

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE) SEMESTER – VII			
ELECTRIC VEHICLES (OPEN ELECTIVE)			
Course Code	18EE752	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
Course objectives: <ul style="list-style-type: none"> • To Understand the fundamental laws and vehicle mechanics. • To Understand working of Electric Vehicles and recent trends. • Ability to analyze different power converter topology used for electric vehicle application. • Ability to develop the electric propulsion unit and its control for application of electric vehicles. 			
Module-1			
Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.			
Module-2			
Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.			
Module-3			
Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.			
Module-4			
Electric Propulsion: EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.			
Module-5			
Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design. • Explain the working of electric vehicles and hybrid electric vehicles in recent trends. • Model batteries, Fuel cells, PEMFC and super capacitors. • Analyze DC and AC drive topologies used for electric vehicle application. • Develop the electric propulsion unit and its control for application of electric vehicles. 			

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Husain	CRC Press	2003
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design	M. Ehsani, Y. Gao, S.Gay and Ali Emadi	CRC Press	2005
Reference Books				
1	Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles	Sheldon S. Williamson	Springer	2013
2	Modern Electric Vehicle Technology	C.C. Chan and K.T. Chau	OXFORD University	2001
	Hybrid Electric Vehicles Principles And Applications With Practical Perspectives	Chris Mi, M. Abul Masrur, David Wenzhong Gao	Wiley Publication	2011