Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, January 2021

Course: Alternate Energy Technologies — **Semester: I**
Program: M. Tech REE & ES — **Time: 03 hrs.**
Course Code: EPEC 7020 — **Max. Marks: 100**

SECTION A

1. Each Question will carry 5 Marks
2. Instruction: Write short / brief notes

S. No.		CO
Q 1	1. Two types of MHD cycles are _____ and _____. 2. The power generated from MHD power plant is AC. True / False? 3. In an MHD generator, Potassium is used for a. Reduce toxicity of gas b. Increase electrical conductivity c. Reduce temperature for attaining ionization potential d. Increase efficiency of conversion 4. A MHD efficiency is limited by a. MHD duct design b. Faraday cage phenomenon c. Ionization potential of gas d. Ions combine with electrons to form neutral molecules below ~2000K	**CO 1**
Q 2	i. The energy efficiency of electrolytic hydrogen is given as the ratio of _____ to _____ ii. Nickle plated iron is used as anode due to its superior corrosion resistivity and high oxygen overvoltage. True / False ? iii. Presence of chlorides or sulphates in electrolyte corrodes the electrodes, especially cathode. True/False? iv. The ratio of actual amount of product to the amount of product calculated based on electricity passes is known as _____	**CO 2**
Q 3	1. Which of the following does not affect the reactions in a fuel cell? a. Electrolyte composition b. Electrode composition c. A combination of fuel and oxidiser d. Catalytic effect of the reaction containerThe fuel used in a fuel cell is usually 2. The reaction occurring at the cathode of hydrogen-oxygen fuel cell is a. $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$ b. $2H_2 + O_2 \rightarrow 2H_2O$ c. $H^+ + OH^- \rightarrow H_2O$ d. $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ 3. The electrodes in a fuel cell must be a. Good conductor	**CO 3**

	b. Highly resistant to corrosive environment c. Must be able to separate charges d. All the above 4. The efficiency of PEMFC is _____.	
Q 4	1. The ocean thermal energy conversion (OTEC) is uses _____ a. Energy difference b. Potential difference c. Kinetic difference d. Temperature difference 2. Which of the following has the lowest efficiency? a. Solar energy b. Wave energy c. Tidal energy d. OTEC 3. The tidal range a. remains constant throughout the lunar month b. is maximum at the middle of the lunar month and minimum by end of the month c. is minimum at the middle of the lunar month and maximum by end of the month d. is maximum at the middle of and end of the lunar month 4. Pumping of water from ocean to basin during high tide a. increase the net energy generation b. decrease the net energy generation c. helps in uniform power generation d. decrease the net tidal range 5. The minimum tidal range required for power generation is about a. 1m b. 5m c. 10m d. 20m	**CO 5**
Q 5	1. The working fluid chosen for OTEC is _____ 2. Two basin tidal schemes a. are more economical than single basin schemes b. operate on ebb cycles in both basins c. produce less uniform power d. produce more uniform power 3. The two-pool tidal system is less dependent on_____ a. barrage b. tidal fluctuation c. reservoir d. gravitational force 4. The kinetic energy that results from the oscillation of water is called a. wave energy b. tidal energy c. ocean thermal energy d. hydro energy 5. How is the height of wave determined? a. By wind speed	**CO 5**

	b. By force of the wave c. By an immersion scale d. By a floating device	
Q 6	1. What is the major disadvantage of wave energy? a. It is not efficient enough b. It is available only in the ocean c. The harnessing cost is more d. Unstable during high wind pressures 2. The motion of water in a wave is primarily a. vertical b. horizontal c. linear d. opposite 3. How many high peaks occur in a single pool tidal system? a. 1 b. 2 c. 3 d. 4 4. What happens if the turbine generators are smaller and operate much longer? a. Resulting work is reduced b. High power generation c. Less power loss d. Less sound is created 5. Difference between water height at high tide and water height at low tide is called a. tidal variation b. tidal volume c. tidal range d. tidal current	**CO 5**
SECTION B **1. Each question will carry 10 marks** **2. Instruction: Write short / brief notes**		
Q 7	An MHD duct consist of gas of velocity v=600x+100y+0z (m/s). The magnetic field, B=3.2T is applied in z direction. The conductivity of ionized gas is 65 mho/m. Mean collision time of electron is 10^{-10} and loading factor k = 0.65. Given width, height and length are 0.60 m, 0.30 m and 1.2 m respectively. Calculate i. Generated voltage and its gradient inside the duct ii. Indicate the direction of flow of conventional current in the load and indicate the polarities of electrodes. iii. Load voltage and its gradient caused inside the duct iv. Current density and current in the system v. Power density and Total power generated	**CO 1**
Q 8	Explain in detail about the production of hydrogen using Tank type and Bipolar electrolyser with neat diagram.	**CO 2**
Q 9	Explain the working principle of PEM Fuel cell and SOFC with a neat diagram.	**CO 3**
Q 10	i. Calculate the Open Circuit Voltage value of a Hydrogen fuel cell operating at 100 ^{o}C with pure Hydrogen and air. System pressure is 1 atm. Assume $\Delta g_f = -225.2\ kJ/mol.$	**CO 4**

	ii. Calculate the amount of water produced for a 100 kW fuel cell operating for 1 min, at a cell voltage of 0.7 V	
Q 11	A tidal project has installed capacity of 2000 MW in 50 units. The head at rated output is 5 m. Assume 95 % efficiency for both turbine and generator. The generation is 6 hours twice a day. Calculate a. The quantity of water flowing through each turbine and the total flow out of the tidal basin. b. Energy produced in TW-h per year	**CO 5**
Section C **1. Each Question carries 20 Marks.** **2. Instruction: Write long answer.**		
Q 12	Derive an expression for maximum power output from a Hall generator. Calculate the same for the MHD having the dimensions w=0.6 m h=0.35 m, and l=1.7m. The magnetic field strength is B = 4.2 T along h and the gas velocity is 600 m/s. Assume the performance coefficient as 0.65.	**CO 1**