

HYBRID ELECTRIC VEHICLES

VIII Semester: EEE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEE019	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3ss	30	70	100
Contact Classes: 45		TutorialClasses:Nil		Practical Classes: Nil		Total Classes: 60		
<p>COURSEOBJECTIVES: The students will try to Learn:</p> <p>I The performance of hybrid electric vehicles and compare with conventional vehicles.</p> <p>II The different powertrain architecture options and sort out the appropriate solutions within the realistic performance and commercial constraints.</p> <p>III The type of motors with its specifications used in hybrid electric drive applications.</p> <p>IV The various technology options for energy generation, storage, transmission, and management for a hybrid electric vehicle.</p> <p>COURSE OUTCOMES: After successful completion of the course, Students will be able to:</p> <p>CO 1 Interpresocial and environmental impacts of Hybrid and Electric vehicles over conventional vehicles.</p> <p>CO 2 Developmathematical models for source characterization and transmission characteristics of conventional vehicles.</p> <p>CO 3 Analyzevarious hybrid drive train topologies for fuel efficiency.</p> <p>CO 4 Explainthe braking concepts used and its impact on the performance of hybrid electric drive trains.</p> <p>CO 5 Describeload modeling concepts based on road profile in hybrid electric vehicles.</p> <p>CO 6 Buildelectric propulsion unit for DC Motors and Induction Motor drives for hybrid electric vehicles.</p> <p>CO 7 Elaboratethe control characteristics and configuration of Switch Reluctance Motor Drivesfor System Efficiency.</p> <p>CO 8 Estimatethe drive system, propulsion motor and power electronic sizing for energy storage system in the vehicles.</p> <p>CO 9 Developimplementation technique for communication and supporting subsystems for Vehicle Systems</p> <p>CO10 Formulatedifferent types of Energy management strategies in hybrid electric vehicles for regeneration of energy.</p>								
UNIT-I	INTRODUCTION						Classes: 09	
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.								

UNIT -II	HYBRID ELECTRIC DRIVE TRAINS	Classes: 09
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: 09
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: 09
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:		
<ol style="list-style-type: none"> 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:		
<ol style="list-style-type: none"> 1 B D Mc Nicol, D A J Rand, “Power Sources for Electric Vehicles”, Elsevier publications, 1st Edition, 1998. 2 Seth Leitman, “Build Your Own Electric Vehicle” McGraw Hill, 1st Edition, 2013. 3 Jeffrey Gonder, Tony Markel, “Energy Management Strategies for Plug-In Hybrid Electric Vehicles”, 2007-01-0290, National Renewable Energy Laboratory. 		
Web References:		
<ol style="list-style-type: none"> 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.unlangen.de/winterakademie/2010/report/content/course03/pdf/0308.pdf 		
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