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Question Paper Code: U7103

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Professional Elective

Mechanical Engineering

21MEV103 – E-VEHICLE TECHNOLOGY

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which EV type uses both an internal combustion engine and an electric motor? CO1- U
(a) BEV (b) HEV (c) FCEV (d) Solar EV
2. Which of the following is commonly used as a traction motor in EVs? CO1- U
(a) Synchronous motor (b) Stepper motor
(c) Shaded pole motor (d) Universal motor
3. In a BLDC motor, commutation is performed by: CO1-U
(a) Mechanical brushes (b) Battery pack (c) Electronic controller (d) Rotor magnets
4. The selection of an electric motor for EVs depends mainly on: CO1- U
(a) Availability in the market (b) Power, torque, and efficiency requirements
(c) Color and design (d) Compatibility with ICE
5. What is the typical voltage range of an EV battery pack? CO3-App
(a) 12–24V (b) 24–48V (c) 100–400V (d) 700–1000V
6. Battery recycling is important for: CO1- U
(a) Cost reduction only (b) Reducing the EV size
(b) Environmental and resource sustainability (d) Better AC performance

7. Engine start-stop function in hybrids: CO2-App
- (a) Is a manual operation (b) Increases fuel consumption
(c) Shuts off ICE when idle to save fuel (d) Runs the ICE continuously
8. The key goal of hybrid control strategies is to: CO1- U
- (a) Increase braking power (b) Reduce cost of engine
(c) Optimize energy flow and fuel efficiency (d) Disable the electric drive
9. What is the principle behind fuel cell operation? CO1- U
- (a) Nuclear fusion (b) Combustion
(c) Electrochemical reaction (d) Radiation
10. Autonomous EVs use AI for: CO2-App
- (a) Fuel injection (b) Engine control
(c) Real-time decision making and navigation (d) Wheel balancing

PART – B (5 x 2= 10 Marks)

11. Mention two key components of an EV powertrain. CO1 - U
12. Define thermal management in electric drives. CO1 - U
13. List any two characteristics of Lithium-ion batteries. CO3-App
14. What is a plug-in hybrid electric vehicle (PHEV)? CO1 - U
15. What is the main by-product of a hydrogen fuel cell? CO1 - U

PART – C (5 x 16= 80Marks)

16. (a) Analyze how regenerative braking improves overall vehicle efficiency and contributes to energy recovery. CO1 U (16)
- (b) Justify the choice of EV configuration for a logistics delivery vehicle operating in urban areas. CO1 U (16)
17. (a) Evaluate the selection criteria for electric motors based on torque-speed characteristics, cost, and thermal limits. CO2-App (16)
- (b) Develop the regenerative braking implementation through inverter circuitry. CO2-App (16)

18. (a) Develop different charging infrastructure and their compatibility with battery types. CO3- App (16)
- (b) Inspect the decision matrix that suitable for battery technology of an EV startup project. CO4- App (16)
19. (a) Design a hybrid battery power management strategy for a city commuter vehicle. CO2- App (16)
- (b) Conclude the real-world efficiency of hybrid vs electric vs conventional vehicles. CO4- App (16)
20. (a) Investigate the Vehicle-to-Grid (V2G) and its energy flow through a neat diagram. CO2- App (16)
- (b) Justify the investment in fuel-cell-based mobility in comparison with battery EVs for fleet operations. CO6- App (16)

