



Department of Electrical and Electronics Engineering		LP: OE22607
B.E/B.Tech/M.E/M.Tech : EEE	Regulation: R2022	Rev. No: 00
PG Specialisation : Nil		Date: 26.06.2024
Sub. Code / Sub. Name : OE22607 / Electric Vehicle Technology		
Unit : I		

Unit Syllabus: Electric and Hybrid vehicle components – Configurations of Electric vehicles and Hybrid electric vehicles – Plug-in hybrid electric vehicle – Fuel cell electric vehicle – Challenges and benefits of EVs - Current scenario of EV and HEVs in market.

Objective: To introduce the architecture of electric vehicles and fundamentals of vehicle dynamics, and power train components specific to electric and hybrid electric vehicle

Session No *	Topics to be covered	Ref	Teaching Aids
1	Electric and Hybrid vehicle components	1,3,4,7	Laptop and OHP projector
2	Configurations of Electric vehicles	1,3,4,7	Laptop and OHP projector
3	Configurations of Hybrid electric vehicles	1,3,4,7	Laptop and OHP projector
4	Configurations of Hybrid electric vehicles	1,3,4,7	Laptop and OHP projector
5	Configurations of Plug-in Hybrid electric vehicles	1,3,4,7	Laptop and OHP projector
6	Fuel cell electric vehicle	1,2,3,4,7	Laptop and OHP projector
7	Challenges and benefits of EVs	1,3,4,7	Laptop and OHP projector
8	Current scenario of EV in market.	1,3,4,7	Laptop and OHP projector
9	Current scenario of HEVs in market.	1,3,4,7	Laptop and OHP projector
Content beyond syllabus covered (if any): Penetration of EV Market in the Automobile sector and the job opportunities for the skilled persons.			

* Session duration: 50 minutes



Sub. Code / Sub. Name: OE22607 / Electric Vehicle Technology

Unit : II

Unit Syllabus : Fundamentals of vehicle dynamics: Vehicle resistance and dynamic equation – Power train components – Gears, Clutches, Differential, Transmission and Vehicle Brakes – EV and HEV power train sizing.

Objective : To introduce the architecture of electric vehicles and fundamentals of vehicle dynamics, and power train components specific to electric and hybrid electric vehicle

Session No *	Topics to be covered	Ref	Teaching Aids
10	Fundamentals of vehicle dynamics: Vehicle resistance and dynamic equation	1,3,4,7	Laptop and OHP projector
11	Fundamentals of vehicle dynamics: Vehicle resistance and dynamic equation	1,3,4,7	Laptop and OHP projector
12	Power train components – Gears	1,3,4,7	Laptop and OHP projector
13	Power train components – Clutches	1,3,4,7	Laptop and OHP projector
14	Power train components –Differential	1,3,4,7	Laptop and OHP projector
15	Power train components –Transmission	1,3,4,7	Laptop and OHP projector
16	Power train components – Vehicle Brakes	1,3,4,7	Laptop and OHP projector
17	EV power train sizing.	1,3,4,7	Laptop and OHP projector
18	HEV power train sizing.	1,3,4,7	Laptop and OHP projector

Content beyond syllabus covered (if any): Power Train Model used in the latest Electric Vehicle.

* Session duration: 50 mins



Sub. Code / Sub. Name: OE22607 / Electric Vehicle Technology

Unit : III

Unit Syllabus : Energy storage technologies in electric and hybrid electric vehicles – battery, flywheel, fuel cell, ultra capacitors- Hybridization of different energy storage devices – Ragone Plot – Range prediction of batteries

Objective: To impart the knowledge on the energy storage technologies, charging and battery management technologies in EV

Session No *	Topics to be covered	Ref	Teaching Aids
19	Energy storage technologies in electric and hybrid electric vehicles - Introduction	1,3,4,7	Laptop and OHP projector
20	Energy storage technologies - battery	1,3,4,7	Laptop and OHP projector
21	Energy storage technologies - flywheel	1,3,4,7	Laptop and OHP projector
22	Energy storage technologies - fuel cell	1,3,4,7	Laptop and OHP projector
23	Energy storage technologies - ultra capacitors	1,3,4,7	Laptop and OHP projector
24	Hybridization of different energy storage devices	1,3,4,7	Laptop and OHP projector
25	Hybridization of different energy storage devices	1,3,4,7	Laptop and OHP projector
26	Ragone Plot	1,3,4,7	Laptop and OHP projector
27	Range prediction of batteries	1,3,4,7	Laptop and OHP projector

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins



Sub. Code / Sub. Name: OE22607 / Electric Vehicle Technology

Unit : IV

Unit Syllabus : Comparison of speed torque characteristics of IC engine and Electric motor – Requirements of EV motor compared to industrial motor – Chopper control of DC motor, Vector control of Induction motor drive. Control of Switched reluctance motor. Brushless DC motor and Permanent Magnet Synchronous motor – Choice of electric motors for EVs.

Objective: To understand the principles and speed control methods of electric drive motors used in EVs.

Session No *	Topics to be covered	Ref	Teaching Aids
28	Comparison of speed torque characteristics of IC engine and Electric motor	1,3,4,7	Laptop and OHP projector
29	Requirements of EV motor compared to industrial motor	1,3,4,7	Laptop and OHP projector
30	Chopper control of DC motor	1,3,4,7	Laptop and OHP projector
31	Vector control of Induction motor drive	1,3,4,7	Laptop and OHP projector
32	Vector control of Induction motor drive	1,3,4,7	Laptop and OHP projector
33	Control of Switched reluctance motor	1,3,4,7	Laptop and OHP projector
34	Brushless DC motor	1,3,4,7	Laptop and OHP projector
35	Permanent Magnet Synchronous motor	1,3,4,7	Laptop and OHP projector
36	Choice of electric motors for EVs	1,3,4,7	Laptop and OHP projector

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins



Sub. Code / Sub. Name: OE22607 / Electric Vehicle Technology

Unit : V

Unit Syllabus: Charging schemes for EV: Normal charging, opportunity charging and fast charging – Charging algorithms – On₁ board and Off-board chargers – Wireless power transfer schemes: Inductive and Capacitive – Vehicle to grid technology – Battery Management System: SoC estimation and Cell balancing.

Objective: To impart the knowledge on the energy storage technologies, charging and battery management technologies in EV

Session No *	Topics to be covered	Ref	Teaching Aids
37	Charging schemes for EV: Normal charging	5,6	Laptop and OHP projector
38	Charging schemes for EV: opportunity charging	5,6	Laptop and OHP projector
39	Charging schemes for EV: fast charging	5,6	Laptop and OHP projector
40	Charging algorithms – On ₁ board	5,6	Laptop and OHP projector
41	Charging algorithms – Off-board chargers	5,6	Laptop and OHP projector
42	Wireless power transfer schemes: Inductive	5,6	Laptop and OHP projector
43	Wireless power transfer schemes: Capacitive	5,6	Laptop and OHP projector
44	Vehicle to grid technology	5,6	Laptop and OHP projector
45	Battery Management System: SoC estimation and Cell balancing.	5,6	Laptop and OHP projector

Content beyond syllabus covered (if any): Nil

* Session duration: 50 mins



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REFERENCES:

1. Iqbal Hussein, 'Electric and Hybrid Vehicles: Design Fundamentals', CRC Press, 2021, 3rd Edition.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2018, 3rd Edition.
3. James Larminie, John Lowry, 'Electric Vehicle Technology Explained', Wiley, 2012, 2nd Edition.
4. C.C. Chan and K.T. Chau, 'Modern Electric Vehicle Technology', OXFORD University Press, 2001.
5. Sheldon S. Williamson, 'Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles', Springer, 2013.
6. Chris Mi, M. Abul Masrur, 'Hybrid Electric Vehicles Principles and applications with practical perspectives', Wiley Publication, 2017.
7. NPTEL lecture on 'Electric Vehicles Part 1'.

	Prepared by	Approved by
Signature		
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Designation	Asso. Prof	f HOD/EEE
Date	26.06.2024	26.06.2024
Remarks *:		
Remarks *:		

* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD