22EE320 DC MACHINES & TRANSFORMERS

Category	L	T	P	Credit
PCC	2	1	0	3

Preamble

The course aims in imparting fundamental knowledge of construction, types, Operation of Transformers and Direct current (DC) machines. DC machine is a highly versatile energy converting device. They can be designed to give a wide variety of voltage-current or speed- torque characteristics for both dynamic and steady-state operation. Due to their flexibility in speed control, DC motors are widely used in applications requiring a wide range of motor speeds or precise control of motor output. A transformer is a device used to transfer electrical energy from one circuit to another. It changes electricity from one level to other level of voltage using the properties of electricity.

Prerequisite

22EE230 : Electric Circuit Analysis

Course Outcomes

On the successful completion of the course, students will be able to

CO	Course Outcome (CO)	TCE Proficiency Scale	Expected Proficiency in %	Expected Attainment Level %
CO1	Explain the construction, principle of operation and various types of DC machines.	TPS2	80%	70%
CO2	Determine the characteristics and performance of DC machines at loaded conditions.	TPS3	70%	60%
CO3	Choose the starting methods, speed control, and testing methods DC Motors.	TPS3	80%	70%
CO4	Explain the basic principles and construction of single phase, three phase transformer and application specific transformers	TPS2	80%	70%
CO5	Illustrate the operation of transformer at no load and loaded conditions	TPS3	80%	70%
CO6	Determine the performance of the given single transformer using equivalent circuit diagram and testing methods	TPS3	70%	60%

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO7.	**M**	**L**						**M**		**M**			**M**		
CO8.	**M**	**L**						**M**		**M**			**M**		
CO 3	**S**	**M**	**L**	**L**				**M**		**M**			**S**		
CO 4	**S**	**M**	**L**	**L**				**M**		**M**			**S**		
CO 5	**M**	**L**						**M**		**M**			**M**		
CO 6	**S**	**M**	**L**	**L**				**M**		**M**			**S**		

S- Strong; M-Medium; L-Low

Assessment Pattern

CO	CAT 1			CAT 2			ASSIGNMENT 1				ASSIGNMENT 2				TERMINAL			
TPS SCALE	1	2	3	1	2	3	3	4	5	6	3	4	5	6	1	2	3	4
CO1	**8**	16													4	8		
CO2	6	8	20				50								4	8	10	
CO3	6	16	20				50								2		10	
CO4				**8**	16										4	8		
CO5				6	8	20					50				4	8	10	
CO6				6	16	20					50				2	8	10	
	20	40	40	20	40	40									20	40	40	

*Terminal examination should cover all Course Outcomes in the appropriate TPS Scale level.

Syllabus

DC Generators

Construction-Principle of operation, Emf equation-types, Armature reaction-commutation, Characteristics of generators, Losses & efficiency, Regulation, parallel operation, Applications

DC Motors

Principle of operation, Torque equation, Types-characteristics, Losses-Efficiency, Speed control and starters, Swinburne's Test , Heat run Test ,Hopkinson's Test

Transformers

Transformer construction and principle, Ideal Transformer, EMF equation, Transformer on no load & load Losses, efficiency and regulation, All day efficiency, Auto transformer, three phase transformer connections, Parallel operation of Transformers, Welding transformers, Tap changers on load & off load , OC&SC Test on transformers, Sumpners Test

Text Book

1. D.P.Kothari & I.J.Nagrath, " Electrical Machines", Tata-McGrawhill, Newdelhi, 5th Edition, 2010.

Reference Books& web resources

1. R.K.Rajput, " Electrical Technology", Laxmi Publications, 3rd edition, 2005.

2. Vincent Deldoro ," Electromechanical Energy Conversion " PHI III edition,

3. M.G.Say, Theory and performance of electrical machines, Tata-Mcgraw hill

Course Contents and Lecture Schedule

Module No.	Topic	No. of Periods
1	**DC Generators**	
1.1	Construction- Principle of operation	2
1.2	EMF equation	1
1.3	Types & Characteristics of generators	1
1.4	Armature reaction-commutation	1
1.5	Losses & efficiency, Condition for Maximum Efficiency	2
1.6	Regulation,	1
1.7	Parallel operation, Applications	2
2	**DC Motors**	
2.1	Principle of operation	1
2.2	Torque equation	1
2.3	Types-characteristics	2
2.4	Losses-Efficiency	2
3	**Control & Testing of DC Machines**	
3.1	Speed control and starters	2
3.2	Swinburne's Test , Heat run Test ,Hopkinson's Test	2
4	**Transformer**	
4.1	Transformer construction and principle	2
4.2	Ideal Transformer	1

Module No.	Topic	No. of Periods
4.3	EMF equation	1
4.4	Auto transformer, three phase transformer connections, , Welding transformers	2
5	**Transformer Performance**	
5.1	Transformer on no-load & load Losses	2
5.2	Voltage Regulation, Tap changers on load & off load	2
5.3	Efficiency and All day efficiency	2
5.4	Parallel operation of Transformers	1
6	**Transformer Modelling & Testing**	
6.1	OC&SC Test on transformers,	1
6.2	Transformer Equivalent Circuit	1
6.3	Sumpners Test	1
	Total	36

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