(57)   **SARDAR PATEL UNIVERSITY**

M.Sc. Renewable Energy Examination (Semester –II)

Thursday, 10-04-2017, Time: 10.00 to 01.00P.M

PS02CREN01: Renewable Energy: Conversion, Storage and Environmental Aspects

Total Marks: 70

Q-1 Select most appropriate answer   (8x1=8)

1. Which of the primary energy sources are available from the nature in raw form?
   a) Non-conventional energy sources   c) All the above
   b) Conventional energy sources   d) None of the above
2. The conversion efficiency of Integrated Coal gasification combined cycle (ICGC) is ___
   a) 35-41%   c) 27-38%
   b) 45-50%   d) 45-80%
3. Rating of power plant is _____
   a) Wh   c) MW
   b) kWh   d) None of the above
4. Super conducting magnetic energy storage
   a) Store electricity from the grid within a magnetic field   c) It is used for grid balancing
   b) It is used for short duration storage   d) All the above
5. The energy is stored in Flywheel in form of
   a. Potential energy   c. Heat energy
   b. Kinetic energy   d. Electrical energy
6. The units of specific energy density are
   a) W kg-1   c) Wh kg-1
   b) J kg   d) Wh
7. In lead acid cell $PbSO_4$ is formed during
   a) Charging only   d) Neither during charging nor discharging
   b) Discharging only
   c) Both during charging as well as discharging
8. The flue gases from coal fired power plants
   a)Fly ash, SOx, NOx .   b) Fly ash, SOx, CO, NOx .

   c) CO, CO2, Fly ash.   d)Fly ash, SOx, NOx, CO, CO2

Q-2 Answer **any seven** questions   (7x2=14)

1. Write the energy conversion efficiency of different power plant and write their commercial applications.
2. Define the following terms:
   a. Base load
   b. Intermediate load
   c. Peak load
3. Write a short note on Indian coal fired power plant
4. What is energy storage? Write the classification of energy storage.
5. What is the difference between sensible and latent heat energy storage.
6. Write short note on lead acid battery
7. Write flywheel energy storage. How does flywheel work in Car?
8. What are flue gases? Give the examples.
9. Define air pollutant and give the examples

Q-3 A) Describe coal fired steam power plant & Integrated Coal Gasification Combined Cycle plant (ICGCC)   (06)

Q-3 B) Describe magneto-hydro dynamics power plant technology. Write its advantages and disadvantages.   (06)

OR

Q-3 B) Discuss the various difficulties in electrical energy route   (06)

Q-4A) Describe pumped hydro energy storage plant. State its operating modes with respect to peak load and off-peak hours.   (06)

Q-4B) Describe in detailed mechanical energy storage with neat diagram.   (06)

OR

Q-4B) A underground cavern will be used to store the energy of compressed air. If the cavern has a volume of 29,000m³ determine the value of stored energy by the compression of air from 100 to 1,500 kPa at 300K at isothermal conditions with a heat loss of 55, 000kJ   (06)

Q-5 A) Explain the principle of chemical energy storage.   (06)

Q-5 B) Describe lead acid battery energy storage.   (06)

OR

Q-5 B) Write in detailed metal hydride hydrogen storage and write the advantages of hydrogen energy storage   (06)

Q-6 A) State the principle of emissions from coal fired power plants and its harmful effects. Enlist the equipments installed in coal fired thermal power plants for controlling emission of a) fly ash b)SOx and c)NOx.   (06)

Q-6B) Describe various controlling methods of particulate matter from thermal power plant (06)

OR

Q-6B) Explain the criteria of permitting emission up to certain limits as a basis of formulating air quality standards.   (06)

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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: 15-04-2017, 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: Choose the correct answer   **10**

i The power equation for the hydro electric power station is given by.........................
  a. $P = 9.81\, QH\eta$
  c. $P = 9.81 / QH\eta$
  b. $P = QH\eta / 9.81$
  d. $P = 9.81 QH/\eta$

ii Kaplan turbine falls under the category of ....
  a. Impulse turbine
  c. Reaction Turbine
  b. Both a and b
  d. None of the above

iii. Turgo impulse turbine is ideal for heads in the range of ....
  a. 10-30 m
  c. More than > 250 m
  b. 30-210 m
  d. None of the above

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

v. Maximum efficiency of hydrogen oxygen fuel cell is ....
  a. 63 %
  c. 93 %
  b. 53 %
  d. 83 %

vi. The process of splitting water into hydrogen and oxygen by means of direct electric current is known as ....
  a. Photolysis
  c. Photosynthesis
  b. Hydrolysis
  d. Electrolysis

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

viii. Hydrogen as a fuel can be stored in the mode of storage as ....
  a. Only liquid
  c. Only Gaseous storage
  b. Only Solid state storage
  d. All of the above

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

x. Power conditioner performs the work of ....
  a. Convert AC to DC
  c. Invert DC in to AC
  b. Regulate battery current
  d. All of the above

Q-2: Answer **any Eight** short questions   20

    i.   Explain the power equation and different heads of small hydropower in details
    ii.   Explain bulb turbine in detail with suitable figure.
    iii.   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?
    iv.   Explain hydrogen fuel processor in brief with figure
    v.   Give different types of fuel cell with their characteristics
    vi.   Describe alkaline fuel cell with suitable figure in brief
    vii.   Brief about liquid storage method for hydrogen
    viii. Give characteristic and application of hydrogen
    ix.   Explain biomass diesel hybrid system
    x.   Discus in brief about hybrid electric vehicle.
    xi.   Give advantages of fuel cell power plant

Q-3: i. Give the classification of water turbines and classification of water turbines   5

       ii. Explain reaction turbine with the example of francis turbine with figures.   5
                                       OR
       What is impulse turbine? Explain any one with suitable figure.   5

Q-4: i. Explain principle operation of acidic fuel cell with suitable diagram   5

       ii. Explain fuel cell analysis with thermodynamic potential. Draw suitable diagram.   5
                                         OR
       A hydrogen oxygen fuel cell operates at 25 °C,. Calculate the voltage output of the cell, the   5
       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: i. What are the different methods of hydrogen production? Explain hydrogen production by   5
       electrolysis in details.

       ii. What are the different methods of hydrogen storage? Explain solid state storage in details.   5
                                         OR
       Explain in brief. a) Hydrogen production from sunflower; b) Hydrogen production from steam   5
       reformation

Q-6: i. Explain biogas –solar thermal hybrid system with case study. Draw suitable diagram.   5

       ii. What is the need of hybrid system? Give list of different types of hybrid system and explain PV
       hybrid with diesel generator with suitable diagram.   5
                                         OR
       Explain with suitable diagram a) Wind diesel hybrid system; b) Micro hydel-PV hybrid system   5

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SARDAR PATEL UNIVERSITY

M.Sc. (Renewable Energy)   Semester: Second
Course Code: PS02EREN01
Course Title: Alternate Energy Sources

Date and Day:, 18-04-2017, Tuesday   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: Choose the correct answer   **10**

i. Magneto Hydro Dynamic power generation principle is based on ....
   a. Joule law   c. Faraday law
   b. Thomson law   d. Peltier law

ii. In MHD, gas velocity should be ....
   a. 10^3 m/sec   c. 10^2 m/sec
   b. 10 m/sec   d. 10^4 m/sec

iii. Overall efficiency possible in MHD is ....
   a. 15-35 %   c. 25-40 %
   b. 50-60 %   d. 35-55 %

iv. Thermoelectric converter is a form of ....
   a. IC engine   c. Cryogenic engine
   b. Heat Engine   d. Nuclear reactor

v. The magnitude of the current developed in thermoelectric will depend on ....
   a. Material   c. Both a and b
   b. Temperature of junction   d. None of the above

vi. When an electric current flows across the two isothermal junction of two dissimilar material with an evolution or absorption heat is known as ....
   a. Seebeck Effect   c. Joule Effect
   b. Peltier Effect   d. Thomson Effect

vii. Minimum temperature of emitter required in thermionic convertor should be ....
   a. 900 °C   c. 1000 °C
   b. 800 °C   d. 500 °C

viii. The process accompanied with release of energy as well as neutrons called
   a. Emission   c. Fusion
   b. Reduction   d. Fission

ix. .... is naturally available radioactive substance used for nuclear fission
   a. Plutonium-239   c. Uranium- 233
   b. Uranium- 235   d. Tritium

x. The practical fusion ignition temperature for a D-T plasma is roughly...........................
   a. 100 million °C   c. 1000 million °C
   b. 10 million °C   d. 1 million °C

Q-2: Answer any Eight short questions

i. Draw the detailed diagram of closed cycle MHD system for inert gas system

ii. What are the advantages of the MHD systems

iii. A MHD generator has specification as Plate area: 0.25 m²; Distance between plates: 0.50 m; Flux density: 2 Wb/ m²; Avg. gas velocity: 10³ m/sec; Gas conductivity; 10 Mho/m. **Calculate-** open circuit voltage and maximum power output.

iv. Explain peltier effect in details with figure.

v. Find a Thomson heat transferred to the surroundings from a wire whose end points are maintained at 373 and 273 K. A current of 10 mA is flowing in the wire and its absolute thermoelectric power increases linearly with temperature at rate $(daS_I/dT)=5.4 \times 10^{-9}$ V/°K²

vi. Explain in brief what is thermionic emission

vii. Explain in brief what is work function in thermionic emission

viii. Write in brief about nuclear fusion?

ix. State the advantages of nuclear fusion.

Q-3: i. Explain working principle of magneto hydro dynamic power generation with suitable figure. 5

ii. Derive an expression for the voltage and power output of MHD generator in short with suitable figure. 5

OR

Write about gas conductivity. Explain different type of types of ionization of gas in brief. 5

Q-4: i. A 100 kW, 115 volt, thermoelectric generator operates between 1500 and 1000 °K. The material properties are: 5
αSAB at 1250 °K = 0.0012 volt/ °K;   κA= 0.02 watt/cm °K;   κB= 0.03 watt/cm °K;
pA= 0.01 ohm cm   pB= 0.012 ohm cm.
For optimum design: AA= 43.5 cm²;   AB= 48.6 cm²;   LA= LB= 0.49 cm, and the current density in the element is limited to 20 amps/cm², **Calculate:** Maximum efficiency of thermoelectric power generator

ii. The seabeck coefficient of a junction is 55 µV/°K at 373 K and 50 µV/°K at 273 K. Find the Peltier heats absorbed and rejected when the thermocouple is operating between these heat reservoirs and supplying a current of 10 mA. 5

OR

Explain basic principle of thermoelectric power generation 5

Q-5: i. Describe the principle of working and constructional details of a basic thermionic generator (basic diode) with suitable figures 5

ii. Following are the data are given for thermionic generator 5
Cathode work function · ϕ_c=2.5 volt;   Anode work function ϕ_a=2.0 volt
Temperature of cathode T_c=2000 °K;   Temperature of surrounding Ts=1000 °K
Plasma potential drop ϕ_p=0.1 volt;   Charge of electrons   ē=1.6 x 10⁻¹⁹ Coulomb
Boltzmann Constant   κ=1.38 x 10⁻²³ J/°K;   Emissivity ε =0.2 for electrode material used.
Calculate the efficiency of the generator.

OR 5

Explain in brief a) Thermionic emission; b) Work function

Q-6: i. Explain different methods of plasma heating in magnetic confinement fusion 5
5

ii. Explain the requirement of the nuclear fusion in details 5

OR

Write down the characteristics of D-T reactions 5

X = X = X