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SARDAR PATEL UNIVERSITY

M.Sc. (Renewable Energy) **Semester: Second**

Course Code: PS02CREN03

Course Title: Hydro Energy and Chemical Energy Sources

Day and Date: 23-03-2019, Saturday **Time: 10:00 AM to 1:00 PM**

Total Marks: 70

Note: 1. All the questions are compulsory
2. Figures on the right bracket indicated marks

Q-1: Select the correct answer **(10)**

i. Low head hydropower plant has head .....
   a. < 3 m
   b. Above 40 m
   c. > 3 and upto 40 m
   d. none of the above

ii. Specific speed for the impulse turbine ranges between .....
   a. 10-50 m
   b. 60-300 m
   c. > 1000
   d. 300-1000

iii. As per MNRE, micro hydro power station has the capacity of
   a. 101-1000 kW
   b. 1-25 MW
   c. Upto 100 kW
   d. None of the above

iv. Energy requirement to produce hydrogen by electrolysis process .....
   a. Increase with increase in electrolyte
   b. Decreased with decrease in electrolyte
   c. Decreased with increase in electrolyte
   d. Increased with decrease in electrolyte

v. In thermal decomposition for hydrogen production, the heat energy used at temperature of .....
   a. 1000 °C
   b. 2500 °C
   c. 1500 °C
   d. 2000 °C

vi. Two different energy systems installed at a location to ensure continuity of electrical supply is known as .....
   a. Stand alone system
   b. Hybrid energy system
   c. Remote energy system
   d. Primary energy system

vii. Power conditioner performs .....
   a. Convert AC to DC
   b. Invert DC to AC
   c. Regulate current and voltage
   d. All of the above

viii. The operating temperature range of the Solid Oxide Fuel Cell is .....
   a. 70-100 °C
   b. 800-1000 °C
   c. 50-100 °C
   d. 160-210 °C

ix. Voltage efficiency of fuel cell given by .....
   a. $\eta_v = (V_o - V_p)/V_o$
   b. $\eta_v = (V_o + V_p)/V_o$
   c. $\eta_v = (V_o - V_p)/V_p$
   d. None of the above

x. The individual fuel cell produces the voltage in the range of .....
   a. 1.0 -1.5 V
   b. 0.55 – 0.75 V
   c. 1.5 – 2.0 V
   d. None of the above

(P.T.O)

Q-2: Answer **any Eight** questions in brief **20**

(i) Write about liquid storage method for hydrogen

(ii) Write short note on solar electrolyte hydrogen production

(iii) Find a reversible voltage for hydrogen oxygen fuel cell having the reaction $H_2 + ½ O_2 = H_2O$ (l); Given: $(\Delta G^\circ)_{25}$= -56,690 cal/gm-mole of H_2 (-237.3 x 103 J/gm-mole of H_2)

(iv) Give advantages of fuel cell power plant

(v) Give different types of fuel cell with their characteristics

(vi) Define hybrid energy system. Why hybrid systems are needed?

(vii) Discus in brief about hybrid electric vehicle.

(viii) Explain micro hydel-PV hybrid system

(ix) Explain bulb turbine in detail with suitable figure.

(x) It is required to develop 15000 kW at 214 RPM under head of 100 m with single runner. What type of turbine should be installed?

Q-3: (A) Give the classification of small hydro power plant and water turbines **5**

(B) What is impulse turbine? Explain pelton turbine with suitable figure. **5**

OR

Explain reaction turbine with the example of francis turbine with figures.

Q-4: (A) Derive the expression for the energy output and efficiency of a fuel cell **5**

(B) Explain principle of alkaline fuel cell with suitable diagram **5**

OR

A hydrogen oxygen fuel cell operates at 25 °C,. Calculate the voltage output of the cell, the efficiency and the electric work output per mole of H_2 consumed and power mole of H_2O produced and heat transferred to the surrounding.

$\Delta H^\circ_{298}\,{}^\circ k$ = -285838 kJ/kg mole ; $\Delta G^\circ_{298}\,{}^\circ k$ = -237191 kJ/kg mole

Q-5: (A) What are the different methods of hydrogen production? Explain hydrogen production by electrolysis in details. **5**

(B) What are the different methods of hydrogen storage? Explain solid state storage in details. **5**

OR

Write short note on hydrogen production from sunflower oil

Q-6: (A) Explain biogas –solar thermal hybrid system with case study. Draw suitable diagram. **5**

(B) Explain with suitable diagram a) Biomass-diesel hybrid system; b) Wind PV hybrid system **5**

OR

List of different types of hybrid system. Explain PV hybrid with diesel generator with suitable diagram.

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