SYLLABUS

EE2203PC: Electrical Machines–II

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Prerequisite: Basic Electrical Engineering**,** Electrical Machines-I

Course Objectives:

- To deal with the detailed analysis of poly-phase induction motors & Alternators.
- To understand operation, construction and types of single-phase motors and their applications in house hold appliances and control systems.
- To introduce the concept of parallel operation of alternators
- To introduce the concept of regulation and its calculations.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines.

UNIT – I

Poly-Phase Induction Machines: Constructional 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 Power factor at standstill and during operation.

UNIT – II

Characteristics of Induction Machines: 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 - equivalent circuit - phasor diagram - crawling and cogging -.No-load Test and Blocked rotor test – Predetermination of performance-Methods of starting and starting current and Torque calculations.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator- principle of operation**.**

UNIT – III

Synchronous Machines: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated E.M.F. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reaction analysis – experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT – IV

Parallel Operation of Synchronous Machines: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form – determination of sub-transient, transient and steady state reactance‘s.

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 – synchronous induction motor.

UNIT – V

Single Phase & Special Machines: Single phase induction motor – Constructional Features - Double revolving field theory – split-phase motors – shaded pole motor- Principles of A.C. Series motor- Universal motor.

TEXT BOOKS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery‖, McGraw Hill Education, 2013.
2. M. G. Say, ―Performance and design of AC machines‖, CBS Publishers, 2002.

REFERENCE BOOKS:

1. P. S. Bimbhra, ―Electrical Machinery‖, Khanna Publishers, 2011.
2. J. Nagrath and D. P. Kothari, ―Electric Machines‖, McGraw Hill Education, 2010.
3. S. Langsdorf, ―Alternating current machines‖, McGraw Hill Education, 1984.4. P. C. Sen, ―Principles of Electric Machines and Power Electronics‖, John Wiley & Sons, 2007.