ELECTRICAL VEHICLES

Course Code	20EE4702B	Year	IV	Semester(s)	I
Course Category	Professional Elective-IV	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Basic Electrical and Electronics Engineering
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Define** the concepts of electric vehicle, hybrid vehicle, fuel cell vehicle and energy storage. (L1)
CO2	**Classify** performance of electric vehicle, hybrid vehicle, fuel cell vehicle and energy storage. (L4)
CO3	**Develop** the basic schemes of electric vehicle, hybrid vehicle, fuel cell vehicle and battery technology of Electric vehicles. (L3)
CO4	**Identify** various drive system and technologies used in the vehicles. (L3)
CO5	**Submit a report** in electric and hybrid vehicle, propulsion system, energy storage systems, energy management for Electric vehicle applications**.**

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2		3				3	3					3	3	
CO3	3		3	3			3					3	3	
CO4	3					3						3	3	
CO5									3	3			3	

SYLLABUS

Unit No.	Contents	Mapped CO
I	**Introduction to Electric Vehicles:** History of Electric and Hybrid Vehicles, Environmental Impact. **Vehicle Fundamentals:** Vehicle resistance, Dynamic Equation, Vehicle Performance, Braking Performance.	**CO1, CO3, CO5**
II	**Configuration and Performance of Electric Vehicles:** Configurations of Electric Vehicles, Performance of Electric Vehicles, Traction Motor Characteristics, Tractive Effort, Concept and Architectures of Hybrid Electric Drive Trains.	**CO2, CO3, CO4, CO5**

III	**Hybrid Electric Vehicles:** Concept of Hybrid Electric Drive Trains, Architectures of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel Hybrid Electric Drive Trains.	**CO2, CO3, CO4, CO5**
IV	**Fuel Cell Vehicles:** Operating Principles of Fuel Cells, Electrode Potential and Current–Voltage Curve, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, Fuel Cell Technologies, Fuel Supply.	**CO2, CO3, CO4, CO5**
V	**Energy Storage:** Electrochemical Batteries: Electrochemical Reactions, Thermodynamic Voltage, Specific Energy, Specific Power, Energy Efficiency, Battery Technologies. Ultra capacitors: Features of Ultra capacitors, Basic Principles of Ultra capacitors, Performance of Ultra capacitors, Ultra capacitor Technologies, Ultrahigh-Speed Flywheels, Hybridization of Energy Storages.	**CO1, CO2, CO3, CO4, CO5**

Learning Resources
Text Books
1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electrical and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004. 2. Iqbal Hussein, *Electric and Hybrid Vehicles: Design Fundamentals*, CRC Press, 2003.
Reference Books
1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.
e- Resources & other digital material
1. https://www.sciencedirect.com/topics/social-sciences/hybrid-electric-vehicle