

**RCETMECHAC01 -Electric Vehicle****Course outcomes:**

- 1 Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- 2 Analyse the use of different power electronics devices and electrical machines in hybrid electric vehicles.
- 3 Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology
- 4 Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.

**Syllabus:****UNIT – I**

Introduction to Electric Vehicle (EV) & Hybrid Vehicle(HV): A brief history of Electric and Hybrid vehicles, basic architecture of hybrid drive train and analysis of series drive train., vehicle motion and the dynamic equations for the vehicle, types of HV and EV, advantages over conventional vehicles, limitations of EV and HV, impact on environment of EV and HV technology, disposal of battery, cell and hazardous material and their impact on environment.

**UNIT – II**

Power Management and Energy Sources of EV and HV: Power and Energy management strategies and its general architecture of EV and HV, various battery sources, energy storage, battery based energy storage and simplified models of battery, Battery Management Systems (BMS), fuel cells, their characteristics and simplified models, Super capacitor based energy storage, its analysis and simplified models, flywheels and their modeling for energy storage in HV/BEV, hybridization of various energy storage devices, Selection of the energy storage technology.

**UNIT – III**

Power Electronics in EV & HV: Introduction, various power electronics converter topologies and its comparisons, Control of convertor operations in EV and HV, battery chargers used in EV & HV



## UNIT IV

DC and AC Machines & Drives in EV & HV: Various types of motors, selection and size of motors, Induction motor drives and control characteristics, Permanent magnet motor drives and characteristics, Brushed & Brushless DC motor drive and characteristics, switched reluctance motors and characteristics, IPM motor drives and characteristics, mechanical and electrical connections of motors..

## UNIT V

Electric and Hybrid Vehicles and Grid interconnection Issues: Introduction to smart charging: Grid to vehicle and vehicle to grid, smart metering and ancillary services, preliminary discussion on vehicle to vehicle and vehicle to personal communication systems, introduction to battery charging stations and its installation and commissioning, preliminary discussion on estimation on station capacity and associated technical issues, different connectors, policy regulations and standards for EV and HV, BEE standards, Indian and Global scenario, case studies

### Reference Text Books

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016