

Total No. of printed pages = 4

**EE 1817 PE 42**

Roll No. of candidate

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2022

BINA CHOWDHURY CENTRAL LIBRARY  
(GIMT & GIPS)  
Azara, Hatkhowapara,  
Guwahati - 781017

**B.Tech. 7<sup>th</sup> Semester End-Term Examination**

**EE**

**RENEWABLE ENERGY SOURCES**

**(New Regulation (w.e.f 2017 – 2018) &**

**New Syllabus (w.e.f 2018 – 2019)**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks  
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)
- (i) Which of the following is a non-renewable energy source
- (a) coal (b) solar
- (c) geothermal (d) tidal
- (ii) What type of radiation does earth emit?
- (a) UV (b) Visible
- (c) Infrared (d) Longitudinal
- (iii) What are three relevant bands of solar radiation?
- (a) UV, infrared and far infrared
- (b) UV, visible and infrared
- (c) Ultrasonic, infrared and visible
- (d) UV, ultrasonic and near-infrared

[Turn over

- (iv) In a wind turbine, if the velocity of wind is doubled within the operating range, the power output will be
- (a) six times (b) eight times  
(c) doubled (d) reduced to half
- (v) Compared to a conventional steam plant, the temperature and pressure in a geothermal plant are
- (a) comparable (b) much higher  
(c) higher (d) lower
- (vi) Biogas is predominantly
- (a) hydrogen (b) carbon monoxide  
(c) carbon dioxide (d) methane
- (vii) The minimum tidal range required for power generation is about
- (a) 1 m (b) 5 m  
(c) 10 m (d) 20 m
- (viii) Wave energy is basically harnessed in the form of
- (a) thermal energy (b) chemical energy  
(c) mechanical energy (d) electrical energy
- (ix) A fuel cell is basically
- (a) an electromechanical energy conversion device  
(b) an electro-static energy conversion device  
(c) an electrochemical energy conversion device  
(d) a thermos-electric conversion device
- (x) An MPPT is basically
- (a) a dc-dc switching regulator (b) an ac-dc converter  
(c) a dc-ac inverter (d) an amplifier

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2. (a) Define declination angle hour angle, zenith angle, solar azimuth angle and angle of incidence. (10)
- (b) Calculate the number of daylight hours (day length) at Guwahati on 21<sup>st</sup> June and 21<sup>st</sup> December in a leap year. The latitude of Guwahati is 26.1445°N. (5)
3. (a) Classify different types of solar thermal collectors with neat sketches. Write the advantages of concentrating collectors over the flat-plate types of solar collector. (7)
- (b) Derive the mathematical expression for efficiency of a flat-plate solar thermal collector. (8)
4. (a) Derive an expression for efficiency and power produced by PV cells. Write the various factors affecting the performance of the cell. (7)
- (b) Calculate the open-circuit voltage of a silicon solar cell at 47°C if short circuit and reverse saturation currents are given as 2 A and 10 nA respectively. (8)
5. (a) Derive an expression for energy available in the wind. (7)
- (b) A two-blade HAWT is installed at a location with free wind velocity of 20 m/s. The rotor diameter is 30 m. What rotational speed should be maintained to produce maximum output? (8)
6. (a) What is the source of tidal energy? What do you understand by spring and neap tides? (7)
- (b) A deep ocean wave of 2 m peak to peak appears at a period of 8 s. Find the wavelength, phase velocity and power associated with the wave. At this power rate, what is the average annual wave energy in MWh/m. (8)

7. Write short notes on any *three* of the following.

(3 × 5 = 15)

- (a) Solar Still
- (b) Ocean Thermal Energy Conversion Technology
- (c) Geothermal energy
- (d) Biomass
- (e) Fuel cell

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