



**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**MAKE UP EXAMINATION – JAN 2023**

**Date:** 28-JAN-2023

**Time:** 9:30AM to 12:30PM

**Max Marks:** 100

**Weightage:** 50%

**Course Code:** EEE 319

**Course Name:** Electric Vehicles

**Program** : B.Tech

**Instructions:**

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(10Qx 2M= 20M)**

- 1.
- i. When talking about EVs, we generally refer to three main types of electric vehicles: hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEV). Which vehicle uses a high-voltage battery? (C.O.No.1) [Knowledge]
- a. Hybrid Electric Vehicle      b. Plug in Hybrid electric vehicle  
c. Electric Vehicle              d. All of these
- ii. Which of the following factors adversely affects the capacity of the lead-acid battery? (C.O.No.3) [Knowledge]
- a. Temperature of surroundings      c. Rate of discharge  
b. Specific gravity of electrolyte      d. All of these.
- iii. What is meant by the term regeneration? (C.O.No.2) [Knowledge]
- a. It's when electricity is generated during deceleration and braking  
b. It's when the battery is charged during engine idling  
c. It's when the battery is recharged from the mains supply  
d. None of these
- iv. Most commonly, the propulsion force in HEV is provided by a combination of electric motor and an ICE. Which of the following has simple drive train system? (C.O.No.1) [Knowledge]
- a. Series Hybrid                      c. Series-Parallel Hybrid  
b. Parallel Hybrid                      d. All of these



## Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries TWELVE marks.

(4Qx12M=48M)

2. In HEV one powertrain favours steady state operation, such as an ICE or fuel cell. The other powertrain in the HEV is used to supply the dynamic power. Select a drivetrain which is used in heavy commercial vehicles, military vehicles and buses. Defend your answer.

(C.O.No.1) [Comprehension]

3. Mr. James is good at estimating the design parameters of Electric vehicle. After estimating the vehicle specifications he wanted to buy a suitable battery for his design specifications in order to meet his requirements. Mr. James approached you regarding the selection of battery. Explain the way you are going to guide him, so that he will be able to choose a battery which will be best suited for his application.

(C.O.No.3) [Comprehension]

4. Electric propulsion systems are at the heart of EVs and HEVs. They consist of electric motors, power converters, and electronic controllers. The core element of the EV, apart from Electric Vehicle Batteries, which replaces the Internal Combustion engines is an Electric motor. EVs use traction motors that are capable of delivering torque to the wheels. Classify the motors and select the motors which are used in 2, 3 and 4 wheeler Electric vehicles based on the features of motors.

(C.O.No.3) [Comprehension]

5. Charging an electric car battery is a simple process: you simply plug your car into a charger that is connected to the electric grid. However, not all EV charging stations (also known as electric vehicle supply equipment, or EVSE) are created equal. Distinguish the configurations of different charging mechanisms that are available as public or private charging.

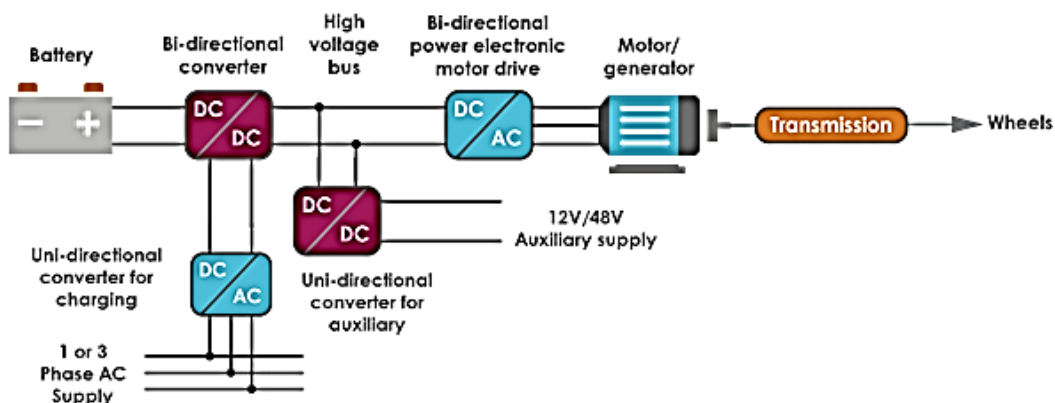
(C.O.No.4) [Comprehension]

## Part C [Problem Solving Questions]

Answer all the Questions. Each question carries SIXTEEN marks.

(2Qx16M=32M)

6. a. In an electric vehicle, there is a presence of drivetrain arrangement which is shown below.



Report the significance of each block which is present in the drive train system.

In the same figure if the battery voltage is 200 V and the high voltage DC bus is 500 V. What happens when power from the battery is used for powering the wheels in the reverse direction while the EV moves backward?

- b. The input voltage and current of a DC-DC power converter are 200V and 20A, respectively. The output voltage is 800V. What is the output current and output power if the converter has an efficiency of 90%? (C.O.No. 4)  
[Application]
7. The appropriate design parameters will help us in understanding the economy of energy utilization and balancing between mileage and fuel efficiency by doing a mathematical framework analysis of vehicle mechanics based on Newton's second law of motion. A Nissan Leaf electric vehicle is having the following specifications: The curb weight of the vehicle is 1400 kg, mass of driver is 80 kg, drag coefficient of 0.28, frontal area of 2.8 meter square, air density of 1.25 kg per meter cube, rolling coefficient is 0.015, gear ratio is 7.7:1, transmission efficiency of 85%, wheel radius is 0.29 m, acceleration time is 0-60 kmph in 10 sec. The manufacturer given a chance to you for selecting the motor power rating and battery capacity and cells which are present in that battery with the above conditions. A. list the design parameters and B. Compute the listed design parameters. Also write your inference about the calculations.

(C.O.No. 2) [Comprehension]