Name: **Enrolment No:**	

UPES

End Semester Examination, December, 2023

Course: Alternate Energy technologies **Semester: V**

Program: B. Tech- Renewable and Sustainable Energy Engineering **Time : 03 hrs.**

Course Code: EPEG-3037 **Max. Marks: 100**

Instructions: Attempt all the sections.

SECTION A
(5Qx4M=20Marks)

S. No.	**Attempt all the questions.**	**Marks**	**CO**
Q 1	Explore some of the challenges or limitations that MHDG technology encounters in terms of efficiency, materials, or scalability	**4**	**CO1**
Q2	Examine and provide a detailed explanation of the fundamental operating principle underlying the functionality of a magneto-hydrodynamic generator.	**4**	**CO1**
Q3	Compare and contrast the environmental and economic impacts of using renewable energy sources like solar and wind power with those of fossil fuels.	**4**	**CO2**
Q4	Investigate how fuel cells can be integrated into existing energy systems, such as micro-grids and as backup power sources, and the challenges associated with this integration	**4**	**CO3**
Q5	Predict the role of tidal energy in future energy portfolios in Indian Perspective.	**4**	**CO4**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Analyze the operating principles of MHDGs with neat sketch diagram, considering the interaction between magnetic fields and conductive fluids. Also, write the advantages and challenges of MHDGs as a potential energy conversion technology, taking into account efficiency, materials, and scalability.	**10**	**CO1**
Q7	Identify and discuss the challenges, including cost, technical barriers, and public perception, that may be hindering the widespread adoption of fuel cell systems.	**10**	**CO2**

Q8	A typical tidal project has an installed capacity of 2176 MW in 64 units each of 34 MW rated output. The embankment is 6.4 km long and the head at rated output is 5.52 m. The turbine and generator efficiency is 93% each. Assume the density of sea water as 1025 kg/m^3. If generation is 5 hours twice a day, calculate the basin capacity. *Assuming that the power decreases linearly.	**10**	**CO3**
Q9	Define briefly with schematic diagram, **(a)** Fuel cell powered electrical vehicle operation **(b)** Hybrid fuel cell-Grid connected power generation system for EVs charging station OR A company is developing a new car powered by a fuel cell system that runs on H_2. You have been asked to consider generating the H_2 by electrolysis with a fuel cell. The H_2 tank to be used is 10 liters in volume and a fill-up requires a pressure of 34 atm. a) Calculate the current required to operate at a voltage of 1.8V. b) Calculate the rate of hydrogen production per membrane area and the total membrane area required to fill the tank in 2 minutes. Consider the following specifications of the system. 60% conversion of H_2O, E_o = 1.172 V The cathode pressure is maintained at 1 atm. The anode pressure is maintained at 1 atm Membrane thickness = 100 μm Membrane conductivity (σ) = 0.1 S/cm (S = 1/Ω) Electrolysis T = 373 K (assume water is in the gas phase). H2 storage tank T = 298 K.	**10**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	**(a)** Predict the future trends and developments in fuel cell technology, including advancements in materials, applications, and the role of fuel cells in achieving a more sustainable energy future. Analyze the operation of Proton exchange membrane fuel cell (PEMFC) system with the operating temperature and membrane behaviour also. **(b)** A progressive sea wave has a wave width of 100 m with a period of 5 seconds. Calculate the wavelength, the wave velocity and wave area.	**10+10**	**CO3**
Q11	**(a)** Design and analyze an in-depth layout to show the integration of tidal energy systems with other renewable energy sources, such as wind and solar, to develop a reliable hybrid energy grid system. Show all the necessary components and utilizations, too. **(b)** Analyze the energy potential estimation for a tidal power project.	**10+10**	**CO4**