

5/1/23  
X

Sr. No...117501...

December 2023

**B.Tech (EL(Minor Degree(EVT)) - V SEMESTER  
Fundamentals and Architecture of Electric Vehicles (MD-EV-501)**

Time: 3 Hours

Max. Marks:75

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
  2. Answer any four questions from Part -B in detail.
  3. Different sub-parts of a question are to be attempted adjacent to each other.

**PART -A**

- Q1 (a) How does the electric motor in an EV differ from the engine in an Internal (1.5)[CO1]  
Combustion Engine vehicle?
- (b) Enumerate the environmental concerns related to the production and (1.5)[CO1]  
disposal of batteries in electric vehicles.
- (c) State two environmental advantages of electric vehicles. (1.5)[CO1]
- (d) Define total tractive effort. (1.5)[CO1]
- (e) Explain the function of a differential in a vehicle's drivetrain. (1.5)[CO1]
- (f) Discuss one advantage and one disadvantage of hybrid electric vehicles (1.5)[CO2]  
compared to electric vehicles.
- (g) Identify two advantages of hybrid electric vehicles in terms of fuel efficiency. (1.5)[CO2]
- (h) List the various factors that are considered in the sizing of components in an (1.5)[CO1]  
electric vehicle (EV) powertrain?
- (i) Define the terms "mild hybrid" and "full hybrid" in the context of hybrid (1.5)[CO2]  
vehicles.
- (j) Draw the B-H characteristics of a permanent magnet and also give two (1.5)[CO3]  
examples of permanent magnets.

**PART -B**

- Q2 (a) Explain the differences between Battery Electric Vehicles (BEVs) and Plug-in (7.5)[CO1]  
Hybrid Electric Vehicles (PHEVs).
- (b) How do factors like range anxiety and charging time impact the adoption of (7.5)[CO1]  
electric vehicles?
- Q3 (a) Differentiate between rolling resistance and grading resistance. Discuss (7.5)[CO1]  
strategies for minimizing rolling resistance in vehicles for improved energy  
efficiency.
- (b) How does aerodynamic drag influence the overall performance of a vehicle? (7.5)[CO1]  
Provide examples of design modifications to reduce aerodynamic drag.
- Q4 (a) With a neat sketch, explain the configuration of parallel hybrid electric drive train. (7.5)[CO2]
- (b) Discuss the potential drawbacks or challenges associated with hybrid electric (7.5)[CO2]  
vehicles, considering factors like maintenance costs and the complexity of  
hybrid systems.

117501/60/11/715

- Q5 (a) Explain the concept of the degree of hybridization in hybrid vehicles. How (7.5)[CO2] does the degree of hybridization impact the efficiency and functionality of a hybrid vehicle?
- (b) What are the unique considerations in sizing the powertrain of a hybrid (7.5)[CO2] electric vehicle (HEV)?
- Q6 (a) How does the presence of a permanent magnet affect the performance of a DC (7.5)[CO3] motor? Explain the speed-torque characteristics of a permanent magnet DC motor.
- (b) What are the key factors that influence the selection of a specific motor type (7.5)[CO3] for a given application? Provide a comparative analysis of DC motors, BLDC motors, and induction motors.
- Q7 Write short note on the followings:
- (a) Vehicle Transmission Characteristics for Hydrodynamic Transmission and (7.5)[CO1] Continuously Variable Transmission (CVT)
- (b) Four quadrant operation of motor (7.5)[CO4]

\*\*\*\*\*

**PART-B**