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Q.4

#### **GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016** Date:06/01/2017 Subject Code: 2712109 Subject Name: Renewable Energy Engineering Time: 2:30 pm to 5:00 pm **Total Marks: 70** Instructions: 1. Attempt all questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks. 07 (a) Define for solar application Insolation, aperture area, concentration ratio, optical efficiency, tau-alpha product, thermal efficiency, instantaneous collector efficiency. State basic principle of OTEC and explain the closed cycle OTEC plant (b) 07

- Q.2 Discuss the site selection criteria for installation of WTGs. What are the (a) 07 environmental aspects of installing WTGs.
  - Explain the principle of photovoltaic cells. Define and draw cell, module, (b) 07 array and array field.

### OR

- Explain the terminologies related to wind energy: (b) 07 Hub Height, Swept Area, Wind farm, Cut-in speed, Cut-off speed, angle of attack, camber
- Q.3 07 (a) Define incidence angle. From the general expression of incidence angle, write expression for (i)vertical surface, (ii)horizontal surface, (iii)vertical surface facing south. The general expression for incidence angle is  $\cos\theta = \sin\delta \sin\phi \sin\beta - \sin\delta \sin\phi \sin\beta \cos\gamma + \cos\delta \cos\phi \cos\beta \cos\omega + \cos\delta$  $\sin\phi \sin\beta \cos\gamma \cos\omega + \cos\delta \sin\beta \sin\gamma \sin\omega$ where,  $\theta$  is incidence angle,  $\delta$  is declination angle,  $\phi$  is latitude,  $\beta$  is slope,  $\gamma$  is azimuth angle,  $\omega$  is hour angle.
  - (b) Define solar constant. Deduce the value of solar constant and radiation 07 emitted by sun, if diameter of sun is 1.39 x 109 m, mean sun-earth distance is 1.495 x 1011 m, diameter of earth is 1.275 x 107 m. Assume the Stefan-Boltzmann constant and sun appropriate surface temperature.

# OR

Determine zenith angle, solar altitude angle at 11 am solar time at a 07 0.3 (a) location 48N on 21<sup>st</sup> January. 07

Give an overview of India's energy consumption/ utilization pattern. (b)

- What are the materials used for biogas generation? (a)
- (b) What are the industrial applications of hydrogen? What are the 07 disadvantages of using hydrogen as fuel?

## OR

- Discuss enzymatic hydrolysis and anaerobic fermentation Q.4 (a)
  - What are the main features of biogas plant (write on any one: batch type or 07 (b) continuous type)?
- Q.5 (a) Differentiate: fuel cell and battery, regenerative fuel cell and rechargeable 07 (secondary) battery, low temperature and high temperature fuel cell.
  - What is gasifier? Explain the applications of gasifier. Discuss the problems (b) 07 in development of gasifier.

# OR

- Q.5 Discuss with a neat sketch, various components of Wind energy (a) 07 conversion system
  - (b) Discus with sketch any one arrangement for wave power generation. 07

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