



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE-R19

II Year – I SEMESTER		L	T	P	C
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	ELECTRICAL MACHINES – I				

Preamble:

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.

Learning objectives:

- Understand the construction, principle of operation and performance of DC machines.
- Learn the characteristics, performance, methods of speed control and testing methods of DC motors.
- To predetermine the performance of single phase transformers with equivalent circuit models.
- Understand the methods of testing of single-phase transformer.
- Analyze the three phase transformers and achieve three phase to two phase conversion.

UNIT-I:

Construction and Operation of DC machines

Construction and principle of operation of DC machine – emf equation for generator – classification of DC machines based on excitation – OCC of DC shunt generator – applications of DC Generators

UNIT-II:

Performance of DC 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 DC Machines

Necessity of a 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 – phasor diagrams of transformers - equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency.



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UNIT-V

Testing of Transformers and 3-Phase Transformers

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 –comparison with two winding transformers.

Polyphase connections - Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ – Scott connection.

Learning outcomes:

After the completion of the course the student should be able to:

- assimilate the concepts of electromechanical energy conversion.
- mitigate the ill-effects of armature reaction and improve commutation in dc machines.
- understand the torque production mechanism and control the speed of dc motors.
- analyze the performance of single phase transformers.
- predetermine regulation, losses and efficiency of single phase transformers.
- parallel transformers, control voltages with tap changing methods and achieve three-phase to two-phase transformation.

Text Books:

1. Electrical Machines by 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, Mc Graw Hill Publications, 4th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition.
3. Electrical Machinery by Abijith Chakrabarthy and Sudhipta Debnath, Mc Graw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman Mc Graw Hill education 2010
5. Electric Machines by Mulukutla S.Sarma & Mukesh k.Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria & Sons