Bengal Engineering & Science University, Shibpur
Semester Examination, 2011
B. E.(ETC) 7th Semester
Subject: Non-Conventional Energy System (ET 706/2)

Time: 3 hrs.                                                      F. M.: 70

Answer question 1 and any four from rest; All questions are of equal value.

1.  Write down only the expressions for the following with defined symbols:
    (i)     Solar Constant
    (ii)    Overall efficiency of a PV System
    (iii)   Efficiency of a Solar Dryer
    (iv)    Minimum distance of separation between rows of a solar collector array.
                                                               (4+4+3+3)

2.  a. What is the role played by Thermopiles with respect to the operation of a Pyrheliometer? Mention typical values of thermopile sensitivity and output impedance of the pyrheliometer.
    b. Draw a neat labeled sketch for a brief explanation of the principle of operation of an Angstrom Pyrheliometer
    c. Why does a standard Pyranometer use shading rings?
                                                               (6+6+2)

3.  a. Classify solar cells according to :
    (i)     Active semiconductor materials (ii) Device Structure
    Also indicate the state of the art efficiencies for above categories of solar cells.
    b. Following are the electrical characteristics of a PV Module(consisting of 36 Nos. of 4 inch diameter solar cells)
        $I_{SC}$ =2.0 Amp, $I_m$=1.65 Amp
        $V_{oc}$=18.0 volts, $V_m$ = 15.5 volts
    under standard Test Conditions(STC). Estimate the value of Fill-Factor(F.F.) and power conversion efficiency of the module.
    c. Is it possible to estimate the F.F. and efficiency of the same module at any non standard condition?
                                                               (6+6+2)

4.  a.  Draw a neat labeled sketch to explain the principle of operation of Solar Ponds.
    b.  Draw only a neat sketch of a closed loop SWHS and indicate briefly the roles of :
    (i) Coil Type Heat Exchange in the secondary circuit
    (ii) Differential Temperature Controller(DTC)
                                                               ( 10+4)

5. a. Draw a neat block diagram of a PV-Hybrid Energy System and indicate the particular merits over a standalone system.

b. Give three/four examples of Hybrid Energy Systems.

c. The following data is available from a designer's note book pertaining to PV array installation at Bhubaneswar in the month of November:

(i) $E_L$= 38.3 kwh/day (ii) I= 5.14 Kwh/$m^2$/day (iii) S=0.42 (iv) $n_{ov}$= 5.0%. Estimate required number of 30 peak-watt PV modules for configuring the array.

(4+3+7)

6. i)) Indicate why Wind Energy Conversion is regarded as an indirect form of utilization of Solar Energy.

ii) How Wind Mapping & Wind roses are of use to the designer of WECS?

iii) Define all the figures of merit pertaining to a WECS and sketch(two graphs only) the inter-relation between these parameters also.

(2+4+8)

7. a. Starting from the power–velocity sketch in a HAWT, deduce the expression for (i) Maximum power from a flowing cross-section of wind (ii) Maximum axial thrust on the Turbine blades.

b. Why is sea-water considered as a suitable platform for generating Ocean thermal Energy?

c. Mention only the suitable materials used for

(i) Turbine Blades of a HAWT

(ii) Body of the Heat Exchanger in OTEC Systems

(8+4+2)

8. Write a clear technical note on (Any Two):

i) Role of Power Conditioner in various PV Systems (ii) Mobile Solar PV charger (iii) Solar Air Heaters (iv) Tidal Energy.

(7x2)