G. NARAYANAMMA INSTITUTE OF TECHNOLOGY & SCIENCE
(For Women)

(AUTONOMOUS)
Shaikpet, HYDERABAD - 500 104

II Year B.Tech.EEE II-Semester

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ELECTRICAL MACHINES-II

Prerequisites: Basic Electrical Engineering, Circuit Theory and Electrical Machines-I

Course Objectives:

1. To understand the construction and operating characteristics of Induction motor, synchronous machines and fractional KW machines.
2. To Analyse the Induction motor and Synchronous machine performance for different loading conditions, as well operating in parallel.
3. To know Different starting methods of Induction motor, Synchronous motor and Special motors.
4. To identify different speed control methods and various tests to assess the performance of AC Machines.

Unit 1: (~10 Lecture Hours)
Poly-Phase Induction Motors:
Poly -phase Induction motors-construction details of cage and wound rotor machines -production of a rotating magnetic field-principle of operation-rotor EMF and rotor frequency-rotor reactance, rotor current and pf at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation – deduction from torque equation-expressions for maximum torque and starting torque-torque slip characteristic – double cage and deep bar rotors-equipment circuit –phasor diagram-crawing and cogging.

Unit 2:(~10 Lecture Hours)
Circle Diagram & Speed control of Induction Motors:
Circle diagram: No load and blocked rotor tests –predetermination of performance – methods of starting and starting current and torque calculations.
Speed control: Change of frequency; change of poles and methods of consequent poles; cascade connection; Injection of EMF into rotor circuit (Qualitative treatment only)-induction generator – principle of operation.

Unit 3: (~10 Lecture Hours)
Synchronous Generators:
Constructional features of cylindrical rotor & Salient pole machines, armature windings- Integral Slot and Fractional Slot, distributed and concentrated, full pitch and short pitch windings. Pitch factor, distribution factor, winding factor and EMF equation, numerical problems.
Harmonics in generated EMF, suppression of harmonics, Armature reaction, Leakage reactance, Synchronous reactance & synchronous impedance-

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Experimental determination of synchronous reactance, Phasor diagram. Voltage regulation by synchronous impedance method, MMF method, ZPF method and ASA methods.
Salient pole alternators- Two reaction theory, Experimental determination of X_d&X_q, Phasor diagram, regulation of salient pole alternator, numerical problems.

Unit4: (~10 Lecture Hours)
Parallel operation of Synchronous generators and Synchronous Motors:

Parallel operation of Synchronous generators: Synchronization methods, synchronizing power, torque, parallel operation and Load sharing. Effect of change of excitation and mechanical power input, Analysis of short circuit current waveform – determination of sub-transient, transient and steady state reactance, numerical problems.
Synchronous Motors: Theory of operation, Phasor diagram, variation of current and power factor with excitation, synchronous condenser, mathematical analysis for power developed, hunting and its suppression. Methods of starting, numerical problems.

Unit 5: (~5 Lecture Hours)
Single phase induction motors and Special motors:
Constructional features, double revolving field theory, equivalent circuit – determination of parameters split phase starting methods, stepper motor, BLDC motor, Applications, numerical problems.

Text Books:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. J.B. Gupta. "Theory & Performance of Electrical Machines" Published by S.K. Kataria & Sons, Latest edition
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.

Course Outcomes:

1. Analyze the construction and operating characteristics of Induction motor, synchronous machines and fractional KW machines.
2. Analyze the Induction motor and Synchronous machine performance for different loading conditions, as well operating in parallel.

3. Carry out different speed control methods and various tests to assess the performance of AC Machines.
4. Identify and design the suitable AC machine for the desired application based on their characteristics.
5. Understand Different starting methods of AC Machines.
6. Apply conceptual things to implement real time electrical problems in commercial and domestic application.

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