NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ENERGY AND NVIRONMENTAL

COURSE PLAN – PART I			
Name of the programme and specialization	M. Tech / Energy and Environment		
Course Title	POWER SOURCES FOR ELECTRIC VEHICLE		
Course Code	EN639	No. of Credits	3
Course Code of Pre-requisite subject(s)			
Session	July 2021	Section (if, applicable)	
Name of Faculty	N.KALAISELVAN	Department	ENERGY AND ENVIRONMENT
Official Email	reshi89@gmail.com	Telephone No.	9751910639
Name of Course Coordinator(s) (if, applicable)	Prof. Dr. M. PREMALATHA		
Official E-mail	latha@nitt.edu	Telephone No.	+919751910639
Course Type (please tick appropriately)	Core course	☑ Elective course	
Syllabus (approved in BoS)			

Fundamentals of vehicle dynamics- Vehicle subsystems: EV power-train and accessories Comparison of Electric Vehicles with Internal Combustion Engines - Architecture of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV) – Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.

Storage for EVs :Primary Energy Sources and Alternative Fuels for Transportation, Electrochemical Power Sources- Secondary Batteries and Fuel Cells Sources- Aqueous Electrolyte Batteries –Lead Acid, Nickel – Iron, Nickel – Zinc, Metal – Air Zinc – Halogen Non Aqueous Electrolyte Batteries.

Fuel Cells – Acid Systems, Direct Methanol / Air Systems, Alkaline Systems- Ultra capacitors.

EV motors and Control: Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives- battery modeling, SOC of battery, Traction Batteries and their capacity for standard drive cycles.

Internal Combustion Engine Hybrid Electric Vehicles, Laboratory Test of Electric Vehicle Batteries, Vehicle tests with Electric Vehicle Batteries, Future of Electric Vehicles- Management of EV infrastructure.

COURSE OBJECTIVES
o To Study about Electric vehicle technologies & different types of batteries used in Electric vehicles o To familiarize the power traction components used in EV. o To familiarize the control techniques & fast charging techniques used in EV

MAPPING OF COs with POs	
Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)
1. Get acquainted with Electric vehicle and their storage techniques	**1,2,7,8,11,12,13,14**
2. Describe vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)	**1,2,5,6,7,8,11,12,13,14**
3. Describe the knowledge about electric vehicle architecture and power train components	**1,2,6,7,8,9,10,11,12,13,14**

COURSE PLAN – PART II

COURSE OVERVIEW

Students get exposure to the electric vehicle technologies and advanced storage techniques used the Electric vehicles, also learn about power traction components and its control techniques, learn about environmental benefits of Electric and hybrid electric vehicles.

Students have an opportunity to design their own electric bicycle and learn about the power sources (Batteris) and its SOC and DOD characteristics. Also learn about the power converter and fast charger circuits.

COURSE TEACHING AND LEARNING ACTIVITIES (Add more rows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week 1 to 2	Fundamentals of vehicle dynamics- Vehicle subsystems: EV power-train and accessories- Comparison of Electric Vehicles with Internal Combustion Engines	Online(MS teams)
2	Week 3 to 4	Architecture of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV)- Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes. **Assessment -1**	Online

3	Week 5 to 6	Storage for EVs: Primary Energy Sources and Alternative Fuels for Transportation, Electrochemical Power Sources-Secondary Batteries and Fuel Cells	Online
4	Week 7 to 8	Sources- Aqueous Electrolyte Batteries – Lead Acid, Nickel – Iron, Nickel – Zinc, Metal – Air Zinc – Halogen Non Aqueous Electrolyte Batteries. **Assessment 2**	Online
5	Week 9 to 10	Fuel Cells – Acid Systems, Direct Methanol / Air Systems, Alkaline Systems- Ultra capacitors	Online
6	Week 11 to 12	. EV motors and Control: Speed control for constant torque, constant HP operation of all electric motors- DC/DC chopper based four quadrant operation of DC motor drives- battery modeling, SOC of battery **Assessment -3**	Online
7	Week 13 to 14	Traction Batteries and their capacity for standard drive cycles- Internal Combustion Engine Hybrid Electric Vehicles, Laboratory Test of Electric Vehicle Batteries **Assessment -4**	Online
8	Week 15	Vehicle tests with Electric Vehicle Batteries, Future of Electric Vehicles- Management of EV infrastructure **Final Assessment - 5**	Online

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	**Assessment -1**	Week 4	60 Minutes	25
2	**Assessment -2**	Week 7	60 Minutes	25
3	**Assignment**	Week 11		10
4	**Seminar/ Project presentation**	Week 12		10
CPA	Compensation Assessment*	Week 13	60 Minutes	
5	End Sem	Week 15		30

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

- Feedback from the student during class committee meeting
- Institute end semester feedback

COURSE POLICY (including compensation assessment to be specified)

PASSING CRITERIA

A minimum of 30% should be scored in the final assessment (for all courses) for a pass.

The passing minimum for all the courses shall be the maximum of 35% or Class Average/2.

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

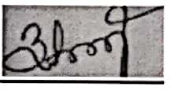
- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental 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

Text Book and Reference

1. Iqbal Husain, 'Electric and Hybrid Electric Vehicles', CRC Press, 2011.
2. Wei Liu, 'Hybrid Electric Vehicle System Modeling and Control', Second Edition, WILEY, 2017.
3. James Larminie and John Lowry, 'Electric Vehicle Technology Explained', Second Edition, 2012.

FOR APPROVAL

Course Faculty  CC- Chairperson M. Mathivanan HOD M. Ramalingam