



# SILVER OAK UNIVERSITY

## Engineering and Technology (M. Tech.) Mechanical (I.C. Engine & Automobile Engineering)

Subject Name: Electric Vehicle Technology

Subject Code:

Semester: III

**Prerequisite:** Basic of Electrical Engineering

**Objective:** This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Evaluation Scheme				Total Marks
L	T	P	C	Internal		External		
				Th	Pr	Th	Pr	
3	0	2	4	40	20	60	30	150

### Content:

Unit No.	Course Contents	Teaching Hours	Weightage %
1	<b>Electric and Hybrid Electric Vehicles</b> 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	6	15
2	<b>Energy storage for EV and HEV</b> Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modeling of PEMFC, Super Capacitors	6	15
3	<b>Electric Propulsion</b> 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	20

4	<b>Design of Electric and Hybrid Electric Vehicles</b> 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	12	30
5	<b>Power Electronic Converter for Battery Charging</b> Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology	7	20

#### Course Outcome:

Sr. No.	CO statement	Unit
CO-1	Understand working of Electric Vehicles and recent trends	1,2
CO-2	Analyze different power converter topology used for electric vehicle application	3
CO-3	Develop the electric propulsion unit and its control for application of electric vehicles	4,5

#### Books Recommended:-

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.

#### List of Open Source Software/learning website:

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