UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2020

Course: Alternate Energy Technologies   Semester: III
Program: M. Tech REE   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. The air at the entrance of MHD duct is seeded with potassium upto
	    a. 7%
	    b. 5%
	    c. 3%
	    d. 1%
	2. To reduce the power consumption of electromagnets, which type of coils have been suggested?
	    a. cryogenic
	    b. high temperature resistant
	    c. superconducting
	    d. aluminum
	3. The Hall generator operates at low pressure and high velocity. True/False?
	4. In closed cycle MHD-steam power plant, which of the following gas is seeded in the MHD duct?
	    a. helium
	    b. xenon
	    c. sodium vapour
	    d. chlorine
	5. Which of these is not a property of MHD power generation?
	    a. has no moving part, so is reliable
	    b. overall generation cost is less
	    c. closed cycle has almost no pollution
	    d. conversion is about 80-90%
		CO 1

Q 2	i. The voltage efficiency of electrolyser is given as the ratio of _____ to _____ ii. The current efficiency of electrolyser is given as the ratio of _____ to _____ iii. The quenching distance of hydrogen and gasoline is comparatively same. True/False?	**CO 2**

Q 3	1. The calorific value of hydrogen as fuel is of the order of
	    a. 100 kJ/g
	    b. 150 kJ/g
	    c. 30 kJ/g
	    d. None of the above
	2. The fuel used in a fuel cell is usually
	    a. CO
	    b. CO_2
		CO 3

	c. H_2
	d. All the above
	3. At the cathode in a fuel cell, which reaction takes place
	   a. $H_2 \rightarrow 2 H^+ + 2e^-$
	   b. $O + 2e^- + H_2O \rightarrow 2 OH^-$
	   c. $KOH + OH \rightarrow K^+ + O^- + H_2O$
	   d. None of the above
	4. The electrodes in a fuel cell must be
	   a. Good conductor
	   b. Highly resistant to corrosive environment
	   c. Must be able to separate charges
	   d. Be catalytic and bot take part in chemical reaction
	   e. Must be all four
	5. The efficiency of SOFC is _____.	

Q 4	1. Sea waves
	   a. Occur with high amplitudes
	   b. have low frequency
	   c. originate in the open sea
	   d. all the three are true
	2. Abbreviation of LIMPET is _____
	3. The amount of energy transferred and the size of the resulting wave depend on _____ , _____ and _____
		CO 5

Q 5	1. Wave energy can be used for
	   a. Electric power generation
	   b. Desalination
	   c. Condenser
	   d. All the above
	2. Wave energy harnessing devices can be characterized in terms of their placement or location by _____ , _____ and _____
	3. What the time period of a single lunar day?
		CO 5

Q 6	1. 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 2. What is the movement of water away from the shore called? a) Flood tide b) Spring tide c) Ebb tide d) Neap tide 3. On what is two-pool tidal system is less dependent? a) Barrage b) Tidal fluctuation c) Reservoir d) Gravitational force 4. How many basins does a single pool tidal system have? a) 1	**CO 5**

b) 2
c) 3
d) 4

5. 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

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=650x+150y+0z (m/s). The magnetic field, B=4.2T is applied in z direction. The conductivity of ionized gas is 60 mho/m. Mean collision time of electron is 10^{-10} and loading factor k = 0.6. Given width, height and length are 0.65 m, 0.35 m and 1.5 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 photo-electrochemical process with neat diagram.	**CO 2**
Q 9	Explain the working principle of Alkaline Fuel cell and Solid oxide fuel cell with a neat diagram.	**CO 3**
Q 10	i. Calculate the Open Circuit Voltage value of a Hydrogen fuel cell operating at 50 ºC with pure Hydrogen and air. System pressure is 2 atm. Assume $\Delta g_f = -232.5\ kJ/mol$. ii. Calculate the amount of water produced for a 1-kW fuel cell operating for 1 h, at a cell voltage of 0.7 V	**CO 4**

Q 11	A tidal project has installed capacity of 2176 MW in 64 units each of 34 MW rated output. The head at rated output is 5.52 m. The embankment is 4 km. Assume 95 % efficiency for both turbine and generator. The generation is 5 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 segmented electrode faraday generator. Calculate the same for the MHD having the dimensions $w = 0.65m\ \ h = 0.4m\ and\ l = 1.75m$. The magnetic field strength is B = 4.2 T along h and the gas velocity is 620 m/s. Assume the performance coefficient as 0.65.	**CO 1**