Course code	Course Name	L-T-P -Credits	Year of Introduction
EE469	Electric and Hybrid Vehicles	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To present a comprehensive overview of Electric and Hybrid Electric Vehicles

Syllabus

Introduction to Hybrid Electric Vehicles, Conventional Vehicles, Hybrid Electric Drive-trains, Electric Propulsion unit, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, switched reluctance motor, Energy Storage Requirements in Hybrid and Electric Vehicles, Sizing the drive system, Design of a Hybrid Electric Vehicle , Energy Management Strategies.

Expected outcome.

The students will be able to

i. Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
ii. Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
iii. Choose proper energy storage systems for vehicle applications
iv. Identify various communication protocols and technologies used in vehicle networks.

Text Book:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

References:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
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, mathematical models to describe vehicle performance.	7	15%
II	Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.	7	15%
FIRST INTERNAL EXAMINATION			
III	Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives	7	15%
IV	Energy Storage: 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, Hybridization of different energy storage devices.	7	15%
SECOND INTERNAL EXAMINATION			
V	Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power	7	20%

	electronics, selecting the energy storage technology,		
VI	Communications, supporting subsystems: In vehicle networks- CAN, Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies	**7**	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3Hourrs.

Part A: 8 compulsory questions.

One question from each module of Modules I - IV; and two each from Module V & VI.

Student has to answer all questions. (8 x5)=40

Part B: 3 questions uniformly covering Modules I & II. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part C: 3 questions uniformly covering Modules III & IV. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.

Part D: 3 questions uniformly covering Modules V & VI. Student has to answer any 2 from the 3 questions: (2 x 10) =20. Each question can have maximum of 4 sub questions (a,b,c,d), if needed.