

# SARDAR PATEL UNIVERSITY

M.Sc. (Renewable Energy) Examination, Second Semester

Day and Date: Monday, 11.04.2016

Session: Morning, Time: 10:30 AM to 1:30 PM

Subject/ Course Code: PS02CREN03 / Paper No. 3

**Subject/ Course Title: Hydro Energy and Chemical Energy Sources**

Total Marks: 70

Note: 1. All the questions are compulsory

2. Figures on the right bracket indicated marks

**Q-1: Choose the correct answer**

(12)

- (i) The power equation for the hydro electric power station is given by.....
- |                        |                        |
|------------------------|------------------------|
| a. $P = 9.81 QH\eta$   | b. $P = 9.81 / QH\eta$ |
| c. $P = QH\eta / 9.81$ | d. $P = 9.81QH/\eta$   |
- (ii) ..... is used to feed the water to the generating machine in power house
- |                     |             |
|---------------------|-------------|
| a. Reaction Turbine | b. Penstock |
| c. Spillway         | d. Forebay  |
- (iii) Alkaline Fuel Cell (AFCs) uses..... as an electrolyte
- |              |              |
|--------------|--------------|
| a. NaCl      | b. KOH       |
| c. $H_2SO_4$ | d. $H_3PO_4$ |
- (iv) Maximum efficiency of Hydrogen Oxygen fuel cell is .....
- |         |         |
|---------|---------|
| a. 63 % | b. 93 % |
| c. 53 % | d. 83 % |
- (v) The process of splitting water into hydrogen and oxygen by means of direct electric current is known as .....
- |                   |                 |
|-------------------|-----------------|
| a. Photolysis     | b. Hydrolysis   |
| c. Photosynthesis | d. Electrolysis |
- (vi) The operating temperature range of the Solid Oxide Fuel Cell is .....
- |                |               |
|----------------|---------------|
| a. 70-100 °C   | b. 50-100 °C  |
| c. 800-1000 °C | d. 160-210 °C |
- (vii) As per Ministry of New and Renewable Energy, micro hydro power station has the capacity of .....
- |                |                      |
|----------------|----------------------|
| a. 101-1000 kW | b. Upto 100 kW       |
| c. 1-25 MW     | d. None of the above |
- (viii) The combination of two different energy systems installed at a single location to ensure the continuity of electricity supply is called .....
- |                               |                      |
|-------------------------------|----------------------|
| a. Stand alone system         | b. Hybrid System     |
| c. Decentralized power system | d. None of the above |

Q-2: Answer any Six short questions

(18)

- i. Give the classification of water turbines
- ii. 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?
- iii. Explain principle operation of acidic fuel cell with suitable figure
- iv. Give different types of fuel cell with their characteristics
- v. Describe in brief solar energy method for H<sub>2</sub> production
- vi. Give Characteristic and application
- vii. Explain biomass diesel hybrid system
- viii. Discuss in brief about hybrid electric vehicle.
- ix. Give advantages of fuel cell power plant

Q-3: A. Explain working of Francis water turbine with suitable diagrams

(5)

B. Explain major components of small hydropower project

(5)

OR

Explain with suitable diagram

i. Bulb turbine

(2.5)

ii. Pelton turbine

(2.5)

Q-4: A. Explain Molten Carbonate Fuel Cell (MCFC) with suitable diagram

(5)

B. Explain fuel cell analysis with thermodynamic potential. Draw suitable diagram.

(5)

OR

Hydrogen fuel oxygen cell in which the following reaction occurs

(5)

At Anode,  $H_2 \rightarrow 2H^+ + 2e^-$

At cathode,  $2e^- + \frac{1}{2} O_2 + H_2O \rightarrow 2OH^-$ , Operates at 25 °C,

Calculate-

a. The voltage output of the cell

b. The efficiency

c. Electrical output per mole of H<sub>2</sub> consumed and per mole of H<sub>2</sub>O produced

d. Heat transfer to surrounding

Given:  $\Delta H^\circ_{298 K} = -68317 \text{ kcal/kg mole}$

$\Delta G^\circ_{298 K} = -68317 \text{ kcal/kg mole}$

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)

Different storage methods

OR

Explain

(2.5)

a. Hydrogen production from sunflower

(2.5)

b. Hydrogen production from Steam reformation

Q-6: A. What is the need of hybrid system? Give different types of hybrid system and explain PV hybrid with diesel generator with suitable diagram. (5)

B. Explain Biogas –Solar Thermal Hybrid system with case study. Draw suitable diagram. (5)

OR

Explain with suitable diagram

c. Wind PV hybrid system

(2.5)

d. Micro hydel-PV hybrid system

(2.5)

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