentals, MOSFET, DIAC, TRIAC, SCR, Commutation techniques, Power BJT, Relays, Thyristor, IGBT, Buck, Boost, Buck -Bost Converters, Inverters, SMPS

Unit VI: Electromagnetics (10%)
Sources and effects of electromagnetic fields, Coordinate Systems, Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications. Poisson's Equation, Lorentz force, magnetic field intensity (H) – Biot– Savart's Law – Ampere's Circuit Law, Faraday's law, Maxwell's equations (differential and integral form) Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth – Poynting vector – Plane wave reflection and refraction. Transmission lines, Decibels, Attenuation, noise, Radio waves, transmission losses: conductor losses, dielectric losses, Electromagnetic spectrum.

Unit VII: Communication (10%)
Basics of Communication Systems, Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, base band and broad band communication. Wave propagation: permeability, permittivity, noise concept and types, signal to noise ratio, noise figure, noise temperature, Need of modulation, concept of modulation, Amplitude Modulation, frequency Modulation, AM waveform, mathematical expression of AM power, concept of sideband, modulation index, power distribution.

Demodulation principles, demodulator circuit using diode, super-heterodyne receiver, characteristics of receiver: selectivity, sensitivity, Image frequency and dynamic range, square law modulator, Digital Communication Systems, advantages of digital communication system, bit rate, baud rate and bandwidth. Serial and parallel communication, concept of sampling, Sampling theorem, concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM, Concept of FDM and TDM, Antenna

Unit VIII: Nanoelectronics and devices (10%)

Basics of nanostructures, Characterization of nanostructures, electronic transport in nanostructures, Region of nanostructures, scaling of devices in silicon technology, estimation of technology Limits, Uncertainty principle, duality principle, Schrodinger's equation and its applications, Materials for nano electronics and Devices, short channel MOSFETS., Coulomb Blockade, Single- Electron Transistor, Carbon Nanotube, Semiconductor Nanowire, Quantum well and quantum dot laser.

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