

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**  
**(Autonomous Institution – UGC, Govt. of India)**  
**UG Model question paper – I**

**ELECTRIC & HYBRID VEHICLES**  
**IV YEAR II SEMESER**  
**EEE- MODEL PAPER-1**

**Time: 3 hours**

**Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**5\*14=70M**

**SECTION-I**

1. Draw a general lay out of a EV and discuss the transmission characteristics. (14M)

**(OR)**

2. Explain rolling resistance and aerodynamic drag in vehicles. (14M)

**SECTION-II**

3. a. What is meant by Constant Power Speed Ratio as applied to an electric motor? (7M)

- b. What is its typical value for Induction Motors used in HEV applications? (7M)

**(OR)**

4. With a neat sketch, explain the configuration of Series hybrid electric drive train. (14M)

**SECTION-III**

5. Draw the typical torque Vs speed envelope curves of drive train motors and show the continuous, intermittent and peak overload ratings. (14M)

**(OR)**

6. (a) Discuss in detail about the control of permanent magnet motor drives (7M)

- (b) Dissect the configuration and control of Switched reluctance motor (7M)

**SECTION-IV**

7. Explain the Amp- hr measurement and direct measurement of SOC in battery (14M)

**(OR)**

8. A hybrid electric vehicle has two sources- an ICE with output power of 80kW and battery storage. The battery storage is a 150 Ah, Cio battery at 120V. (i) Calculate the battery energy

capacity (ii). Without de-rating the Attr 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%? (14M)

#### **SECTION-V**

9. 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. (14M)

**(OR)**

10. Classify and Explain the different energy management strategies (14M)

**MALLA REDDY COLLEGE OF ENGINEERING &  
TECHNOLOGY**(Autonomous Institution – UGC, Govt. of India)  
**UG Model question paper – II**

**ELECTRIC & HYBRID VEHICLES  
IV YEAR II SEMESER  
EEE- MODEL PAPER-1I**

**Time: 3 hours**

**Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**5\*14=70M**

**SECTION-I**

1. Describe the mathematical models to determine vehicle performance.(14M)  
(OR)
2. a) Write a short note on basics of vehicle performance.  
b) Compare conventional vehicle with Hybrid electric vehicle. (14M)

**SECTION-II**

3. a. Discuss the history of hybrid electric vehicles. (7M) b.  
Dissect the environmental importance of EV and their social impacts. (7M)

**(OR)**

4. Explain the different power flow control modes of a typical parallel hybrid system with the help of block diagrams. (14M)

**SECTION-III**

5. Draw six different configurations of drivetrains in electric vehicles. Briefly explain each configuration. (14M)

**(OR)**

6. Explain the two-quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicle. (14M)

**SECTION-IV**

7. a) What are factors affecting the performance of batteries used in EVs? (7M)  
b) What are different modes of charging batteries? Compare them in detail.(7M)

**(OR)**

8. Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle (14M)

**SECTION-V**

9. Elaborate energy management system and issues of energy management strategies of EHV (14M)

**(OR)**

10. Classify and Explain the different energy management strategies (14M)

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**  
**(Autonomous Institution – UGC, Govt. of India)**  
**UG Model question paper – III**

**ELECTRIC & HYBRID VEHICLES**  
**IV YEAR II SEMESER**  
**EEE- MODEL PAPER-III**

**Time: 3 hours**

**Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**5\*14=70M**

**SECTION-I**

1. a) Under what condition a pure EV can be chosen as a better option compared to hybrid vehicles considering the impact on climate change? (7M)
- b) Write a short note on vehicle power source characterization. (7M)

**(OR)**

2. State and explain the dynamic equation of vehicle motion (14M)

**SECTION-II**

3. With the help of a neat block diagram explain different subsystems of electric drive train. (14M)

**(OR)**

4. Explain the different power flow control modes of a typical parallel hybrid system with the help of block diagrams. (14M)

**SECTION-III**

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

**(OR)**

6. (a) Explain briefly the electrical and mechanical constraints to be considered while sizing an electrical machine for a EV (7M)
- (b) Comment on the suitability of DC and AC machines for electric and hybrid electric vehicle applications. (7M)

**SECTION-IV**

7. Explain the Amp- hr measurement and direct measurement of SOC in battery (14M)

**(OR)**

8. a). What is meant by Peukert capacity of a battery? What is its significance? (7M)  
b) What are different modes of charging batteries? Compare them in detail. (7M)

**SECTION-V**

9. 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. (14M)

**(OR)**

10. a) Compare and Explain the different energy management strategies (7M)  
b) Discuss the issues of energy management strategies. (7M)

**MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY**  
**(Autonomous Institution – UGC, Govt. of India)**  
**UG Model question paper – IV**

**ELECTRIC & HYBRID VEHICLES**  
**IV YEAR II SEMESER**  
**EEE- MODEL PAPER-IV**

**Time: 3 hours**

**Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

**5\*14=70M**

**SECTION-I**

1. a) Explain rolling resistance and aerodynamic drag in vehicles. (7M)
- b) Explain the EV drive train alternatives based on power source configuration. (7M)

**(OR)**

2. Draw and explain the ideal traction power plant characteristic and various power source characteristics used in electric and hybrid electric vehicles (14M)

**SECTION-II**

3. Explain historical background of EV and HEV technology involvement. (14M)

**(OR)**

4. Enlist the different architectures of hybrid electric drive train and explain the series hybrid electric drive train (14M)

**SECTION-III**

5. A DC separately excited motor is powered by a dc to dc converter from a 600 volts dc source. The armature resistance is  $0.05 \Omega$ . The back emf constant of the motor is  $1.527 \text{ V/A rad/sec}$ . The average armature current is 250 amps. The field current is 2.5 amps. The armature current is continuous and has negligible ripple. If the duty cycle of the converter is 60%, determine (a) the input power from the source, (b) the equivalent input resistance of the dc-dc converter drive, (c) the motor speed, and (d) the developed torque. (14M)

**(OR)**

6. Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle (14M)

#### **SECTION-IV**

7. A 12V battery pack is connected to series RL load with  $L=100\text{mH}$ . The battery pack has rated capacity of 120Ah. At  $t=0$  switch is closed and the battery begins to discharge. Calculate and plot battery discharge current  $i(t)$ , if the steady state discharge is  $C/5$ . Neglect voltage drop. Calculate and plot SoC, assuming that  $t=0$ , the battery is charged to rated capacity. Calculate the time according to 70% DoD, assume  $t \gg 100\text{ms}$ . (14M)

**(OR)**

8. a). Why a gear system is needed for an ICE? Explain with relevant characteristic curves. (7M)  
b) Explain the working principle of a fuel-cell and its analysis. (7M)

#### **SECTION-V**

9. Explain fuzzy logic implementation of energy management system in a parallel HEV with induction motor and ICE with an objective of reduction in environmental pollution with the help of a block diagram. (14M)

**(OR)**

10. a) What are the advantages of fuzzy logic based energy management control strategy in electric hybrid vehicles. (7M)  
b) Discuss the issues of energy management strategies. (7M)