GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering
Level: PG
Branch: Electric Vehicle Technology
Course / Subject Code: ME01064011

Subject Name : Electric & Hybrid Vehicles Technology

WEF Academic Year :	2024 - 25
Semester :	1st Semester
Category of the Course :	PCC

Prerequisite:	NA
Rationale:	To aware the students for basic of electrical vehicles,types of electric motor used for propulsion, energy sources and its management.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Content	Total Hrs
1	**Electric and Hybrid Electric Vehicles** Benefits of EV, Configuration of Electric Vehicles, Performance of Electric Vehicles, Introduction of Different source of power for Electric Vehicle. Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Tractive effort in Gradient, Tractive effort for other forces.	11
2	**Energy storage for EV and HEV** Energy storage requirements, Battery parameters, Types of Batteries, Charging method of battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super Capacitors, Introduction to Ultra fly wheel. Energy management and their strategies used in hybrid vehicle	11
3	**Electric Vehicle Motors** DC Motor, Induction Motor, BLDC Motor and Switch Reluctance Motor – Types, Construction operating Principle, Equivalent circuit for each motor and selection of motor for vehicle application	11

4	**Hybrid Electrical Vehicle Subsystem and Configuration** Series HEV, Parallel HEV, and Series Parallel HEV, Complex HEV system and Its Configuration, HEV mode of operation, Drive train comparison	12
	TOTAL	45

Suggested Specification table with Marks (Theory) :

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	30	25	0	0

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

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 :

1. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005
2. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
3. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
4. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001.
5. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011.
6. Michael Nikowitz, "Advanced Hybrid and Electric Vehicles: System Optimization and Vehicle Integration", Springer International Publishing, 2016.
7. James Larminie and John Lowry "Electric Vehicle Technology Explained", John Wiley and Sons, 2nd ed., 2014.
8. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.

Course Outcomes :

Students will be able to

S. No	CO STATEMENT	Bloom's taxonomy level	Marks % weightage
CO1	Understand the Basics of electric and hybrid vehicles, Tractive effort, vehicle performance	**Understand**	**25%**
CO2	Demonstrate energy management concepts for EV	**Application**	**30%**
CO3	Analyze the requirements of Motors	**Analysis**	**25%**
CO4	Identify various configuration of Electric and hybrid vehicles.	**Remember**	**20%**

After learning the course, the students should be able to :

- Understand working of Electric Vehicles and require effort for movement of vehicle.
- Analyze different power converter, Energy Management system used for electric vehicle application
- EV and Hybrid vehicle sub system and configuration.

Suggestive List of Experiments :

- Modeling of electric vehicle sub-systems
- Study of different Energy management strategies

Major Equipment :

- Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.
- Simulation software like MATLAB, PSIM or Scilab and Power Electronic Converters as demanded by the course
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List of Open Source Software/learning website :

- E-materials available at the website of NPTEL- http://nptel.ac.in/
- MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

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