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Syllabus for Ph.D. Entrance Test
(Electrical Engineering)
[2023]

Note:- The Entrance Test shall be based on a single question paper comprising of two parts i.e. 'A' and 'B'. The part 'A' of the question paper will be on research methodology while part 'B' of the question paper will be according to the concerned subject syllabus. The question paper will be multiple choice (objective type) questions of one mark each. Each question will have 4 alternative responses marked as (A), (B), (C) and (D). Everyone is required to darken the circle as indicated below against the most appropriate response.

Here D is the most appropriate response.

PART A: (Research Methodology)

Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.

Types of Research: Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.

Research Design: Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design.

Sampling, Data Collection and analysis: Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling, classification and tabulation of data, graphical representation of data, graphs and charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties.

Statistical Methods for Data Analysis : Applications of Statistics in Research, measures of central tendency and dispersion

Research Report: Research report and its structure, journal articles – Components of journal article. Explanation of various components. Structure of an abstract and keywords. Thesis and dissertations. Components of thesis and dissertations. Referencing styles and bibliography.

Part B: (Electrical Engineering)

1. Electric Circuits and Networks

Nodal and mesh analysis, Network theorems: Thevenin's , Norton's ,Superposition and Maximum Power Transfer theorems, Star-Delta transformation, Steady state sinusoidal analysis using phasors, Linear constant coefficient differential equations, time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform, frequency domain analysis of RLC circuits, 2-port network parameters: driving point and transfer functions. State equations for networks and three phase circuits.

2. Electrical Machines

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

3. 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; overcurrent, 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.

4. Electrical and Electronic Measurements

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.

5. 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; choppers and inverters; power quality, adjustable speed dc and ac drives, Renewable Energy Systems (Small Hydro, PV, Wind), Energy Audit & Efficiency.

Model Question Paper

1. For a series R-L-C circuit at resonance condition, the power factor of the circuit at lower half power frequency is:
A) leading
B) lagging
C) unity
D) zero

2. Pure capacitive circuit takes power from the ac line when:
A) voltage and current are of same sign
B) voltage –ive and current +ive
C) voltage +ive and current -ive
D) none of these

3. A transformer has maximum efficiency at 4/5th of full-load. Its iron loss (Pi) and full load copper loss (Pc) are related as:
A) Pi / Pc = 25/16
B) Pi / Pc = 4/5
C) Pi / Pc = 5/4
D) Pi / Pc = 16/25

4. In a given magnetic circuit, a current of 1 A flowing in the exciting winding produces a flux of 1 Wb. If the circuit reluctance is doubled, for the production of same flux, the exciting current required would be:
A) 2 A
B) 1 A
C) 0.5 A
D) 1.5 A