JGI JAIN DEEMED-TO-BE UNIVERSITY | FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SYLLABUS FOR THE Ph.D. ENTRANCE EXAMINATION FOR ELECTRICAL ENGINEERING DISCIPLINE

Electric Circuits Theory and Network theory

AC and DC Circuits - Node and Mesh Analysis - Network theorems - Network graphs - matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Star - Delta Transformations.

Steady state sinusoidal analysis using phasors. time domain analysis of simple RLC circuits, - frequency domain analysis of RLC circuits. 2-port network Parameters - three phase circuits.

Electronic Devices and circuits

Electronic devices –principle- construction -working - Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers.

Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters.

Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. integrated circuits fabrication process,

Digital circuits: Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

Signals and Systems:

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

Control Systems:

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-

Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

Electrical Machines:
Single phase transformer -equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers -connections, parallel operation; auto-transformer; energy conversion principles; DC machines -types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors - principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous Machines -performance, regulation and parallel operation of generators, motor starting, characteristics and applications; servo and machines stepper motors.

Power Systems:
Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference; distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control; power factor correction; economic operation; symmetrical components; fault analysis; principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

Measurements and instrumentation:
Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurement of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

Power Electronics and Drives:
Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs -static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters -fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.