



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code: ME02000691

Course / Subject Name: E-Vehicle Technology and Mobility

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	NA
Rationale:	Transportation is a fundamental requirement of modern life. Traditional, IC engine based, transportation has many issues. So, now days electrical vehicles (EV) are quickly replacing them. Because of the many advantages of EVs, it has become necessary to introduce courses related to EVs in academics. This subject focuses on Electrical Mobility and related technology.

Course Outcome:

After Completion of the Course, the student will be able to:

No	Course Outcomes
01	understand concepts of Electrical mobility options.
02	understand energy sources for EV.
03	develop understanding of battery and battery charging concepts.
04	Compare EV propulsion system.

Teaching and Examination Scheme:

Teaching Scheme (in Hours/ week)			Total Credits (L+T+PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction: History of EV, EV and Environment, Types of EV- Battery Electric Vehicles, Electric Hybrid Vehicle, Fueled EVs, EVs using Supply Lines, EVs which use Flywheels or Supercapacitors, Solar-Powered Vehicles, Vehicles using Linear Motors, EVs for the Future	6	20
2.	Energy Sources and Storage for Electrical Vehicle: Electric supply, Energy storage means- battery, super capacitors, flywheel etc., Electric supply rails, solar power, fuel cell etc.	8	20
3.	Battery and Battery Charging: Battery concept, battery parameters, battery types – lead acid, nikel based, sodium based, lithium based, metal air, comparison of battery, battery modelling, battery charging, charger types, charging methods etc., Battery Management System, cell balancing concepts, smart charging	8	20



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code: ME02000691

Course / Subject Name: E-Vehicle Technology and Mobility

4.	Charging Infrastructure: Principles for location planning of EV charging stations, Geospatial analysis and locations, Land allocation, Off-grid charging with renewable sources. Improving the utilization of the grid with V2G concept, Grid planning with EV charging stations, Metering or pricing with commercial charging, Regulatory framework for charging stations, Roles of DISCOMs, Safety provisions for the EV charging stations, Battery swapping concept a critical overview, Grid integration and stability issues with Vehicle to Grid, Harmonic and power quality issues associated with high power commercial charging.	10	20
5.	Propulsion System for EV: Electric motors, motor types used for EV, Power converters and electronic controllers for EV, types, working, comparison.	7	10
6	Recent Electric Vehicles: Low-Speed Rechargeable Battery Vehicles like bicycle, Battery-Powered Cars and Vans, Electric Bus, Electric trucks, Hybrid Vehicles, High Speed trains, Hybrid and electric aircraft, Electric boats, Electric marine vessels, ships, boats, their types etc.	6	10
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (%)					
R Level	U Level	A Level	N Level	E Level	C Level
40	20	20	20	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. James Larminie, John Lowry, "Electric Vehicle Technology Explained, 2nd Ed.", Oxford Brookes University, UK
2. Edited by Ali Emadi, "Advanced Electric Drive Vehicles", CRC press
3. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles- Fundamentals, Theory, and Design", CRC Press
4. Edited by Ali Emadi, "Handbook of Automotive Power Electronics and Motor Drives"
5. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", ISBN: 978-1 119-06364-3
6. Wei Liu, " Hybrid Electric Vehicle System Modeling and Control", ISBN:9781119279327, Wiley

(b) Open-source software and website:

1. <https://nptel.ac.in/>

Suggested Course Practical List:

The subject teacher can give simulation/ case study on various topics of the syllabus according to availability of resources



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Subject Code: ME02000691

Course / Subject Name: E-Vehicle Technology and Mobility

List of Laboratory/Learning Resources Required:

Any Other:

Data sheets and application notes from various semiconductor manufacturers. Some websites are as under

1. www.ti.com
2. www.stm.com
3. [Electric Ships: the Future of Shipping - Infineon Technologies](#)
4. [Electric Ships: The World's Top Five Projects by Battery Capacity](#)
5. [Future Of Marine Propulsion Systems: Electric, Hybrid & Wind](#)
6. [Full electric, battery powered ships – Wärtsilä](#)

* * * * *