



# **C. U. SHAH UNIVERSITY**

## **Wadhwan City**

**FACULTY OF:** - Technology and Engineering  
**DEPARTMENT OF:** -Automobile Engineering  
**SEMESTER:** -VIII  
**CODE:** - 4TE08HYV1  
**NAME:** –Hybrid vehicles

### Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE08HYV1	Hybrid vehicles	3	0	2	5	4	30	1.5	70	3	---	20	30	150

### Objectives:

This course “Hybrid and Fuel Cell Vehicle ” is designed with the following objectives in mind:

1. The student shall gain appreciation and understanding about layout of electric vehicle and different components of electric vehicle.
2. Shall be able to know architecture and power plant specifications of hybrid vehicle and performance parameter of hybrid vehicle.
3. Student shall gain knowledge of types of fuel cell and characteristics of fuel cell.

### Prerequisite:

Basic knowledge of Automotive Transmission, Automotive Electrical and Electronics

### Course Outline:

Sr. No.	Course Content	Hours
1	<b>Hybrid Vehicles and Propulsion Methods:</b> Introduction to hybrid vehicles performance characteristics of road vehicles; calculation of road load- predicting fuel economy- grid connected hybrids.	09
2	<b>Hybrid Architecture and Power Plant Specifications:</b> Series configuration locomotive drives- series parallel switching- load tracking architecture. Pre transmission parallel and combined configurations Mild hybrid- power assist- dual mode- power split- power split with shift- Continuously Variable transmission (CVT)- wheel motors. Grade and cruise targets- launching and boosting- braking and energy recuperation- drive cycle implications.	09
3	<b>Electric Vehicles and Motors:</b> Electric vehicle, introduction, components, advantages, disadvantages, applications, vehicles. DC motors series wound- shunt wound- compound wound and separately excited motors AC motors Induction- synchronous- brushless DC motor- switched reluctance motors.	09
4	<b>Sizing the Drive System and Energy Storage Technology:</b> Matching electric drive and ICE; sizing the propulsion motor; sizing power electronics. Battery basics; lead acid battery; different types of batteries; battery parameters.	09

5	<b>Nonelectric Hybrid Systems:</b> Short term storage systems flywheel accumulators. Continuously variable transmissions hydraulic accumulators hydraulic pumps/motors- pneumatic hybrid engine systems operation modes.	<b>09</b>
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### Learning Outcomes:

- Student will be able to understand about pollution formation in engine, treatment and control technique and pollution measurement.
- The subject helps the students to understand the latest developments in the field of pollution control.

### Books Recommended:

1. The Electric Car: Development and Future of Battery- Hybrid and Fuel Cell Cars, by **Mike Westbrook**- M H Westbrook- British library Cataloguing in Publication Data.
2. Electric and Hybrid Vehiclesby **Robin Hardy- Iqbal Husain**- CRC Press.
3. Propulsion Systems for Hybrid Vehicles by John M. Miller Institute of Electrical Engineers- London.

### Reference Books:-

1. Handbook of Electric Motors by **Hamid A Toliyat- Gerald B Kliman**, Marcel Decker Inc.
2. Electric and Hybrid-electric vehicles by **Ronald K. Jurgen** - SAE 2002