

SYLLABUS FOR PH.D. ADMISSION (WRITTEN TEST)

Specialization: Electric Drive and Power Electronics (EDPE Group)

ELECTRICAL ENGINEERING DEPARTMENT INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Part A : Mathematics (10 marks)

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigenvalues, Eigenvectors.

Calculus: Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series, Vector identities, Directional derivatives, Line integral, Surface integral, Volume integral, Stokes's theorem, Gauss's theorem, Divergence theorem, Green's theorem.

Differential equations: First order equations (linear and nonlinear). Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's equation, Euler's equation, Initial and boundary value problems, Partial Differential Equations, Method of separation of variables.

Complex variables: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor series, Laurent series, Residue theorem, Solution integrals.

Probability and Statistics: Sampling theorems, Conditional probability, Mean, Median, Mode, Standard Deviation, Random variables. Discrete and Continuous distributions, Poisson distribution, Normal distribution, Binomial distribution, Correlation analysis, Regression analysis.

Part B : Specialization (30 marks)

Electric Machines, Electric Drives and Power Electronics (EDPE group):

AC Machines (synchronous and asynchronous types), DC Machines, Transformers, Semiconductor switches (Diode, SCRs, MOSFET, IGBT), Fundamentals of Gate drive circuit, Phase controlled rectifier/inverter, Front end PWM rectifier, Improved power factor based single phase converter, Multi-quadrant chopper, DC-DC converter (non-isolated and isolated types), Basic Pulse Width Modulation technique for VSI, Multi-level Inverters, Converter/chopper fed DC drives, VSI/CSI fed Induction Motor Drive, Basic transient studies in electrical circuits, Quality of voltage and current (PF, THD etc.).