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B.Tech. DEGREE EXAMINATION, DECEMBER 2022

Fourth and Fifth Semester

18EEO301T – SUSTAINABLE ENERGY

(For the candidates admitted from the academic year 2020-2021 and 2021 -2022)

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. Diffused radiation (A) Has no unique direction (B) Has an unique direction (C) Has short wavelength as compared to beam radiation (D) Has larger magnitude as compared to beam radiation	1	1	1	1
2. What is the standard value of solar constant? (A) $1kW.m^2$ (B) $1.367\ kW/m^2$ (C) $1.5kW.m^2$ (D) $5kWm^2$	1	1	1	1
3. A vertical angle between suns rays and a line perpendicular to the horizontal plane through the pint is _____ (A) Zenith angle (B) Solar azimuth angle (C) Hour angle (D) Altitude angle	1	1	1	1
4. A typical open circuit voltage of a solar cell is (A) 12 V (B) 1 V (C) 1.5 V (D) 0.5 V	1	1	1	1
5. In India the standard meridian crosses_____ (A) Delhi (B) Calcutta (C) Mumbai (D) Alagabhat	1	1	1	1
6. The maximum theoretical power coefficient of a wind turbine is (A) 0.35 (B) 0.59 (C) 0.65 (D) 0.95	1	1	2	1
7. Wind turbine intended for generating substantial amount of power should have (A) Small rotor and be located in area of high wind speeds (B) Less diameter of rotor (C) Large rotor diameter and be mounted on the lower tower (D) Large rotor and be located in areas of high wind speed	1	1	2	1

8. Darrieus type wind turbine is an example of 1 1 2 1
   (A) Vertical axis wind turbine (B) Horizontal axis wind turbine
   (C) Radial turbine (D) Axial wind turbine

9. How does the output power vary between cut in speed and the rated speed? 1 1 2 1
   (A) Cubically (B) Square
   (C) Linearly (D) Exponentially

10. A wind turbine extracts maximum power from wind when the downstream wind speed reduces to 1 1 2 1
   (A) One third that of upstream wind (B) Half that of upstream wind
   (C) Two third that of upstream wind (D) Zero

11. The composition of carbon dioxide in biogas is 1 1 3 1
   (A) $(10-30)\%$ (B) (35-65)%
   (C) (70-80)% (D) (0-5)%

12. Which among the following is not an essential part of for anaerobic digestion? 1 1 3 1
   (A) High temperature (B) Oxygen
   (C) pH value (Acidic) (D) Uniform feed rate

13. _____is a process of temperature decomposition of organic material in the absence of oxygen. 2 1 3 1
   (A) Pyrolysis (B) Energy forming
   (C) Photosynthesis (D) Cofiring

14. Biodiesel is 1 1 3 1
   (A) Obtained from fermentation of sugars (B) Obtained from pyrolysis process
   (C) Exudates of plants (D) An upgraded vegetable oil

15. Liquefiction of biomass is carried out at 1 1 3 1
   (A) High temperature and low pressure (B) Relatively low temperature and high pressure
   (C) Relatively low temperature and normal pressure (D) Room temperature and high pressure

16. Difference in water levels between consecutive high tide and low tide is 1 1 3 1
   (A) Tidal movement (B) Tidal range
   (C) Tidal basin (D) Ebb tide

17. The kinetic energy that results from the oscillation of water is called 1 1 3 1
   (A) Wave energy (B) Tidal energy
   (C) Ocean thermal energy (D) Hydro energy

18. Compared to an open cycle system a closed cycle OTEC system 1 1 4 1
   (A) Has higher working pressure in boiler/turbine and lower specific volume of working fluid (B) Has lower working pressure in boiler/turbine and higher specific volume of working fluid

(C) Has higher working pressure in boiler/turbine and higher specific volume of working fluid

(D) Has lower working pressure in boiler/turbine and lower specific volume of working fluid

19. In trophic regions the ocean surface temperature may be as high as — 1 1 4 1
(A) 80°C
(B) 40°C
(C) 17°C
(D) 27°C

20. The minimum temperature difference between source and sink required by a practical heat engine is — 1 1 4 1
(A) 540°C
(B) 120°C
(C) 10°C
(D) 20°C

21. Which fuel cell has the lowest operating temperature? — 1 1 5 1
(A) PAFC
(B) PEMFC
(C) SOFC
(D) MCFC

22. For proper operation of a fuel cell the operating point is set in which region of the VI characteristics — 1 1 5 1
(A) In the low load region
(B) In the middle near flat region
(C) In the high load region
(D) In any region irrespective of load

23. Hydrogen can be used — 1 1 5 1
(A) As primary energy source only
(B) As an energy carrier only
(C) Both as primary energy source as well as energy carrier
(D) Neither as primary energy source nor as energy carrier

24. The most mature technology available for hydrogen storage is — 1 1 5 1
(A) Liquid hydrogen storage at low temperature
(B) Metal hydride
(C) Carbon nano tubes
(D) Compressed hydrogen gas in steel tank or cylinder

25. Which one of the following is supplied to the cathode of a fuel cell? — 1 1 5 1
(A) Hydrogen
(B) Nitrogen
(C) Oxygen
(D) Chlorine

PART – B (5 × 10 = 50 Marks) — Marks BL CO PO
Answer **ALL** Questions

26. a. A solar cell having an area of 100 cm^2 gives 3.1 A current at maximum power point and 0.5 V at maximum power at STC. The cell gives 3.5 A. short circuit current and 0.6 V open circuit voltage. What is the maximum power point of the solar cell? Also, find out the efficiency of the cell. — 10 3 1 2

(OR)

b.	Explain the solar grid connected photovoltaic system for large scale power plant.	10	2	1	1
27. a.	Prove that the maximum power is generated from ideal horizontal axis wind turbine system is equal to $P_{max} = \frac{1}{2}[0.59]\rho AVi^3$.	10	1	2	1
	(OR)				
b.	With neat sketch, explain the types of generators used in HAWT.	10	1	2	1
28. a.	With neat sketch, explain how the power is generated in variable dome type gas plant.	10	1	3	1
	(OR)				
b.	With neat sketch, explain the various types of biomass plant.	10	1	3	1
29. a.	Draw and explain with neat sketch about single basin tidal power plant.	10	1	4	1
	(OR)				
b.	Explain about the ocean thermal energy conversion with neat sketch.	10	1	4	1
30. a.	Describe with a neat sketch the fuel cell power plant.	10	1	5	1
	(OR)				
b.	Write short notes on				
	(i) Challenges and trends in fuel cell	5			
	(ii) Applications of fuel cell	5	1	5	1

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