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Seventh Semester B.E. Degree Examination, July/August 2022

Introduction to Electric Vehicles

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Discuss the need for an electric drive vis-a-vis and IC engine based on (i) Efficiency (ii) Pollution (iii) Capital and operating cost (iv) Dependence on oil (10 Marks)
- b. Explain major issues of electric vehicles. (10 Marks)

OR

- 2 a. Briefly give an account of past 30 years development of electric vehicles. (10 Marks)
- b. What is the engineering philosophy of electric vehicles? Brief on key EV technologies. (10 Marks)

Module-2

- 3 a. Write briefly on conductors and insulators. (06 Marks)
- b. Explain the functions of resistors, relays, capacitors and solenoids. (08 Marks)
- c. What are the weight and size parameters considered for electric vehicles? (06 Marks)

OR

- 4 a. Classify AC and DC motors. Explain the working of a simple DC motor of brushed type. (10 Marks)
- b. Explain what are the energy and performance parameters of an EV? (10 Marks)

Module-3

- 5 a. With the aid of a block diagram, describe major components of a Battery Operated EV (BOEV). (10 Marks)
- b. Make a comparison of a battery operated EV (BOEV) with IC engine vehicle (ICEV) with reference to, (i) torque (ii) emission. Further, list out the disadvantages of an EV. (10 Marks)

OR

- 6 a. Using / drawing a schematic diagram, explain regenerative braking and the energy flow during acceleration and braking. (10 Marks)
- b. Write a brief note on steps followed in logical diagnosis of the battery operated electric vehicle. (10 Marks)

Module-4

- 7 a. Define the following parameters with reference to an EV battery :
 - (i) Battery capacity.
 - (ii) Discharge rate.
 - (iii) Depth of discharge (DoD)
 - (iv) State of charge (SoC)
 - (v) State of Discharge (SoD) (10 Marks)
- b. A 3.5 V battery is at 2.7 V at SoC of 0% and 4.3 V at SoC of 100%. This implies the voltage of the battery lies between $3.5 \pm \Delta\%$ volts. Find Δ . (05 Marks)
- c. Assuming SoC is a linear function of voltage what is (i) SoC at 4 V and (ii) Voltage at SoC of 64%? Assume the relation, $\text{SoC} = (100V - 270)/1.6$ (05 Marks)

OR

- 8 a. Discuss briefly how battery rating is done in the following cases:
- (i) Cold Cranking Amps (CCA)
 - (ii) Cranking Amps (CA)
 - (iii) Ampere-Hour (Ah)
 - (iv) Reserve capacity (RC)
 - (v) Watt-hour (Wh). (10 Marks)
- b. Sketch and explain the working of a,
- (i) lead-acid battery
 - (ii) Nickel-metal hydride (NiMH) battery. (10 Marks)

Module-5

- 9 a. Mention different types of fuel cells. With a schematic sketch explain the working of a proton exchange membrane fuel cell. (10 Marks)
- b. Explain the working of a solid oxide fuel cell, with the aid of a neat sketch. (10 Marks)

OR

- 10 a. What are the challenges and solutions for hydrogen storage systems? (06 Marks)
- b. Write a brief note on reformers and explain how a typical methanol-steam reformer works. (08 Marks)
- c. Make a brief note on fuel cell EV, with a simple block diagram. (06 Marks)

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