COURSE HANDOUT

Hybrid and Electric Vehicles (EE-702(A))

EE-7th SEMESTER

ACADEMIC YEAR (2024-25)

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
EE-702(A)	Hybrid and Electric Vehicles	Core	3	2	1	0	50	100	150

COURSE OUTCOMES

At the end of the course the student will be able to:	
CO1	Explain the concept and working principle of electric vehicles.
CO2	Describe the working principle of traction and its utilization.
CO3	Identify and evaluate the significance of Lithium batteries and battery management systems for vehicles.
CO4	Analyze various energy management techniques in hybrid and electric vehicles.
CO5	Design the charging station for electric vehicles.

Unit-I

History of hybrid and electric vehicles, Social and environmental importance of hybrid and electric vehicles, Basics of vehicle performance, Vehicle power source characterization, Transmission characteristics, Mathematical models to describe vehicle performance. (10 Hours)

Unit-II

Basic concept of hybrid traction,Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Basic concept of electric traction, Fuel efficiency analysis. Fundamentals of Drives and Control of EV Using DC motor, Induction Motor, Permanent Magnet Motor, Switched Reluctance Motor, BLDC motor, Design and Sizing of Traction Motors.

(8 Hours)

Unit-III

Introduction to lithium batteries and their applications,working principle, advantages, and disadvantages. Evaluation of various battery parameters: State of charge, Depth of discharge, charging rate, etc. current and voltage variation as per different loads.Issues and remedies for battery balancing.Government policies to fulfill the demands of lithium batteries for e-vehicles. (10Hours)

Unit- lV

Energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. (8 Hours)

Unit-V

Introduction to various charging techniques and schematic of charging stations, classification of different charging technology for EV charging station, introduction to Grid-to-Vehicle, Vehicle to Grid (V2G) or Vehicle to Buildings (V2B) or Vehicle to Home (V2H) operations, bi-directional EV charging systems, Wireless power transfer (WPT) technique for EV charging. (10 Hours)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Electric and Hybrid Vehicles: Design Fundamentals	Iqbal Hussein	CRC Press	1st (2012)
2	Fundamentals and Applications of Lithium-Ion Batteries in Electric Drive Vehicles	Jiuchun Jiang and Caiping Zhang Beijing	Wiley	1st (2015)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Electric Vehicle Technology	Larminie, James, and John Lowry.	John Wiley and Sons	1st (2012)

COURSE PLAN		
Unit-I		
S.No	**Topics**	**Recommended Books**
1	History of hybrid and electric vehicles	Book 1, Ch.1
2	Social and environmental importance of hybrid vehicles	Book 1, Ch.1
3	Social and environmental importance of electric vehicles	Book 1, Ch.1
4	Basics of vehicle performance	Book 2, Ch.2
5	Vehicle power source characterization	Book 2, Ch.2
6	Transmission characteristics	Book 2, Ch.2
7	Mathematical models to describe vehicle performance	Book 2, Ch.2
Unit-II		
8	Basic concept of hybrid traction	Book 2, Ch.3
9	Introduction to various hybrid drive-train topologies	Book 2, Ch.3
10	Power flow control in hybrid drive-train topologies	Book 2, Ch.3
11	Basic concept of electric traction	Book 2, Ch.3
12	Fuel efficiency analysis	Book 2, Ch.3
13	Fundamentals of Drives and Control of EV Using DC motor	Book 2, Ch.3
14	Induction Motor, Permanent Magnet Motor, Switched Reluctance Motor, BLDC motor	Book 2, Ch.3
15	Design and Sizing of Traction Motors	Book 2, Ch.3
Unit-III		
16	Introduction to lithium batteries and their applications	Book 2, Ch.4
17	Working principle, advantages, and disadvantages	Book 2, Ch.4
18	Evaluation of various battery parameters State of charge,	Book 2, Ch.4
19	Depth of discharge, charging rate, etc	Book 2, Ch.4
20	Current and voltage variation as per different loads	Book 2, Ch.4
21	Issues and remedies for battery balancing	Book 2, Ch.4
22	Government policies to fulfill the demands of lithium batteries for e-vehicles	Book 2, Ch.4

Unit-IV		
23	Energy management strategies used in hybrid and electric vehicles	Book 2, Ch.5
24	Classification of different energy management strategies	Book 2, Ch.5
25	Comparison of different energy management strategies	Book 2, Ch.5
26	Implementation issues of energy management strategies.	Book 2, Ch.5
Unit-V		
27	Introduction to various charging techniques and schematic of charging stations	Book 1, Ch.6
28	Classification of different charging technology for EV charging station	Book 1, Ch.6
29	Introduction to Grid-to-Vehicle	Book 1, Ch.6
30	Vehicle to Grid (V2G)	Book 1, Ch.6
31	Vehicle to Buildings (V2B)	Book 1, Ch.6
32	Vehicle to Home (V2H) operations	Book 1, Ch.6
33	Bi-directional EV charging systems	Book 1, Ch.6
34	Wireless power transfer (WPT) technique for EV charging	Book 1, Ch.6

ADDITIONAL WEB RESOURCES

1.	**MOOC**: Electric Vehicles and Mobility https://www.coursera.org/learn/electric-vehicles-mobility
2.	**NPTEL:** Video lectures on Electric Vehicles and Renewable Energy https://archive.nptel.ac.in/courses/108/106/108106182/

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Monday (12:05 PM - 12:55 PM)
  Friday (12:05 PM - 12:55 PM)

- **Contact Information**
  Parveen.ee@mietjammu.in