

25HEET402	MODELLING AND ANALYSIS OF ELECTRICAL MACHINES	Category	L	T	P	R	Credit	Year of Introduction
		VAC	4	0	0	0	4	2025

Preamble: This course introduces the basic modeling and performance of DC, synchronous, and induction machines. It focuses on understanding and application of steady-state and transient machine behavior.

Prerequisite: IEE104 Introduction to Electrical & Electronics Engineering.

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the primitive two-pole machine representation of commutator, synchronous, and induction machines, including voltage and torque equations.	K2 Understand
CO2	Apply mathematical models of DC motors (separately excited, shunt, and series) to determine steady-state and transient performance.	K3 Apply
CO3	Apply primitive machine models and equivalent circuits to determine steady-state performance of synchronous and induction machines.	K3 Apply
CO4	Explain the operating principles and performance characteristics of three-phase and single-phase induction motors.	K2 Understand

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO4	2	2	1	1	-	-	-	-	-	-	-	2	1
Avg	2.75	2.5	1.5	1.5	-	-	-	-	-	-	-	2.5	1.5

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK 5	WK 6	WK 7	WK8	WK9
CO1	*	*	*	*	*	-	-	*	-
CO2	*	*	*	*	*	-	-	*	-
CO3	*	*	*	*	*	-	-	*	-
CO4	*	*	*	*	*	-	-	*	-

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	-	-	*	-

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 Hours

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
 Continuous Assessment Test : 20 marks
 Continuous Assessment Assignment: 15 marks

SYLLABUS

Module 1 (15 Hours)

Basic Two - pole Machine representation of Commutator machines, 3 phase synchronous machine with and without damper bars and 3 - phase induction machine. Primitive machine - Conventions - transformer and rotational voltages in the armature voltage and torque equations, resistance, inductance and torque matrix.

Module 2 (12 Hours)

DC Machine modelling: Mathematical model of separately excited D.C motor –Steady State analysis - Transient State analysis - Sudden application of Inertia Load - Transfer function of Separately excited D.C Motor - Mathematical model of D.C Series motor, Shunt motor.

Module 3 (14 Hours)

Synchronous machine reactance and time constants - Primitive machine model of synchronous machine with damper windings on both axes. Balanced steady state analysis-power angle curves.

Induction Machines: Primitive machine representation. Transformation - Steady state operation- Equivalent circuit. Torque slip characteristics.

Module 4 (15 Hours)

Three phase induction machine, equivalent circuit and analysis of steady state operation. Single phase induction motor- Revolving Field Theory equivalent circuit- Voltage and Torque equations - Cross field theory-Comparison between single phase and polyphase induction motor.

Text Books

1. Bimbra, P. S. (2017). *Generalized theory of electrical machines* (6th ed.). Khanna Publishers.
2. Krishnan, R. (2002). *Electric motor drives: Modeling, analysis, and control*. Pearson Publications.
3. Krause, P. C., Wasynczuk, O., & Sudhoff, S. D. (2002). *Analysis of electrical machinery and drive systems* (2nd ed.). IEEE Press.

Reference Books

1. Langsdorf, A. S. (2001). *Theory of alternating current machinery* (2nd rev. ed.). Tata McGraw-Hill.
2. Concordia, C. (1988). *Synchronous machines: Theory and performance*. John Wiley & Sons.
3. Say, M. G. (1978). *Introduction to unified theory of electrical machines*. Pitman Publishing.
4. Bimbra, P. S. (2017). *Generalized theory of electrical machines* (6th ed.). Khanna Publishers.
5. Jones, C. V. (1985). *Unified theory of electrical machines*. Plenum Press.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER (STC 2025 SCHEME)

Course Code	25HEET402
Course Name	MODELLING AND ANALYSIS OF ELECTRICAL MACHINES
Max. Marks: 60	Duration: 2.5 Hours





