Department of Electrical and Electronics Engineering

COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION SEPT – JAN 2025-2026

Course Syllabi with CO's

Faculty Name: **Raghavendra L**			Academic Year: 2025-26				
Department: **Electrical & Electronics Engineering**							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE304	**Transformers and Generators**	**Core**	Electromagnetism, Fundamentals of single phase and three phase ac circuits.	**3**			**40**
Objectives	**After going through the course, the students should be able to:** 1. To understand the construction, working and various tests of single phase Transformer. 2. To understand the construction, working and parallel operation of three phase Transformer. 3. To understand the construction, working and analysis of Synchronous Generator. 4. To understand the construction, working of solar and wind power generators.						

Topics Covered as per Syllabus

Module-1

Single phase Transformers:

Necessity of transformer, principle of operation, Types and construction, EMF equation, equivalent circuit, Operation of practical transformer under no-load and on-load with phasor diagrams. Losses and methods of reducing losses, efficiency and condition for maximum efficiency. Polarity test, Sumpner's test.

Open circuit and Short circuit tests, calculation of equivalent circuit parameters. Predetermination of efficiency, voltage regulation and its significance. Numerical. **8 Hours**

Module-2

Three-phase Transformers: Introduction, Constructional features of three-phase transformers.

Transformer connection for three phase operation– star/star, delta/delta and star/delta, comparative features. Labelling of three-phase transformer terminals.

Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation– Single phase and three phase. Load sharing in case of similar and dissimilar transformers. Numerical.

Auto transformers and Tap changing transformers: Introduction to autotransformer-copper economy, equivalent circuit, no load and on load tap changing transformers. Numerical. **8 Hours**

Module-3

Synchronous Generators: Construction, working, Armature windings, winding factors, EMF equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit.

Synchronous Generators Analysis: Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, Alternator on load. Voltage regulation. Voltage regulation by EMF and MMF methods. Excitation control for constant terminal voltage. Numerical. **8 Hours**

Module-4

Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power.

Performance of Synchronous Generators: Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings. Numerical. **8 Hours**

Department of Electrical and Electronics Engineering

Module-5

Wind power Generator –Basic components of wind energy conversion system, types of wind generators- Horizontal and vertical axis. Advantages and disadvantages of WECS.

Solar power generator - principle of solar cell, Basic Solar Photo voltaic, system for power generation, Advantages and disadvantages. **8 Hours**

List of Text Books

1. Electric Machines, D. P. Kothari, et al, 4th Edition, 2011.
2. Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013.
3. Non conventional Energy sources by G D Rai

List of Reference Books

1. Electric Machines, Mulukuntla S. Sarma, at el, Cengage, 1st Edition, 2009.
2. Electrical Machines, Drives and Power systems, Theodore Wildi, Pearson, 6th Edition, 2014.
3. Principals of Electrical Machines, V.K Mehta, Rohit Mehta, S Chand, 2nd edition, 2009

Course Outcomes

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

1. **Analyse** the performance of a single-phase transformer by interpreting its construction and working. (L3)
2. **Analyse** the parallel operation of a three-phase transformer by interpreting its construction and working. (L3)
3. **Examine** the synchronous generator regulation using EMF and MMF by interpreting its construction and working. (L3)
4. **Apply** parallel and infinite bus operation to study the salient pole synchronous generator performance. (L3)
5. **Explain** the construction and working of solar and wind power generators. (L2)

CIE: 50 Marks

Note: 3 Session Tests are conducted during the semester, and marks are allotted based on the best average of 2 IAs.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code:	BEE304	TITLE: Transformers and Generators						Faculty Name:		Raghavendra L		
List of Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO11
CO-1												
CO-2												
CO-3												
CO-4												
CO-5												

Note: 3= Strong Contribution 2 = Average Contribution 1 = Weak Contribution "-"= No Contribution

Department of Electrical and Electronics Engineering

The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Course Code: BEE304	TITLE: Transformers and Generators	Faculty Name: Raghavendra L
List of Course Outcomes	Program Specific Outcome	
	PSO1	PSO2
CO-1		
CO-2		
CO-3		
CO-4		
CO-5		

Note: 3= Strong Contribution 2 = Average Contribution 1 = Weak Contribution "-"= No Contribution