



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: PG

Branch: Electric Vehicle Technology

Course / Subject Code: ME01064021

Subject Name : Power Electronics & Drives for Electric Vehicles

WEF Academic Year :	2024 – 25
Semester :	1 st Semester
Category of the Course :	PCC

Prerequisite :	Nil
Rationale :	Transportation is a fundamental requirement of modern life. Traditional, IC engine-based, transportation has many issues. So, now days electrical vehicles (EV) are quickly replacing them. Because of many advantages of EVs, it has become necessary to introduce the courses related to EVs in academics. This subject focuses on working of subsystems/ part of EVs like traction motors, power converters, motor drives, thermal management etc.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	Traction motor : Introduction to Traction motors, Specifications for Traction Motors, Motor topologies and design choices, Characteristics of EV motors, Drivetrain architecture, Peak ratings and performance calculations, Factors to be considered while designing motor for EV.	07	15
2	Power Converters : Power Electronics System, Concept of controlled and uncontrolled Power Electronic Switch, Voltage Conversion, Power Electronic Converter, Types, Working principle of switch mode DC-DC, DC-AC and AC-DC converters, control of power converters, Modulation (PWM) concepts etc.	10	25



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3	Power Converters for EV applications : Requirements of power converters in EV, Converters for on-board chargers, power converters for motor drives, High power density inverters, Fabrication of power electronics, concept of Digital control of power electronics converters.	09	20
4	Electric Motors for EV and their control : Characteristics of electric motors used in EV applications like BLDC, PMSM, and SRM. Open loop and closed loop control strategies for these motors with reference to EV	10	25
5	Thermal design and management in EV : Thermal Management of Battery, Power Electronic Systems, Electric Motors inEV. Cooling Loop in Electric Vehicles, Thermal management in EV.	09	15
TOTAL		45	100

Suggested Specification table with Marks(Theory) :

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	20	20	10	-

Note : This specification tables shall be treated as a general guide line for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books :

- 1) John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", ISBN: 978-1-119-06364-3
- 2) Ali Emadi, "Advanced Electric Drive Vehicles", CRC press
- 3) James Larminie, John Lowry, "Electric Vehicle Technology Explained, 2nd Ed.", Oxford Brookes University, UK
- 4) Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", ISBN:9781119279327, Wiley



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Course Outcomes :

Sr. No.	CO Statement	Marks % weightage	Topics Mapped
CO-1	To understand concepts of traction and electric motors used for it in EV.	25	1,4
CO-2	To develop understanding of power electronic converters used for power conversion in EV.	25	2,3
CO-3	To select power converter for controlling subsystems of EV.	25	3
CO-4	To apply thermal management concepts in subsystems of EV.	25	5

Suggested List of Experiments :

- Experiments based on Simulation of various power converters, control of various motors using simulation software like OCTAVE, SCILAB, MATLAB etc.

List of Open-Source Software/ learning website :

- OCTAVE - <https://www.gnu.org/software/octave/>
- SCILAB - www.scilab.org
- Swayam- <https://swayam.gov.in/>
- NPTEL- <https://onlinecourses.nptel.ac.in/>
- Mooc- <http://mooc.org/>
- Edx - <https://www.edx.org/>
- Coursera- <https://www.coursera.org/>
- Udacity -<https://in.udacity.com/> Udemy - <https://www.udemy.com/>
- Harvard University - <https://online-learning.harvard.edu/>
- Ted - <https://ed.ted.com/>
- Alison - <https://alison.com/>
- Futurelearn - <https://www.futurelearn.com/>
- Open Learn - <http://www.open.edu/openlearn/>
- Future Learn - <https://www.futurelearn.com/>
- Tuts Plus - <https://tutsplus.com/>
- Open Culture - <http://www.openculture.com/>



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