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DC MACHINES & TRANSFORMERS 23EE3703

Pre-requisite: Principles of Electromechanical Energy Conversion, Electromagnetic fields and Electrical Circuit Analysis.

Course Objectives:

Students will get exposure to

- Understand the characteristics and applications of DC Machines.
- Develop problem solving skills about the starting, speed control and testing of DC Machines.
- Understand the concepts of efficiency and regulation of a transformer by obtaining Equivalent circuit.
- Analyze the performance of single-phase transformers and to understand the connection diagrams of three-phase transformers

Course Outcomes:

At the end of the course, the student will be able to,

CO1: Understand the process of voltage build-up in DC generators and its characteristics.

CO2: Understand the process of torque production, starting and speed control of DC motors and illustrate their characteristics.

CO3: Obtain the equivalent circuit of single-phase transformer and determine its efficiency & regulation.

CO4: Analyse various configurations of three-phase transformers.

UNIT – I: DC Generators:

Construction and principle of operation of DC machines – EMF equation for generator – Excitation techniques – characteristics of DC generators –applications of DC Generators, Back-EMF and torque equations of DC motor – Armature reaction and commutation.

UNIT – II: Starting, Speed Control and Testing of DC Machines

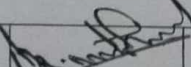
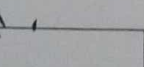
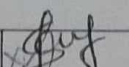
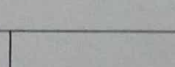
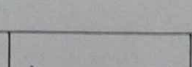
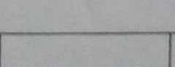
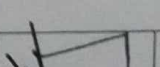
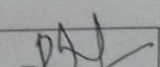
Characteristics of DC motors – losses and efficiency – applications of DC motors. Necessity of a starter – starting by 3-point and 4-point starters – speed control by armature voltage and field current control – testing of DC machines – brake test, Swinburne’s test –Hopkinson’s test.

UNIT – III: Single-phase Transformers

Introduction to single-phase Transformers (Construction and principle of operation)–EMF equation – operation on no-load and on load –lagging, leading and unity power factors loads –phasor diagrams– equivalent circuit –regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency.

UNIT –IV: Testing of Transformers

Open Circuit and Short Circuit tests – Sumpner’s test – separation of losses— Parallel operation with equal and unequal voltage ratios– auto transformer – equivalent circuit – comparison with two winding transformers.

Signature								
Name	Dr. B. Muthuvel, Chairman BOS	Dr. N. Sumathi Member	Dr. K. Siva Kumar, Member	Dr. M. Gopichan d NaikMember	Mr. T. Veerababu, Member	Dr. K. Bapayya Naidu, Member	Dr. JVG Ramarao, Mem ber	Prof. ANVJ Raja Gopal, Member

UNIT – V

Three-Phase Transformers:

Poly-phase connections- Y/Y, Y/ Δ , Δ /Y, Δ / Δ , open Δ – third harmonics in phase voltages– Parallel operation–three winding transformers-off load and on load tap changing transformers–Scott connection.

Textbooks:

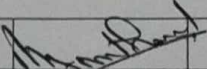
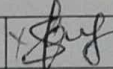
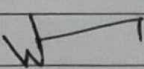
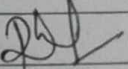
1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi, 2021.
2. Performance and analysis of AC machines by M.G. Say, CBS, 2021.

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition 2017
2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill Publications 4th edition 2017.
3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, Khanna Publications 7th Revised Edition, 2021
4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K. Kataria & Sons Publications 2013
5. Electric Machinery by Fitzgerald, A.E., Kingsley, Jr., C., & Umans, S. D, 7th edition, McGraw-Hill Education, 2014.

Online Learning Resources:

1. nptel.ac.in/courses/108/105/108105112
2. nptel.ac.in/courses/108/105/108105155

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