

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Architecture of Electrical and Hybrid Vehicles (Professional Elective-II)
Course Code:	2ET1090608T
Pre-requisite Course:	Automobile Electrical System and Mechanism

Course Objectives:

1. The main objective of this course is to understand the fundamental of electrical and hybrid vehicles.
2. To compare the battery technology and battery indication system.
3. To analyze the configuration of a battery charger and communication mechanism.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	Introduction to Hybrid and Electric Vehicle: Types of EVs, Electric vehicle development: Past, present and future, Electric vehicles and environment, Hybrid electric drive train, Tractive effort in normal driving, Comparison with internal combustion engine driven vehicle.	09	20
2	Electric Vehicle Powertrain: Concept & types of power train, Power train components, Concept & different types of drive train, Transmission efficiency, Differential, Auxiliary systems of EV.	08	18
3	Electrical Vehicle Sources: Introduction to energy requirements in hybrid and electric vehicles, Battery based energy storage and its analysis, Fuel cell based energy storage and its analysis, Hybridization of different energy storage devices, Sizing the drive system, Design of hybrid electric vehicle and plug in electric vehicle.	10	22
4	Hybrid Electric Vehicles: Classification, Micro, Mild, Full, Plug in, Types: Series, Parallel and series parallel configurations, I/C engine rating, Hybrid drive train topologies, Analysis and control of hybrid electric vehicle systems, Fuel efficiency analysis.	10	22
5	Vehicular Communication and Grid Integration: Overview of vehicular communication protocols within vehicle, Grid integration, Standards for grid integration, Concept of driverless car, Concept of cybersecurity standards for connected vehicles.	08	18

Text Books:

1. Husain, I. "Electric and Hybrid Vehicles" Boca Raton, CRC Press, 3rd edition-2019.
2. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2nd edition-2020.

Reference Books:

1. Sandeep Dhameja." Electric Vehicle Battery Systems", Newnes-2017.
2. K. T. Chau, Zheng Wang, Chaos " Electrical Drive Systems: Analysis, Control & Applications", John Wiley and Sons.P. S Bimbhra, "Electrical Machinery", Khanna Pub., Delhi.
3. Michael H. Westbrook. " The Electric Car: development and future of battery, hybrid and fuel-cell cars", Institution of Electrical Engineers, 4th edition-2016.

ICT/MOOCs Reference:

1. <https://nptel.ac.in/courses/108106170>
2. <https://nptel.ac.in/courses/108102121>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand the fundamental of electrical and hybrid vehicles.	2 Understanding
CLO2	Explain the power derive mechanism and regulation.	2 Understanding
CLO3	Compare the battery technology and battery indication system.	4 Analyzing
CLO4	Analyze the configuration of a battery charger and communication mechanism.	4 Analyzing

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H					L	L		M			H		L	M	
CLO2	H	L			L	M					L	M	M	H	M	L
CLO3	H	H		M	H	L						M	H	H	M	M
CLO4	H	H	M	M	H	L	L	L				M	H	H	M	

H: High, M: Medium, L: Low