



G1169

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## APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

### Scheme for Valuation/Answer Key

*Scheme of evaluation (marks in brackets) and answers of problems/key*

**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 | 2.5 marks each for each term explanation.   | (5) |
| 2 | block diagram: 3 marks;<br>explanation: 2 marks.  | (5) |
| 3 | Classification: 5 marks.  | (5) |
| 4 | specific power: 2.5 marks<br>energy efficiency: 2.5 marks.  | (5) |
| 5 | Explanation with diagram of typical drive cycle: (3+2 Marks).   | (5) |
| 6 | Explanation of major constraints: 5 marks.  | (5) |
| 7 | Explanation: 5 marks.   | (5) |
| 8 | Need for an energy management control system in an HEV: 4 Marks<br>No, because no need to split energy sourcing. Hence only battery management is needed. ( 1mark). | (5) |

#### **PART B**

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

- |    |  |     |
|----|--|-----|
| 9  | a) Explanation: 3 marks; Characteristics: 3 marks.   | (6) |
|    | b) Diagram + explanation: (2+2)  | (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?<br>Velocity = Power/force. ( 3 marks) | (3) |
|    | b) Diagrams: 4 Marks+Explanation: 3Marks   | (7) |
| 11 | a) What is meant by “gradeability”? Explain.<br>Statement , Explanation: (2+2 Marks)   | (4) |

- b) Diagram-power flow control modes: 4Marks +Explanation:2Marks. (6)

**PART C**

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

- 12 a) Explanation:3 Marks, Diagrams: 3Marks. (6)  
 b) State-of-Charge: 2 Marks, Depth-of-Discharge: 2Marks. (4)
- 13 a) Peukert capacity of a battery- Explanation: 3Marks-significance: 2Marks (5)  
 b) Advantages of AC motor over DC motors: 5 Marks (5)
- 14 a) Explanation- the configuration of v/f controlled induction motor: 4 Marks- field-weakening mode and constant-torque mode -2 Marks (6)  
 b) Explanation:-Diagrams: =2+2 Marks (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 and battery storage. The battery storage is a 150 Ah, C<sub>10</sub> battery at 120V. Without de-rating the Ahr capacity, what is the maximum power that can be transmitted to the wheels if the transmission efficiency is 95% and overall efficiency of power converters and motor together is 98%. (6)
- Answer: (i). Battery energy = 150Ah\* 120V = 18000Wh. (1 mark)  
 (ii). Power that can be supported without de-rating: 18000Wh/10h = 1800W (1.5mark)  
 (iii). Electrical motor power output = 1800 \*0.98 W (1.5 mark)  
 (iv). Total power supplied by transmission= (1800\*0.98+80kW)\*0.95 (2 mark).
- b) Advantages of fuzzy logic based energy management control strategy in hybrid vehicles- Marks (4)
- 16 a) Block diagram of a general Fuzzy Logic Controller (FLC): 2Marks (5)  
 Core components of the FLC and the inputs and outputs relevant to a hybrid electric vehicle control:3Marks  
 b) Constant Power Speed Ratio: 3 Marks (5)  
 Typical value for Induction Motors: 2Marks



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- 17 a) Explanation- Fuzzy logic implementation of energy management system –Block (5)  
diagrams: 3 Marks+ Strategy for reduction in environmental pollution:2 Marks
- b) Figure- Typical torque Vs speed envelope curves of drivetrain motors and (5)  
showing the continuous, intermittent and peak overload ratings-  
expiations:3+2Marks

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