

**THE KAVERY ENGINEERING COLLEGE**  
(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

*Third Semester*

*Power System Engineering*

OME434 – Electric Vehicle Technology

*Regulations - 2021*

*Duration : 3 Hrs*

*Maximum Marks: 100*

**PART – A(ANSWER ALL QUESTIONS) (Marks 10\*2=20)**

| Q.No | Questions                                                           | BLT | CO | Marks |
|------|---------------------------------------------------------------------|-----|----|-------|
| 1.   | Define Electric Vehicle.                                            | RE  | 1  | 2     |
| 2.   | List out the limitations of Electric Vehicles.                      | RE  | 1  | 2     |
| 3.   | What is Degree of Hybridization (DOH)?                              | RE  | 2  | 2     |
| 4.   | Outline the advantages of electric motors over IC engines.          | UN  | 2  | 2     |
| 5.   | List out the energy storage devices used in Electric Vehicles.      | RE  | 3  | 2     |
| 6.   | Define Energy Efficiency in battery.                                | RE  | 3  | 2     |
| 7.   | What are the factors that improve the efficiency in electric drive? | RE  | 4  | 2     |
| 8.   | How is speed controlled in DC motors?                               | RE  | 4  | 2     |
| 9.   | Define gear ratio.                                                  | RE  | 5  | 2     |
| 10.  | Outline the challenges in electric vehicle safety.                  | UN  | 5  | 2     |

**PART – B (ANSWER ALL QUESTIONS) (Marks 5\*13 = 65)**

| Q.No | Questions                                                                                                                                                                                                                              | BLT | CO | Marks |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----|-------|
| 11.  | a     Discuss in detail, the impacts of Electric Vehicles on environmental aspects.                                                                                                                                                    | UN  | 1  | 13    |
|      | Or                                                                                                                                                                                                                                     |     |    |       |
|      | b     Write a detailed note on technical challenges in adaptation of Electric Vehicles.                                                                                                                                                | UN  | 1  | 13    |
| 12.  | a     Explain the different types of Electric Vehicles with neat diagram.                                                                                                                                                              | UN  | 2  | 13    |
|      | Or                                                                                                                                                                                                                                     |     |    |       |
|      | b     Illustrate the architecture and working of series and parallel hybrid electric vehicle.                                                                                                                                          | UN  | 2  | 13    |
| 13.  | a     Analyze in detail about the electrochemical reactions in Lead-acid batteries during charging and discharging condition with neat diagram. Also discuss about the gassing reactions and its impact under fully charged condition. | AN  | 3  | 13    |
|      | Or                                                                                                                                                                                                                                     |     |    |       |

|     |   |                                                                                                                                                                                                                                         |    |   |    |
|-----|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|----|
|     | b | Classify the working principle of Super Capacitors and Flywheels as energy storage devices in EVS. Compare flywheels and super capacitors in terms of energy density and power density.                                                 | AN | 3 | 13 |
| 14. | a | Classify the different types of electric drives for EV and HEV applications. Explain the construction, working and control of BLDC motor drive in detail with neat diagram.                                                             | UN | 4 | 13 |
|     |   | Or                                                                                                                                                                                                                                      |    |   |    |
|     | b | Explain in detail about the working of Switched Reluctance motor drive and derive the expression for maximum output torque.                                                                                                             | UN | 4 | 13 |
| 15. | a | Explain the concept of an ideal gear ratio in electric vehicles and discuss how the torque-speed characteristics of electric motors affect its selection.                                                                               | AN | 5 | 13 |
|     |   | Or                                                                                                                                                                                                                                      |    |   |    |
|     | b | Compare the acceleration performance, range, and powertrain design of the Nissan Leaf, Toyota Prius, Tesla Model 3, and Renault Zoe. Discuss how their differing engineering choices impact vehicle performance and market positioning. | AN | 5 | 13 |

*PART – C (Marks 1\*15 = 15)*

| <i>Q.No</i> |   | <i>Questions</i>                                                                                                                                                        | <i>BLT</i> | <i>CO</i> | <i>Marks</i> |
|-------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------|
| 16.         | a | Explain the architecture of Hybrid Electric Vehicle (HEV) with neat block diagram and discuss about the energy saving potentials in HEV.                                | UN         | 1         | 15           |
|             |   | Or                                                                                                                                                                      |            |           |              |
|             | b | Draw the equivalent circuit model of battery and explain how battery modeling helps in predicting battery behavior and predicting the performance of Electric Vehicles. | UN         | 3         | 15           |