



**B.E/B.TECH DEGREE EXAMINATIONS: APRIL /MAY 2024**

(Regulation 2018)

Fifth Semester

**ELECTRICAL AND ELECTRONICS ENGINEERING**

U18EEE0015: Drives for Electric Vehicle

**COURSE OUTCOMES**

**CO1:** Distinguish the types and components of Electric Vehicles (EV).

**CO2:** Design and analyse PMBLDC motor drive for EV.

**CO3:** Formulate control strategies and analyse PMSM motor drive for EV.

**CO4:** Develop and analyse induction motor drive for EV.

**CO5:** Compare and choose the energy storage devices and charging methods for EV.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

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|-----|---|-----|------|
| 1.  | What is the main component that differentiates a Battery Electric Vehicle (BEV) from other types of EVs?                                | CO1 | [K2] |
| 2.  | Name one key subsystem of an electric vehicle responsible for managing the flow of electrical energy between the battery and the motor. | CO1 | [K1] |
| 3.  | What is the typical construction of a Brushless DC (BLDC) motor?  | CO2 | [K2] |
| 4.  | What are the two main types of power controllers used in BLDC motor drives?   | CO2 | [K2] |
| 5.  | What is the primary structure of a Permanent Magnet Synchronous Motor (PMSM)?   | CO3 | [K2] |
| 6.  | What control method is commonly used for speed control of PMSM drives by varying the voltage and frequency of the supplied power?       | CO3 | [K2] |
| 7.  | What is the main objective of field-oriented control in motor drives?   | CO4 | [K2] |
| 8.  | What is soft switching in power electronics?  | CO4 | [K2] |
| 9.  | What role do ultra-capacitors play in electric vehicles?  | CO5 | [K2] |
| 10. | What is the primary advantage of fuel cells in electric vehicles?   | CO5 | [K2] |

**Answer any FIVE Questions:-**

**PART B (5 x 16 = 80 Marks)**

**(Answer not more than 400 words)**

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|-----|--|----|-----|------|
| 11. | a) Discuss the classification, subsystems, characteristics, and motor drive selection criteria of electric vehicles. | 14 | CO1 | [K2] |
|-----|--|----|-----|------|

- b) What are two characteristics that are critical for electric vehicles to be competitive with conventional internal combustion engine vehicles? 2 CO1 [K<sub>2</sub>]
12. a) Discuss the construction, operation, control methods, and applications of Permanent Magnet Brushless DC (BLDC) Motor Drives. 14 CO2 [K<sub>2</sub>]
- b) Name one common position sensor used in BLDC motor drives for commutation. 2 CO2 [K<sub>3</sub>]
13. a) Draw the structure, operation, control methods, and design criteria of Permanent Magnet Synchronous Motor (PMSM) drives, along with their application in Electric Vehicles (EVs). 14 CO3 [K<sub>3</sub>]
- b) What is the primary advantage of Vector Control over V/f Control in PMSM drives? 2 CO3 [K<sub>2</sub>]
14. a) Explain the design criteria and challenges involved in implementing induction motor drives for electric vehicles. 14 CO4 [K<sub>3</sub>]
- b) What are the key considerations in designing induction motor drives for electric vehicles (EVs)? 2 CO4 [K<sub>3</sub>]
15. a) Discuss the working principle, benefits, and challenges of implementing vehicle-to-grid (V2G) systems. 14 CO5 [K<sub>2</sub>]
- b) What is smart charging in the context of electric vehicles? 2 CO5 [K<sub>2</sub>]
16. a) Explain the design criteria and challenges involved in implementing induction motor drives for electric vehicles. 14 CO3 [K<sub>2</sub>]
- b) What are the main types of charging systems used for electric vehicle batteries? 2 CO3 [K<sub>2</sub>]

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