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| Course No | Course Name | L-T-P-Credits |
| **EE 203** | **Electrical Machines-I** | **3-1-0: 4** |
|  Prerequisite: Basic Electrical Engineering Co requisite: NIL |
| **Course Objectives**:

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| 1. Knowledge of underlying principle of rotating machines
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| 1. Understand the basic concept of a DC Machines
2. Gain knowledge about the characteristics and types of DC Machines
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| 1. Analysis of single phase Transformer
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| 1. To gain proficiency in three phase Transformers and the applications
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|  **SYLLABUS** |
| **Module** | **Contents** | **Hours** |
| I | **Basics of Rotating Electrical Machines:** General Constructional details for Rotating Electrical Machines, Electrical & Mechanical degree, Pole pitch & Coil pitch, Full-pitched coil & short-pitched coil; Pitch factor. Elementary view of rotating machines: Flux per pole, Generated EMF in full pitched coil, Generated EMF in a short-pitched coil, winding factor. Different types of torques in Electrical Machines; Physical concept of torque production. MMF waveform for commutator machines.  | 10 |
| II | **DC Machines:**Armature winding- types, designs, Lap and Wave winding. EMF equation Torque equation Armature reaction-cause, effect & remedial measures commutation-types, methods, effect on field flux distribution Methods for improving commutation. DC Generator: Methods of excitation, shunt, series and compound generators, open circuit characteristics, External Load characteristics  DC motor: Speed torque characteristics Methods of starting & speed control. Losses and Efficiency of DC machines: Swinburne’s test & Hopkinson’s test | 16 |
| III | **Transformers:**Single Phase Transformers: Review of e.m.f equation and equivalent circuit, voltage regulation and efficiency, Determination of parameter from OC & SC tests, Back to Back test, parallel operation and load sharing, per-unit representation of transformer parameters. Auto Transformer: Principle of operation, Phasor diagram, Equivalent circuit and comparison with two winding transformer. Three Phase Transformer: Construction of various types, operating characteristics of Star–Star, Star–Delta, Delta – star, Delta – Delta, Open – Delta and Zigzag connections, Vector Groups, Phase transformation, Three phase to Two phase, Three phase to Six phase, Three phase to Twelve phase transformation, Scott connection, parallel operation of Three phase transformer, Three winding transformers equivalent circuit and applications. | 14 |

**Essential Readings:**

* 1. A. Fitzgerald, C. Kingsley, S. Umans, Electric Machinery, TMH, New Delhi., 6th Edition,2013
	2. I. J. Nagrath, D.P. Kothari, Electric Machines, TMH, New Delhi, 4th Edition,2015

**Supplementary Readings:**

1. Say M. G., The performance and design of alternating current machines, CBS Publishers, Delh,

4th Edition,2004.

2) Bimbhra P. S., Electrical Machinery, Khanna Pub., Delhi., 7th Edition, 2018

3) Clayton A. E., The performance and design of direct current machines, Pitman and sons, London.

 4th Edition,1961

4) Bhag S. Guru, H. R. Hiziroglu, Electric Machinery and Transformers, Oxford, 4th Edition,2014