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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth Semester B.Tech Degree Regular Examination June 2023 (2019 Scheme)



Course Code: EET418

Course Name: ELECTRIC AND HYBRID VEHICLES

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks.

Marks

- | | | |
|----|---|-----|
| 1 | Explain the vehicle power plant characteristics. | (3) |
| 2 | Explain the significance of levels of automation in autonomous vehicle. | (3) |
| 3 | With neat block diagrams explain the working of a parallel hybrid drive train. | (3) |
| 4 | What are the various modes of operation in power flow control of series hybrid drive train? | (3) |
| 5 | Explain with a block diagram the major components of an electric vehicle. | (3) |
| 6 | How the independent control of flux and torque is achieved in DC drives. | (3) |
| 7 | Define C-rating of a battery. If a 150Ah battery is rated C10, what would be its discharge current expressed as 0.75C10 | (3) |
| 8 | With pin diagrams explain the GB/T standard connectors used in EV charging. | (3) |
| 9 | Explain the FLEXRAY communication systems used in EV. | (3) |
| 10 | What does CP and PP pins denote in EV charging connectors? | (3) |

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

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|----|---|------|
| 11 | a) Derive the dynamic equation of vehicle movement considering the resistive forces acting on it. | (10) |
| | b) What is meant by "aerodynamic drag" that retard the vehicle motion? | (4) |

OR

- | | | |
|----|---|-----|
| 12 | a) Explain the necessity of gear system for an ICE with its characteristic curves | (6) |
| | b) Explain the social and environmental importance of hybrid and EV. | (8) |

Module II

- | | | |
|----|--|-----|
| 13 | a) Explain the functional block diagram of complex hybrid drive train. | (6) |
| | b) Explain in detail the EV drive train alternatives based on power source configuration | (8) |

OR

- 14 a) Explain the working and parts of electric traction system in detail. (6)
b) With a neat block diagrams explain the working of power flow control in typical EM dominated series parallel hybrid drive. (8)

Module III

- 15 a) Explain with block diagram the speed and torque closed loop control of DC motor drives (8)
b) Permanent Magnet Synchronous Motor is extensively used in EV drive. Justify. (6)

OR

- 16 a) Why Field Oriented Control is preferred for motor drives control? (6)
b) Draw the block diagram of sensor less Field Oriented Control in PMSM drive. (8)

Module IV

- 17 a) What are factors affecting the performance of batteries used in EVs? (8)
b) Explain with block diagram the working of grid to EV on board charger. (6)

OR

- 18 a) Give the advantages and disadvantages of super capacitors as an energy storage device in electric vehicle? (6)
b) With pin diagrams, explain the working of CCS Type 1, CCS Type 2 and CHAdeMO connectors used in EV charging. (8)

Module V

- 19 a) A hybrid electric vehicle has two sources- an ICE with output power of 70kW and battery storage. The battery storage is a 100 Ah, C10 battery at 150V. Without de-rating the Ahr capacity, what is the maximum power that can be transmitted to the wheels if the transmission efficiency is 90% and overall efficiency of power converters and motor together is 95%. (8)
b) Explain the LIN and CAN communication protocols used in EV with diagram. (6)

OR

- 20 a) Explain briefly the electrical and mechanical constraints to be considered while sizing an electrical machine for an EV? (8)
b) Explain the significance of Power Line Communication used in EV. (6)
