



II Year-I Semester		L	T	P	C
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ELECTRICAL MACHINES – I (R1621022)					

Prerequisite Course: Electrical Circuit Analysis and Engineering Drawing.

Course Description and Objectives:

This is a basic course on rotating electrical machines. This course covers the topics related to principles, performance, applications and design considerations of dc machines and transformers.

Objectives:

1. Understand the unifying principles of electromagnetic energy conversion.
2. Understand the construction, principle of operation and performance of DC machines.
3. Learn the characteristics, performance, methods of speed control and testing methods of DC motors.
4. To predetermine the performance of single phase transformers with equivalent circuit models.
5. Understand the methods of testing of single-phase transformer.
6. Analyze the three phase transformers and achieve three phase to two phase conversion.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes.

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1	Assimilate the concepts of electromechanical energy conversion.	4
2	Mitigate the ill-effects of armature reaction and improve commutation in dc machines.	4
3	Understand the torque production mechanism and control the speed of dc motors.	3
4	Analyze the performance of single phase transformers.	2
5	Predetermine regulation, losses and efficiency of single phase transformers.	2
6	Parallel transformers, control voltages with tap changing methods and achieve three-phase to two-phase transformation.	4

Syllabus:

UNIT-I:

Electromechanical Energy Conversion and introduction to DC machines

Principles of electromechanical energy conversion – singly excited and multi excited system – Calculation of force and torque using the concept of co-energy. Construction and principle of operation of DC machine – EMF equation for generator – Classification of DC machines based on excitation – OCC of DC shunt generator.

UNIT-II:

Performance of D.C. Machines

Torque and back- emf equations of dc motors– Armature reaction and commutation – characteristics of separately-excited, shunt, series and compound motors - losses and efficiency- applications of dc motors.

UNIT-III:

Starting, Speed Control and Testing of D.C. Machines

Necessity of starter – Starting by 3 point and 4 point starters – Speed control by armature voltage and field control – testing of DC machines - brake test, Swinburne’s method – principle of regenerative or Hopkinson’s method - retardation test -- separation of losses.

UNIT–IV:

Single-phase Transformers

Types and constructional details - principle of operation - emf equation - operation on no load and on load – lagging, leading and unity power factors loads - phasor diagrams of transformers – equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – All day efficiency.

UNIT-V

Single-phase Transformers Testing

Tests on single phase transformers – open circuit and short circuit tests – Sumpner’s test – separation of losses – parallel operation with equal voltage ratios – auto transformer equivalent circuit – comparison with two winding transformers.

UNIT-VI

3-Phase Transformers

Polyphase connections - Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ -- Third harmonics in phase voltages - three winding transformers: determination of Z_p , Z_s and Z_t -- transients in switching – off load and on load tap changers -- Scott connection.

TEXT BOOKS:

- 1 Electrical Machines – P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald,Charles kingsley,Stephen D.Umans, TMH

REFERENCE BOOKS

1. Electrical Machines by D. P.Kothari, I .J .Nagarth,McGrawHill Publications, 4th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications,5th edition.
3. Electrical Machinery by AbijithChakrabarathi and SudhiptaDebnath,McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
5. Electric Machines by MulukutlaS.Sarma&Mukeshk.Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons