

5th Semester	REL5C003	Electrical Machines - II	L-T-P 3-0-0	3 Credits
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Electrical Machines - II

Module I: (8 Hours)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; singleturn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

Module II: (4 Hours)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Module III: (12 Hours)

Three Phase Induction Motor

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Module IV: (6 Hours)

Single Phase Induction Motor

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

Module V: (10 Hours)

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Books:

- [1] Stephen J. Chapman-‘Electric Machinery and Fundamentals’- Mc Graw Hill International Edition, (Fourth Edition), 2015.
- [2] M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
- [3] A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
- [4] P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
- [5] I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

- [6] A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.
- [7] P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007

Digital Learning Resources:

Course Name: Electrical Machine-II
Course Link: <https://nptel.ac.in/courses/108/105/108105131/>
Course Instructor: Prof. T K Bhattacharya, IIT Kharagpur