II Year I Semester	**L**	**T**	**P**	**C**
Code: 20EE3002	**3**	**0**	**0**	**3**

DC MACHINES AND TRANSFORMERS

Preamble: This course provides an introduction to basic concepts of rotating machines, DC Machines (Generators and Motors), transformers and their testing methods, emphasizing their interrelations and applications to engineering, It introduce students to cognitive learning and develops problem solving skills with both theoretical and engineering oriented problems.

Course Objectives

1. To impart the basic knowledge of principle of operation and Types of DC Machines and Transformers.
2. To provide working knowledge on how to develop Phasor Diagrams and Equivalent Circuits for Transformers
3. To understand performance characteristics of DC Machines and Single Phase Two winding Transformers.
4. To Highlight the importance of DC Motors in Commercial, Domestic, Industrial and Electric Traction Applications.
5. To Highlight the importance of transformers in Commercial, Domestic, Industrial, Transmission and distribution of electric power Applications.

Course Outcomes

1. Student will be able to understand basic principle of operation and can also categorize different Types of DC Machines, Single Phase Two winding Transformers, Single Phase Auto Transformer and Three Phase Transformers.
2. Student will be able to compare the performance characteristics of DC Machines and Single Phase Two winding Transformers
3. Student will be able to develop Phasor Diagrams and Equivalent Circuits for Single Phase Two winding Transformers, Single Phase Auto Transformer.
4. Student will be able to analyze the performance of DC Machines and Single Phase Two winding Transformers by different methods of testing.
5. Student will be able to compute load sharing between two Single Phase Two winding Transformers connected in parallel and also able to understand the working of Tap-changing of three phase transformers and conversion of three phase to two phase.
6. Student will be able to realize the requirement of Transformers in Transmission and distribution of Electric Power and other applications of both DC Machines and Transformers.

CO – PO/CO – PSO Mapping:

	PO1	PO2	PO3	PO4	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PS03
CO1	2												2	-	-
CO2		2											2	-	-
CO3		2											2	-	-
CO4		2											2	-	-
CO5	2												2	-	-
CO6		2				1							2	-	

1 – Weak, 2 – Moderate and 3 – Strong

Unit– I: DC Generators

Principle of Operation Construction, EMF Equation, Types, Characteristics, Armature Reaction and methods to reduce armature reaction (elementary treatment only),Commutation and methods to improve commutation(elementary treatment only).

Unit – II: DC Motors

Principle of Operation, Back-Emf, Types, Torque, Characteristics. Necessity of Starter, Types (2,3,4-Point). Speed control (armature voltage control method, field flux weakening method and Ward Leonard method). Losses and Efficiency calculation of DC machines, Swinburne's Test, Separation of Core Losses test, Hopkinson's Test, Numerical Problems. Permanent Magnet DC (PMDC) Motors, Applications.

Unit – III: Construction and Operation of Transformers

Principle of Operation, EMF Equation, Construction, Types (Core and Shell Type), No-Load and Load Phasor Diagrams, Equivalent Circuit, Losses, Efficiency, All–Day Parallel Operation of Single Phase two winding Transformers (Equal & Unequal Voltage Ratios). Voltage Regulation..

Unit – IV: Testing Of Transformers and Auto-Transformers

Testing of Transformers: Polarity Test, Open circuit, Short circuit, Sumpner's Tests. Numerical Problems.

Single Phase Auto transformers: Principle of Operation, Types, Phasor diagrams, Equivalent circuits, Savings in copper, Comparison with Two winding Transformer, Applications of Auto Transformers.

Unit – V: Three Phase Transformers

Three Single Phase Transformer Bank, Three Phase Transformer and comparison. Three Phase connections (Y/Y,Δ/Δ,Y/Δ,Δ/Y,Δ/Open-Δ), Scott Connection, Tap changing transformers (On-Load and Off Load).

Text Books:

1. Electrical Machinery by Dr. P.S. Bhimbra, Khanna Publishers
2. A Text Book of Electrical Technology, Volume-II, AC and DC Machines by B.L. Theraja and A.K.Theraja.S.Chand Publications
3. The Performance and Design Of Alternating Current Machines by MG Say

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 AbijithChakrabarthi and SudhiptaDebnath,McGraw Hill education 2015.
4. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria& Sons