

DC MACHINES AND TRANSFORMERS

III Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE004	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil			Total Classes: 60			
OBJECTIVES:								
The course should enable the students to:								
I. Illustrate the theory of electromechanical energy conversion and the concept of co energy.								
II. Demonstrate the working principle of different types of dc machines and transformers.								
III. Analyze the losses in dc machines to improve the efficiency by conducting various tests								
IV. Outline the principle of operation, construction and testing of single phase transformers.								
COURSE LEARNING OUTCOMES (CLOs):								
1. Solve simple and complex problems related to electromagnetic circuits.								
2. Describe the basic electromagnetic energy conversion process, energy storage and energy balance.								
3. Derive the force and torque produced in singly excited, multi excited magnetic systems.								
4. Outline the construction, operation and the windings used in DC machines.								
5. Illustrate the concept of armature reaction, commutation and study the characteristics and applications of DC generators.								
6. Examine the parallel operation of DC generators, importance of equalizer bars and load sharing.								
7. Study the operation, significance of back EMF, characteristics and speed control methods of DC motors.								
8. Classify the different types of losses occurred in DC machines.								
9. Determine the efficiency of DC machines by conducting direct and indirect tests.								
10. Discuss the principles of operation, construction and EMF equation of single phase transformers.								
11. Explain the operation of single phase transformer under no-load and on-load along with its phasor diagrams.								
12. Calculate the efficiency and regulation of single phase transformers by conducting different tests.								
13. Examine the parallel operation of single phase transformers and analyze the load sharing.								
14. Summarize the different types of connections of three phase transformers.								
15. Demonstrate the operation of open delta connection and Scott connection with two single phase transformers.								
16. Explain the functioning of autotransformers, tap changing transformers and off-load, on-load tap changers.								
Unit-I	ELECTROMECHANICAL ENERGY CONVERSION						Classes: 05	
Electromechanical energy conversion: Forces and torque in magnetic systems, energy balance, energy and force in a singly excited and multi excited magnetic field systems, determination of magnetic force, coenergy.								
Unit -II	DC GENERATORS						Classes: 12	
Principle of operation, construction, armature windings, lap and wave windings, simplex and multiplex windings, use of laminated armature, commutator, EMF equation, types of DC generators, voltage buildup, critical field resistance and critical speed. causes for failure to self excite and remedial measures: Armature reaction: Cross								

magnetization and demagnetization, ampere turns per pole, compensating winding, commutation, reactance voltage, methods of improving commutation; Characteristics: Principle of parallel operation load sharing, use of equalizer bars and cross connection of field windings problems		
Unit -III	DC MOTORS AND TESTING	Classes: 10
Principle of operation, back EMF, torque equation, condition for maximum power developed, types of DC motors, armature reaction and commutation, characteristics, methods of speed control, types of starters, numerical problems; Losses and efficiency: Types of losses, calculation of efficiency, condition for maximum efficiency Testing of DC machines: Swinburne's test, brake test, regenerative testing, Hopkinson's test, field's test, retardation test and separation of stray losses, problems.		
Unit -IV	SINGLE PHASE TRANSFORMERS	Classes: 10
Single phase transformers: Principle of operation, construction, types of transformers, EMF equation, concept of leakage flux and leakage reactance, operation of transformer under no load and on load, phasor diagrams, equivalent circuit, efficiency, regulation and all day efficiency; Testing of transformer: objective of testing, polarity test, measurement of resistance, OC and SC tests, back to back test, heat run test, parallel operation, problems.		
Unit -V	POLY PHASE TRANSFORMERS	Classes: 08
Three phase transformer: Principle of operation, star to star, delta to delta, star to delta, delta to star, three phase to six phase, open delta connection, scott connection; Auto transformers: Principles of operation, equivalent circuit, merits and demerits, no load and on load tap changers, harmonic reduction in phase voltages, problems.		
Text Books:		
1. J B Gupta, "Theory and Performance of Electrical Machines", S K Kataria & Sons publications, 14th edition, 2010. 2. P S Bimbra, "Electrical Machines", Khanna publications, 2nd edition, 2008. 3. I J Nagrath, D P Kothari, "Electrical Machines", Tata Mc Graw Hill publications, 3rd Edition, 2010. 4. Abhijit Chakrabarti, Sudipta Debnath, "Electrical Machines", McGrawhill education (India) private limited, 1st edition, 2015		
Reference Books:		
1. Ian McKenzie Smith, Edward Hughes, "Electrical Technology", Prentice Hall, 10th edition, 2015. 2. M G Say, E O Taylor, "Direct current Machines", Longman higher education, 1st edition, 1985. 3. M V Deshpande, "Electrical Machines", PHI learning private limited, 3rd edition, 2011.		
Web References:		
1. https://www.electrical4u.com/working-or-operating-principle-of-dc-motor 2. https://freevideolectures.com/ 3. electrical%20machines">https://www.ustudy.in/>electrical machines 4. https://www.freeengineeringbooks.com/		
E-Text Books:		
1. https://www.textbooksonline.tn.nic.in/ 2. https://www.freeengineeringbooks.com/ 3. https://www.eleccompengineering.files.wordpress.com/ 4. https://www.books.google.co.in/		