



**PILLAI COLLEGE OF ENGINEERING, NEW PANVEL**  
**(Autonomous) (Accredited 'A+' by NAAC)**  
**END SEMESTER EXAMINATION**  
**May 2023**  
**BRANCH: Automobile Engineering**

**SEM VIII**

<b>Subject:- Hybrid and Electric Vehicles</b>	<b>Time: 03.00 Hours</b>
<b>Max. Marks: 80</b> <b>N.B 1. Q.1 is compulsory</b> <b>2. Attempt any three from the remaining four questions.</b> <b>3. Each Question carries 20 marks.</b>	<b>Date: 02/05/2023</b> <b>Subject Code:AEC801</b>

<b>Q.1.</b>	<b>Attempt All</b>	<b>Marks</b>
a)	Write a note on Global warming and Air pollution.	<b>5</b>
b)	Explain rolling resistance, aerodynamic resistance and gradient resistance in Electric vehicle.	<b>5</b>
c)	Compare Hybrid, Electric and Fuel cell vehicles.	<b>5</b>
d)	A vehicle needs to run continuously at 60kmph and should have a peak torque of 180 Nm. A motor gives peak torque of 30 Nm at 4000 rpm. What should be the gear ratio and minimum tire radius for the motor to be used by the vehicle?	<b>5</b>
<b>Q.2.</b>	<b>Attempt all</b>	
a)	The sedan with $\rho = 1.2 \text{ kg/m}^3$ , $C_d = 0.35$ , $A = 2.5 \text{ sq.m}$ , $\mu = 0.013$ and weight 1200 kg and radius of wheel 0.31m is stuck on a climb $12^\circ$ slope. It needs to start and have a acceleration of $0.5 \text{ m/sec}^2$ . What is the starting Torque required? (Assume any other suitable data if necessary)	<b>10</b>
b)	Write different components of Li-ion battery and explain construction and working of any two in detail with neat labeled diagram.	<b>10</b>
<b>Q.3.</b>	<b>Attempt all</b>	
a)	How many types of fuel cells do you know? Explain construction and working of PEMFC.	<b>10</b>
b)	Draw and explain different configurations of Electric vehicles with neat labeled diagram for all of them.	<b>10</b>
<b>Q.4.</b>	<b>Attempt all</b>	
a)	A Battery pack of configuration 2P14S is made with 3.65V, 13Ah Li Ion cells to power a two wheeler. The pack is used in field for some time and has undergone 7% degradation. The pack operation is limited from 5% SoC to 95% SoC level to improve life.	<b>10</b>

	a) Indicate the SoH (%) of this battery pack. b) What is DoD (%) of operation. c) What is the nominal voltage (V) of pack. d) What is the nominal capacity in kWh. e) What is the usable capacity (kWh) of battery pack at current level of SoH.	
<b>b)</b>	What is HEV? Explain in detail working of parallel hybrid. Also explain power flow modes of parallel hybrid.	<b>10</b>
<b>Q.5</b>	<b>Write short notes on any 4 of following</b>	
<b>a)</b>	Working of Induction Motor	<b>5</b>
<b>b)</b>	Types of EV Charger pins and connectors	<b>5</b>
<b>c)</b>	Need of BMS and its topologies	<b>5</b>
<b>d)</b>	Comparison of different hybrid electric vehicles	<b>5</b>
<b>e)</b>	History of HEV and EV's	<b>5</b>