

ELECTRICAL MACHINES-I

Course Code	20EE3303	Year	II	Semester(s)	I
Course Category	Professional Core	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Basic Electrical and Electronics Engineering
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1	Understand the basic concepts of magnetic circuits, construction and operation of DC machines, single phase transformer, auto transformer and three phase transformer. (L2)
CO2	Apply the basic knowledge to obtain the desired parameters/performance characteristics of magnetic systems and DC machines. (L3)
CO3	Apply the basic knowledge to obtain the desired parameters/performance characteristics of single phase transformer, auto transformer and three phase transformer. (L3)
CO4	Analyze the performance characteristics, speed control methods and testing techniques of DC machines. (L4)
CO5	Analyze the different configurations and testing techniques of single phase transformer, auto transformer and three phase transformer. (L4)
CO6	Submit a report in DC machines, single phase transformer, auto transformer and three phase transformer.

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2	3												2	1
CO3	3												2	1
CO4		3											2	1
CO5		3											2	1
CO6									3	3			2	1

SYLLABUS

Unit No.	Contents	Mapped CO
I	Magnetic circuits: Definition of magnetic quantities, analysis of magnetic circuits- series, parallel, leakage flux, comparison of magnetic and electric circuits. B-H curve of magnetic materials; flux- linkage vs current characteristic of magnetic circuits; Energy in Magnetic Systems-Field energy and mechanical force-singly and doubly excited magnetic field systems- forces and torques in systems with electromagnets.	CO1 CO2 CO6

II	DC Generators: Principle of operation, armature winding - lap and wave windings, separately and self excited generators, armature reaction-cross magnetization and demagnetization AT/pole, compensating winding, commutation process, methods of improving commutation, voltage build-up in a shunt generator, critical field resistance and critical speed, internal and external characteristics of shunt, series and compound generators, parallel operation.	CO1 CO2 CO4 CO6
III	DC Motors: Principle of operation, characteristics of shunt, series and compound motor, speed control methods, 4-point starter- design of starter elements , losses in DC machine, testing of DC machine – No load test, load test, Hopkinson’s test , retardation test and field test.	CO1 CO2 CO4 CO6
IV	Single-Phase Transformers: Principle of operation, ideal transformer, transformer under no load and on load with Phasor diagrams, equivalent circuit, condition for maximum efficiency and voltage regulation, all day efficiency. Determination of equivalent circuit parameters, efficiency at different loadings and regulation using O.C and S.C test, polarity test, back-to-back test, separation of hysteresis and eddy current losses, Parallel operation of single-phase transformers.	CO1 CO3 CO5 CO6
V	Autotransformers - construction, principle of operation, applications and comparison with two winding transformer. Three-Phase Transformers: Types of connection and their comparative features, Scott connection, Tap-changing transformers - No- load and on-load tap-changing of transformers.	CO1 CO3 CO5 CO6

Learning Resources

Text Books

1. Electrical Machinery by Dr.P. S Bimbhra, 7/e, Khanna Publishers,2018.
2. Electric Machines by I.J. Nagarath and D.P. Kothari,4/e, McGraw Hill, 2010.

Reference Books

1. Theory and performance of Electrical Machines by J.B. Gupta, Katson Publishers.
2. Performance and Design of DC Machines by A.E. Clayton and N N Hancock,Oxford,1987
3. Electrical Machines by Abhijit Chakrabarti, Sudipta Debnath, 1/e, Mc Graw Hill,2015.
4. Electric Machine Fundamentals by S.J. Chapman, 5/e, McGraw Hill, 2011.

e- Resources

<https://nptel.ac.in/courses/108/105/108105155/>