

Reg. No.	R	A	1	9	1	1	0	0	9	0	1	0	0	9	3
----------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

B.Tech. DEGREE EXAMINATION, MAY 2022
Fifth, Sixth and Seventh Semester

18EEO301T – SUSTAINABLE ENERGY

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:

- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

- | | Marks | BL | CO | PO |
|--|-------|----|----|----|
| 1. Select the process by which solar energy is used to evaporate water and collect its condensate within the same closed system.
(A) Solar distillation (B) Solar condensation
(C) Solar evaporation (D) Solar cooling | 1 | 1 | 1 | 1 |
| 2. What is the rate of solar energy reaching the earth surface?
(A) 1016 W (B) 865 W
(C) 2854 W (D) 1912 W | 1 | 1 | 1 | 1 |
| 3. Identify the meter which is used to measure the solar beam radiations
(A) Pyrheliometer (B) Anemometer
(C) Thermometer (D) Sunshine recorder | 1 | 1 | 1 | 1 |
| 4. _____ is a point on the celestial sphere directly over the observer's head.
(A) Nadir (B) Zenith
(C) Visible horizon (D) Azimuth angle | 1 | 1 | 1 | 1 |
| 5. Select the maximum percentage efficiency obtained from the thin film solar panels.
(A) 14% (B) 16%
(C) 12% (D) 20% | 1 | 1 | 1 | 1 |
| 6. How does the output power vary between cut-in speed and the rated speed?
(A) Cubically (B) Linearly
(C) Square (D) Exponential | 1 | 1 | 2 | 1 |
| 7. Which of the following are the limits of the range of wind speeds for which the turbines are designed?
(A) Elasticity (B) Threshold voltage
(C) Networking (D) Cut-in speed and cut-out speed | 1 | 1 | 2 | 1 |

8. Indicate the function of grid side converter in wind energy conversion system. 1 1 2 1
 (A) To ensure operation at low power factor (B) To control generator in terms of reactive power
 (C) To control generator in terms of active power (D) To control the DC-link voltage
9. What happens to the output power when the wind turbine blades rotate faster for the entire operation time? 1 1 2 1
 (A) The output power first increases then decreases (B) The output power first decreases then monotonically increases
 (C) The output power decreases (D) The output power increases
10. Select the speed type which is the most flexible in terms of the generator used in wind energy conversion system 1 1 2 1
 (A) Full variable (B) Limited variable
 (C) Half variable (D) Fixed
11. The by-products that are produced during rectification of bio ethanol is used as 1 1 3 1
 (A) Pig feed (B) Cow feed
 (C) Dog feed (D) Sheep feed
12. Which of the following forestry materials can be used as biomass? 1 1 3 1
 (A) Fish oil (B) Logging residues
 (C) Tallow (D) Manure
13. List out the two processes under bio-chemical conversion 1 1 3 1
 (A) Photosynthesis and respiration (B) Photosynthesis and photovoltaic
 (C) Anaerobic digestion and fermentation (D) Anaerobic digestion and photosynthesis
14. Which of the following is a product of pyrolysis of biomass? 1 1 3 1
 (A) Steel (B) Producer gas
 (C) Agricultural residue (D) Sodium
15. Bio ethanol is denatured alcohol that is also called as 1 1 3 1
 (A) Ethylene (B) Methylated spirit
 (C) Ethylene glycol (D) Methylene
16. Name the type of turbine which is commonly used in tidal energy 1 1 4 1
 (A) Francis turbine (B) Kalpan turbine
 (C) Pelton wheel (D) Gorloy turbine
17. What type of tide is it if the difference between high and low tide is greatest? 1 1 4 1
 (A) Diurnal tide (B) Neap tide
 (C) Spring tide (D) Ebb tide

27. a. Prove that maximum power is generated from ideal horizontal axis wind turbine system is equal to $P_{\max} = \frac{8}{27g_c} \rho A V_i^3$. 10 2 2 1

(OR)

- b. Calculate the total power density, maximum obtainable power density and the total power generated in a propeller type wind turbine for a wind at 1 standard atmospheric pressure and 15°C. Wind velocity is 15 m/s, turbine diameter is 120 m and turbine operating speed is 40 rpm at maximum efficiency. Consider air density as 1.226 kg/m³. 10 2 2 1

28. a. With neat sketch, explain how the energy is generated using two stage digestion process. Also summarize the advantages of fixed dome type plant. 10 1 3 1

(OR)

- b. Define anaerobic digestion, explain the constructional detail and working of KVIC digester. 10 1 3 1

29. a. Describe the construction and working of closed cycle thermal power plant with neat diagram. Distinguish between closed and open cycle OTEC system. 10 1 4 1

(OR)

- b. Discuss in detail about the working of single basin single effect type tidal power plant with neat sketch. Write the limitation of double basin type tidal power plant. 10 1 4 1

30. a. Describe the construction and principle of operation of an alkaline fuel cell and phosphoric acid fuel cell with neat diagrams. 10 1 5 1

(OR)

- b. Describe the principle of working of a fuel cell. With reference to $H_2 - O_2$ cell. Write some of the applications of fuel cell. 10 1 5 1

* * * * *