



B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Seventh 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. Differentiate between Battery Electric Vehicles (BEVs) and Hybrid Electric Vehicles (HEVs). | CO1 | [K ₂] |
| 2. Name the components of electric vehicles. | CO1 | [K ₁] |
| 3. What is sensorless control in BLDC motors? | CO2 | [K ₁] |
| 4. What is unique about the construction of an outer-rotor PM BLDC motor and mention its advantages. | CO2 | [K ₁] |
| 5. Give the EMF equation for a PMSM. | CO3 | [K ₁] |
| 6. Why is vector control preferred for high-performance PMSMs? | CO3 | [K ₂] |
| 7. How does Direct Torque Control (DTC) differ from Field-Oriented Control (FOC)? | CO4 | [K ₂] |
| 8. Why are soft switching inverters preferred over hard switching in high-power applications? | CO4 | [K ₂] |
| 9. Mention two advantages of using fuel cells over batteries in electric vehicles. | CO5 | [K ₁] |
| 10. How can V2G benefit both EV owners and the power grid? | CO5 | [K ₂] |

Answer any FIVE Questions: -

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

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| 11. a) Describe the main subsystems and components of an electric vehicle (EV) and their roles. | 8 | CO1 | [K ₂] |
| b) What factors influence the selection of motor drives for electric vehicles (EVs)? Explain any two factors with examples. | 8 | CO1 | [K ₂] |

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| 12. | a) | Describe the construction of a Permanent Magnet Brushless DC (BLDC) motor. | 8 | CO2 | [K ₂] |
| | b) | Derive the EMF and torque equations for a Permanent Magnet Brushless DC (BLDC) motor . | 8 | CO2 | [K ₂] |
| 13. | a) | Explain the structure and rotor types of a Permanent Magnet Synchronous Motor (PMSM). | 8 | CO3 | [K ₂] |
| | b) | Discuss the inverter requirements for PM Brushless Motor Drives in Electric Vehicles. | 8 | CO2 | [K ₂] |
| 14. | a) | Define Field-Oriented Control (FOC) for induction motors. How does it improve performance compared to scalar control methods? | 8 | CO4 | [K ₂] |
| | b) | Enumerate the importance of inverter technology in induction motor drives for electric vehicles. | 8 | CO4 | [K ₂] |
| 15. | a) | Discuss the construction and operation of a Three-Phase induction motor. | 8 | CO4 | [K ₂] |
| | b) | Explain the working principle of PWM switching inverters and their role in induction motor drives. | 8 | CO4 | [K ₂] |
| 16. | a) | Explain any two charging systems for EV batteries and their impact on charging speed and efficiency. | 8 | CO5 | [K ₂] |
| | b) | Explain any two commonly used drive cycles for testing electric vehicles. | 8 | CO5 | [K ₂] |
