Marwadi University

**Syllabus for Diploma Engineering**

**Electrical Engineering**

**Semester – V**

**Subject Name: Electric Vehicle Technologies**

**Subject Code: 09EE0505**

**Diploma Branches in which this subject is offered:** Electrical Engineering

**Objective:** Main objective of subject is to introduce major parts of electric vehicle system, its parameters, battery, charging system and safety.

**Credits Earned:** 6 Credits

**Course Outcomes:** After completion of this course, student will be able

1. Understand electric vehicle, and its applications
2. Understand selection of appropriate motor for EV applications
3. Understand requirement of battery type, characteristics for EV applications
4. Understand requirement of power train & in-wheel drive operation
5. Understand safety requirement for EVs

**Pre-requisite of course:** Basic knowledge of D.C. Circuits, A.C. Circuits, Electrical Machines, Power System.

**Teaching and Examination Scheme**

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial/ Practical Marks | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| Theory | Tutorial | Practical | | ESE | IA | CSE | Viva | Term work | |
| 2 | 0 | 4 | 6 | 50 | 30 | 20 | 25 | 25 | 150 |

**Contents:**

| Unit | Topics | Contact hours | Weightage (%) |
|---|---|---|---|
| 1 | **Introduction to EV & HEV:**<br>• Past, Present & Feature of EV<br>• Current Major Issues<br>• Recent Development Trends<br>• Comparison of EV Vs IC Engine. | **05** | **17.8** |
| 2 | **DC Motors for EV:**<br>• Type of wound-field DC Motor, Torque speed characteristics<br>• Speed control of DC Motor | **04** | **14.4** |

| | | | |
|---|---|---|---|
| | • Suitability and limitation | | |
| **3** | **Induction Motor for EV:**<br>• Three Phase Inverter Based Induction Motor<br>• Advantages over DC motor<br>• Speed torque characteristics<br>• Speed Control | **04** | **14.4** |
| **4** | **Power Train:**<br>• EV Configuration<br>• Fixed & variable gearing<br>• single & multiple motor drive<br>• In-wheel drives | **05** | **17.8** |
| **5** | **EV Battery**<br>• EV Battery Types<br>• Battery Characteristics (Charging & Discharging)<br>• Comparisons<br>• Safety & Precautions | **05** | **17.8** |
| **6** | **EV Charging System**<br>• Domestic Charging Infrastructure<br>• Public Charging Infrastructure<br>• Normal Charging Station<br>• Occasional Charging Station<br>• Fast Charging Station<br>• Battery Swapping Station<br>• Move-and-charge zone. | **05** | **17.8** |

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|---|---|---|---|---|
| Remember | Understand | Apply | Analyse | Evaluate | Create |
| 35% | 35% | 15% | 15% | 0% | 0% |

**Suggested List of Experiments:**

| Sr. No. | Unit No. | Name of Topics | Contact Hours |
|---|---|---|---|
| 1 | 2 | Starting torque comparison of DC motor Shunt Motor versus DC Series motor | 4 |
| 2 | 2 | Regenerative breaking of DC motor | 4 |

| | | | |
|---|---|---|---|
| 3 | 3 | Starting Performance of Three phase Induction Motor | 4 |
| 4 | 3 | Speed Reversing of Three Phase Induction motor | 4 |
| 5 | 2 | Efficiency Measurement of DC Motor | 4 |
| 6 | 3 | Efficiency Measurement of Induction Motor | 4 |
| 7 | 2 | Efficiency Measurement of Geared Permanent Magnet DC Motor | 4 |
| 8 | 5 | To study Lead Acid Battery Characteristics | 4 |
| 9 | 5 | To Study Li-ion Battery Characteristics | 4 |
| 10 | 6 | To Study Battery Charging System for Lead Acid Battery | 4 |
| 11 | 6 | To Study Battery Charging System for Li-ion Battery | 4 |
| 12 | 6 | To study safety and protection requirement of Li-ion Battery | 4 |

**Instructional Method:**

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**References:**

1. C.C Chan, K.T Chau, *"Modern Electric Vehicle Technology"*, Oxford University Press Inc., New York 2001
2. Iqbal Hussein, *"Electric and Hybrid Vehicles: Design Fundamentals"*, CRC Press, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, *"Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design"*, CRC Press, 2004.
4. James Larminie, John Lowry, *"Electric Vehicle Technology Explained"*, Wiley, 2003.

Supplementary Resources:

1. https://nptel.ac.in/courses/108102121/
2. https://nptel.ac.in/courses/108103009/