EE459: ELECTRIC AND HYBRID VEHICLES
CREDITS = 3 (L=3, T=0, P=0)

Course Objective:

1. To acquaint the students with the knowledge of Electric and Hybrid Electric Vehicle
2. To aware the students about the history and advanced power electronics based control strategies to meet the smooth speed control of EV and HEV.
3. To get acquainted with the knowledge of electric machines drives used in EV and HEV as well as the component and design of them.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory		Practical		Total Marks
				ESE	CE	ESE	CE	
3	0	0	3	70	30	00	00	100

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to EV & HEV:** A brief history of EV & EHV, Basics of EV & HEV, Architectures of EV & HEV, Types of HEV, EV and HEV advantages over conventional vehicles, Limitations of EV and HEV.	07
2	**Power Management and Energy Sources of EV and HEV:** Power management of EV and HEV, Various battery sources, Alternative energy sources like various Fuel cells, Super and Ultra capacitors, Flywheels, Hydrogen storage system.	07
3	**Power Electronics in EV & HEV :** Introduction, Principles of power electronics, Rectifiers, Converters, Inverters, Battery chargers used in EV & HEV, Emerging power electronic devices, Various Converter topologies and their comparison.	07

Unit No.	Topics	Teaching Hours
4	**DC and AC Machines & Drives in EV & HEV :** Introduction, Induction motor drives, Permanent magnet motor drives, Brushed & Brushless DC motor, Switched reluctance motors, Electric drive components, DC drive and operating point analysis, AC drive and operating point analysis.	07
5	**Components & design considerations of EV & HEV:** Batteries, Ultra capacitors, Fuel Cells, Controls, Aerodynamic considerations Consideration of rolling resistance, Transmission efficiency, Consideration of vehicle mass, Electric vehicle chassis & body design, General issues in design, Sizing of components.	07
6	**Modelling, Simulation & case studies of EV & HEV:** Introduction, Fundamentals of vehicle system modeling, Battery modeling, EV and HEV modeling, Case studies – Rechargeable battery vehicles, Hybrid vehicles.	07
	TOTAL	**42**

List of References:

1. Iqbal Hussain, "*Electric and Hybrid Vehicles Design Fundamentals*", 1st Edition, CRC Press, 2003.
2. James Larminie, John Lowry "*Electric Vehicle Technology Explained*", 1st Edition, John Wiley and Sons, 2003.
3. Chris Mi, M. Abul Masrur, David Wenzhong GAO, "*Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives*", Wiley publication, 2011.
4. Allen Fuhs, *"Hybrid Vehicles and the future of personal transportation",* CRC Press, 2009.

Course Outcomes (COs):

At the end of this course students will be able to …

1. Conceptualize of Electric Vehicles, Hybrid Electric Vehicles.
2. Implement Power electronics & electric machine requirements of EV & HEV.
3. Design issues of EV & HEV.
4. Carry out How to model EV & HEV Compare the conventional and advanced technology.
5. Optimize the component design in respect with the environment consent.
6. Analyse various EV and HEV technology.