MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EC- 802C

RENEWABLE ENERGY

Time Allotted:3 Hours *Full Marks* 70

The figures in themargin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for *any ten* of the followings: 1×10=10

(i) Name of the instrument to measure Sun radiation
- (a) Pyranometer
- (b) Sunshine recorder
- (c) Pyrheliometer
- (d) All of these

(ii) Name of the instrument to measure Wind speed
- (a) Anemometer
- (b) Wind recorder
- (c) Air reader
- (d) None of these

(iii) According to Betz criterion, maximum power extraction from wind occurs when interference factor is
- (a) 1
- (b) 1/2
- (c) 1/3
- (d) 0

(iv) For Silicon solar cell maximum wavelength of incident photon is required to produce electron-hole pair
- (a) 0.3 um
- (b) 1.1 um
- (c) 0.7 um
- (d) 10 mm

(v) The voltage of a single solar cell is
- (a) 0.5 V
- (b) 1 V
- (c) 1.1 V
- (d) 5 W

(vi) Nominal Power rating of typical single PV cell when exposed to full sunlight is
(a) 1.5 W (b) 0.33W
(c) 2.5W (d) 1.33W

(vii) For a high temperature range which fuel cell will generally be used?
(a) Solid oxide (b) Hydrogen-Oxygen
(c) Molten carbonate (d) Fossil fuel cell

(viii) India receives an annual intensity of solar radiation between
(a) 16,700-29,260J/m^2/day (b) 16,700-29,260 kJ/m^2/day
(c) 16,700-29,260 J/m/day (d) 16,700-29,260 kJ/day.

(ix) A geothermal field may yield
(a) dry steam (b) wet steam
(c) hot air (d) all of these

(x) Tidal energy utilises
(a) kinetic energy of water. (b) potential energy of water.
(c) both kinetic and potential energies of water. (d) none of these.

(xi) The greenhouse gas is
(a) Carbon dioxide (b) Nitrous oxide
(c) Methane (d) all of these

(xii) An illuminated solar cell is
(a) constant voltage device. (b) constant current device.
(c) constant power output device. (d) none of these.

Group – B
(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Describe the principle of solar PV energy conversion.
3. State the reasons for formation of Tides with suitable diagram.
4. Explain the types of generators used with wind turbines for producing electricity.
5. (a) Assuming that each of the single Crystal Silicon Solar Cell delivers an open circuit voltage of 600mV under STC, estimate the actual open circuit voltage of a non-standard module containing 18 identical interconnected cell at an ambient temperature 40°C. 3
   (b) What is earth's albedo? 2
6. (i) Define (a) Wind Shear (b) Gradient Height 2
   (ii) Explain the Teetering of rotor of a wind turbine. 3
7. Define the local apparent time (L.A.T.). Determine L.A.T. corresponding to 1430h (IST) at Bombay (19°07′N, 72°51′E) on JULY 1st. In India, standard time is based on 82°50′E. 2+3

Group – C

(Long Answer Type Questions)

Answer *any three* of the following. 15x3=45

8. (a) A wind energy generator generates 1600w at rated speed of 7 m/s at atmospheric pressure and temperature 20°C. Calculate the power generated and the change in output if the wind generator is operated at an altitude of 1750m, temperature 11°C, wind speed 8.5 m/s and air pressure 0.9 atmosphere.

(b) Briefly explain the main factors governing the selection of site for a wind turbine generating system and indicate the environmental impacts of wind turbine generating system. 6

9. (a) What is geothermal energy?

(b) What are the environmental impacts of geothermal energy?

(c) What are the main limitation in the development of tidal energy?

(d) What are the major application of geothermal energy? 3+4+5+4

10. Discuss on spectral energy distribution of solar radiation with the help of a suitable diagram. Discuss on depletion of solar radiation. How is electrical power produced by distributed collector solar thermal electrical power plant? Discuss how solar energy is transferred into electrical energy in solar PV cell. What do you mean by CR of collector? Discuss on fixed mirror solar collector.

11. (i) Define the following with proper expression: Tilt factor for both beam & diffuse radiation, Declination angle.

(ii) How the efficiency of a flat plate collector can be enhanced by booster mirror?

(iv) Calculate the angle of incidence or beam radiation with the normal to a collector (FPC) on December 1 at 9000h. The collector is located in New Delhi (28°35′N, 77°12′E) and is tilted at an angle of 36° with the horizontal plane and is pointing due south. 5+3+7

12. (a) Calculate the volume of a fixed dome type biogas digester for the output of two cows. Also, Calculate the thermal power available from the biogas. Use the following data:

Retention time – 30 days

Dry matter produced – 2 kg / day/ cow

Biogas yield – 0.22 m^3/kg of dry matter

Percentage of dry matter in cow dung – 18%

Density of slarry – 1090 kg/m^3

Burner efficiency – 60%

Heating valve of bio gas – 23 MJ/m^3

(b) Explain the basic principle of wave energy. 4

(c) Describe about the selection of site for harnessing wind energy. 4