Total number of printed pages – 6 B. Tech
PEMR 8407

Eighth Semester Examination – 2008 RENEWABLE ENERGY SOURCES AND APPLICATIONS

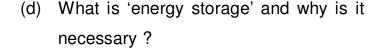
Full Marks - 70

Time: 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

- 1. Answer the following questions: 2×10
 - (a) What do you mean by "Energy Yield Ratio"?
 - (b) Write a short note on the common forms of energy.
 - (c) What is 'Beam radiation', 'Diffuse radiation', 'Air mass' and 'Global radiation'?



- (e) Write a note on variation of wind speed with height.
- (f) What are the limitations of Tidal Energy?
- (g) Write a short note on 'wave devices'.
- (h) Write about the various applications of fuel cell.
- (i) Comment on use of Hydrogen as energy carrier.
- (j) Write a short note on 'Bio-Diesel'.
- (a) Explain the working of the instruments required for the collection of solar radiation data.
 - (b) Calculate the angle of incidence on a horizontal plane surface at Cuttack at 12:50 Hrs (1st), on March 21, in a leap year. The longitude and latitude of Cuttack are 85°54′E and 20°28′N respec-

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tively. The standard longitude of 1st is 81°44′E.

The following formula, having their usual connotations, may be used:

- (i) $B = \frac{360}{364} (n 81)$
- (ii) $E=9.87 \sin 2B 7.53 \cos B 1.5 \sin B$
- (iii) Solar time=Standard time $\pm (L_{st} L_{loc}) + E$
- (iv) $\omega = [Solar time 12.00] hrs \times 15^{\circ}$
- (v) $\delta = 23.45 \times \sin \left[\frac{360}{365} (284 + n) \right]$
- (vi) $\cos \theta_i = [\cos \phi.\cos \beta + \sin \phi.\sin \beta.\cos \gamma].$ $\cos \delta.\cos \omega + \cos \delta.\sin \omega.\sin \beta.\sin \gamma + \sin \delta$ $[\sin \phi.\cos \beta - \cos \phi.\sin \beta.\cos \gamma].$
- On what basis energy storage systems are classified? Can energy available in one form be stored in another form? Explain briefly.

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- (a) Explain the terms 'Beanfort scale' and 'wind rose'.
 - (b) A HAWT has the following data :Speed of free wind at a height of 10 m

Pressure is 1 std atmosphere i.e., $1.01325 \times 10^5 \text{ Pa}$

Ambient temperature is 15°C

For air, the gas constant R = 287 J/kgk

 $\alpha = 0.13$

= 14 m/s

Height of tower = 110 m

Diameter of rotor = 85 m

Downstream wind velocity is 0.45 times that of upstream wind

Find:

- (i) Power available in the wind
- ii) Power extracted by the turbine

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- (iii) Axial force on the turbine
- (iv) Axial force on the turbine
 - (a) When maximum power is extracted, and
 - (b) When the blade stalls completely and no power is extracted.
- (a) Write a note on origin and nature of TidalEnergy.
 - (b) Derive an expression for Tidal power generation potential with single filling or emptying of a basin.6
- Show that power in waves is directly proportional to the square of amplitude and to the period of wave for ocean waves.

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- Describe the various classifications of fuel cells.
- What are the various Bio-mass conversion technologies presently used?

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