Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Energy Storage & Fuel Cells **Semester: VI**
Programme: B.Tech Electrical Engineering **Max Marks:100**
Course Code: EPEG 3015 P **Duration : 3 Hrs.**

S. No.		Marks	CO
	Section A Short Answer Question. Each Question carries 4 marks		
Q.1	Explain the construction and working of Primary cell	**4**	**CO1**
Q.2	What is Formation process in Li-Ion batteries?	**4**	**CO1**
Q.3	With neat diagram explain the construction of Li-Ion cell	**1*4**	**CO1**
Q.4	What are sources (supply) in fuel cells?	**4**	**CO2**
Q.5	In battery management system A) SoC affects the (Specific Power/ Specific Energy) of battery. B) As SoC decreases, the (weight of battery / available Energy) decreases C) Lithium Ion Batteries works better at (sub zero / room) temperature. D) Batteries are connected in parallel to increase (Current / Voltage)	**1*4**	**CO4**
	Section B **Each Question carries 10 marks**		
Q.6	With neat diagram, describe structure of Battery Management System.	**10**	**CO4**
Q.7	With a neat diagram, explain the constant voltage method of battery charging and brief about the challenges associated with it.	**10**	**CO1**
Q.8	Estimate the size of IC engine based generator required for a PHEV with following configuration: Battery Bank Size: 30 kWh, Mileage 290 km @ 75 km/Hr; Proposed travelling distance 550 kM and IC engine based generator is allowed to use for max. of 4 hours.	**10**	**CO3**
Q.9	With neat block diagram, enumerate parallel hybrid system for eVs.	**10**	**CO3**
	Section 'C' **Long Answer Question (20 Marks each)**		
Q 10	In South Africa, it was proposed to set up a micro grid to supply energy to 300 Houses. Along with other Energy Sources like Solar, Wind etc, it was proposed to use Fuel cell based Energy Source as standby/ Back up Energy Source. The specification of the fuel cells are as following: Max power generation : 50 kW Cell Voltage = 0.61 V Hydrogen Utilization Factor = 72% Air Utilization factor = 28%	**20**	**CO2**

	Daily working hours are not exceeding = 10 Hours per day. Estimate the weekly storage of liquid Hydrogen required. Take Liquid hydrogen density as 71 gm/liter.		
Q.11	A) Explain the effect of following on Battery performance: 1) High current Charging 2) Depth of Discharge 3) Temperature of batteries 4) Specific Power B) With reference to Li-Ion batteries describe following: i) Electrolyte ii) Calendaring iii) Binder iv) First Charging	**10** **10**	**CO4**