

**Malaviya National Institute of Technology Jaipur**  
**Department of Electrical Engineering**

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**PhD Examination Model questions:**

1. Nobody knows how the Indian cricket team is going to cope with the difficult and seamer friendly wickets in Australia. Choose the option which is closest in meaning to the underlined phrase in the above sentence.  
  
(a) Put down to (b) Put in with (c) Put up with (d) Put up against
  
2. If  $137+276=435$  how much is  $731+672$ ?  
  
(a) 534 (b) 1403 (c) 1623 (d) none of these options
  
3. A 6-pole, 50 Hz induction motor runs at a speed of 1200 rpm. The frequency of the rotor current is  
  
(a) 5 Hz (b) 7.5 Hz (c) 2.5 Hz (d) none of these options
  
4. The Conduction loss (vs) device current characteristic of a power MOSFET is best approximated by  
  
(a) Parabola (b) Straight line (c) rectangular hyperbola (d) none of these options
  
5. For a filter with  $|H(\omega)|=1$  in a certain band of frequency, this filter is  
  
(a) Low pass filter (b) High pass filter (c) Band pass (d) Band stop

**Syllabus for PhD Entrance Examination**

**Linguistic and Mathematical Ability:**

Mathematical skills, Intelligence and critical reasoning, Language comprehension, Data Analysis and Sufficiency.

**Technical:**

Network elements, Network solution methods, and Network Theorems. Response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.

Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Capacitance of simple configurations, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Continuous and discrete time signals, shifting and scaling properties, linear time invariant and causal systems, Fourier series representation of continuous and discrete time periodic signals, sampling theorem, Laplace Transform and Z transform.

Single phase transformer, and Three-phase transformers, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles, DC machines: motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines, Single-phase induction motors; Synchronous machines, and starting of synchronous motors. Types of losses and efficiency calculations of electric machines

Basic concepts of electrical power generation, ac and dc transmission concepts, Performance of transmission lines, Series and shunt compensation, Distribution systems, Per-unit quantities, Bus admittance matrix, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Over-current, differential, directional and distance protection; Circuit breakers, System stability concepts, Equal area criterion, Economic Load Dispatch

Mathematical modeling and representation of systems, Feedback principle, transfer function, Transient and Steady-state analysis of linear time invariant systems, Stability analysis, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems,.

Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Sallen Key, Butterworth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.

Static V-I characteristics and firing/gating circuits for Thyristor, MOSFET, IGBT; DC to DC conversion, Single and three-phase configuration of uncontrolled rectifiers, Bidirectional ac to dc voltage source converters; Magnitude and Phase of line current harmonics, Power factor and Distortion Factor of ac to dc converters; Single-phase and three-phase voltage and current source inverters, sinusoidal pulsewidth modulation.