CBCS SCHEME

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18EE646

Sixth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Electric Vehicles Technologies

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Compare electric vehicle with conventional IC engine vehicle **(04 Marks)**

b. With the help of block diagram, explain conceptual illustration of a general EV configuration of a modern electric vehicle. **(08 Marks)**

c. With the help of block diagram, explain any four types of possible EV configuration. **(08 Marks)**

OR

2 a. Explain the merits of hybrid electric vehicle considering IC engines and battery powered electric vehicles as power trains. **(04 Marks)**

b. What are hybrid vehicles? Explain the concept of hybrid drive trans that implement possible different flow routes among two power trains and load. **(08 Marks)**

c. With the help of block diagram explain the configuration paralled hybrid drive train and hence discuss the seven operating modes controlled by vehicle controllers of hybrid electric vehicle. **(08 Marks)**

Module-2

3 a. Explain the various components of a battery cell and hence compare the basic types of batteries with complex. **(06 Marks)**

b. Explain the cell discharge operation of a lead acid battery with chemical reaction equations. **(06 Marks)**

c. Explain the constructional details and operating lithium-ion battery with chemical reaction equations and hence list their applications. **(08 Marks)**

OR

4 a. Explain the following parameter with respect to the battery
i) Capacity of battery ii) State of charge iii) Depth of discharge. **(06 Marks)**

b. Find the curve fitting constant n and λ for the Peukert's equation for the two measurement available from a constant current discharge experiment for a battery.
i) $(t_1, I_1) = (10, 18)$
ii) $(t_2, I_2) = (1, 110)$ **(06 Marks)**

c. With the help of chemical reaction equations, explain the basic fuel cell structure and hence discuss the fuel cell characteristics. **(08 Marks)**

Module-3

5 a. Explain the functional block diagram of an EV propulsion system and hence discuss the various choices of electric propulsion system for EV consideration. **(08 Marks)**

b. Discuss the various classifications of EV motors and hence discuss the various computer aided design CAD tools used for simulation of motor. **(08 Marks)**

c. Compare conventional resistive armature control of DC motor with basic one quadrant dc chopper control. **(04 Marks)**

OR

6 a. With the help of circuit diagram and operating characteristics, explain the two quadrants zero voltage transition converter for EV DC motor drive and hence discuss voltage conversion ratio relationship for both deriving and regenerate modes of operation. **(08 Marks)**

b. List the various types soft switching inverter used of induction motor drives and hence explain the three phase topologies of auxiliary resonant Snubber (ARS) inverter. **(08 Marks)**

c. Compare constructional details of induction motors used for electric propulsion at that of industrial induction motor. **(04 Marks)**

Module-4

7 a. With the help of block diagram, explain the configuration of a typical series hybrid electric drive train and hence explain the operating patterns and various operating modes of operation. **(10 Marks)**

b. With the help of plot and control flow chart, explain the maximum SOC PPS control strategy applied to series hybrid drive train, where
SOC : State of Charge, PPS : Peak Power Source. **(10 Marks)**

OR

8 a. With the help of block diagram, explain electric coupling configuration with DC/DC converter, peak power source and traction motor. And also discuss the basic function of the DC/DC converter in PPS charging discharging modes. **(10 Marks)**

b. Explain the power rating design of the engine/generator/transmission design and hence discuss the vehicle speed versus load power characteristics of the jet. **(10 Marks)**

Module-5

9 a. Explain any five methods of charging of the battery. **(10 Marks)**

b. Explain the following termination method of battery power i) Time ii) voltage drop (dv/dt) iii) current iv) Temperature v) voltage. **(10 Marks)**

OR

10 a. With the help of circuit diagram, explain Non-isolated grid tied Z-converter and grid tied Z-converter with isolated charger and hence discuss the advantages and drawback of the circuit. **(10 Marks)**

b. With the help of block diagram, explain control strategies with no battery and with battery of Z-source converter. **(10 Marks)**

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