Reg. No.

B.Tech. DEGREE EXAMINATION, MAY 2024

Sixth Semester

18AUO102T – RENEWABLE SOURCES OF ENERGY

(For the candidates admitted from the academic year 2018-2019 to 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 & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO
1. Identify the factor responsible for regulating wind turbine speed for optimal energy output (A) Wind adjustment (B) Pitch control (C) Turbine alignment (D) Yaw control	1	1	1	1
2. Select the approximate value of the cut in speed for most modern wind turbines. (A) 2 – 4 mph (B) 5 – 9 mph (C) 9 – 10 mph (D) 11 – 13 mph	1	1	1	1
3. The used for an anemometer used in the wind turbine is to (A) Measure wind direction (B) Measure wind speed (C) Adjust turbine orientation (D) Monitor bladder rotation	1	1	1	1
4. If wind speed doubles, how does it affect wind turbine power output according to the power generation formula? (A) It quadruples (B) It triples (C) It doubles (D) It increases by eight times	1	1	1	1
5. Select the material serving as the semiconductor in solar PV modules (A) Silicon (B) Aluminum (C) Copper (D) Head	1	1	2	1
6. The function of the anti-reflective coating on solar PV modules is _____ (A) To reduce the absorption of sunlight (B) To increase the reflection of sunlight (C) To decrease the reflection of sunlight (D) To increase the absorption of sunlight	1	1	2	1
7. Which collector type is most cost-effective for pool heating in sunny regions? (A) Evacuated table collector (B) Concentrating dish collector (C) Flat-plate collector (D) Parabolic trough collector	1	1	2	1

8. Identify the type of collector suitable for applications requiring high temperatures, such as in power generation. 1 1 2 1

(A) Flat-plate collector (B) Air collector
(C) Parabolic trough collector (D) Liquid collector

9. Select the type of geothermal resource that demands water injection to enhance heat extraction 1 1 3 1

(A) Hydrothermal (B) Enhanced Geothermal Systems (EGS)
(C) Biomass (D) Geopressured

10. Choose the depth range characterizing geothermal wells. 1 1 3 7

(A) 100 – 500 meters (B) 500 – 1000 meters
(C) 1000 – 3000 meters (D) 3000 – 5000 meters

11. Identify the turbine that is commonly used in low head hydropower installations. 1 1 3 1

(A) Pelton turbine (B) Kaplan turbine
(C) Francis turbine (D) Cross flow turbine

12. How does a pumped storage hydropower plant operate during periods of low electricity demand? 1 1 3 1

(A) It generates electricity and stores excess energy in batteries (B) It uses surplus electricity to pump water from a lower reservoir to a higher reservoir
(C) It shuts down operations until demand increases (D) It releases stored water to generate electricity

13. State the typical thermodynamic cycle employed in Ocean Thermal Energy Conversion (OTEC) plants. 1 1 4 1

(A) Carnot cycle (B) Rankine cycle
(C) Brayton cycle (D) Stirling cycle

14. How does the efficiency of a wave energy converter vary with wave period? 1 1 4 7

(A) Efficiency increases with longer wave periods (B) Efficiency decreases with longer wave periods
(C) Efficiency remains constant regardless of wave periods (D) Efficiency is not affected by wave period

15. Identify the gasifier type characterized by a downward flow of biomass and upward flow of gas 1 1 4 1

(A) Downdraft gasifier (B) Updraft gasifier
(C) Cross draft gasifier (D) Fluidized bed gasifier

16. Which of the following factors contributes to the formation of tar in a gasifier? 1 1 4 1

(A) High oxygen to feedstock ratio (B) Low moisture content in the feedstock
(C) Short residence time in the gasifier (D) Presence of contaminants in the feedstock

17. State the physical principle behind thermoelectric generator operation 1 1 5 1

(A) Seebeck effect (B) Peltier effect
(C) Joule-Thomson effect (D) Faraday's law

18. Which of the following factors is crucial for improving the performance of thermoelectric generators? 1 1 5 1

(A) Thermoelectric material with higher seebeck coefficients (B) Increasing thickness of thermoelectric materials
(C) Decreasing the temperature gradient across the thermoelectric material (D) Reducing the electrical conductivity of thermoelectric materials

19. Identify the vital parameter for optimizing MHD engine efficiency 1 1 5 1

(A) Magnetic field strength (B) Fluid velocity
(C) Temperature gradient (D) Electrical conductivity of the working fluid

20. Name the fuel cell type most suitable for Combined Heat and Power (CHP) applications. 1 1 5 1

(A) Solid Oxidic Fuel Cell (SOFC) (B) Alkaline Fuel Cell (AFC)
(C) Phosphoric Acid Fuel Cell (PAFC) (D) Direct Methanol Fuel Cell (DMFC)

PART – B (5 × 4 = 20 Marks) Marks BL CO PO
Answer **ANY FIVE** Questions

21. Evaluate the functions of cut-in and cut-off speeds in wind turbines and assess their significance in the design process. 4 2 1 1

22. Differentiate between zenith angle, solar altitude angle and azimuth angle. 4 2 2 7

23. Enumerate the factors to be considered for selecting a solar thermal collector for a specific application. 4 4 2 1

24. Elucidate the concept of head and its relevance in hydropower generation. 4 2 3 1

25. Explain the two thermodynamic cycles commonly employed in ocean energy conversion. 4 2 3 1

26. Describe the factors influencing biogas yield in anaerobic digestion processes. 4 4 4 7

27. Distinguish between an MHD accelerator and an MHD engine based on their operational principles. 4 2 5 1

PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Derive the equation to calculate the total power conversion to coefficient and effective power output in the context of wind energy conversion.	12	4	1	1
	(OR)				
b.	Write concise explanations for the following parameters concerning wind energy conversion		2	1	1
	(a) Tip speed ration	3			
	(b) Forces experienced by a wind turbine	3			
	(c) Wind power density	3			
	(d) Lanchester – Betz limit	3			
29. a.	Elucidate the concept of Concentrating Photo Voltaic (CPV) systems and outline their potential benefits compared to conventional solar thermal collectors.	12	4	2	1
	(OR)				
b.	Derive the equation to determine the efficiency of a flat plane collector and explain the factors influencing it.	12	4	2	1
30. a.	Explain the various types of turbines employed in hydropower plants and their respective applications.	12	4	3	1
	(OR)				
b.	Compare geothermal and hydropower energy sources, analyzing factors such as resource availability, conversion methods, environmental effects and economic viability.	12	4	3	7
31. a.	Elaborate on the three primary types of ocean thermal energy conversion (OTEC) systems and assess their efficiency, complexity and applicability across diverse oceanic.	12	4	4	1
	(OR)				
b.	Estimate the air requirement for the conversion of coconut shells into syngas in a down draft gasification system, considering the following elemental analysis: Carbon : 53.88% Hydrogen : 6.56% Oxygen : 38.56% Nitrogen : 0.97% Sulfur : 0.03%	12	4	4	1
32. a.	Explain the potential utilization of Thermo Electric Generators [TEGs] in waste heat recovery systems, highlighting their unique advantages and limitations.	12	4	5	7
	(OR)				
b.	Explore the types of fuel cells commonly used in different applications and compare their operating principles and limitations.	12	4	5	7

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