19EE211 ELECTRICAL MACHINES - I

Hours Per Week :

L	T	P	C
3	-	2	4

Source:

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PREREQUISITE COURSE :   Basic Electrical and Electronics Engineering.

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with construction, types, working principle, operation and applications of DC Machines and Transformers. The objective of the course is to enable the students to understand the characteristics of DC Machines and Transformers and analyze their performance under different testing conditions.

COURSE OUTCOMES:

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

COs	Course Outcomes
1	Analyze the effect of armature reaction and the process of commutation.
2	Evaluate the performance and characteristics of DC motors through experimentation.
3	Describe the construction and working principle of single phase Transformers.
4	Analyse parallel operation of single phase Transformers and DC Generators.
5	Select different 3-phase transformers connections in real time transmission system.

SKILLS:

- ü *Analyse magnetizing and load characteristics of DC Generators.*
- ü *Speed control of DC Motors.*
- ü *Analyse performance of DC machines by conducting various tests.*
- ü *Identify the specifications of the given transformer.*
- ü *Test the transformer and analyze its performance.*

UNIT - I L - 9

DC GENERATORS: DC Generators, Armature winding types - lap and wave; Armature reaction, effects and remedy methods, Commutation, Conditions to Build-up of EMF, Critical field resistance and critical speed, Types of generators, Characteristics of generators, Parallel operation of DC shunt and series generators, Numerical problems.

UNIT - II L - 9

DC MOTORS: Operation, Torque equation, Speed control of DC motors, Introduction to 3 point and 4 point Starters, Characteristics and Applications of DC motors, Losses, Efficiency, Methods of testing - Brake test, Swinburne's test, Hopkinson's test, Field's test and Retardation test, Numerical problems.

UNIT - III L - 9

SINGLE PHASE TRANSFORMERS: Concept of ideal transformer, Operation under no load and on load condition, Phasor diagrams, B-H curve nonlinearity, Magnetizing current, Causes of Voltage drop, Equivalent circuit, Problems, Voltage regulation, Conditions for minimum and maximum voltage regulation, Numerical problems.

UNIT - IV L - 9

PERFORMANCE, TESTING & PARALLEL OPERATION: Losses, Efficiency, Condition for maximum efficiency, All-day efficiency, Effect of variation of frequency and supply voltage on iron losses, Separation of iron losses, OC and SC tests, Sumpner's test, Parallel operation with equal and unequal voltage ratio, Autotransformer – Comparison with two winding transformer, Numerical problems.

UNIT - V L - 9

THREE PHASE TRANSFORMERS: Constructional details, Polyphase connections - Star / Star, Star / Delta, Delta / Star, Delta / Detla and open Delta, Three phase to two phase conversion-Scott connection, tap changing transformers, no-load and on-load tap-changing of transformers, Numerical problems.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS   **TOTAL HOURS: 30**

1. Determination of critical field resistance and critical speed using magnetization characteristics of DC shunt generator.

2. Load test on DC shunt generator.

3. Brake test on DC shunt motor.

4. Speed control of DC shunt motor.

5. Swinburne's test on DC shunt motor.

6. Hopkinson's test on DC machines.

7. Field test on DC series machines.

8. OC and SC test on single phase transformer.

9. Sumpner's test on a pair of single phase transformers.

10. Separation of core losses in a transformer.

11. Parallel operation of two single phase transformers.

12. Scott connection of transformers.

TEXT BOOKS:

1. P.S. Bimbra, "Electrical Machinery", 7th edition, Khanna Publishers, 2011.

2. I.J. Nagrath and D.P. Kothari, "Electric Machines", 5th edition, Tata Mc-Graw Hill Publishers, 2017.

REFERENCE BOOKS:

1. A.E. Clayton and Hancock, "Performance and Design of D.C Machines", 3rd edition, BPB Publishers, 2004.

2. R. D. Begamudre, "Electromechanical Energy Conversion with Dynamics of Machines", 2nd edition, New Age International (P) Ltd., 2003.

3. M. V. Deshpande, "Electric Machines", 1st edition, Wheeler Publishing, 2000.

4. S.K. Battacharya, "Electrical Machines", 2nd edition, Tata Mc-Graw Hill Companies, 2006.