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

COURSE OUTLINE TEMPLATE			
Course Title	**ELECTRIC AND HYBRID VEHICLES**		
Course Code	**EE636**	**No. of Credits**	**03**
Department	**EEE**	**Faculty**	**C.Nagamani**
Pre-requisites Course Code	**Power Conversion Techniques, Electrical Machines**		
Course Coordinator(s) (if, applicable)	**---**		
Other Course Teacher(s)/Tutor(s) E-mail	**---**	**Telephone No.**	**0431-2503254**
Course Type	☐	**Core course**	☑ **Elective course**

COURSE OVERVIEW

This course is designed to impart the fundamental principles, analysis and design aspects of hybrid and electric vehicles to the graduate students of Electrical & Electronics Engineering. It builds up on the basic concepts of electrical machines and power control and energy storage management leading to the techniues for modeling electric and hybrid vehicular systems.

COURSE OBJECTIVES

- To provide the key concepts and tools in a logical sequence to analyze and understand electrical and hybrid vehicular systems.

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned Programme Outcomes (PO)**
Upon completion of the course, the students will be able to 1. Understand mathematical models, performance and characteristics of hybrid and electric vehicles. 2. Analyze the concepts, topologies and power flow control of electric traction systems. 3. Appraise the configuration and control of various hybrid electric motor drives. 4. Plan and design appropriate vehicle management system.	

CO no.	PO 1	PO 2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14
1	M	L	NA	NA	L	L	L	H	H	L	L	L	L	L
2	M	L	NA	NA	L	L	L	H	H	L	L	L	L	L
3	M	L	NA	NA	H	M	NA	H	H	L	L	L	L	L
4	M	L	NA	NA	H	M	NA	H	H	L	L	L	L	L

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	**Week**	**Topic**	**Mode of Delivery**
1	Weeks 1 to 3 (8 contact hours including two contact hours for group work)	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.	Lecture/ ppt/video illustration
2		Examples/ illustration	Group work (exercise)
3	Weeks 4 to 6 (8 contact hours including two contact hours for group work)	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	Lecture / ppt/ video illustration
4		Examples/ illustration	Group work (exercise)
5	Weeks 7 to 9 (8 contact hours, including two contact hours for problem solving)	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	Lecture / ppt/ video illustration
6		numerical examples/ problem solving	Group work (exercise)
7	Weeks 10 to 12 (8 contact hours, including two contact hours for group work)	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.	Lecture / ppt/ video illustration
8		Examples/ illustration	Group work (exercise)
9	Weeks 13 to 15 (8 contact hours, including two contact hours for group work)	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.	Lecture / ppt/ video illustration
10		numerical examples/ problem solving	Group work (exercise)

Mode of Assessment				
S.No.	**Mode of Assessment**	**Week/Date**	**Duration**	**% Weightage**
1	1st Mid Semester Examination (Written test) (1st and 2nd Units)	6th Week	60 Minutes	20
2	2nd Mid Semester Examination (Written test) (3rd and 4th Units)	12th Week	60 Minutes	20
3	Take Home / individual Task	3rd to 13th week	Work will be carried out along with the course	10
4	Retest (Written Test) (1st to 4th Unit)	14th week	60 Minutes	20
5	End Semester Examination (Written test)	16th week	180 Minutes	50

Note:

1. **Attending all the assessments (Assessment 1-3 and 5) are MANDATORY for every student.**
2. **If any student is not able to attend Assessment-1 (1st Mid Sem) / Assessment-2 (2nd Mid Sem) due to genuine reason, student is permitted to attend the Assessment- 4 (retest) with 20% weightage (20 marks).**
3. **In any case, retest will not be considered as an improvement test.**

Reference books

1. Husain, Electric and Hybrid Electric Vehicles, CRC Press, 2003
2. G. Lechner and H. Naunheimer, Automotive Transmissions: Fundamentals, Selection, Design and Application, Springer, 1999
3. Gianfranco, Electric and Hybrid Vehicles: POWER SOURCES, MODELS, SUSTAINABILITY, INFRASTRUCTURE AND THE MARKET, Pistoia Consultant, Rome, Italy, 2010
4. M. Ehsani, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2005
5. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd edition, Pearson, 2004

COURSE EXIT SURVEY
Shall be obtained at the end of the course

COURSE POLICY

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours. Every student should maintain minimum 75 % physical attendance in these contact hours to attend the end semester examination.
2. Any student, who fails to maintain 75% attendance need to appear for the retest. Student who scores more than 50 % marks in the retest will be eligible for attending the end semester examination.
3. Students not having 75% minimum attendance at the end of the semester and also fail in retest (scoring less than 50%) will have to RE-DO the course.

ACADEMIC HONESTY & PLAGIARISM

1. Copying in any form during assessments is considered as academic dishonesty and will attract suitable penalty.

FOR APPROVAL

CNagamani

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

Dr. V. Sam.