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Question Paper Code: U9379

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Open Elective

Electrical and Electronics Engineering

21UEE979 – ELECTRIC AND HYBRID VEHICLE

(Regulations 2021)

(Common to All Engineering branches)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The force from the propulsion unit of an EV is known as _____. CO1-U
(a) Tractive force (b) Road Load Force (c) Resistive force (d) Net force
2. The motor drive used in EV is a/an _____. CO1- U
(a) Hydraulic drive (b) Eddy current drives
(c) DC-to-AC variable frequency drive (d) None of these
3. In batteries, oxidation means _____. CO1-U
(a) Deficiency of electrons (b) Increase in electrons
(c) No change in electrons (d) None of these
4. The positive electrode gets chemically reduced as it absorbs electrons from the external circuit and the negative electrode gets oxidized during _____. CO1-U
(a) Charge of battery (b) Discharge of battery
(c) State of charge (d) State of discharge
5. A _____ is essential for an IC engine to match the vehicle speed with the narrow high-power speed range of the engine CO1- U
(a) Battery pack (b) Transmission (c) Piston (d) None of these
6. The power and torque densities of electric machines are typically _____ that of a comparable-sized IC engine. CO1- U
(a) much higher than (b) much lesser than (c) equal to (d) None of these

7. Which of the following is not the component of a power train in EV? CO1- U
 (a) Engine (b) Tyres (c) Gear set (d) Clutch
8. The _____ is a simple machine used for mechanical power transmission with a mechanical advantage through increase in torque or reduction in speed CO1- U
 (a) Clutch (b) Motor (c) Battery (d) Gear
9. The IC engine acts as a prime mover in _____ to drive an electric generator that delivers power to the battery or energy storage link and the propulsion motor. CO1- U
 (a) Series HEV (b) Parallel HEV (c) Series-Parallel HEV (d) None of these
10. The propulsion component needed in a series HEV is/are _____. CO1- U
 (a) IC Engine (b) Generator (c) Motor (d) All of these

PART – B (5 x 2= 10 Marks)

11. Illustrate the functional components of an EV. CO1-U
12. Explain the State of Charge (SoC) of a battery. CO1-U
13. Compare the Induction and BLDC motor with respect to electric vehicle application. CO1-U
14. Explain the differential in the power train? State its role. CO1-U
15. List the advantages and disadvantages of a series HEV architecture. CO1-U

PART – C (5 x 16= 80Marks)

16. (a) Illustrate the block diagram of an EV System and explain its working. CO1-U (16)
 Or
 (b) Explain the dynamic equation for Road load force and explain the significance of each element of this equation, with necessary diagram. CO1-U (16)
17. (a) Discuss a Battery Management System (BMS) in cut off voltage 3.5V optimizing the safety, efficiency, and longevity of batteries in Electric Vehicles (EVs). CO3-App (16)
 Or
 (b) Discuss the performance, efficiency, and range of Lithium-ion battery of 3.0 to 4.2v per cell range in optimum operation for EV application. CO3-App (16)

18. (a) Explain the working of BLDC motor used in EV. Also explain the converter circuit and its communication system. CO1-U (16)
- Or
- (b) Illustrate the Permanent Magnet Synchronous Motor is extensively used in EV drive. CO1-U (16)
19. (a) How would you design an optimized EV drive train system to enhance energy efficiency and vehicle performance for long-distance travel? CO2- App (16)
- Or
- (b) How would you implement different types of regenerative braking systems in an EV to maximize energy efficiency under varying driving conditions? CO2- App (16)
20. (a) Elaborate the overall power train architecture and components of the typical electric scooter with relevant schematic sketch. CO1-U (16)
- Or
- (b) Explain the architecture of a series-parallel hybrid electric vehicle with necessary sketch and list the advantages and disadvantages of this configuration. CO1-U (16)

