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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S) MAY 2019

Course Code: EE469
Course Name: Electric and Hybrid Vehicles

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 5 marks.
                                                                       Marks

1   Explain rolling resistance and aerodynamic drag in vehicles.   (5)

2   With the help of a neat block diagram explain different subsystems of electric drive train.   (5)

3   Classify the electric motors drives for EV and HEV application.   (5)

4   Explain the terms specific power and energy efficiency of a battery.   (5)

5   Explain the role of drive cycle for a city bus in designing the size of energy storage for electric vehicle.   (5)

6   What are the sizing constraints for the electric motor?   (5)

7   What is the significance of a communication network in electric/hybrid vehicles? What are the functions of the in-vehicle communication network?   (5)

8   Why an energy management control system is required in an HEV? Do you think an elaborate energy management system similar to that applied to a hybrid vehicle, is required in an electric vehicle? Explain.   (5)

PART B
Answer any two full questions, each carries 10 marks.

9 a) Why a gear system is needed for an ICE? Explain with relevant characteristic curves.   (6)

   b) Explain the EV drivetrain alternatives based on power source configuration.   (4)

10 a) A vehicle with power plant power output at the drivetrain considering all losses is 100kW. The maximum total resistance the vehicle experiences is 3.6 kN. Calculate the velocity the vehicle can achieve in km/h under this condition?   (3)

   b) Explain the various power flow control modes for a series hybrid vehicle.   (7)

11 a) What is meant by "gradeablity"? Explain.   (4)

   b) Explain the power flow control modes for a series-parallel hybrid vehicle.   (6)

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PART C

Answer any two full questions, each carries 10 marks.

12 a) Explain the four-quadrant chopper control of dc motor.   (6)

    b) Describe the terms State-of-Charge and Depth-of-Discharge as applied to   (4)
batteries.

13 a) What is meant by Peukert capacity of a battery? What is its significance?   (5)

    b) What is the advantage of AC motor over DC motors for EV applications?   (5)

14 a) Explain the configuration of v/f controlled induction motor drive with field-   (6)
weakening mode and constant-torque mode.

    b) Explain the working principle of a fuel-cell.   (4)

PART D

Answer any two full questions, each carries 10 marks.

15 a) A hybrid electric vehicle has two sources- an ICE with output power of 80kW   (6)
and battery storage. The battery storage is a 150 Ah, C_{10} battery at 120V. (i).
Calculate the battery energy capacity (ii). Without de-rating the Ahr capacity,
what is the maximum power that can be supported by the battery. (iii). What is
the electrical motor power output if the total efficiency of power converter and
motor combination is 98%. (iv). What is the maximum power that can be
transmitted to the wheels if the transmission efficiency is 95%?

    b) What are the advantages of fuzzy logic based energy management control   (4)
strategy in hybrid vehicles?

16 a) Draw the block diagram of a general Fuzzy Logic Controller (FLC) and show   (5)
the core components of the FLC and the inputs and outputs relevant to a hybrid
electric vehicle control.

    b) What is meant by Constant Power Speed Ratio as applied to an electric motor?   (5)
What is its typical value for Induction Motors used in HEV applications?

17 a) Explain fuzzy logic implementation of energy management system in a parallel   (5)
HEV with induction motor and ICE with an objective of reduction in
environmental pollution with the help of a block diagram.

    b) Draw the typical torque Vs speed envelope curves of drivetrain motors and show   (5)
the continuous, intermittent and peak overload ratings.

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