Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

End Term Examinations – December 2025

Date: 05-12-2025 **Time:** 01:00pm – 04:00pm

School: COMMON TO ALL SCHOOL	**Program:** COMMON TO ALL PROGRAM	
Course Code : EEE3103	**Course Name:** Electric Vehicles and Battery Technology	
Semester: OE	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**22**	**21**	**23**	**22**	**22**

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Compare hybrid and electric vehicle	**2 Marks**	**L2**	**CO1**
2.	List out the limitations of EV with IC engine-based vehicles	**2 Marks**	**L1**	**CO2**
3.	Sketch Conceptual Illustration of a Hybrid Electric Drive Train	**2 Marks**	**L2**	**CO2**
4.	How many patterns are available for combining the power flows to meet load requirements in HEV	**2 Marks**	**L2**	**CO2**
5.	List out the types of batteries.	**2 Marks**	**L1**	**CO3**
6.	List the drawbacks of fuel cell	**2 Marks**	**L1**	**CO3**
7.	Mention energy storage requirements.	**2 Marks**	**L1**	**CO3**
8.	Define the term State of Charge.	**2 Marks**	**L1**	**CO3**
9.	Identify the concept of Cell balancing in BMS.	**2 Marks**	**L2**	**CO4**
10.	Define the Battery Management System.	**2 Marks**	**L1**	**CO5**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Explain in detail the historical development of electric vehicles (EVs) and describe the major milestones, key inventors, technological breakthroughs, market trends, and policy influences that shaped the evolution of EVs over time.	**10 Marks**	**L2**	**CO1**
Or					
12.	**a.**	Elucidate the general layout of an electric vehicle (EV) by describing its major subsystems such as the battery pack, power electronics, electric motor, drivetrain, thermal management system, onboard charger, control units, and auxiliary systems. Explain how these components are interconnected, how power flows through the vehicle during operation, and how the layout differs from that of a conventional internal combustion engine vehicle.	**10 Marks**	**L2**	**CO1**

13.	**a.**	Explain in detail the various possible electric vehicle (EV) configurations, such as front-wheel drive, rear-wheel drive, all-wheel drive, series hybrid, parallel hybrid, and series–parallel hybrid layouts. Describe the power flow in each configuration and discuss the advantages, limitations, and typical applications. and explain suitable diagrams to illustrate the powertrain structure of each EV configuration.	**10 Marks**	**L2**	**CO1**
Or					
14.	**a.**	Outline and explain in detail the key parameters that determine vehicle driving performance. And discuss parameters such as acceleration, gradeability, maximum speed, starting torque, tractive effort, aerodynamic drag, rolling resistance, vehicle mass, and power-to-weight ratio. Explain how each parameter influences overall vehicle behavior, energy consumption, drivability, and suitability for different operating conditions.	**10 Marks**	**L2**	**CO1**

15.	**a.**	Explain in detail the configuration and operation of a series hybrid electric drive train with a neat and well-labeled sketch. In your answer, analyze the power flow during different driving conditions such as vehicle start-up, cruising, acceleration, regenerative braking, and battery-only mode. Discuss the roles of the engine, generator, power electronics, battery pack, and traction motor in this architecture.	**15 Marks**	**L4**	**CO2**
Or					

16.	**a.**	A vehicle manufacturer wants to improve fuel economy and performance without completely redesigning its existing internal combustion engine drivetrain. They are considering adding an electric propulsion system that can either assist the engine or operate independently at low loads. Based on this requirement, identify the type of hybrid electric drive train they are likely to adopt. Analyze the major components and power flow paths of this drivetrain with a neat sketch of the configuration.	**15 Marks**	**L4**	**CO2**

17.	**a.**	Explain the conceptual illustration of a hybrid electric drive train and describe how different patterns of combining power flows from the internal combustion engine and the electric motor are used to meet varying load requirements. In your answer, discuss how power is shared, split, or alternated between the two sources in different hybrid configurations.	**15 Marks**	**L3**	**CO3**
		Or			
18.	**a.**	Briefly explain the basic working principles of series, parallel, series–parallel, and complex hybrid electric vehicles, highlighting how the engine and electric motor share or split power in each hybrid configuration	**15 Marks**	**L3**	**CO3**

19.	**a.**	Explain the significance of the SAE J227a driving cycle in evaluating the performance of electric vehicles (EVs) and their energy sources. How is this standardized driving cycle used in testing, and why is it important for comparing different EV technologies under consistent operating conditions?	**20 Marks**	**L3**	**CO4**
		Or			
20.	**a.**	Explain in detail the construction and working principle of a Nickel-Cadmium (Ni-Cd) battery. Describe the chemical reactions that occur during both the charging and discharging processes, and discuss how these reactions enable the reversible storage and release of electrical energy.	**20 Marks**	**L3**	**CO4**

21.	**a.**	Explain in detail the major functions of a Battery Management System (BMS), including cell monitoring, balancing, protection, state estimation, thermal management, and communication. Further, discuss the diverse applications of BMS in EV, HEV, RES systems, consumer electronics, UPS systems, and industrial battery packs. How do the functions of the BMS ensure safety, reliability, performance, and long-term durability in these applications?	**20 Marks**	**L4**	**CO5**
		Or			

22.	**a.**	Explain in detail the important terminology used to describe battery cells. And elaborate the terms such as cell voltage, capacity, specific energy, energy density, power density, C-rate, state of charge (SoC), state of health (SoH), depth of discharge (DoD), internal resistance, cycle life, and thermal stability. Discuss how each parameter influences battery performance, durability, and suitability for different applications.	**20 Marks**	**L4**	**CO5**