MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

Ph. D ADMISSION TEST (MR-PAT)

Ph.D. in Electrical and Electronics Engineering

Module 1: Electrical Circuits

1.1 KCL, KVL, Node and Mesh analysis
1.2 Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem
1.3 Transient response of DC and AC networks
1.4 resonance, two port networks, balanced three phase circuits, star-delta transformation,
1.5 complex power and power factor in AC circuits.

Module 2: Electrical Machines

2.1 Single phase transformer,3-Phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency
2.2 DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors
2.3 Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors
2.4 Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators

Module 3: Power Electronics

3.1 Thyristor, MOSFET, IGBT:V-I characteristics and firing/gating circuits
3.2 Buck, Boost and Buck-Boost Converters
3.3 Voltage and Current commutated Thyristor based converters
3.4 Bidirectional ac to dc voltage source converters
3.5 Single- phase and three-phase voltage and current source inverters, sinusoidal pulse width modulation

Module 4: Control Systems

4.1 Feedback principle, transfer function, Block diagrams and Signal flow graphs
4.2 Transient and Steady-state analysis of linear time invariant systems
4.3 Stability analysis using Routh-Hurwitz and Nyquist criteria
4.4 Bode plots, Root loci, Lag, Lead and Lead-Lag compensators
4.5 P, PI and PID controllers

Module 5: Analog and Digital Electronics

5.1 Diode circuits: clipping, clamping, rectifiers
5.2 Amplifiers: biasing, equivalent circuit and frequency responseTopic 3
5.3 Operational amplifiers: characteristics and applications
5.4 Active Filters: Sallen Key, Butterwoth, VCOs and timers
5.5 Combination and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers
5.6 A/D and D/A converters

Module 6: Measurements and Instrumentation

6.1 Bridges and Potentiometer
6.2 Measurement of voltage, current, power, energy and power factor
6.3 Instrument transformers, Digital voltmeters and multi-meters
6.4 Phase, Time and Frequency measurement
6.5 Oscilloscopes, Error analysis

Suggested Readings:

1. Transient Analysis Of Electric Power Circuits by Arieh L Shenkmann
2. Electrical Machinery by P.S Bimbhra
3. Power Systems Engineering by Nagrath and Kothari
4. Control Systems Engineering by Nagrath and Gopal
5. Electrical and Electronic Measurement and Instrumentation by AK Sawhney
6. Electronic Devices and Circuit Theory by Boylestad
7. Power Electronics by P. S. Bimbhra
8. Integrated Electronics : Analog And Digital Circuits And Systems by Christos C. Halkias, Chetan D. Parikh Jacob Millman