

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Supplementary Examination June 2022 (2015 Scheme)

**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 Briefly describe the historical background of electric and hybrid electric vehicles with the help of timeline. (5)
- 2 Draw the various power flow control modes for a series hybrid vehicle. (5)
- 3 How the electric motor used in EVs differs from that of used in industrial applications? (5)
- 4 Explain the operation of fuel cell with relevant chemical reaction and diagram. (5)
- 5 What are the factors to be considered while selecting energy storage technology for hybrid electric vehicle? (5)
- 6 What is meant by Constant power speed ratio as applied to an electric motor? (5)
- 7 Explain "state machine" energy management control strategy in hybrid vehicles? (5)
- 8 Draw the control architecture of HEV. (5)

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

- 9 a) With help traction hyperbola explains the need of gear system for an ICE? (4)
- b) Draw and explain various power flow control modes for an ICE dominated series-parallel hybrid system. (6)
- 10 a) Explain shape drag and skin effect in vehicle? (5)
- b) With help of a block diagram explain different subsystems of electric vehicle. (5)
- 11 a) Draw and briefly explain drive train alternatives based on drive train configuration in electric vehicle. (6)
- b) Explain gradient resistance and rolling resistance in vehicle (4)

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

- 12 a) Write short note on (i) State of Charge (SOC) (ii) State of Health of a battery (6)

- b) Give the desired features of DC and AC motors for electric and hybrid electric vehicle applications (4)
- 13 a) With help of neat figures and relevant chemical reaction explain the working principle of lithium – ion batteries (10)
- 14 a) Explain the four –quadrant operation of speed control of DC motor driven electric vehicle? (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Explain “power follower” and “modified power follower” energy management strategy in hybrid vehicles. (6)
- b) Draw the schematic diagram of an epicyclic (planetary) gear set. (4)
- 16 a) Draw and explain CAN system of an HEV (10)
- 17 a) Explain the terms continuous rating, intermittent overload operation, peak overload operation related to electric machines used for HEV. Sketch torque Vs speed plot of drive train motors and identify these regions (6)
- b) What are the fundamental sizing constraints to be considered while sizing an electrical machine for an EV? (4)
