ELECTRICAL MACHINES-I

B Tech II Year I Sem

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
23EE302	**Professional core**	**L**	**T**	**P**	**4**	**CIA**	**SEE**	**TOTAL**
		3	**1**	**0**		**40**	**60**	**100**
Contact Classes: 48	**Tutorial Classes: 16**	**Practical Classes: Nil**			**Total Classes:64**			

Prerequisites: Electrical Circuit Analysis-1 & Electrical Circuit Analysis-2

Course Objectives:

1. To study and understand different types of DC Generator s and their performance evaluation through various testing methods.
2. To study and understand different types of DC Motor and their performance evaluation through various testing methods
3. To analyze the performance of transformers through various testing methods.
4. To understand the operation of single Transformers
5. To understand the operation of ploy-phase Transformers

Course Outcomes: After learning the contents of this paper the student must be able to

1. Identify different parts of a DC generator & understand their operation.
2. Identify different parts of a DC motor & understand their operation.
3. Analyze and test the d.c machines performances.
4. Understand the operation and characteristics of transformers.
5. Analyze single & three phase transformers and their performance through testing.

UNIT-I:

D.C. GENERATORS: Principle of operation – Action of commutator– constructional features –armature windings – lap and wave windings – use of laminated armature – E.M.F Equation. Armature reaction–Cross magnetizing and de-magnetizing AT/pole – compensating winding–commutation– reactance voltage – methods of improving commutation. Methods of Excitation – separatelyexcitedandself-excitedgenerators– build-upofE.M.F-criticalfieldresistanceandcriticalspeed.Loadcharacteristicsand applications of shunt, series and compound generators.

UNIT-II:

D.C MOTORS: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation.
Speed control of D.C. Motors - Armature voltage and field flux control methods.
Motor starters (3- point and 4- point starters) Losses in D.C Machines– Constant & Variable losses –calculation of efficiency – condition for maximum efficiency.

UNIT-III:

TESTING OF DC MACHINES: Methods of Testing–direct, indirect, and regenerative testing–Brake test –Swinburne's test–Hopkinson's test–Field's test-separation of stray losses in a D.C. motor test.

UNIT-IV:

SINGLE PHASE TRANSFORMERS: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams and Applications. Auto transformer-constructional details and operation.
Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency &supply voltage on iron losses.

UNIT-V:

TESTING OF TRANSFORMERS AND POLY-PHASE TRANSFORMERS: Open Circuit and Short Circuit tests- Sumpner's test - predetermination of efficiency and regulation -separation of losses test- parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers – Poly-phase connections -Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electrical Machines", Oxford, 2017.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
3. A.E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
4. A.E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS