

BITS PILANI, DUBAI CAMPUS
DUBAI INTERNATIONAL ACADEMIC CITY, DUBAI
IV Year I Semester - 2011-2012
Course: BITS C462 RENEWABLE ENERGY
COMPREHENSIVE EXAMINATION [CLOSED BOOK]

Max.Marks: 80

Date: 02-01-2012

Weightage: 40 %

Time: 3 hours

Note: (i) Answer **Part A & B** in **separate** booklets.

(ii) Thermodynamics tables are permitted

(iii) Draw neat sketches wherever necessary

(iv) Assume suitable data wherever necessary

PART A

1a) What is the principle of solar Photovoltaic power generation? What are the main elements of a PV systems: - **[2 Marks]**

b) Determine the average value of solar radiation on a horizontal surface for December 1, at the latitude of 12°N, if constants a and b are given as equal to 0.28 and 0.52 respectively and the ratio

$$\frac{n}{N} = 0.52$$

[8 Marks]

2a) Explain MSW **[3 Marks]**

b) What is the difference between Biomass and Bio Gas **[3 Marks]**

c) What is meant by anaerobic digestion? What are the factors which affect biodigestion?

Explain briefly :-

[3 Marks]

3a) A thermoelectric generator operates between the temperature limits of 923°K and 323.°K . The cross sectional areas and lengths of **n** and **p** type elements are:

$$A_1 = 2.30 \text{ cm}^2, \quad l_1 = 1.50 \text{ cm},$$

$$A_2 = 1.303 \text{ cm}^2, \quad l_2 = 0.653 \text{ cm}.$$

Calculate Optimum efficiency, Overall thermal conductance & Resistance of the generator.

The following properties may be used:

[8 Marks]

Property	n type	p type
Seebeck coefficient (volt/°C)	-190×10^{-6}	190×10^{-6}
Figure of merit (K^{-1})	2.0×10^{-3}	1.8×10^{-3}
Specific Resistivity (ohm-cm)	1.45×10^{-3}	1.7×10^{-3}

b). A H_2-O_2 fuel cell operates at $25^\circ C$. Calculate the voltage output of the fuel cell, the efficiency and the electric work output per mole of H_2 consumed and per mole of H_2O produced. Also compute the heat transferred to the surroundings

$$\text{Given } \Delta H_{25^\circ C}^0 = -285838 \text{ kJ/kg-mole}$$

$$\Delta G_{25^\circ C}^0 = -237191 \text{ kJ/kg-mole}$$

[3 Marks]

- 4) Write short Notes on:
- i) Manufacture of Ethanol
 - ii) Solar Collector Efficiency
 - iii) Production of hydrogen
 - iv) Seebeck Effect

[2.5x4=10 Marks]

PART B

5.a. A open cycle of 160 kW capacity ocean thermal conversion technology plant operates on the parameters given below:

Turbine efficiency: 85%

Warm water temperature: $35^\circ C$

Temperature of vapor entering the turbine: $30^\circ C$

Cold water temperature: $10^\circ C$

Condenser temperature: $15^\circ C$

Assume the isentropic expansion in turbine. Find (i) specific turbine output (ii) mass flow rate of vapor entering the turbine in kg/hour (iii) mass flow rate of cold water entering the condenser in kg/hour and (iv) quality of steam exhausting from turbine.

[7 Marks]

b. Give the comparison of the Open & closed cycle of OTEC systems:-

[3 Marks]

6.a. A wind mill with 3 blade rotor lifts $3.08 \text{ m}^3/\text{hour}$ of water through a head of 26 m when the wind speed is 2.4 m/s. If the tip speed ratio is 10 and it rotates at 60 rpm, calculate the power coefficient.

Assume the following: Transmission efficiency 85%, Pump efficiency 70%, density of water 988 kg/m^3 , density of air 1.222 kg/m^3 .

[7 Marks]

b. What are the main components in Wind Turbine Generator:-

[3 Marks]

7. Classify solar thermal power plants based on working temperature and explain the working principle and construction of solar pond.

[10 Marks]

8. Write short notes of the following:

[3+3+4]

(i) Hot Dry Rock resources

(ii) Bio-fouling (iii) Double-cycle system—energy from tides

BITS PILANI, DUBAI CAMPUS
FIRST SEMESTER 2011 – 2012
RENEWABLE ENERGY BITS C462 (ELECTIVE)
TEST – II (OPEN BOOK)

Date: 13-11-2011; Duration: 50 min.; Maximum Marks: 40, Weightage 20%

Notes:

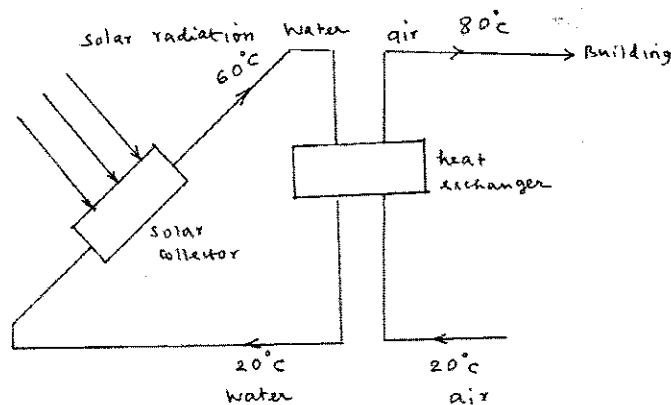
1. Answer all the questions
2. **Hand written Note books and Text book are permitted**
3. Draw neat sketches wherever necessary

Q.1. Prepare a **case study** report based on any survey report on installing Rural Co-operative Power Plant in a village incorporating different power requirements and different Biomass availability. Not single items should be taken from the text book while preparing the report (Marks will not be awarded if the same items are repeated from the text book) **[10Marks]**

Q2. Explain how Photo voltaic cell plays an important role in the different application of solar energy: - **[5Marks]**

Q3. A solar hot air system for a residential building is shown in Fig. Calculate hot water produced in kg per sec and hot air delivered to building in kg per hour. The solar radiation is $5\text{kWh/m}^2\text{-day}$ and collector efficiency and area are 50 % and 100 m^2 respectively. Assume the $C_{p,w} = 1.163\text{ Wh/kg-K}$ and $C_{p,a} = 1.0082\text{ kJ/ kg-K}$.

[10Marks]



Q4.A . Give detail comparison of the performance of single and double flash liquid dominated systems.

[5Marks]

B. In a vapor dominated hydrothermal power plant, 1000 kg / hour of saturated steam is throttled to a lower pressure before it enters the turbine. The steam condition at inlet of turbine is 3 MPa, 350 °C and exhaust pressure is 20 kPa. Assuming the expansion inside the turbine is isentropic process and efficiency is 100 %, calculate **(i)** actual work output of the turbine and **(ii)** the quality the exhaust steam for 70 % of actual work output of the turbine and exit pressure of 30kPa.

[10Marks]

BITS, Pilani –Dubai Campus

Dubai International Academic City, Dubai, U.A.E

IV Year I Semester 2011-2012

Test No.1 (Closed Book)

Course No. BITS C462

Course Title: RENEWABLE ENERGY

Date: 25-09-2011

Max.Marks: 50

Weightage: 25%

Duration: 50 min.

Notes:

- Answer all the questions
- Draw neat sketches wherever necessary
- Make suitable assumptions if required and clearly state them

1A. What is meant by *Non-conventional energy* sources? Explain in brief these energy sources with special reference to Indian context? **[6M]**

B. What are secondary energy sources? Give two examples **[4M]**

2A. What are causes of diffused radiation in solar system? **[4M]**

B. Define the following terms:

- Insolation
- Altitude angle
- Zenith angle
- Slope

[8M]

C. Determine the Local Solar Time, Hour angle and Declination angle at a Mumbai ($23^{\circ} 30' N$, $77^{\circ} 30' E$) at 12.30 IST ON June 1, 2002 AD. Equation of time correction is $(-1^m 01^{s})$ **[8M]**

3A. A wind mill with 3 blade rotor lifts $3.05 \text{ m}^3/\text{hour}$ of water through a head of 25 m when the wind speed is 2.4 m/s. If the width of the blade is 30 cm and solidity is 0.025, calculate the power coefficient. Assume the following: Transmission efficiency 85% , Pump efficiency 70%, density of water 988 kg/m^3 , density of air 1.222 kg/m^3 . **[8M]**

B. Derive the maximum axial force, $F_{x,\max} = \frac{\pi}{9} \rho D^2 V_i^2$ from energy equation **[8M]**

C. Define the terms (i) Solidity and (ii) Tip speed ratio **[4M]**

BEST OF LUCK

BITS PILANI, DUBAI CAMPUS
FIRST SEMESTER 2011 – 2012
QUIZ -II

A

Course Code: BITS C462

FINAL YEAR

Date: 19.12.11

Course Title: RENEWABLE ENERGY

Max Marks: 14

Duration: 20 minutes

Weightage: 7%

Name: ID No: Sec / Prog:

Instructions: 1. Attempt all questions
2. All question carries equal marks

1. The solar radiation intensity at surface of sea is 1345 w/m^2 . Find the solar radiation intensity at 10 m deep very salty water sea.

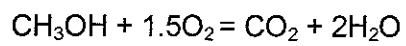
2. Draw the schematic diagram for OTEC closed cycle and name the processes.

3. What is the function of flash separator and purpose of water from deep sea in open cycle?

4. What are the different methods for Hydrogen production?

5. Explain how Hydrogen can be stored?

6. Find the **reversible voltage** for the methanol Fuel Cell having the reaction:



7. Explain the difference between a **fuel cell** and a **battery**

BITS PILANI, DUBAI CAMPUS
FIRST SEMESTER 2011 – 2012
QUIZ -I

A

Course Code: BITS C462

FINAL YEAR

Date: 10.10.11

Course Title: RENEWABLE ENERGY

Max Marks: 16

Duration: 20 minutes

Weightage: 8%

Name: ID No: Sec / Prog:

Instructions: 1. Attempt all questions
2. All question carries equal marks

1. What are the standard materials used as insulation in solar Collector?

2. What are the two main drawbacks of Liquid heating Solar Collector?

3. What are the applications of Air Heaters?

4. Discuss Parabolic Collector

5. Name the four design principles involving in passive system of space heating.

6. "Heated water in flat plate collector, with low density rises and flows into the top of the storage tank." Comment the statement

7. How are power cycles classified in solar thermal electric converter.

8. What are heliostats?