

315335

25226

3 Hours / 70 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
(2) Answer each next main Question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following: 10
- a) Enlist the types of Electric Vehicle.
 - b) State need of BMS.
 - c) State the goal of EV30@30 campaign.
 - d) Define battery swapping.
 - e) State any two objectives of Maharashtra Electric Vehicle Policy, 2021.
 - f) Enlist the different types of electric vehicles.
 - g) Write the physical location of motor and battery in a four wheeler electric vehicle.

P.T.O.

- 2. Attempt any THREE of the following: 12**
- a) Compare AC and DC charging methods. (Any four points)
 - b) An electric car needs to travel 120 km on a single charge. The car's average energy consumption is estimated to be 160 wh/km. Assuming a battery pack efficiency of 80% and a system voltage of 100V. Calculate required battery capacity in kWh and Ah.
 - c) Compare electric vehicle and IC engine vehicle on the given points:
 - i) Power source
 - ii) Maintenance
 - iii) Capital cost
 - iv) Punning cost.
 - d) Enlist the motors used in Electric vehicle also state salient features of brushless DC motor. (Any two)
- 3. Attempt any THREE of the following: 12**
- a) Explain the electrical and mechanical connections in an electric vehicle.
 - b) Define self discharge rate, battery geometry, battery temperature and deep cycle in EV batteries.
 - c) Describe the function of bidirectional DC-DC converter in EV's.
 - d) Describe how the Maharashtra EV policy aims to reduce air pollution in urban area.
- 4. Attempt any THREE of the following: 12**
- a) Describe the role of scrappage incentives in promoting electric vehicle adoption.
 - b) Compare fuel cell and battery on given points:
 - i) Energy source
 - ii) Cost
 - iii) Weight
 - iv) Efficiency.

- c) Explain the working principle of a permanent magnet synchronous motor (PMSM). State any two advantages and features.
- d) Draw block diagram of EV architecture showing name of main components.
- e) Compare battery EV and Hybrid EV on given points:
 - i) Driving component
 - ii) Energy source used
 - iii) Models available in market
 - iv) Problems.

5. Attempt any TWO of the following: 12

- a) Explain the principle and working of BLDC motor. With the help of a neat block diagram explain torque control of BLDC motor.
- b) Draw block diagram of BMS and explain function of each block.
- c) Explain difference between Level-1, Level-2 and Level-3 (DC fast) charging. (Any two points)

6. Attempt any TWO of the following: 12

- a) An electric vehicle has a battery with usable capacity of 50 kWh. The owner wants to charge it from 20% state of charge (SOC) to 80% SOC using a Level-2 charger that delivers 7.4 kW of power. Calculate the estimated charging time in hours.
 - b) State selection criteria of EV motors.
 - c) Compare IM and BLDC EV motors based on power to weight ratio, torque speed characteristics, cost of controllers, cost of motors.
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