

HYBRID ELECTRIC VEHICLES

PEC- II: EPS								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB08	Elective	3	-	-	3	30	70	100
		Contact Classes: 45		Tutorial Classes: Nil		Practical Classes: Nil		Total Classes: 45
I. COURSEOVERVIEW:								
<p>This course will help students to acquire fundamental concepts and principles of hybrid electric vehicles (HEV). It will give an idea about design and analyze HEVs, electric machine and the internal combustion. It also covers the application of electric drives in vehicles / traction and strategies of energy management in HEVs</p>								
II.COURSE OBJECTIVES:								
This course should enable the students to:								
<p>I. Identify the necessity of reactive power compensation. II. Explain upcoming technology of hybrid system. III. Understand different aspects of drives application. IV. Describe the electric traction.</p>								
III. COURSEOUTCOMES:								
After successful completion of the course, students will be able to:								
CO 1	Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals						Understand	
CO 2	Analyze the use of different power electronics devices and electrical Machines in hybrid electric vehicles.						Analyze	
CO 3	Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology						Understand	
CO 4	Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.						Understand	
CO 5	Develop the electric propulsion unit and its control for hybrid electric vehicles.						Apply	
IV. SYLLABUS								
UNIT-I	INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES						Classes: 09	
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, basics of vehicle performance, vehicle power source characterization transmission characteristics, mathematical models to describe vehicle performance								
UNIT-II	HYBRID TRACTION						Classes: 09	
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive train topologies, fuel efficiency analysis.								
UNIT-III	CONFIGURATION AND CONTROL OF DRIVES						Classes: 09	
Introduction to electric components used in hybrid and electric vehicles, configuration and control of dc motor drives, configuration and control of introduction motor drives.								
Configuration and control of permanent magnet motor drives configuration and control of switch reluctance, motor								

drives, drive system efficiency.		
UNIT-IV	ELECTRIC MACHINE AND THE INTERNAL COMBUSTION ENGINE	Classes: 09
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 AND STRATEGIES	Classes: 09
Introduction to energy management and their strategies used in hybrid and electric vehicle, classification of different energy management strategies comparison of different energy management strategies Implementation issues of energy strategies.		
Text Books:		
<ol style="list-style-type: none"> 1. Sira Ramirez, R Silva Ortigoza, "Control Design Techniques in Power Electronics Devices" Springer, 1st Edition, 2004. 2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, "Sliding mode control of switching Power Converters", 1st Edition, 2002. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 1st Edition 2003. 2. Mehrdad Ehsani, Yimi Gao, Sebastian E Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 1st Edition 2004. 3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 1st Edition 2003. 4. Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV). 		
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/pcf/PDF/HEV_Report.pdf 1. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf 		
E-Text Books:		
<ol style="list-style-type: none"> 1. https://www.onlinelibrary.wiley.com/book/10.1002/9781119998914 2. https://www.go2hev.com/hybrid-electric-vehicles-student-textbook.html 3. https://www.sciencedirect.com/science/book/9780444535658 4. https://www.accessengineeringlibrary.com/browse/hybrid-electric-vehicle-design-and-control-intelligent-omnidirectional-hybrids 		