

Code No: 157BK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech IV Year I Semester Examinations, January/February - 2023****ELECTRICAL AND HYBRID VEHICLES****(Electrical and Electronics Engineering)****Time: 3 Hours****Max.Marks:75**

- Note:** i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A**(25 Marks)**

- 1.a) Give the classification of various electric vehicles. [2]
- b) What are the standard features of an EV? [3]
- c) Write the different train topologies used in EVs. [2]
- d) Give the basic concept of hybrid traction. [3]
- e) What is a drive train? Give its need in EVs. [2]
- f) Explain drive system efficiency. [3]
- g) What is sizing the propulsion motor? [2]
- h) What are different modes of charging batteries? [3]
- i) List various energy management strategies. [2]
- j) What are the major issues in energy management of EHV's? [3]

PART – B**(50 Marks)**

- 2.a) Give the conditions needed for choosing a pure EV when compared with hybrid vehicles including the impact of climate changes?
 - b) Based on power source configuration explain the EV drive train alternatives. [5+5]
- OR**
3. State and explain the dynamic equation of vehicle motion. [10]
 4. Give different architectures of hybrid electric drive trains and explain the series hybrid electric drive train. [10]
- OR**
- 5.a) Explain constant power speed operation mode to an electric motor.
 - b) Discuss about the typical value of Induction Motors used in HVE applications. [5+5]

- 6.a) Explain in detail about the controlling of permanent magnet motor drives. [5+5]
b) Discuss the working and control of Switched Reluctance motors. [5+5]

OR

- 7.a) Discuss the suitability of DC and AC machines for electric and hybrid electric vehicle applications.
b) Write a short note on v/f controlled induction motor drive with in field weakening mode and constant torque mode. [5+5]

8. A 12V battery pack is connected to series RL load with $L=110\text{mh}$. The battery pack has rated capacity of 120Ah. At $t=0$ switch is closed and the battery begins to discharge. Calculate and plot the battery discharge current $i(t)$, if the steady state discharge is $C/5$. Neglect voltage drop, also calculate the SoC assuming that $t=0$, the battery is charged to rated capacity. Calculate the time according to 70% DoD, assume $t \gg 100\text{ms}$. [10]

OR

- 9.a) Explain the working principle of a fuel-cell and its analysis.
b) What is the need for gear system in ICE? Explain with relevant characteristic curves. [5+5]

10. Elaborate energy management system and issues of energy management strategies of EHV. [10]

OR

11. Explain the procedure for design of a Hybrid Electric Vehicle (HEV). [10]

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