(31) SARDAR PATEL UNIVERSITY

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

Thursday, 02-11-2017, Time: 10.00 A.M to 01.00P.M

PS01CREN01: Fundamental of Renewable Energy Technology

Total Marks: 70

Q-1 Select the most appropriate options   (8x1= 08)

1. Which of the following is commercial energy source?
   a) Electricity
   b) Wind
   c) Uranium ore
   d) Solar radiation

2. A Natural resource that can be replaced in same rate at which it is consumed or used is known as
   a) Artificial resources
   b) Renewable resources
   c) Natural resources
   d) Nonrenewable resources

3. Current, Voltage and Resistance are related to
   a) a) V=IR
   b) b) I=V/R
   c) $P=I^2R$
   d) All the above

4. The SI unit of the force is
   a) Newton
   b) $Kg.m/sec^2$
   c) Answer a and b are correct
   d) Erg

5. Process in which heat is transferred in form of waves is called
   a) Conduction
   b) Convection
   c) Radiation
   d) Thermal climbing

6. 1kWh is equal to _____
   a. $3600,000Ws^{-1}$
   b. $3600,000J$
   c. $3.6x10^6J$
   d. All the above

7. Second law of thermodynamics defines
   a) Internal energy
   b) Enthalpy
   c) Work
   d) Entropy

8. Which of the following processes are thermodynamically reversible
   a) Throttling
   b) Free expansion
   c) Constant volume and pressure
   d) Isothermal and adiabatic.

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

1. Categorise types of the energy available on the earth? Give example for each.
2. List out primary & secondary source energy
3. What are the types of conventional power plants and write there efficiencies
4. Two infinite black plates at 800°C and 300°C exchange heat by radiation. Calculate the heat transfer per unite area (q/A). $\sigma = 5.669 \times 10^{-8}$.
5. Write relation between Man, Energy and Environment.
6. Define absorptivity, reflectivity and transmitivity
7. Define conduction, convection and radiation
8. Define Entropy and Enthalpy

9. Distinguish reversible & irreversible process?

Q-3 A) What is meant by renewable energy sources? Explain in brief these energy sources with special reference to Indian context.
(06)

Q-3 B) Explain prospects of non-conventional energy sources in India? Also mention the advantages and limitation of renewable energy sources.
(06)

OR

Q-3 B) Write in detail alternative and renewable energy power plants and their remarks. (06)

Q-4 A) State difference between 1) KW and kWhr 2) Kelvin and Celsius 3) Charge andCurrent. (06)

Q-4 B) State the definition and units for 1) Change in Enthalpy 2) Entropy and 3) Specific heat capacity 4) and Temperature of the body.
(06)

OR

Q-4 B) The sun converts approximately 4×10^9 kg matter into thermal energy per second. What is the power rating of the sun?
(06)

Q-5 A) Derive expression for product $<\tau.\alpha>$ for a glass plate combination in terms of τ, α and ρ_d
(06)

Q-5 B) Calculate the reflectance of one surface of glass for an angle of incidence of 75°. The average index of refraction of glass for the solar spectrum is 1.526. Also calculate the reflectance for normal incidence.
(06)

OR

Q-5 B) One face of copper plate 3cm thick (thermal conductivity of copper plate k = 370W/mK) is maintained at 400°C, and the other face is maintained at 100°C. How much heat is conducted through the plate?.

Air at 20°C blows over a hot plate 50 by 75cm maintained at 250°C. The convection heat-transfer coefficient is 25W/m²K. Calculate the convective heat transfer for the hot plate. The convective heat transfer coefficient (h) = 25W/m²K.
(06)

Q-6 A) Explain system surroundings/environment and boundary conditions with sketch diagram.(06)

Q-6 B) Explain first law of thermodynamics in detailed.
(06)

OR

Q-6 B) Explain second law of thermodynamics in detailed
(06)

_____End_____

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(25)   SARDAR PATEL UNIVERSITY

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

Monday, 06-11-2017, Time: 10.00 to 01.00P.M

PS01CREN02: Solar Energy

Total Marks: 70

Q-1 Select the most appropriate options   (8x1= 08)

1. The average solar power received on the Earth's surface is

   a) 1000 mW cm^{-2} c) 100 W cm^{-2}
   b) 1 kW m^{-2} d) 1000 W cm^{-2}

2. Pyrheliometer is an instrument used to measures _____
   a) Diffuse solar radiation   c) Direct beam solar radiation
   b) Scattered solar radiation   d) Total radiation

3. A body reflects all incident thermal radiation is called
   a) Opaque body   c) Gases
   b) Black body   d) Specular body

4. The amount of solar radiation received on a unit area exposed perpendicularly to the rays of the sun at an average distance between the sun and the earth is defined as
   a) Solar insolation   c) Solar radiation
   b) Solar constant   d) Solar insulation

5. In solar collector, why transparent cover provide for
   a) Protect from dust   c) Transmit solar radiation
   b) Reduce heat losses   d) All the above

6. Solar cell convert light energy into
   a) Potential energy   c) Kinetic energy
   b) Electrical energy   d) None of the above

7. Hydrogen can be stored _____
   a) High pressure tank   c) In chemical compound
   b) Cryogenics liquids   d) All the above

8. A solar pond it is ____
   a) A pool of salt water which collect and store thermal energy
   b) Need separate collector for energy storage
   c) Due to evaporation non-saline water is constantly required to maintain salinity
   d) Answer a and c are correct
   e) Answer b and c are correct

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

1. What is solar constant?
2. Explain Sunrise, sunset and day length
3. Define beam, diffuse and global solar radiation.

4. Determine L.S.T and declination at Bhopal 23° 15', 77° 30' at 12.30 IST on June 19. (E= 1' 01")
5. Calculate the day length at location 28° 35'N, 77° 12'E on December 1.
6. Classify different type of solar energy measuring equipment's
7. Define kirchhoff law
8. Write the working principle of solar cell.
9. Differentiate different type of tracking and non-tracking collectors and its temperatures.

Q-3 A) Discuss the structure of the sun in detail. Discuss the sun-earth relationship. (06)
Q-3 B) Describe electromagnetic spectrum, its wavelength and approximate percentage of available total energy on the earth.
(06)

<div align="center">(OR)</div>

Q-3 B) What is the declination on January 30, March 22, August 10?
(06)

Q-4 A) Classify different solar radiant energy measuring equipment's with diagram. Discuss the merits and demerits of each technology.
(06)
Q-4 B) Discuss the working principle of pyrheliometer & sunshine recorder. (06)

<div align="center">(OR)</div>

Q-4 B) Calculate the angle made by beam radiation with normal to a flat plate collector on December 1, at 9.00 A.M ($\omega=45°$) solar time for a location at 28° 35' N 77° 12'E. The collector is tilted at an angle of 38.58° with horizontal and is pointing due south. (06)

Q-5 B) Write in detail estimation of average solar radiation
Q-5 B) Write in detail estimation of direct and diffuse solar radiation (06)

<div align="center">(OR)</div>

Q-5 B) Determine the value of H_{av} over a horizontal surface for June 22, at the latitude of 10°N, if a =0.3, b=0.51' and n/N=0.55
(06)
Q-6 A) Classify solar thermal energy collecting devices and explain each solar thermal collector technology with diagram. What are the advantages and limitations of each collector technology?
(06)

Q-6 B) What is solar pond? What are the arrangements made in solar pond to retain heat energy content in solar pond? Discuss advantage and disadvantage of this technology. (06)

<div align="center">(OR)</div>

Q-6 B) Discuss the different types of hydrogen energy storage and write merit and demerits of each technology,.
(06)

<div align="center">_____ End_____</div>

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

Course Title: Geothermal Energy and Biomass Energy

Course Code: PS01CREN03

Day and Date: Wednesday, 08-11.2017   **Time:** 10:00 AM to 1:00 PM

Total Mark: 70

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

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

i   Anaerobic digestion results in generation of ....
     a. CH_4 and H_2 c. CH_4 and N_2
     b. H_2 and SO_2 d. CH_4 and CO_2

ii   The thermal energy content in the interior of the earth is called.......................
     a. Nuclear Energy   c. Geothermal Energy
     b. Wave Energy   d. Magma

iii   The centre of the earth is at temperature about .... ^0C
     a. $6000\ ^0C$ c. $4500\ ^0C$
     b. $2500\ ^0C$ d. $3000\ ^0C$

iv   In, Vapor dominated geothermal power plant .... is used to separate particulate matter
     a. Centrifugal Separator   c. Flash steam separator
     b. Bag Filters   d. Gravity separators

v   The .... is used as working fluid for binary cycle system in geothermal power plant
     a. n-Butanol (CH_3-CH_2-CH_2-CH_2-OH)   c. Isobutene (2-methyl propane) (C_4H_{10})
     b. Propylene carbonate ($C_4H_6O_3$)   d. Iodine (I)

vi   The optimum pH for biogas generation is in the range of ....
     a. 6.5 -7.5   c. 7-9
     b. 5.2-8.5   d. 3.5 -6.5

vii   HRT for pig manure is ....
     a. 20 days   c. 32 days
     b. 50 days   d. 12 days

viii   .... is obtained from biomass by the process of fermentation
     a. Ethyl alcohol   c. Syngas
     b. Biogas   d. Carbon Monoxide

ix.   For electrical power plant with steam water cycle, discharge of production well should be .... m^3/day.
     a. 10000   c. 15000
     b. 25000   d. 5000

x.   The product of pyrolysis is ....
     a. Liquid fuel   c. Solid fuel
     b. Gaseous fuel   d. All of the above

Q-2:   **Answer any Eight**   (8 x 2.5=20)
    1. Give classification and engineering criteria for geothermal electric power plants
    2. Explain types of geothermal energy resources in brief
    3. Explain geo pressure energy resources with suitable diagram.
    4. Give the types of geothermal electric power forms with geothermal fluid and types of turbine used in table form.
    5. Explain the T-S diagram for vapor dominated geothermal power plant
    6. What are the advantages and disadvantages of floating drum biogas plant

       (PTo)

7. The fallowing data are given for family size biogas digester suitable for output of five cows. The retention time is 20 days, temperature 30 ^{0}C, dry matter consumed per day = 2 kg. The efficiency of the burner is 60 %. Methane proportion is 0.8. Heat of combustion of methane= 28 MJ/m^3.
   Calculate: i. Volume of biogas digester,
                     ii. The power available from the digester
8. Define biomass. Explain photosynthesis process in brief.
9. Give the different sources of biomass
10. Explain floating drum type biogas plant with suitable diagram.

Q-3 (A) Explain in details the origin of geothermal resources with detailed diagram   (05)

Q-3 (B) Explain hot dry rock geothermal resources with suitable diagram. Give merit and demerits   (05)
         OR
Q-3 (B) Define geothermal gradient? Explain non-uniform geothermal gradient with suitable diagram

Q-4 (A) Explain liquid dominated flashed geothermal electric power plant and its thermodynamic cycle. Draw   (05)
         diagrams.

Q-4 (B) Explain binary cycle liquid dominated geothermal electric power plant and its thermodynamic cycle.   (05)
         Draw suitable diagrams.
         OR
Q-4 (B) Explain vapor dominated geothermal electric power plant and its thermodynamic cycle. Draw suitable
         diagrams.

Q-5 (A) Explain the fermentation process, products obtained from fermentation and their applications

Q-5 (B) What are the different biomass conversion processes? Explain thermo-chemical conversion process in
         brief.
         OR
Q-5 (B) A farmer has 4 dairy cows that weight 1200 kg. Estimate the methane gas production and design   (05)
         digester for cases of fresh manure and urine. Assumptions to be made as below-
              i.   Cow will produce 12.5 kg /day solid dung and 10 kg volatile solid
              ii.   Volume of manure and urine is 90 litre/day
              iii. Ultimate methane production is 0.2 m^3/kg
              iv.   Water addition 10 litres /day

Q-6 (A) A village consisting of 98 families, each family consisting of 5 persons (adults). Two children are equivalent to one person. Villages have 102 cows, 124 oxes, 52 buffalos and 3 pigs. A community biogas plant is to be designed only for cooking and house lighting. Gas required for cooking/person/day=0.227 m^3, gas required for lightning 100 CP lamp per hour=0.126 m^3. Each family allotted 2 lamps for 2 hour operation daily. Calculate height and diameter of the digester.

Q-6 (B) What are the different factors that affect the operation of biogas plant?   (05)
         OR
Q-6 (B) List the classification of biogas plants. Explain continuous plant in details with suitable diagram.   (05)

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Sardar Patel University

M.Sc. Renewable Energy   Semester: First

Course Title: Wind Energy

Course Code: PS01EREN01

Day and Date: Friday, 10-11-2017   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 x 1= 10)

i   Wind turbine uses ……………………,…… in the wind
     a. Kinetic Energy   c. Potential Energy
     b. Chemical Energy   d. Thermal Energy
ii The factors determine the output of the wind energy converter is/are …….
     a. Wind speed   c. Conversion efficiency of rotor
     b. Swept area   d. all of the above
iii Pitch angle for propeller type wind mill is ………………….
     a. 0-25 ^{0} c. 0-30 ^{0}
     b. 10-18 ^{0} d. 5-15 ^{0}
iv The ……………… force is responsible for rotation of the aerofoil.
     a. Drag Force   c. Lift Force
     b. Pneumatic force   d. None of above
v   In synchronous type generator, synchronous speed is given by …………………..
     a. Ns= 120 f/p   c. Ns=120 p/f
     b. Ns=180 p/f   d. Ns=180 f/p
vi ……………… require external mechanical aid for start up.
     a. Savonius rotor   c. h type rotor
     b. Darrieus rotor   d. none of the above.
vii The value of an amount of money expressed for a future time in terms of today money is called as
     …………….
     a. Initial cost   c. Present value of money
     b. Operating cost   d. cost of capital
viii The systematic repair and maintenance work to prevent a fault or failure before it happens is called
     …………..
     a. Corrective maintenance   c. Overhaul
     b. Preventive maintenance   d. None of the above
ix. The construction of wind farms in bodies of water to generate electricity from wind is ………….
     a. Onshore wind power   c. Wave energy
     b. Offshore wind power   d. Ocean energy
x. Indian territorial waters, which generally extend up to ………….. from the baseline
     a. 18 nautical miles   c. 16 nautical miles
     b. 12 nautical miles   d. 10 nautical miles

Q-2:   Answer any Eight questions   (8 x 2.5= 20)

     1) Derive the expression for forces and torque acting on blades of propeller
     2) Explain daily wind power curve with suitable diagram.
     3) Explain mono-blade HAWT with its advantages and disadvantages. Draw diagram.
     4) Explain ideal PV characteristic of wind velocity and wind turbine with suitable figure.
     5) Explain variable speed constant frequency system with suitable diagram

6) Discuss fundamentals of economics of wind energy in brief.
7) With an annual rate of interest of 8%, determine the future value of $15M investment after 5 years. The interest is compounded every 6 month.
8) What are the objectives of Indian offshore wind energy policy?
9) What is role of nodal agency (MNRE) in offshore wind energy policy?
10) Explain common foundations used for current offshore wind projects with suitable figure.

Q-3(A): Wind at standard atmosphere pressure and 15 ^{0}C has velocity of 10 m/s. Turbine operating speed is 40 **(5)** rpm and maximum efficiency 42%. Calculate-
(a) Air Density, ρ ; (b) Total power density in wind stream, W/m^2; (c) Maximum obtainable power density, W/m^2; (d) Reasonably obtainable power density, W/m^2; (e) Total Power from wind turbine of 120 m diameter; (f) Torque and axial thrust.

Q-3(B): Derive the expression for power of wind turbine for given incoming wind velocity Vi. **(5)**
OR
Q-3(B): Explain with suitable diagram (i) Daily wind power curve (ii) Wind velocity duration curve.

Q-4(A): Explain three blade horizontal axis wind turbine with suitable diagram. **(5)**
Q-4(B): Explain teethering control, yaw control and blade pitch control in details. **(5)**
OR
Q-4(B): What are the different types of vertical axis wind turbine? Explain Darrieus rotor wind turbine with suitable diagram.

Q-5(A): What are the different costs involved in initial cost of wind energy project. Explain all in brief. **(5)**
Q-5(B): Explain with suitable diagram **(5)**
(i) Wind turbine generator unit with diesel generator; (ii) Solar-wind hybrid system
OR
Q-5(B): Explain following wind energy conversion system with suitable diagram
(i) Constant speed constant frequency system; (ii) Wind farm sitting

Q-6(A): What are the essential elements of development of offshore wind energy? **(5)**
Q-6(B): What are the important requirements of development model? Explain any two in details. **(5)**
OR
Q-6(B): Give advantages and disadvantages for offshore wind energy technology

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