

Department of Electrical and Electronics Engineering

COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION AY 2026-27

Course Syllabi with CO's

Faculty Name: Dr.Praveen Kumar M			Academic Year: 2026-27				
Department: Electrical & Electronics Engineering							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
1BEE305	Transformers and Generators	Professional Core course	Electromagnetism, Fundamentals of single phase and three phase ac circuits.	3			42
Objectives	After going through the course, the students should be able to: 1: To understand the construction, operating principle and performance characteristics of single-phase and three-phase transformers. 2: To analyse transformer losses, efficiency, voltage regulation, testing, parallel operation and load sharing under various operating conditions. 3: To evaluate the operation, performance and applications of special transformers such as autotransformers, CTs, PTs, welding transformers and pulse transformers. 4: To understand and analyse the construction, operation, excitation, EMF generation, armature reaction and voltage regulation of synchronous generators. 5: To evaluate the steady-state performance of salient-pole and cylindrical-rotor synchronous generators, including power-angle characteristics, synchronization, load sharing and capability curves.						
Topics Covered as per Syllabus							
Module-1 Single phase Transformers: Necessity of transformers, principle of operation, Constructional details of core and windings, EMF equation, equivalent circuit, Operation of practical transformer under no-load and on load with phasor diagrams. Losses, Variation of losses with load, methods of reducing losses. Efficiency and condition for maximum efficiency. Reasons for rating of transformers in kVA. Open circuit and short circuit tests, calculation of equivalent circuit parameters. Polarity test, Sumpner’s test. Predetermination of efficiency, voltage regulation and its significance. parallel operation of single-phase transformers. Numerical Problems. 8 Hours							
Module-2 Three-phase Transformers: Introduction, Three phase transformers in single units or in banks of three, Transformer connection for three phase operation– star/star, delta/delta, star/delta, and delta/open delta, comparative features with reference to vector group, Labelling of three-phase transformer terminals, Parallel Operation of Transformers: Necessity of Parallel operation, conditions for parallel operation of three phase transformers including vector group conditions, Load sharing in case of similar and dissimilar transformers., Numerical Problems.. 9 Hours							
Module-3 Three-Phase Transformers(continued): Voltage regulation by Tap changing on load and on no load. Scott connected transformer, Necessity of transformers with tertiary windings. transformer Noise. Autotransformers: Introduction, copper economy, equivalent circuits, numerical problems. Instrument transformers- Current Transformers (CT) and Potential Transformers (PT): Construction, Operation, and Applications. Welding transformers: construction and operation. Introduction to pulse transformer.. 8 Hours							

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Module-4 Synchronous Generators (Salient Pole): Synchronous Generators: Constructional features of salient and cylindrical types, excitation systems – static and brushless, 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, short circuit ratio, Alternator on load; Voltage regulation, Voltage regulation by EMF, MMF, and ZPF methods; Excitation control for constant terminal voltage when operating on its own load and on infinite bus. Numerical Problems.. 9 Hours	
Module-5 Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Direct and quadrature axis reactances, slip test, electromagnetic power developed in the salient generators. Power angle characteristic (salient and non-salient pole), power angle diagram, reluctance power, capability curve for large turbo generators. Parallel operation of generators and load sharing; Methods of synchronization, Synchronizing power, Hunting and damper windings. Numerical Problems. 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. Electric Machinery, P.S. Bimbhra, Khanna Publishers. 4. Theory & Performance of Electrical Machine, J.B. Gupta, S.K. Kataria & Sons.:	
List of Reference Books	
1. Electric Machinery, A E Fitzgerald, Charles Kingsley, Stephan Umans, McGraw-Hill.	
Course Outcomes	At the end of the course the student will be able to: CO1: Determine the equivalent circuit parameters, voltage regulation, and efficiency of single-phase transformers(L3). CO2: Analyse the operation and performance of parallel operation of three-phase transformers (L4) CO3: Analyse the construction, operation and performance and applications of special transformers (L4). CO4: Analyse the construction, operation and performance of synchronous generators. (L4). CO5: Analyse the steady-state performance of salient-pole and cylindrical-rotor synchronous generators. (L4).
CIE: 50 Marks Note: 3 Session Tests are conducted during the semester, and marks are allotted based on the best average of 2 IAs.	

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

Course Code:	1BEE305	TITLE: Transformers and Generators					Faculty Name:		Praveen Kumar M			
List of Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	
CO-1	3	3	1	1	–	1	–	–	–	–	1	
CO-2	3	3	2	2	–	–	–	–	–	–	1	
CO-3	3	3	2	2	–	2	–	–	–	–	1	
CO-4	3	3	2	2	–	–	–	–	–	–	1	
CO-5	3	3	2	2	–	1	–	–	–	–	2	

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

Course Code: 1BEE305	TITLE: Transformers and Generators	Faculty Name: Praveen Kumar M
List of Course Outcomes	Program Specific Outcome	
	PSO1	PSO2
CO-1	3	1
CO-2	3	1
CO-3	3	2
CO-4	3	1
CO-5	3	2

Note: 3= Strong Contribution 2 = Average Contribution 1 = Weak Contribution “–“= No Contribution