

Electronic Science Department Kurukshetra University

Syllabus for Ph.D. Entrance Test (Papers 1 & II) in the subject of Electronic Science

1. Numerical Methods

Transcendental Equations, Iteration Methods, Operational Methods in Applied Mathematics; Laplace Transforms, Fundamental rules, Approximate Methods in Applied Mathematics,

2. Device Electronics and Modeling

Electronic Transport in Semiconductors, The p-n junction, Junction Break down, The Junction FET, Transistor Action, Active bias, Transistor switching, Ebers-Moll Model, Metal-Semiconductor Junction, Current-Voltage Characteristics, Non-rectifying contacts, Surface effects, Schottky diodes. MOS structure, MOSFET, Basic Theory, Scaling MOSFET to smaller size, Modeling, D-C Models, Small Signal Models, Use of device models in circuit analysis, IC Building-Introduction, Switches (In Brief), Active Resistors (In brief), Current sources and sinks - BJT and MOS (In brief), Circuit Simulation-Introduction, MOSFET, Diode and BJT Models for circuit simulation.

3. Digital Electronics, Computer Architecture and Microprocessors

Logic families, CMOS logic, Electrical behaviour of CMOS circuits, Combinational logic circuits design, Asynchronous Circuits, Sequential logic Design principles, Latches and Flip-Flops, Machine Analysis, State Machine Structures, Characteristic Equations, Microcomputer System: Computer Organisation, Number systems and Codes, Memory, ALU, Control Unit, Personal Computer Concepts and Techniques, PC Hardware Overview: Introduction- 8086 Microprocessor- Internal Architecture, programming the 8086. The Intel 8253 and 8254, Multiple interrupts and the 8259A Priorities Interrupt Controllers. Digital Interfacing, Analog Interfacing: D/A converter operation, Interfacing and applications, an 8086 based Process Control system, DMA Data Transfer, Advance Microprocessors.

4. Communication Fundamentals, Microwave & Optoelectronic Devices

Maxwell's Equation, Wave Equation and Boundary conditions, Wave-guides, Rectangular and Coaxial Waveguides, Resonant cavities, Transmission lines, Impedance Matching, Radio Wave propagation, Pulse Communication, Digital Communication, FSK, PSK, BPSK, QPSK, DPSK. Error Detection and Correction Codes, Modern Telephone Networks, Satellite Communication, Microwave Communication and Optical Fibre Communication, Microwave Introduction, Waveguides, Microwave Passive Components, Measurements of Wavelength, Frequency, Impedance, SWR etc., Q of Cavity, Microwave Linear Beam Tubes, Conventional Tubes-limitations at High Frequencies, Klystron. Reflex Klystron. Traveling Wave Tube, Backward Wave Amplifier & Oscillator, Transferred Electron Devices, Avalanche Transit Time Devices, IMPATT Diode, TRAPATT Diode, BARITT Diode Parametric Devices, Parametric amplifiers, Basic Principles of Light Emission in Semiconductors, Display Devices, Luminescence, LEDs, Photo Detectors, Semiconductor Lasers, Heterostructure, DH Lasers, Quantum Well Devices, Optical Fiber Communication, Propagation in Fibers, Step Index Fibers, Graded Index Fibers, Attenuation in Optical Fibers, Photo-diode. Detectors for Optical Communication Application, Optoelectronic Integrated Circuits.

5. Electronic Instrumentation: Instrument classification and characteristics, Basic control actions and response of control system, Measurement and Control of Pressure, Temperature, Speed etc., Electronic Instruments for Measuring Basic Parameters, Lock-in-Amplifiers, Digital Storage Oscilloscopes, Transducers for displacement, sound, Force Torque, Flow Measurements, Automatic test systems, Computer Integrated Experimentation, Bioelectric Signals and Electrodes, Physiological transducers, Computer Applications in Medical Field, Analogue and Digital Data Acquisition Systems, Interfacing Transducers to Electronic Control and Measuring Systems.

6. Integrated Circuit Processing: Vacuum Science and Technology, Resistivity measurement: Four point probe, Resistivity of Arbitrarily Shaped Samples, Resistivity profiling: Anodic Oxidation- Carrier and Doping Concentration Measurements, Capacitance measurements, Current-Voltage Measurements, Metallization for Conductors, Chemical Vapor Deposition, Molecular Beam Epitaxy, Thermal Oxidation of Silicon, Diffusion in Silicon, Ion implantation. Photolithography, Wet Chemical Etching, Plasma Etching, Fundamental considerations for IC Processing, NMOS IC Technology, CMOS IC Technology, MOS Memory Technology, Bipolar IC Technology, IC Fabrication.