

HYBRID ELECTRIC VEHICLES

PE-II: EPS																										
Course Code	Category	Hours / Week			Credits	Maximum Marks																				
BPSC08	Elective	L	T	P	C	CIA	SEE	Total																		
		3	0	0	3	30	70	100																		
Contact Classes: 45		Total Tutorials: Nil		Total Practical Classes: Nil			Total Classes: 45																			
<p>I. COURSE OVERVIEW: 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> <p>II. COURSE OBJECTIVES: The students will try to learn:</p> <ol style="list-style-type: none"> I. Recognize EV/HEV technical and economic objectives. II. The mechanism of battery and motors in terms of functionality, control and integration. III. How to identify efficient EV/HEV architectures such as P1, P2, P3 and P4. IV. The basic EV marketing strategy. <p>III. COURSE OUTCOMES:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;">After successful completion of the course, students will be able to:</th> </tr> </thead> <tbody> <tr> <td style="width: 10%; text-align: center; vertical-align: middle;">CO 1</td> <td style="width: 70%; padding: 5px;">Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals</td> <td style="width: 20%; text-align: center; vertical-align: middle;">Understand</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 2</td> <td style="padding: 5px;">Analyze the use of different power electronics devices and electrical machines in hybrid electric vehicles.</td> <td style="text-align: center; vertical-align: middle;">Analyze</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 3</td> <td style="padding: 5px;">Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology</td> <td style="text-align: center; vertical-align: middle;">Understand</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 4</td> <td style="padding: 5px;">Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.</td> <td style="text-align: center; vertical-align: middle;">Understand</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">CO 5</td> <td style="padding: 5px;">Develop the electric propulsion unit and its control for hybrid electric vehicles.</td> <td style="text-align: center; vertical-align: middle;">Apply</td> </tr> </tbody> </table> <p>IV. SYLLABUS</p> <p>MODULE –I: INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES (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.</p> <p>MODULE –II: HYBRID TRACTION (09) Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive train topologies, fuel efficiency analysis.</p> <p>MODULE –III: CONFIGURATION AND CONTROL OF DRIVES (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</p>									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
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reluctance, motor drives, drive system efficiency.

MODULE –IV: ELECTRIC MACHINE AND THE INTERNAL COMBUSTION ENGINE (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.

MODULE –V: ENERGY MANAGEMENT AND STRATEGIES(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.

VI. Text Books:

1. Sira Ramirez, R Silva Ortigoza, “Control Design Techniques in Power Electronics Devices” Springer, 1stEdition, 2004.
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, “Sliding mode control of switching Power Converters”, 1stEdition, 2002.

VII. Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design fundamentals, CRC Press, 1stEdition 2003.
2. MehrdadEhsani, YimiGao, Sebastian E Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 1stEdition 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 1stEdition 2003.
4. Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle(BEV).

VIII. Web References:

1. https://www.ae.pwr.wroc.pl/filez/20110606092353_HEV.pdf
2. https://www.unep.org/transport/pcfiv/PDF/HEV_Report.pdf
3. https://www.seai.ie/News_Events/Press_Releases/Costs_and_benefits.pdf

IX. E-Text Books:

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>