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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Eighth Semester B.Tech Degree Supplementary Examination August 2024 (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 Under what condition a pure EV can be chosen as a better option compared to hybrid vehicles considering the impact on climate change? (3)
- 2 A vehicle with power plant power output at the drivetrain considering all losses is 110kW. The maximum total resistance the vehicle experiences is 3.8 kN. Calculate the velocity the vehicle can achieve in km/h under this condition? (3)
- 3 How are HEVs classified based on hybridness? (3)
- 4 What is axial balancing? (3)
- 5 What are the desired features of motors used for Electric vehicles? (3)
- 6 List the advantages of FOC. (3)
- 7 Define the terms specific power and energy efficiency of a battery. (3)
- 8 Explain V2G concept. (3)
- 9 List the design constraints of powertrains in a vehicle. (3)
- 10 What is the significance of a communication network in electric/hybrid vehicles? (3)

**PART B**

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

**Module I**

- 11 a) Explain briefly the performance parameters of vehicle. (4)
- b) Draw and explain ideal traction power plant characteristics of various power plants and various power source characteristics used in electric and hybrid electric vehicles (10)

**OR**

- 12 a) Why a gear system is needed for an ICE? Explain with relevant characteristic curves. (6)
- b) Explain the levels of automation and its significance in autonomous vehicles (8)

**Module II**

- 13 a) Identify the energy saving potentials of hybrid drivetrains. (4)  
b) Explain the general electric vehicle configuration with the help of block diagram. (10)

**OR**

- 14 a) Explain the challenges/ limitations of battery electric vehicle and HEV. (8)  
b) Differentiate between complex hybrid and series-parallel hybrid configurations. (6)

**Module III**

- 15 a) Explain in detail about the various electrical components used in HEV. (10)  
b) Describe the advantages of independent control of flux and torque in separately excited DC Motor. (4)

**OR**

- 16 a) Explain the Permanent Magnet Synchronous Motor control for application in EV. (9)  
b) Explain the armature voltage control and field weakening mode control of DC separately excited motor drive system. (5)

**Module IV**

- 17 a) Compare different batteries based on their specific energy, specific power and suitability for EV/ HEV applications. (6)  
b) With pin diagrams, describe CCS Type 1 & 2 connectors used for EV charging. (8)

**OR**

- 18 a) Explain the operation, advantage and disadvantages of fly wheel energy storage. (8)  
b) What is meant by C-rating of a battery? If a 150 Ah battery is rated  $C_5$ , what would be its discharge current expressed as  $0.5 C_5$ . (6)

**Module V**

- 19 a) Enlist the factors which govern the sizing of power electronics for EV/HEVs. (6)  
b) What is the need of communication protocol? What does CP and PP pins denote in connectors and explain its functions (8)

**OR**

- 20 a) Explain the role of drive cycle for a city bus in designing the size of energy storage for electric vehicle. (5)  
b) Draw and explain the FLEXRAY communication systems used in EV. (9)

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