

ELECTRICAL MACHINES – II

Course Code: 15EE1107

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Course outcomes:

At End of course, a student will be able to

- CO 1** Outline different types of Alternators and their performance criteria.
- CO 2** Identify different types of synchronous motors, interpret their performance under different load conditions
- CO 3** Reproduce the construction and working principle of various types of 3 phase induction motor.
- CO 4** Summarize different techniques related to speed control of 3-phase induction motor.
- CO 5** Associate the principles related to 1 phase induction motors and special motors.

UNIT-I

(10 Lectures)

SYNCHRONOUS GENERATOR

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF and ZPF methods – Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics - Capability curves.

UNIT-II

(10 Lectures)

SYNCHRONOUS MOTORS

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed.

UNIT-III**(10 Lectures)****THREE PHASE INDUCTION MOTOR**

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

UNIT-IV:**(10 Lectures)****STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR**

Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control – Change of voltage, torque, number of poles and slip – Cascaded connection – Slip power recovery scheme.

UNIT-V:**(10 Lectures)****SINGLE PHASE MOTORS & SPECIAL MOTORS:**

Single phase induction motor – Constructional features-Double revolving field theory – Elementary idea of cross-field theory – split phase motors – shaded pole motor.

Principle & performance of A.C. Series motor-Universal motor, Principle of permanent magnet and reluctance motors

TEXT BOOKS:

1. M.G. Say, Performance and Design of A.C. Machines, ELBS and Pitman & Sons, 3rd Edition, 2008.
2. P.S. Bimbra, Electrical Machines, Khanna Publishers, 7th Edition, 2010.

REFERENCES:

1. I. J. Nagrath & D.P. Kothari, Electric Machines, Tata McGraw-Hill Publishers, 4th Edition, 2010.
2. A.E. Fitzgerald, C. Kingsley and S. Umans, Electric Machinery, McGraw-Hill Companies, 5th Edition, 1990.

3. Mukerjee and Chakravarthy, Electrical Machines, Khanna Publishers, 2nd Edition 1993.
4. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw-Hill, 2nd Edition, 2006.
5. A.K. Sawhney, Electrical Machine Design, DhanpatRai& Sons, 5th Edition, 2004.