**19EE41E1-ELECTRICAL AND HYBRID VEHICLES**

**(EEE)**

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| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture-Tutorial-Practical:** | 3-0-0 |
| **Pre-requisite:** | Basics of Electrical engineering | **Sessional Evaluation:**  **External Exam Evaluation:**  **Total Marks:** | 40  60  100 |

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| **Course Objectives:** | To make the student learn about: | |
| 1. The importance of electric vehicle systems 2. The basics of electric vehicle components and storage 3. The basics of battery technology 4. The various charging types and comfort 5. The safety methods in hybrid vehicle 6. The application of electric vehicle in smart grid | |
| **Course Outcomes:** | Upon successful completion of the course , the students will be able to: | |
| **CO1** | Understand the importance of electric vehicle systems |
| **CO2** | Design and develop basic schemes of electric vehicles and hybrid electric vehicles |
| **CO3** | Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources |
| **CO4** | Select proper energy storage systems for vehicle applications |
| **CO5** | Describe the safety methods in hybrid vehicle |
| **CO6** | Identify various communication protocols and technologies used in vehicle networks |
| **Course Content:** | **UNIT –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.  **UNIT-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.  **UNIT-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  **UNIT-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.  **UNIT-V**  **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  **UNIT-VI**  **Communications and 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 | |
| **Text books**  **&**  **Reference books:** | **Text books:**  1. “Modern electric, hybrid electric and fuel cell vehicles: fundamentals,  theory, and design”, by M. Ehsani, Y. Gao, and A. Emadi, 2nd Edition,  CRC Press, Aug. 2009.  2. Iqbal Hussein, “Electric and Hybrid Vehicles”: Design Fundamentals, by Iqbal Hussein, CRC Press, 2003  3.“Advanced electric drive vehicles”, by A. Emadi , CRC Press,  1st Edition Oct. 2014.  4. “Hybrid electric vehicles: principles and applications with practical  perspectives”, by [Chris Mi](https://onlinelibrary.wiley.com/action/doSearch?ContribAuthorStored=Mi%2C+Chris), [M. AbulMasrur](https://onlinelibrary.wiley.com/action/doSearch?ContribAuthorStored=Masrur%2C+M+Abul), 2nd Edition, November  2017, John Wiley & Sons Ltd.  **Reference books:**  1.“Electric & hybrid vehicles – design fundamentals”, by IqbalHussain,  2nd Edition, CRC Press, 2011.  2.“Electric vehicle technology explained”, by James Larminie, John  Wiley & Sons, 2003.  3.“Smart Grid: technology and applications”, by JanakaEkanayake, Nick  Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, John  Wiley & sons inc, 2012. | |
| **e-Resources:** | <http://nptel.ac.in/courses>  <http://iete-elan.ac.in>  http://freevideolectures.com/university/iitm | |