HYBRID ELECTRIC VEHICLE

VIII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE019	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Compare the performance of hybrid electric vehicles and conventionalvehicles.
II. Discuss the concept of hybrid traction and application of power electronics in hybrid electricvehicles.
III. Design hybrid electric vehicle utilizing suitable electric motor anddrive.
IV. Demonstrate the need for energy storage and energy management in hybrid electricvehicles.

COURSE OUTCOMES:

CO1: Impact of Conventional Vehicles on The Society and Different Types of Drive Train Topologies
CO2: Load Modelling Based on The Road Profile and Braking concepts.
CO3: Different types of Motors used in Hybrid Electric Vehicles Concept.
CO4: Different types of Energy Storage Systems used in Hybrid Electric Vehicles
CO5: The Concept of Energy Management Strategies Used in Hybrid Electric Vehicles

COURSE LEARNING OUTCOMES(CLO'S):

1. Explain the social and environmental importance of hybrid and electricvehicles.
2. Describe the performance of hybrid and electricvehicles.
3. Discuss the basic concepts of hybrid traction, introduction to various hybrid drive-traintopologies.
4. Discuss the basic concepts of electrictraction.
5. Explain power flow control in hybrid and electric drive traintopologies.
6. Analyze the fuel efficiency of hybrid and electricdrives.
7. Examine the configuration and control of DC motordrives.
8. Illustrate the configuration and control of induction motordrives.
9. Classify the configuration and control of permanent magnet motordrives.
10. Explain the configuration and control of switched reluctance motordrives.
11. Discuss the energy storage requirements in hybrid and electricvehicles.
12. Analyze the various energy storage systems based on battery and fuelcell.
13. Analyze the various energy storage systems based on super capacitor andflywheel.
14. Explain the hybridization of various energy storage devices, its advantages andchallenges.
15. Classify differentenergymanagement strategies used in hybrid and electricvehicles.
16. Discuss the implementation issues of energy managementstrategies.
17. Understand the impact of the professional engineering solutions in societal and environmental contexts.
18. Explore the knowledge and skills of employability to succeed in national and international level competitiveexaminations.

UNIT - I	INTRODUCTION	Classes: 08
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental impor hybrid and electric vehicles, impact of modern drive-trains on energy supplies; Conventional Vehicles: Basics of performance, vehicle power source characterization, transmission characteristics, and mathematical models to vehicleperformance.		
UNIT - II	HYBRID ELECTRIC DRIVE TRAINS	Classes: 10
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.		
UNIT - III	ELECTRIC MOTORS FOR HYBRID ELECTRIC VEHICLES	Classes: 10
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. Configuration and control of permanent magnet motor drives, configuration and control of switch reluctance motor drives, drive system efficiency.		
UNIT - IV	ENERGY STORAGE	Classes: 08
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, super capacitor based energy storage and its analysis, flywheel based energy storage and its analysis, hybridization of different energy storage devices; sizing the drive system: matching the electric machine and the internal combustion engine (ICE), sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, communications, supporting subsystems.		
UNIT - V	ENERGY MANAGEMENT STRATEGIES	Classes: 09
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, implementation issues of energy management strategies.		

Text Books:

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2nd Edition,2003.
2. James Larminie, John Lowry, “Electric Vehicle Technology”, Wiley publications, 1st Edition,2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals Theory and Design”, CRC Press, 2nd Edition,2004.

Reference Books:

1. B D McNicol, D A J Rand, “Power Sources for Electric Vehicles”, Elsevier publications, 1 st Edition,1998.
2. Seth Leitman, “Build Your Own Electric Vehicle” McGraw-Hill, 1 st Edition,2013.
3. Jeffrey Gonder, Tony Markel, “Energy Management Strategies for Plug-In Hybrid Electric Vehicles”, 2007-01-0290, National Renewable EnergyLaboratory.

Web References:

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.unep.org/transport/pcfv/PDF/HEV_Report.pdf
3. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf
4. https://www.afdc.energy.gov/pdfs/52723.pdf 5.https://www.leb.eei.uni-
5. langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf

E-Text Books:

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.unep.org/transport/pcfv/PDF/HEV_Report.pdf
3. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf
4. https://www.afdc.energy.gov/pdfs/52723.pdf 5.https://www.leb.eei.uni-
5. langen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf