

**BITS, PILANI – DUBAI CAMPUS, ACADEMIC CITY, DUBAI**  
**FIRST SEMESTER 2007-2008**  
**BITS UC462 RENEWABLE ENERGY**

**TEST – 1(CLOSED BOOK)**

**Date: 7-10-2007; Duration: 50 min.; Maximum Marks: 25, Weightage 25%**

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*Notes:*

1. *Answer all the questions*
  2. *Assume any missing data suitably and mention the same at appropriate place in your answer*
  3. *Draw neat sketches wherever necessary*
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1. What are the *Renewable* and *non-renewable* energy sources? Describe briefly:-  
(3 marks)
2. What are the prospects of *Renewable energy* sources in India? (3 marks)
3. What are the advantages and limitations of renewable energy sources? (3 marks)
4. Define the following terms:  
a) Zenith angle b) Declination angle c) Altitude angle d) Latitude angle  
(4 marks)
5. Calculate the angle made by the beam radiation with normal to a flat plate collector, pointing due south located in New Delhi ( $28^{\circ}38'N$ ,  $77^{\circ}17'E$ ) at 9.00 hour, solar time on December 1, The collector is tilted at angle of  $36^{\circ}$  with horizontal  
(6 marks)
6. Calculate the sun set hour angle and day length at location latitude of  $35^{\circ} N$  on February 14  
(6 marks)

**BITS, PILANI – DUBAI,  
INTERNATIONAL ACADEMIC CITY, DUBAI  
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**TEST – 2(OPEN BOOK)**

**Date: 25-11-2007; Duration: 50 min.; Maximum Marks: 20, Weightage 20%**

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*Notes:*

1. *Answer all the questions*
  2. *Assume any missing data suitably and mention the same at appropriate place in your answer*
  3. *Draw neat sketches wherever necessary*
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1. Design a non convective solar pond with 2000sq.m equipped with 20 kW. Describe the suitable solar collector, storage system and extraction of thermal energy from them. (6 marks)
2. Wind at 1 standard atmospheric pressure and 15<sup>o</sup> C temperature has a velocity of 10 m/s. the Turbine has diameter of 120 m and its operating speed in 40 rpm at maximum efficiency. Calculate:
  - a. the total power density in the wind stream,
  - b. the maximum obtainable power density assuming  $\eta = 40\%$  ,
  - c. the total power produced(in kW) and
  - d. the torque and the axial thrust. (5 marks)
3. Make a case study for the energy required for cooking food in a village in India using solar energy discussing the salient features, comparative study with other source of energy:- (5 marks)
4. Compare the source of energy available by Solar and Wind in India:- (4 marks)

RENEWABLE ENERGY BITS UC 462

COMPREHENSIVE EXAMINATION (CLOSED BOOK)

Max. Marks: 40

Date: 31-12-07

Duration: 180 min

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Instructions.

- Answer all the questions.
  - Answer all questions sequentially.
  - Steam tables are allowed
  - Draw neat sketches wherever necessary
  - Make suitable assumptions if required and clearly state them
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1. a. Compare the performance of various types of solar collectors. How is focusing accomplished in paraboloid dish collector ? [3M]  
b. Calculate the Sun's altitude angle and azimuth angle at 7.30 am solar time on August 1 for a location at  $40^{\circ}$  north latitude. [3M]
2. a. Discuss in details the operation and control of a wind Turbine. How are the variations of wind velocity and its directions are taken care ? [3M]  
b. A 10 m/s wind is at 1 standard atmosphere and  $15^{\circ}\text{C}$ . Calculate:
  1. The total power density in the wind stream
  2. The maximum obtainable power density
  3. A reasonably obtainable power density
  4. Total power produced if the turbine diameter is 120 m. [4M]
3. a. Classify various types of biogas generators. Describe a community type Gobar Gas plant developed by Khadi and village Industries Board of India. Also list the requirements for its operations; [4M]  
b. Calculate (i) the volume of a bio gas digester suitable for the output of four cows and (ii) the power available from the digester. Retention time is 20 days, temperature  $30^{\circ}\text{C}$ , dry matter consumed 2 kg/day, biogas yield  $0.24\text{m}^3$  per kg. Burner efficiency is 60 %, methane proportion is 0.8. Hm the heat of combustion of methane may be assumed to be  $28\text{Mj/m}^3$  at STP. [4M]

- 4.a. Explain a closed cycle OTEC plant with help of a diagram. [3M]
- b. The basin area of a tidal power plant is  $20 \times 10^6 \text{ m}^2$ . the tidal range is 8 m, calculate the energy generated in Kwh. [3M]
- 5.a. Compare the following systems
- (1) Hydrothermal systems
  - (2) Geopressured system
  - (3) Petrothermal system [3M]
- b. 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 polytropic efficiency is 0.82 and the turbine-generator combined mechanical efficiency is 0.9. The cooling tower exist is at  $20^\circ\text{C}$ . Calculate the necessary steam flow, the cooling water flow and the plant efficiency and the heat rate if reinjection occurs prior to cooling tower. [4M]
- 6.a. Explain the design and principle of operation of a fuel cell [2M]
- b. What do mean by green house ? [2M]
- c. Write a notes on Solar cooking:- [2M]

GOOD LUCK