



B.P. PODDAR INSTITUTE OF MANAGEMENT AND TECHNOLOGY
137, VIP Road, PoddarVihar, Kolkata: 7000052
Department of Electrical Engineering
Academic Year -2024-25(Odd Semester)
LESSON PLAN

Program : Electrical Engineering Credit: 3 Contact: 3L
Course Name : Electric Machine II
Course Code : PC EE 501
Course Coordinator: Anushree Roy

Lectures Number	Topics to be covered	Text Books / Reference	Teaching Pedagogies
L1	Physical arrangement of windings in stator and cylindrical rotor, Different types of coils: single-turn, two turn and multi turn coil - active portion and overhang	T2, R3, T4, W1	1. Lecture 2. Online video lectures 3. Power Point Presentation
L2	Closed winding and open winding, slots for windings, classification of full-pitch and short pitch coils, visualization of concentrated and distributed winding	T2, R3, T3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L3	Derivation of pitch factor, distribution factor and winding factor, MMF distribution in distributed winding	T2, R3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L4	Air-gap MMF distribution with fixed current through winding-concentrated and distributed, Sinusoidally distributed winding	T2, R3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L5	Numerical Problems on distribution factor, pitch factor, winding factor, phase spread	T2, R3, W1	1. Lecture 2. Power Point Presentation
L6	Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement	T2, R3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L7	Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings	T2, R3, W1	1. Lecture 2. Quiz 3. Power Point Presentation
L8	Pulsating fields produced by spatially displaced windings, development of magnetic field for windings spatially shifted by 90 degrees and with addition of pulsating magnetic fields	T1, T2, R3	1. Lecture 2. Quiz 3. Power Point Presentation
L9	Development of magnetic field three windings spatially shifted by 120 degrees, generation of rotating magnetic field	T1, T2, R3	1. Lecture 2. Quiz 3. Power Point Presentation
L10	Mathematical and graphical analysis of rotating magnetic field.	T1, R2, W3	1. Lecture 2. Power Point Presentation
L11	Construction and types of 3 phase induction machine (squirrel cage and slip-ring)	T3, R3	1. Lecture 2. Quiz 3. Power Point Presentation
L12	Induction motor compared with transformer, frequency and magnitude of rotor induced emf	T2, R3	1. Lecture 2. Quiz 3. Power Point Presentation

L13	Developed torque, output torque and maximum torque equations from power flow in an induction motor	T1, T2, T3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L14	Numerical problems on slip, power and torque	T2, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L15	Equivalent circuit and phasor diagram of induction machine, No load and blocked rotor test to determine equivalent circuit parameters, determination of losses	T4, R2, P2	1. Lecture 2. Online video lectures 3. Power Point Presentation
L16	Numerical problems on equivalent circuit, losses, no load and blocked rotor test	T1, T2, R3. P2	1. Lecture 2. Power Point Presentation
L17	torque-speed characteristics, effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency)	T1, T2, R3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L18	Operation of IM with single phasing, effect of harmonics, cogging,	T3, T4, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L19	Methods of starting, braking and speed control for induction motors with numerical problems.	T1, T4, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L20	Induction generator operation, concept of doubly fed induction generator.	T1, T4, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L21	Constructional features of single-phase IM, double revolving magnetic field	T1, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L22	Starting methods: split-phase starting, shaded pole, repulsion star and reluctance start motor, areas of application.	T1, R2, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L23	Condition for maximum starting torque, equivalent circuit, determination of equivalent circuit parameters.	T2, T4, R2, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L24	Numerical problems on starting and maximum torque, equivalent circuit	T3, T4	1. Lecture 2. Power Point Presentation
L25	constructional features of synchronous machine: constructional structure of rotor and stator	T2, T3, T4, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L26	Operating principle of alternator, Excitation system used in rotor field	T2, T3, T4, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L27	EMF generation in alternator, armature reaction, phasor diagram and equivalent circuit of an alternator	T2, T3, T4, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L28	Determination of synchronous impedance, voltage regulation of an alternator.	T2, T3, T4, W4	1. Lecture 2. Online video lectures 3. Power Point Presentation
L29	Numerical problems on open and short circuit test, voltage regulation.	T1, T2, T3, T4, W4, P3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L30	Power angle characteristics of alternator, two-reaction model of salient pole machine.	T1, T2, T3, T4, W4	1. Lecture 2. Online video lectures

			3. Power Point Presentation
L31	Parallel operation of alternator, numerical problems	T1, T2, T3, T4, W4, P3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L32	Starting of synchronous motor, equivalent circuit, Power flow in synchronous motor, Operating curves: V and inverted V curves of synchronous motor.	T1, T2, T3, T4, W4	1. Lecture 2. Power Point Presentation
L33	Hunting, and synchronous condenser	T1, T2, T3, T4, W4	1. Lecture 2. Power Point Presentation
L34	Numerical problems related to synchronous motor	T1, T2, R3	1. Lecture 2. Power Point Presentation
L35	Special Electromechanical devices: Types and Area of application	T1, T4, W1	1. Lecture 2. Power Point Presentation
L36	Working principle and construction of switched Reluctance motor	T2, W3, P1	1. Lecture 2. Power Point Presentation
L37	Working principle and construction of Permanent magnet machines and Brushless DC machines.	T2, W3, P1	1. Lecture 2. Online video lectures 3. Power Point Presentation
L38	Brushless DC machines contd.	T2, W3, P1	1. Lecture 2. Power Point Presentation
L39	Working principle and construction of Stepper motor and Tacho generators.	T1, T4, W3	1. Lecture 2. Online video lectures 3. Power Point Presentation
L40	Numerical problems related to Stepper motor, Tacho generators	T1, T4, W3	1. Lecture 2. Power Point Presentation

Text Books:

- T1.** Electrical Machines -II , P.S. Bimbhra, Khanna Book Publishing House.
- T2.** Electrical Machinery, P.S. Bimbhra, Khanna Publishing House.
- T3.** Electrical Machines, Nagrath & Kothary, TMH
- T4.** Electrical Machines, P.K. Mukherjee and S. Chakravorti, Dhanpat Rai Publications.
- T5.** Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI

Reference Books:

- R1.** Electric Machinery & Transformer, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
- R2.** Electric Machinery & Transformes, Irving L. Kosow, PHI.
- R3.** Electric Machinery, A.E.Fitzgerald, Charles Kingsley,Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
- R4.** Electrical Machines, R.K. Srivastava, Cengage Learning
- R5.** Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition
- R6.** The performance and Design of Alternating Current Machines, M.G.Say, CBS publishers & distributors
- R7.** Electric Machines, Charles A. Gross, CRC press.
- R8.** Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers & Distributors

Web References:

- W1. <https://nptel.ac.in/courses/108108191> (Lecture 18-23)- AC Machine Winding
- W2. <https://nptel.ac.in/courses/108108076> (Lecture 36-38),
- W3. <https://nptel.ac.in/courses/108102156> – 1 phase Induction Motor and Special Electromechanical machines
- W4. <https://nptel.ac.in/courses/108105131>

Research Paper References:

- P1. Sen, M., and Mutluer, M. (2025). A Review of BLDC Motors: Types, Application, Failure Modes and Detection. *Energies*, 18(24), 6402. <https://doi.org/10.1080/1448837X.2008.11464184>
- P2. Azab, M. (2025). A Review of Recent Trends in High-Efficiency Induction Motor Drives. *Vehicles*, 7(1), 15. <https://doi.org/10.3390/vehicles7010015>
- P3. Xaxa, L. B. et al. (2023). Synchronous Generator Abnormality and Fault Analysis. *J. Electrical Systems*, 19-1, 98-110. <https://doi.org/10.52783/jes.21>