

GUJARAT TECHNOLOGICAL UNIVERSITY

Minor Degree – Electrical Vehicles

Subject Code: 114AL01

Semester – IV

Subject Name: Fundamentals of Electrical Vehicles

Prerequisite: Electrical Machines

Rationale: The advancement in the fields of Power Electronics and Electrical machines played an important role in making highly efficient electric vehicles having low pollution and better fuel economy. The EV has been the need of the time looking to the limitations of fossil fuels and harmful effects on the atmosphere due to vehicles run by conventional fuels. This subject will be helpful to understand the basics of Electrical Vehicle (EV) technology. .

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	0	30	0	100

Content:

Sr. No.	Content	Total Hrs.
1	Introduction to Electric Vehicle Technology Vehicle and automobile industry, Benefits of electric vehicle, Parameters of electric vehicle system, Block diagram of electric vehicle, EV architecture	6
2	Vehicle characteristics Average power calculation, Power to weight ratio, Driving cycle, Force speed characteristics of vehicle, Torque speed characteristics of vehicle, Braking Performance	6
3	Simulation and analysis of vehicle using MATLAB Mathematical model of vehicle, Simulation of Vehicle Model with MATLAB-Simulink, Analysis of Vehicle Model, Understanding Torque-Speed Characteristics of Vehicle.	8
4	Electric Motors for EV Basics of Electric Motor, Induction motor, BLDC/PMSM motor, Switched Reluctance Motor, Selection of Motor for Various Applications.	8
5	Energy sources for EV Battery, Fuel Cell, Ultracapacitor, Flywheel, Hybrid Energy Sources, Regenerative Braking	6
6	Thermal management system Introduction to thermal management system, Need of thermal management, Causes of battery and motor heating, Thermal Runaway Techniques of Battery Cooling, Heat Sink, Air cooling, Liquid Cooling, Direct Liquid Cooling, Indirect Liquid Cooling, Phase Change Material based Cooling, Thermo Electric Peltier Cooling	8

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Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	15	15	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
2. **Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying:** Carrying out or using a procedure for executing or implementing.
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing.
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books/Material:

- 1 Modern Electric Hybrid Electric And Fuel Vehicles 3Rd Edition, Mehrdad Ehsani, CRC Press
- 2 Electric Vehicle Battery Systems, Sandeep Dameja, Newnes publication
- 3 Electric & Hybrid Vehicles, A.K. Babu, Khanna publication
- 4 Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley
- 5 Advanced Electric Drive Vehicles, Ali emadi, CRC press
- 6 Electric Vehicle, Automobiles of the Future, Otto B. Bischof, Ted H. Tanaka, Berkeley, California
- 7 Thermal Management of Electric Vehicle Battery Systems, Halil S. Hamut , Wiley
- 8 Electric and Hybrid Vehicles: Design Fundamentals”, Iqbal Hussein, CRC Press, 2003.

Course Outcomes:

At the end of the course, student should be able to:

Sr. No.	CO statement	Topics Mapped	Marks % weightage
CO-1	Explain the parameters and configuration of Electric vehicles	1	20%
CO-2	Derive the characteristics and performance parameters using analysis and simulation.	2,3	30%
CO-3	Choose proper electric motors and energy sources for electrical and hybrid vehicle applications.	4,5	25%
CO-4	Discuss the thermal management system for Electric Vehicles	6	25%

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Laboratory/Practical Work:

Simulations using tools like MATLAB may be done to obtain performance parameters

Visit to Electric Vehicle manufacturing units may be arranged