

27. a. Design a solar PV system where in the load consists of 1 CFL, 1 Fan, 1 computer. The system should allow the use of loads in non-sunshine hours, The operating hours and power rating are as follows:

Load	W	H/day
CFL	9	5
Fan	60	8
Computer	250	3

(OR)

- b. It is required to design a battery charger for a 24V, 0.5 Ah lead-acid battery. A 230 : 8 V single phase transformer with sufficient rating is recommended. For use a DC-DC converter operating at 25 kHz is recommended on power stage. The maximum allowable ripple voltage and current are 5% and 3% respectively. Design the various components required for the system and draw the power stage.

28. a.i. Compare Darrieus and Savonius wind turbines.
ii. What are the relative features of drag and lift type machines?

(OR)

- b.i. Draw and explain the working of single phase matrix converter.
ii. Draw and explain the working of DFIG based WECS with back-to-back PWM converters.
29. a. Draw the circuit diagram of any two isolated converters and explain their working while power conditioning in a fuel cell system.

(OR)

- b. Describe the working of
(i) Solid oxide fuel cell
(ii) Molten carbonate fuel cell
30. a.i. What are the advantages and disadvantages of hybrid systems over stand alone system?
ii. Draw the schematic diagram of PV-wind and PV-fuel cell hybrid system and explain.

(OR)

- b. What is multiport converter? Explain the working of three port DC-DC converter used in PV-battery hybrid system.

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Reg. No.

B.Tech. DEGREE EXAMINATION, NOVEMBER 2022
Sixth and Seventh Semester

18EEE405T – POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEMS
(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. Global warming is mainly caused due to _____
(A) Emission of heat from heat engines
(B) Emission of CO ₂ due to burning of fossil fuels
(C) Use of nuclear energy
(D) Air pollution | 1 | 1 | 1 | 1 |
| 2. How much solar power is intercepted by the earth's surface?
(A) $1.8 \times 10^{11} MW$
(B) $18 \times 10^{11} MW$
(C) $180 \times 10^{11} MW$
(D) $1800 \times 10^{11} MW$ | 1 | 1 | 1 | 1 |
| 3. Plant matter created by the process of _____ is called biomass.
(A) Gasification
(B) Digestion
(C) Photosynthesis
(D) Fermentation | 1 | 1 | 1 | 1 |
| 4. The current density of an individual fuel cell is _____
(A) 10 to 50 mA/cm ²
(B) 100 to 500 mA/cm ²
(C) 10 to 50 A/cm ²
(D) 1000 to 500 A/cm ² | 1 | 1 | 1 | 1 |
| 5. _____ houses the generator, gear box brakes and yaw mechanism.
(A) Power transmission system
(B) Tower
(C) Hub
(D) Nascelle | 1 | 1 | 1 | 1 |
| 6. A typical photovoltaic cell has
$V_{OC} = 0.611 \text{ Volts}$; $I_{SC} = 2.75 \text{ Amps}$
$V_{mp} = 0.5V$, $I_{mp} = 2.59A$
Calculate the fill factor of the cell
(A) 7.07
(B) 70.7
(C) 0.707
(D) 707 | 1 | 2 | 2 | 2 |
| 7. A photovoltaic panel has two identical modules connected in parallel, each module having an open-circuit voltage (V_{OC}) of 10V and short circuit current (I_{SC}) of 2 A. What should be current axis intercept in the I-V characteristics?
(A) 10
(B) 20
(C) 2
(D) 4 | 1 | 2 | 2 | 2 |

8. Considering solar radiation of $200J/m^2$ and per unit time during daylight, find the area of PV cells needed to generate enough electric power to run a desktop computer using 400 W. Efficiency = 25%
 (A) $2m^2$ (B) $10m^2$
 (C) $8m^2$ (D) $5m^2$
9. A PV array is connected to a resistive load R_L of 30 ohms through a buck-boost converter and operates in continuous conduction mode. Determine the duty cycle of the interfacing converter required to operate the PV array at a voltage of 28.08 V and 1.67 Amps.
 (A) 0.3 (B) 0.8
 (C) 0.9 (D) 0.57
10. A lead acid battery has the reduction potential of cathode in 1.69 V and oxidation potential of anode in $-(-0.36)V$ determine the std cell potential
 (A) 1.69 V (B) +1.33 V
 (C) -0.36 V (D) 2.05 V
11. Which is the largest onshore wind farm in India?
 (A) Dhalgaon wind farm (B) Muppandal wind farm
 (C) Jaisalmer wind park (D) Brahmanvel wind farm
12. The IEEE 1547-2003 provides
 (A) Technical requirements and tests for grid connected operation (B) Information on models to be used for communication
 (C) Information on electrical equipment and wiring safety (D) Rules for realization of grid operation of WECS
13. A two stage ac-ac converter without DC storage link is
 (A) Direct matrix converter (B) Cyclo converter
 (C) AC-AC voltage regulator (D) Indirect matrix converter
14. The rate of change of speed with height is called
 (A) Gradient height (B) Wind shear
 (C) Wind rose (D) Local wind
15. The wind turbine that does not require yaw mechanism is
 (A) Darrieus rotor wind turbine (B) Dotch type rotor wind turbine
 (C) Two bladed rotor wind turbine (D) Chalk multi-blade wind turbine
16. Which fuel cell has the lowest operating temperature?
 (A) PAFC (B) PEMFC
 (C) SOFC (D) MCFC
17. The most mature technology available for hydrogen storage is
 (A) Liquid hydrogen at low temperature (B) Metal hydride
 (C) Carbon nanotubes (D) Compressed hydrogen gas in a steel tank

18. The type of catalyst used in direct methanol fuel cell is
 (A) Platinum-ruthenium (B) Platinum
 (C) Nickel (D) Methane
19. Polarization reduces _____ of a fuel cell.
 (A) Operating temperature (B) Open circuit voltage
 (C) Efficiency (D) Current
20. Assume a fuel cell stack feeding LED load of 20 V, 5A, the stack consists of 5 series connected fuel cell. Individual cell voltage is 0.7 V. Which type of converter is suitable?
 (A) Forward boost converter (B) Full bridge inverter
 (C) Half-bridge bulk converter (D) Push-pull buck converter
21. Hybrid system can be classified based on
 (A) Source (B) Load
 (C) Controller (D) Interfacing element
22. The inverter in a PV-diesel hybrid system should be rated for
 (A) Minimum power source available (B) Maximum power source available
 (C) Minimum load requirement (D) Maximum load requirement
23. In type C regulated standalone system, _____ reduces the battery life and increases the cost of PV system.
 (A) Power conversion (B) Deep-discharging
 (C) Overcharging (D) Maximum power point tracking
24. 1 gram of lead in a lead-acid battery delivers
 (A) 0.26 Ah (B) 103.6 Ah
 (C) 207.2 Ah (D) 2.68 Ah
25. The most suitable stand alone hybrid system suitable for domestic applications is
 (A) Type a unregulated system (B) Type b regulated standalone system
 (C) Type c regulated standalone system with auxiliary power supply (D) Type d system with PV and battery

PART – B (5 × 10 = 50 Marks)

Answer ALL Questions

26. a. Draw the block diagram, label the components and explain the working of wind energy conversion system.
- (OR)
- b. Explain the current scenario of solar and wind power in India. Also describe the various initiatives taken to encourage renewable energy deployment.