III B.Tech – I Semester
(20EE5638) SPECIAL MACHINES FOR ELECTRIC AND HYBRID VEHICLES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	4	-	-	4

Pre-Requisites: DC Machines and Transformers, Synchronous and Asynchronous Machines.

Course Objectives

- Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies
- Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources
- Understand the structure and performance of electric machines used in electric vehicles

UNIT–I: Introduction to Hybrid Electric Vehicles

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance, drive cycles.

UNIT–II: Architecture of Electric and Hybrid Electric Vehicles

Hybrid Electric Drive-trains- Introduction to various hybrid drive-train topologies, power flow control in hybrid drive - train topologies, fuel efficiency analysis.

Electric Drive - trains- Introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

UNIT–III: DC Machines

Structure of DC machines used in electric vehicles-radial tangential flux-internal, external rotor, hybrid excited machine, Steady state characteristics of DC machines, Dynamic model of DC machines, Control of DC machines.

UNIT–IV: Induction Machines and Switched Reluctance machines

Structure of induction machines, Steady state characteristics of induction machines, Dynamic model of induction machines, Control of induction machines.

Constructional features and operation of switched reluctance machines (SRM), Steady state characteristics of SRM, Dynamic model of SRM, Control of SRM.

UNIT–V: Brushless Machines

Principle of operation, Types, Magnetic circuit analysis, EMF and torque equations, Commutation, Motor characteristics and control, Applications.

Steady state characteristics of permanent magnet synchronous machine (PMSM), Dynamic model of PMSM motor, Control of PMSM motor.

Course Outcomes:

After successful completion of the course, the students will be able to:

S.No	Course Outcome	BTL
1.	Demonstrate the impact of modern vehicles on energy supplies	L3
2.	Outline the structures of various electric machines used in electric vehicles	L1
3.	Develop the mathematical models of various electric machines used in electric vehicles	L5
4.	Assess the performance of various electric machines used in electric vehicles	L6
5.	Explain the speed control mechanisms of various electric machines used in electric vehicles	L2

Correlation of COs with POs& PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	1					2				2	
CO2			3	1					2				2	
CO3			3	1					2				2	
CO4			3	1					2				2	
CO5			3	1					2				2	

Text Books:

1. K. T. Chau, “Electric Vehicle Machines and Drives - Design, Analysis and Application”, Wiley, IEEE Press, 2015
2. Husain, I. “Electric and Hybrid Vehicles”, Boca Raton, CRC Press, 2010.

Reference Books:

1. Tariq Muneer and Irene Illescas García, “The automobile, In Electric Vehicles: Prospects and Challenges”, Elsevier, 2017.
2. Sheldon S. Williamson, “Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles”, Springer, 2013