NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRICAL &ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	M. Tech. in Power Systems		
Course Title	Electric and Hybrid Vehicles		
Course Code	EE~~623~~ 687	No. of Credits	3
Course Code of Prerequisite subject(s)	~~EE687~~		
Session	January 2023	Section (if, applicable)	
Name of Faculty	Dr. Pinkymol K.P.	Department	EEE
Official Email	pinkymol@nitt.edu	Telephone No.	9526710598
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		Telephone No.	
Course Type (please tick appropriately)	☐ Core course	☑ Elective course	

Syllabus (approved in BoS)

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concepts of electric traction, introduction to various electric drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

Introduction to energy management strategies used in hybrid and electric vehicle, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy strategies.

Reference Books:

1. Sira -Ramirez, R. Silva Ortigoza, 'Control Design Techniques in Power Electronics Devices', Springer, 2006
2. Siew-Chong Tan, Yuk-Ming Lai, Chi Kong Tse, 'Sliding mode control of switching Power Converters', CRC Press, 2011
3. Bimal Bose, 'Power electronics and motor drives', Elsevier, 2006
4. Ion Boldea and S.A Nasar, 'Electric drives', CRC Press, 2005

COURSE OBJECTIVES

This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles

MAPPING OF COs with POs & PSOs

Course Outcomes (CO)	Aligned Programme Outcomes (POs) Programme Specific Outcomes (PSOs) *correlation levels 1, 2 or 3 as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"*																
Upon completion of the course the students would be able to	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PSO 1	PSO 2	PSO 3
Understand mathematical models, performance and characteristics of hybrid and electric vehicles.	3	3	-	1	-	2	2	2	2	2	2	2	3	3	3	1	3
Analyze the concepts, topologies and power flow control of electric traction systems	3	3	-	-	-	2	2	3	2	2	2	2	3	3	3	1	3
Appraise the configuration and control of various hybrid electric motor drives	3	3	1	3	-	2	3	3	3	3	2	2	3	3	3	1	3
Plan and design appropriate vehicle management system	3	3	-	-	-	3	2	3	3	3	2	2	3	3	3	1	3

COURSE PLAN – PART II

COURSE OVERVIEW

To understand the fundamental concepts, principles, analysis , design and control of hybrid and electric vehicles

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 (1 Lectures) 16-20 January	Course plan discussion Introduction to EV and HEV	Chalk & Talk
2	Week 2 (3 Lectures) 23-27 January	History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies	

3	Week 3 (3 Lectures) 30 January -3 February	Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance- simulation example	PPT/ simulation study in MATLAB
4	Week 4 (3 Lectures) 6-10 February	Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis	Chalk & Talk or PPT
5	Week 5 (3 Lectures) 13-17 February	Basic concepts of electric traction, introduction to various electric drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	PPT
6	Week 6 (3 Lectures)) 20-24 February	Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives. **Assessment I**	Chalk & Talk or PPT
7	Week 7 (3 Lectures) 27 February- 3 March	Configuration and control of Introduction Motor drives	
8	Week 8 (3 Lectures) 6-10 March	configuration and control of Permanent Magnet Motor drives- simulation study	Chalk & Talk or PPT /other suitable techniques
9	Week 9 (3 Lectures) 13-17 March	Configuration and control of Switch Reluctance Motor drives, drive system efficiency	
10	Week 10 (3 Lectures) 20-24 March	Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology **Assessment II**	
11	Week 11 (3 Lectures) 27-31 March	Communications, supporting subsystems	
12	Week 12 (2 Lectures) 3-7 April	Introduction to energy management strategies used in hybrid and electric vehicle, classification of different energy management strategies.	
13	Week 13 (3 Lectures) 10-14 April	comparison of different energy management strategies,	

14	Week 14 (3 Lectures) 17-21 April	implementation issues of energy strategies. - case study
15	Week 15 (3 Lectures) 24-28 April Week 15 (1 Lecture) 1 May	Invited Talks from Industry on "EV Components and Systems" **Compensation Assessment (CPA)**
17	8 May 2023 As per the Academic Calendar	Final Assessment (**Assessment IV**)

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assessment I	Week 6 20-24 February	1 Hour	20%
2	Assessment II	Week 10 20-24 March	1 Hour	20%
3	Assessment III (Seminar and Miniproject)	Continuous	-	20%
CPA	Compensation Assessment (First Four Units)	Week 15 24-28 April	1 hour	Weightage of A1 or AII
5	Assessment IV- Final Assessment	8 May 2023 As per the Academic Calendar	3hours	40%

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

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 (including compensation assessment to be specified)

80% attendance is required to write Compensation Test.
Attending all the assessments (1, 2, 3) are mandatory for every student. If any student fails to attend the assessment due to genuine reason like medical emergency, the student may be permitted to appear for only one compensation assessment (CPA) on submission of appropriate documents as proof. The compensation assessment (CPA) will cover full syllabus. CPA is not considered as an improvement test. Minimum attendance to appear for compensation is 80%.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty 31/1/23 **CC- Chairperson** _____ **HOD** 02/02/23

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

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35% or (Class average/2) whichever is greater.	40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.