



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Syllabus

Subject Code : 3716408

Subject Name : Power Electronics & Drives for Electric Vehicles

| | |
|--------------------------|-----------|
| WEF Academic Year : | 2023 - 24 |
| Semester : | I |
| Category of the Course : | Core II |

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. | 6 | 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 |
| 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. | 8 | 20 |



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Syllabus

Subject Code : 3716408

Subject Name : Power Electronics & Drives for Electric Vehicles

| | | | |
|---|--|----|----|
| 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 in EV. Cooling Loop in Electric Vehicles, Thermal management in EV. | 8 | 15 |

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

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 |



GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Syllabus

Subject Code : 3716408

Subject Name : Power Electronics & Drives for Electric Vehicles

Suggested List of Experiments :

- Experiments based on Simulation of various power converters, control of various motors using simulation software like OCATVE, 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/>

* * * * *