**23EE12T3-DC MACHINES & TRANSFORMERS**

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| **Course Category:** | Professional core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Fundamental concepts of Electrical and Magnetic coupled circuits. | **Sessional Evaluation: External Exam Evaluation:**  **Total Marks:** | 30  70  100 |

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| **Course Objectives:** | Students undergoing this course are expected to learn : | | |
| 1. The process of voltage build-up in DC generators and characteristics. 2. The process of torque production, starting and speed control of DC motors and illustrate their characteristics. 3. To draw the equivalent circuit of single-phase transformer, auto transformer and determine its efficiency & regulation. 4. The various testing methods for transformers and speed control of DC motors 5. About various configurations of three-phase transformers. | | |
| **Course Outcomes:** | After completing the course the student will be able to | | **Blooms level** |
| CO1 | Understand the process of voltage build-up in DC generators and  characteristics. | **L2** |
| CO2 | Understand the process of torque production, starting and speed  control of DC motors and illustrate their characteristics. | **L2** |
| CO3 | Obtain the equivalent circuit of single-phase transformer, auto  transformer and determine its efficiency & regulation. | **L3** |
| CO4 | Apply various testing methods for transformers and speed control of DC motors | **L3** |
| CO5 | Analyze various configurations of three-phase transformers. | **L4** |
| **Course Content:** | **UNIT I**  **DC Machines:**  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, Applications.  **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–Field 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, Applications. | | |

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|  | **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.  **UNIT V**  **Three-Phase Transformers:**  Polyphase connections- Y/Y, Y/Δ, Δ/Y, Δ/Δ, open Δ and Vector groups – third harmonics in phase voltages – Parallel operation– three winding transformers- transients in switching – off load and on load tap changers – Scott connection. |
| **Text Books & Reference Books:** | **TEXT BOOKS:**   1. Electrical Machinery by Dr. P S Bimbhra, 7th edition, Khanna Publishers, New Delhi,1995. 2. Performance and analysis of AC machines by M.G. Say, CBS, 2002.   **REFERENCE BOOKS:**.   1. Electrical Machines by D. P.Kothari, I .J .Nagarth, McGraw Hill Publications, 5th edition 2. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2011. 3. Generalized Theory of Electrical Machines by Dr. P S Bimbhra, 7th Edition, Khanna Publishers, 2021. 4. Theory & Performance of Electrical Machines by J.B.Gupta, S.K.Kataria & Sons,2007. 5. Electric Machinery by Fitzgerald, A.E.,Kingsley, Jr.,C.,& Umans, S. D, 7th edition, McGraw-Hill Education, 2014. |
| **e-Resources:** | 1. <http://nptel.ac.in/courses/108/105/108105112> 2.nptel.ac.in/courses/108/105/108105155 3.[http://iete-elan.ac.in](http://iete-elan.ac.in/) 4.<http://freevideolectures.com/university/iitm> |