



# National Institute of Technology Meghalaya

An Institute of National Importance

**CURRICULUM**

Programme	<b>Bachelor of Technology in Electrical and Electronics Engineering</b>	Year of Regulation	<b>2019-20</b>
Department	<b>Electrical Engineering</b>	Semester	<b>III</b>

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total

<b>EE 203</b>	<b>Electrical Machines-I</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>100</b>	<b>200</b>	
Course Objectives	Introducing basic features of Electrical Machines	Course Outcomes: Students will be able to	CO1	Understand electrical principle, laws, and working of DC machines.						
	Explanation of load performance of DC Machines		CO2	Analyse the construction and characteristics and application of various types of DC generators.						
	Study of speed control & testing of DC machines		CO3	Analyse the construction and characteristics and application of various types of DC motors and testing of motors according to Indian standard.						
	Presenting basic performance details of Transformers		CO4	Understand the working of 1 phase transformer and different tests on the transformers.						
	Imparting concept of phasor diagrams of Transformers		CO5	Analyse the 3-phase transformer and conversion into to multi-phase transformers.						

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	3	0	1	0	0	0	0	2	0	0	0	3	0	3
2	CO2	3	3	0	1	0	0	0	0	2	0	0	0	2	0	2
3	CO3	2	3	3	1	2	0	0	0	0	0	0	0	2	3	2
4	CO4	2	2	3	0	2	2	3	0	2	0	0	1	2	3	2
5	CO5	2	2	3	0	2	2	3	0	2	0	0	1	3	3	3

### SYLLABUS

No.	Content	Hours	COs
I	<b>Basics of Rotating Electrical Machines:</b> 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.	<b>10</b>	<b>CO1</b>
II	<b>DC Machines:</b> 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	<b>18</b>	<b>CO2</b>
	DC motor: Speed torque characteristics Methods of starting & speed control. Losses and Efficiency of DC machines: Swinburne's test & Hopkinson's test.		<b>CO3</b>
III	<b>Transformers:</b> 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.	<b>14</b>	<b>CO4</b>
	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.		<b>CO5</b>
<b>Total Hours</b>		<b>42</b>	

<b>Essential Readings</b>
1. A. Fitzgerald, C. Kingsley, S. Umans, Electric Machinery, TMH, New Delhi., 6 <sup>th</sup> Edition, 2013
2. I. J. Nagrath, D.P. Kothari, Electric Machines, TMH, New Delhi, 4 <sup>th</sup> Edition, 2015

<b>Supplementary Readings</b>
1) Say M. G., The performance and design of alternating current machines, CBS Publishers, Delh, 4 <sup>th</sup> Edition, 2004.
2) Bimbhra P. S., Electrical Machinery, Khanna Pub., Delhi. 7 <sup>th</sup> Edition, 2018
3) Clayton A. E., The performance and design of direct current machines, Pitman and sons, London. 4 <sup>th</sup> Edition, 1961
4) Bhag S. Guru, H. R. Hiziroglu, Electric Machinery and Transformers, Oxford, 4 <sup>th</sup> Edition, 2014