

**NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

<b><u>COURSE PLAN – PART I</u></b>			
<b>Course Title</b>	Electrical Vehicle Technology		
<b>Course Code</b>	EEPE46	<b>No. of Credits</b>	03
<b>Department</b>	Electrical and Electronics Engineering	<b>Faculty</b>	Dr. V Sankaranarayanan
<b>Session:</b>	Jan 2022	<b>Section:</b>	4 <sup>th</sup> year A & B
<b>Pre-requisite Course</b>	EEPC18, EEPC21		
<b>Course Coordinator</b>			
<b>E-mail</b>	vsankar@nitt.edu	<b>Telephone No.</b>	+91 9487627002
<b>Course Type</b>	<b>Program Elective (PE)</b>		
<b>SYLLABUS (APPROVED BY BOS)</b>			
<p>Introduction to vehicle dynamics – Fundamentals of vehicle propulsion and brake – Vehicle Resistance – Dynamic equation of vehicle motion – Tire-Ground Adhesion – Maximum tractive effort – Power train tractive effort – Vehicle power plant characteristics – Transmission characteristics – Vehicle Performance – Gradeability – Acceleration performance – Brake performance</p> <p>Basic components of electric vehicles – Fundamentals of electric traction – Basic architecture of electric drive trains – Electric vehicle drive train topologies – Configuration and power flow control of series, parallel and hybrid drive train – Power converters for electric vehicles</p> <p>Electric vehicle storage technology – Different types of batteries for electric vehicles – Basic battery parameters – Battery modeling and equivalent circuit – Methods of electric vehicle battery charging – Alternative energy sources – Hydrogen storage systems – Reformers – Supercapacitors/Ultracapacitors - Fuel cell powered vehicles – Flywheel technology</p> <p>Electric propulsion drive systems – DC motor drives and control – Induction motor drives and control – Permanent magnet brushless DC motor drives and control – AC and Switch reluctance motor drives and control – Drive system efficiency</p> <p>Design specifications – Selection of motor and sizing – Selection of power electronics components and sizing – Inverter technology – Design of battery pack and auxiliary energy storage system – Design of ancillary systems – EV recharging and refueling system design</p>			
<b>ESSENTIAL READINGS : Textbooks, reference books, Website addresses, journals, etc</b>			
<ol style="list-style-type: none"> <li>1) K. T. Chau, 'Electric vehicle machines and drives: Design, analysis and application', first edition, John Willey and Sons Singapore pte. ltd., 2015.</li> <li>2) M. Ehsani, Y. Gao and A. Emadi, 'Modern electric, hybrid electric and fuel cell vehicles: Fundamentals, Theory and design', second edition, CRC press, 2011.</li> </ol>			

3) J. Larminie and J. Lowry, 'Electric vehicle technology explained', second edition, John Willey and Son Ltd., 2012.  
 4) I. Husain, 'Electric and hybrid vehicles: Design fundamentals', CRC press, 2003.

**COURSE OBJECTIVES**

The main objective of this course is to understand the basics of vehicle dynamics, drive train control, energy storage technology and vehicle design

**COURSE OUTCOMES (CO)**

<b>Course Outcomes</b>	<b>Aligned Programme Outcomes (PO)</b>
Upon completion of the course the students would be able to:	
1. Analyse dynamics, performance and characteristics of electric vehicles	<b>1, 7, 8, 12</b>
2. Understand the concept of electric traction and drive train topologies	<b>1, 2, 7</b>
3. Explain the energy storage and drive control techniques used for electric propulsion systems	<b>5, 8, 9, 11</b>
4. Design electric vehicle drives, controllers and energy storage units	<b>2, 5, 8, 9, 11</b>

**COURSE PLAN – PART II**

**COURSE TEACHING AND LEARNING ACTIVITIES**

<b>S. No.</b>	<b>Week</b>	<b>Topic</b>	<b>Mode of Delivery</b>
<b>1.</b>	4 <sup>th</sup> Week of Jan (3hrs)	Basic Components of Electric Vehicle	PPT/Chalk & Talk
<b>2.</b>	5 <sup>th</sup> Week of Jan (3hrs)	Architecture of Electric Drive Trains, EV Drive Train Topologies	PPT/Chalk & Talk
<b>3.</b>	1 <sup>st</sup> Week of Feb (3hrs)	Hybrid Electric Vehicles, Power Flow Control	PPT/Chalk & Talk
<b>4.</b>	2 <sup>nd</sup> Week of Feb (3hrs)	Assignment 1	PPT/Chalk & Talk

5.	3 <sup>rd</sup> Week of Feb (3hrs)	Vehicle Dynamics	PPT/Chalk & Talk
6.	4 <sup>th</sup> Week of Feb (3hrs)	Power Train Tractive Effort, Vehicle Power Plant Characteristics	PPT/Chalk & Talk
7.	1 <sup>st</sup> Week of Mar (3hrs)	Vehicle Performance, Brake Performance	PPT/Chalk & Talk
8.	2 <sup>nd</sup> Week of Mar (3hrs)	Tutorial on Vehicle Dynamics	PPT/Chalk & Talk
9.	3 <sup>rd</sup> Week of Mar (3hrs)	Assignment 2	PPT/Chalk & Talk
10.	4 <sup>th</sup> Week of Mar (3hrs)	Electric Machines in EVs	PPT/Chalk & Talk
11.	1 <sup>st</sup> Week of Apr (3hrs)	Introduction to dq0 transformation	PPT/Chalk & Talk
12.	2 <sup>nd</sup> Week of Apr (3hrs)	Assignment 3	PPT/Chalk & Talk
13.	3 <sup>rd</sup> Week of Apr (3hrs)	Design of Electric Vehicles	PPT/Chalk & Talk

### **COURSE ASSESSMENT METHODS**

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle Test 1	Third week of Feb	15 minutes per presentation	25%
2.	Cycle Test 2	Second week of March	15 minutes per presentation	25%
3.	Assignment	First week of April	15 minutes per presentation	20%
4.	End Semester Examination	Last week of April/First week of May	2 hours	30%

### **COURSE EXIT SURVEY**

1. Students feedback through class committee meetings

2. Feedback from students on the course outcomes shall be obtained at the end of the course

**COURSE POLICY**

**ATTENDANCE POLICY:** All the students are expected to attend all the contact hours. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination. Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' Grade and will have to REDO the course. A maximum of 10% attendance shall be allowed under On Duty (OD) category. OD is allowed only for the students having minimum attendance of 65%.

**ACADEMIC HONESTY & PLAGIARISM:** In case of any student found guilty indulging in any mal practice, the student will be awarded no marks in that assessment. If found using mobile phones or any other gadgets for mal-practice during the examination, the answer sheet of the student will not be evaluated and will be awarded ZERO marks.

**MODE OF COMMUNICATION:** The Faculty is available for consultation during the time intimated to the students then and there. The lecture notes will be shared through the class representative. For correspondence, please contact vsankar@nitt.edu.

**FOR APPROVAL**



**[Dr. V Sankaranarayanan, P/EEE]**  
Course Faculty



**Course Coordinator**



**HoD (Dept. of EEE)**