B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

ELECTRIC VEHICLE TECHNOLOGY (3:0:0)

(Open Elective -Group 1)

(Effective from the academic year 2021 -2022)

Course Code	21EE654	CIE Marks	50
Teaching Hours/Week (L: T:P)	3	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	3

Course objectives:

This course will enable students to:

1. To Understand the fundamental laws and vehicle mechanics.
2. To Understand working of Electric Vehicles and recent trends.
3. Ability to analyze different power converter topology used for electric vehicle application.
4. 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. (8 Hours)

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. (8 Hours)

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**.** (8 Hours)

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. (8 Hours)

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.

(8 Hours)

Course outcomes: The students will be able to:

CO1: Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
CO2: Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
CO3: Model batteries, Fuel cells, PEMFC and super capacitors.
CO4: Analyze DC and AC drive topologies used for electric vehicle application.

CO5: Develop the electric propulsion unit and its control for application of electric vehicles

Question paper pattern:

SEE will be conducted for 50 marks.

- The question paper will have 50 questions. Each question is set for 01 mark.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks.
- The duration of the examination is 01 Hour.

CIE will be announced prior to the commencement of the course.

- Three Unit Tests each of **20 Marks** (Duration 01 hour).
- Two assignments each of 10 Marks.
- Two alternate assessment tools (AATs) for **20 Marks** (duration 01 hour).
- The sum of three tests, two assignments, and AATs will be out of 100 marks and will be scaled down to 50 marks.

Textbooks

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2005.
2. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.

References:

1. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric", Springer, 2013.
2. C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", Oxford University, 2001.
3. Chris Mi, M. Abul, Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles and Applications with Practical Perspectives", Wiley Publication, 2011.