NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	**2EEDE10**
Course Title:	**Electric Vehicle Technology**
Course Type:	(□ Core/ □ Value Added Course / √ **Department Elective**/ □ Institute Elective/ □ University Elective/ □ Open Elective/ □ Any other)
Year of Introduction:	**2021 – 22**

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to –

1. correlate electric vehicles with fossil fuel driven vehicles and comprehend the basics of vehicle mechanics
2. analyse the fundamental electrochemistry of battery and sustainability of advanced energy storage systems
3. select suitable motor and drive train for electric vehicles
4. gain broad knowledge of hybrid vehicles, networks, communications, actuators and controls used in modern automotive systems

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
Unit-I	**Electric Vehicle Fundamentals** Introduction, electric vehicle development-past present and future, electric vehicles and environment, comparison with internal combustion engine driven vehicle, components – power train and drive train, dynamics of vehicle motion.	**06**
Unit-II	**Electric Vehicle Power Train & Drive Train** Concept & types of power train, different types of drive train, transmission efficiency, power train components, auxiliary systems of EV.	**05**
Unit-III	**Motors and Controllers** Overview of conventional ac and dc motors, special electric machines such as permanent magnet machines, switched reluctance machines, machine rating, requirements, torque – speed characteristics and speed control, cooling of electric machines, controller topologies for induction motor, switched reluctance motor and permanent magnet motors.	**12**
Unit-IV	**Energy Storage Systems and Charging Technology** Battery basics – types, parameters like capacity, discharge rate, state of charge, state of discharge, depth of discharge etc., technical characteristics, battery packs, properties of batteries, selection and	**11**

	sizing, battery management system, testing of battery, types of chargers and charging techniques – level 1, 2 & 3, standards for chargers.	
Unit-V	**Hybrid Electric Vehicles** Types–series, parallel and series-parallel configurations, I/C engine rating, control of HEV.	**04**
Unit-VI	**Vehicular Communication and Grid integration** Overview of vehicular communication-within vehicle, grid integration, standards for grid integration, concept of driverless car.	**07**

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons.
2. Iqbal Husain, Electric and Hybrid Vehicles Design Fundamentals, CRC Press, Taylor and Francis Group.
3. Sandeep Dharmeja, Electric Vehicle Battery Systems, Newnes.
4. K. T. Chau, Zheng Wang, Chaos in Electrical Drive Systems: Analysis, Control & Applications, John Wiley and Sons.
5. Chung Chow Chan, K. T. Chau, Modern Electric Vehicle Technology, Oxford University Press.
6. Michael H Westbrrok, The Electric Car - Development and Future of Battery, Hybrid and Fuel Cell Cars, IEE Power and Energy Series 38, The Institution of Electrical Engineers.
7. International standards in use, relevant research papers and articles.

L = Lecture, T = Tutorial, P = Practical, C = Credit

w.e.f. academic year 2021 - 22 and onwards