

Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	NEEC512	Electric and Hybrid Electric Vehicles	3	1	0	4

#### Course Objective

- Covers various environment friendly transportation systems, components, their connections for hybrid electric and electric propulsion system, motor drives for electric vehicles, energy storage system for vehicle and their energy management.

#### Learning Outcomes

- Understand the need and significance of Electric and Hybrid Electric Vehicle
- Understand the fundamental concepts, operation and analysis of hybrid and electric vehicles
- Understand the applications of Electric Drives for Electric Vehicles.
- Understand the role of energy storage and their management.

Unit No	Topics to be covered	Lecture + Tutorial Hours	Learning Outcome
1	<b>Introduction to Hybrid Electric Vehicles:</b> History and importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.	4L+0T	Understanding the importance and basic functionalities of a electric vehicle
2	<b>Vehicle Fundamentals:</b> General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tractive forces, Vehicle Power Plant and Transmission Characteristics, Vehicle Performance. Longitudinal Vehicle Dynamics, Acceleration Performance and Vehicle Power. Dynamic. Modelling of Vehicle	7L+1T	Acquire knowledge on a vehicle movement, power plant and transmission characteristics, vehicle performance.
3	<b>Hybrid and Electric and Plug-in Electric Vehicle:</b> Configurations of Electric Vehicles (EV), Performance of EV, Hybrid Electric Vehicle (HEV), Architectures of HEV, Battery operated EV, Plug-in EV.	5L+1T	Understand various hybrid electric vehicles, their differences.
4	<b>Electric Propulsion unit-1:</b> Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives.	5L+2T	Understand modern propulsion unit technologies used in electric and hybrid electric vehicles.
5	<b>Electric Propulsion unit-2:</b> Electric Vehicle perspective control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive efficiency.	7L+5T	Understand advanced propulsion unit technologies used in electric and hybrid electric vehicles.
6	<b>Energy Storage:</b> Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.	9L+3T	Understand various storage systems used in electric and hybrid electric vehicles, their importance and applications.
7	<b>Energy Management Strategies:</b> Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, implementation issues of energy management strategies.	5L+2T	Understanding battery management systems, their implementation issues and energy management in hybrid electric vehicles.
<b>Total Contact Hours</b>		<b>42L+14T</b>	

#### Text Book:

- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory, and Design- Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, CRC PRESS.

#### Reference Books:

- Hybrid & Electric Vehicles, CRC Press, Taylor and Francis Power Electronics - Daniel W.
- AC Motor Control and Electric Vehicle Applications