

BITS, Pilani-Dubai
International Academic City, Dubai
First Semester 2008-09
BITS C462 RENEWABLE ENERGY
TEST- 1 (Closed Book)

Max.Marks :25
Weightage: 25 %

Time: 50 min

Date:12.10.08

*Note: (i) Answer all Questions
(ii) Assume suitable value if required
(iii) Draw the sketch wherever required*

1. a) What are the Renewable and Non- Renewable energy sources ? (2 Marks)
- b) What are the reasons for variations in solar radiation reaching the earth than received at the outside of the atmosphere? (3 Marks)
2. Define the terms (5Marks)
 - a) The hour angle
 - b) Altitude angle
 - c) The slope
 - d) Solar azimuth angle
 - e) Solar constant
3. Calculate the angle made by the beam radiation with normal to a flat-plate collector, pointing due south located in New Delhi at $28^{\circ}38'N$ at 9:00 hours solar time on December 1. The collector is tilted at an angle of 36° with horizontal. (5 Marks)
4. a) What is *Angstrom compensation pyr heliometer*? Briefly describe the working principle with sketch. (3 Marks)
- b) What are the different types of non-focusing concentrating collectors? What are their advantages? (3 Marks)
5. What is the principle of solar photovoltaic power generation? Briefly explain the main elements and their function in PV system with sketch. (4 Marks)

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TEST- 2 (Open Book)

Max.Marks :20
Weightage: 20 %

Date:23.11.08
Time: 50 min

Note: (i) Answer all Questions
(ii) Assume suitable value if required
(iii) Draw the sketch wherever required

1. A 100 MW vapor dominated system uses saturated steam from a well with a shut-off pressure of 28 bar. Steam enters the turbine at 5.5 bar and condenses at 0.15 bar. The turbine polytrophic efficiency is 0.82 and the turbine-generator combined mechanical efficiency is 0.9. The cooling exist is at 20⁰C. Calculate the steam flow rate and cooling water flow rate and plant efficiency, if reinjection occurs prior to cooling water (7 Marks)

2. a) For ocean thermal energy conversion effectiveness, discuss the factors to be considered in heat exchanger design. (3 Marks)
b) What are the limitations of OTEC plants? (2Marks)

3. a) What are the difficulties in tidal power developments. (2Marks)
b) Explain about Betz coefficient in wind energy? (2Marks)

4. a) How are variations of wind velocity and its directions taken care? (1.5 Marks)
b) Give comparison study of Darrieus and Savonius type rotor wind mills. (2.5Marks)

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First Semester 2008-09
BITS C462 Renewable Energy
Quiz – 1

DURATION: 15 MINUTES MAXIMUM MARKS: 10

Name: _____

ID Number: _____

1. The angle made biplane surface with the horizontal is called-----
2. High temperature can be obtained in ----- collector.
3. The relation between day length and hour angle is-----
4. A serious of arrangement of thermocouples in Eppley Pyrheliometer is called ----

5. Wien's law which relates -----
6. In roof storage of solar heat, heat is transferred from the heated water to the rooms below by conduction through-----
7. In passive solar heating system to absorbs solar radiation and stores heat in thermal storage wall is called -----
8. A large paraboloid reflector consists of number of mirrors and each mirror is called -----
9. Solar energy reaching the top of the earths atmosphere consists of about ----- percent ultraviolet radiation
10. The system is called-----where water and air are circulated by pumps or fans and conventional means are used to distribute the heat to the interior of the residences.

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Quiz – 2

DURATION: 15 MIMUTES Weightage 5% MAXIMUM MARKS: 10

Name: _____

ID Number: _____

1. Maximum available wind power is proportional to-----wind speed
2. Power coefficient is for wind mill is given by-----
3. Maximum axial force on wind blade is given by
a) $\mu/9 \rho D^2 V_i^2$ b) $\mu/9 \rho D^2 V_i^3$ c) $\mu/8 \rho D^3 V_i^3$ d) $\mu/8 \rho D^3 V_i^2$
4. -----rotors are found to attain a maximum power coefficient
5. Aero generator consists of -----
6. WECS stands for-----
7. Density of air at 1 atmospheric pressure and 15^0 C is -----
8. The sail type wind mill blade made up of -----
9. -----rotor consists of two-half cylinders facing opposite directions in such away as to have almost an S-shaped cross section.
10. -----type machine has two or three thin, curved blade with aerofoil cross section and constant chord length

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Quiz - 3

DURATION: 15 MIMUTES Weightage 5% MAXIMUM MARKS: 10

Name:

ID Number:

1. Organic fluid recommended in binary cycle-----
2. HDR refers in geothermal energy source-----
3. Net power out put is high in -----of various liquid dominated systems.
4. Function of centrifugal separator -----
5. In binary fluid geothermal power system, the heat exchanger used is -----
6. Hot molten rock is called -----and is commonly present at depths greater than-----
7. Two kinds of geothermal stream are -----,
8. Any two geothermal sources are -----
9. Steam temperature and pressure in modern fossil-fuel plant about -----,
10. Any two methods in liquid-dominated systems-----,

BITS, Pilani-Dubai
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First Semester 2008-09
BITS C462 RENEWABLE ENERGY
Comprehensive Examination

Max. Marks: 40
Weightage: 40 %

Date: 29.12.08
Time: 3 Hour

Note:

- (i) Answer all Questions
- (ii) Answer all questions sequentially
- (iii) Assume suitable value if required
- (iv) Draw the sketch wherever required
- (v) Steam tables are allowed

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1. (a) What are heliostats? Explain the main heliostat losses. (3M)
(b) Calculate the sun's altitude angle and azimuth angle at 7:30 am solar time on August 1 for a location at 40° north latitude. (3M)

- 2 (a) A propeller wind turbine has a diameter of 120 m and runs at 40 rpm at efficiency of 80%. The wind at 1 standard atmospheric pressure and 15° C has a velocity of 15 m/s. Calculate (i) the total power density in the wind stream (ii) obtainable power density (iii) the total power (iv) torque and (v) thrust when the exit velocity is 8 m/s. (4M)
(b) Prove that in case of horizontal axis wind turbine, the maximum power

$$P_{\max} = \frac{8}{27} \rho A V_i^3 \quad (3M)$$

- 3.(a) Compare the following:
(i) Open cycle OTEC plant (ii) Closed cycle OTEC plant (3M)
(b) An open cycle of 100 kW capacity operates on the following parameters: Temperature of cold water at condenser inlet = 13°C, temperature at condenser = 15°C, temperature at Turbine inlet = 25°C, temperature of warm water from surface = 27°C. The turbine has a polytropic efficiency of 80 % and the turbine-generator has a combined mechanical-electrical efficiency of 90 %. Calculate the warm and cold water mass and volume flow rates. (4M)

- 4(a) What are the operating and environmental constraints in the designing of geothermal power plants? (3M)
- (b) A hot water geothermal plant with capacity 20MW, of the total flow type receives water at 225° C. The pressure at turbine inlet is 10 bar. The plant uses a direct contact condenser that operates at 0.5 bar. The turbine has polytrophic efficiency of 85%. Calculate the hot water flow in kg/hr. (4M)
- 5(a) What is community biogas plant? What are the main problems encountered in its operation. (3M)
- (b) Calculate: (i) the heat of combustion of methane in MJ/m³ at STP and (ii) the volume of a biogas digester suitable for the output of four cows. The power available from the digester is 300W. Retention time is 20 days, temperature 30° C, dry matter consumed 2 kg/day, biogas yield 0.24 m³ per kg. Burner efficiency is 60 %, methane proportion is 0.8 (4M)
- 6 (a) How will you estimate the average power produced per unit basin area in simple single basin system? (3M)
- (b) Write short notes on types of electrodes for a fuel cell (3M)

*****END*****