

Code No: **R204102F**

**R20**

**SET - 1**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM**  
**IV B. Tech I Semester Regular/Supplementary Examinations OCT/NOV 2025**  
**HYBRID ELECTRIC VEHICLES**

(EEE)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**  
All Questions Carry Equal Marks

**UNIT-I**

1. a) Explain the basic structure and components of a conventional vehicle. [7M]  
b) Analyze the effect of road gradient and aerodynamic drag on propulsion load. [7M]  
(OR)
2. a) Describe the basic architecture of a hybrid electric vehicle. [7M]  
b) Evaluate the role of electric mobility in reducing greenhouse gas emissions. [7M]

**UNIT-II**

3. a) Explain the operation principles of series, parallel, and complex Hybrid Electric Vehicles (HEVs). [7M]  
b) Explain the concept of an extended range hybrid electric vehicle. [7M]  
(OR)
4. a) List the major components of a PHEV and their functions. [7M]  
b) Illustrate the power flow in a fuel cell electric vehicle. [7M]

**UNIT-III**

5. a) Explain the torque–speed characteristics required for traction applications. [7M]  
b) Describe the construction and working principle of a PMSM. [7M]  
(OR)
6. a) Explain the operating principle of a brushless DC motor. [7M]  
b) Describe the converter configuration used for SRM drives. [7M]

**UNIT-IV**

7. a) Illustrate the four-quadrant operation of a bidirectional converter on the torque-speed plane. [7M]  
b) Analyze the performance of a buck–boost converter under continuous and discontinuous conduction modes. [7M]  
(OR)
8. a) Differentiate between on-board and off-board charging systems. [7M]  
b) Describe the working principle of a three-phase voltage source inverter (VSI). [7M]

**UNIT-V**

9. a) Explain why supercapacitors are suitable for transient power requirements in EVs. [7M]  
b) Illustrate the configuration of a hybrid energy storage system using a block diagram. [7M]  
(OR)
10. a) Describe the basic principle of a flywheel energy storage system. [7M]  
b) Discuss the key characteristics of a fuel cell. [7M]

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