ABES ENGINEERING COLLEGE, GHAZIABAD
Department of Mechanical Engineering Session 2023-24
Fundamentals of Mechanical Engineering (BME 101)

Assignment-2
(part 1)

Unit 2
Topic: Electric Vehicles and Hybrid Electric Vehicles

Type (A)

1. Explain the parallel type of hybrid electric vehicle (AKTU, 22-23 odd sem).

Type (B)

1. Present a brief account of the futuristic innovations in the context of All Electric Vehicles.
2. What are the advantages and disadvantages of HEVs?
3. What are the advantages and disadvantages of Battery Electric Vehicles?

Type (C)

1. Discuss the working principle of an electric vehicle. What are the major demerits of these vehicles? (AKTU, 22-23 odd sem)
2. What are the main components of Electric Vehicles? Write down their advantages and disadvantages. (AKTU, 22-23 even sem)
3. Write a brief note on mild, medium and full hybridization in HEVs.
4. How Power transmission takes place in EVs?
5. What are the differences between EV and HEV?
6. Write a brief note on series and parallel hybridization in HEVs.

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Solutions:

Part (A)

1. Study slide 27

Part (B)

1. Study slide 16
2. Study slide 19 and 20.
3. Study slide 12 to slide 15.

Part (C)

1. Here's a simple explanation of the working principle of an electric vehicle:

   Battery as the Energy Source: An electric vehicle is powered by a large rechargeable battery. This battery stores electrical energy, similar to the way your phone stores energy in its battery.

   Electric Motor for Propulsion: Instead of a traditional gasoline engine, an electric vehicle has an electric motor. When you want to drive, electricity from the battery is sent to the electric motor.

   Turning Electricity into Motion: The electric motor then converts the electrical energy into mechanical energy, making the wheels of the vehicle turn. This is what propels the car forward.

   Accelerating and Braking: When you press the accelerator pedal, more electricity is sent to the motor, making the car go faster. When you release the pedal or press the brake, the motor either slows down or stops, depending on your input.

   Regenerative Braking for Energy Recovery: Many electric vehicles use regenerative braking. When you brake, the electric motor acts like a generator, converting some of the energy back into electricity. This energy is then sent back to the battery and stored for later use.

   No Need for Gasoline: Unlike traditional cars that need gasoline, an electric vehicle doesn't require fuel. You charge it by plugging it into an electrical outlet or a charging station.

   Zero Emissions: Since electric vehicles run on electricity, they produce zero tailpipe emissions. This is good for the environment and helps reduce air pollution.

   Major Demerits of EVs : Study slides 14-15.

2. Electric vehicles (EVs) consist of several key components that work together to enable their electric propulsion. Here are the main components of electric vehicles:

   Battery Pack: The battery pack is a crucial component that stores electrical energy in the form of chemical energy. It is typically composed of lithium-ion cells and is responsible for providing power to the electric motor.

   Electric Motor: The electric motor is the heart of the electric vehicle. It converts

electrical energy from the battery into mechanical energy to drive the wheels. There are various types of electric motors, including induction motors and permanent magnet motors.

Power Electronics: Power electronics components, such as inverters, converters, and controllers, are responsible for managing the flow of electrical energy between the battery and the electric motor. They convert direct current (DC) from the battery into alternating current (AC) for the motor.

Charging System: The charging system includes components such as an onboard charger and charging port. It allows the electric vehicle to be charged by connecting to an external power source, such as a charging station or a wall outlet.

Thermal Management System: The thermal management system helps regulate the temperature of the battery and other critical components. It ensures that the battery operates within the optimal temperature range for efficiency and longevity.

Electric Powertrain: The electric powertrain encompasses the battery, electric motor, and power electronics. It represents the overall system responsible for converting electrical energy into mechanical energy to drive the vehicle.

Transmission (in some cases): Electric vehicles often have a simpler transmission system compared to traditional vehicles. Some EVs use a single-speed transmission, while others may have multi-speed transmissions or direct drive systems.

Regenerative Braking System: Regenerative braking systems capture and convert some of the energy normally lost as heat during braking into electrical energy. This energy is then fed back into the battery for reuse.

Onboard Charger: The onboard charger is responsible for converting alternating current (AC) from an external power source into direct current (DC) for charging the vehicle's battery.

Vehicle Controller: The vehicle controller manages and coordinates the operation of various components in the electric vehicle, ensuring smooth and efficient performance.

High-Voltage Wiring: High-voltage wiring connects the major components of the electric powertrain, allowing the flow of high-voltage electricity between the battery, electric motor, and power electronics.

Auxiliary Systems: Similar to traditional vehicles, electric vehicles have auxiliary systems such as air conditioning, heating, lighting, and infotainment systems. These systems are powered by the vehicle's electrical system.

Advantages and disadvantages of EVs : Study slides 12-15.

3. Study slides 21-24.
4. Study slides 5-11
5. Study slide 30-31.
6. Study slides 26-27.