Reg. No																

B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Seventh Semester

18EEE405T - POWER ELECTRONICS IN RENEWABLE ENERGY SYSTEM

(For the candidates admitted during the academic year 2020 - 2021 & 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** and **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
1.	Which one of the following energy is easily accessible for heating and electricity generation? (A) Wind energy (B) Solar Energy (C) Biomass (D) Fuel Cell	1	1	1
2.	_____ is a non-renewable energy source. (A) Solar (B) Wind (C) Biomass (D) Coal	1	1	1
3.	What is the advantage of biomass? (A) Renewable (B) Non versatile (C) Intermittent (D) Construction cost	1	1	1
4.	Which state in India has the highest wind energy generation (A) Gujarat (B) Rajasthan (C) Karnataka (D) Tamilnadu	1	1	1
5.	Identify the correct relation with respective to solar panels. (A) Cell < array < module < farm (B) cell < module < array < farm (C) farm < cell < array < module (D) cell < farm < array < module	1	2	2
6.	Factors for selection of battery and inverters for PV interface include _____ (A) temperature of the environment (B) irradiation level (C) PV model (D) Size, Power rating, Discharge rate	1	2	2
7.	Reverse saturation current in a PV modeling is a function of ----- (A) Voc (B) Vmp (C) Imp (D) Ioc	1	2	2
8.	Major difference between isolated and non-isolated DC DC converters is-------- (A) Voltage ratio (B) current ratio (C) power ratio (D) transformer ratio	1	2	2
9.	Which site is not suitable for establishment of wind energy systems? (A) Open plains (B) Sea shore (C) High on the mountains (D) Near high raised buildings	1	1	3
10.	Which kind of generator is used in wind energy systems? (A) DC Shunt (B) DC series (C) DFIG (D) SFIG	1	2	3
11.	Disadvantage of matrix converters include------- (A) modularity (B) Power loss (C) Controller design (D) Low power operation	1	2	3

12.	What are the positive impacts of wind power penetration in power grid? (A) Power quality issues (B) Voltage misbalancing (C) Frequency variation (D) Fuel cost minimization	1	1	3
13.	Fuel cell has ----- (A) High power density (B) High energy density (C) High voltage density (D) High hydration density	1	1	4
14.	Which fuel cell operates at high temperatures? (A) PEMFC (B) MCFC (C) AFC (D) SOFC	1	1	4
15.	In which part of the fuel cell, water is observed as bi-product? (A) Anode (B) Cathode (C) Electrolyte (D) Terminals	1	2	4
16.	Major issue in a fuel cell for power converter design is ------ (A) Change in temperature (B) Change in input gas pressure (C) Change in voltage (D) Change in hydration	1	2	4
17.	What is the need of hybrid energy conversion systems? (A) To improve steady state response (B) To improve transient response (C) To improve both steady state and transient response (D) To improve steady state and deteriorate transient response.	1	2	5
18.	Major issue among the given list that is not involved in the integration of hybrid renewable energy systems is------ (A) Economic aspect (B) Technical aspect (C) Sustainability aspect (D) Social aspect	1	2	5
19.	Select major power quality issue in hybrid systems. (A) Voltage stability (B) Efficiency (C) Generator field current (D) Resonance	1	2	5
20.	Multi-port n x 1 DC DC converters have (A) (n-1) input port and 1 output port (B) 1 input port and n output port (C) n input port and 1 output port (D) 1 input port and (n-1) output port	1	2	5

PART - B (5 × 4 = 20 Marks)

Answer **any 5** Questions

		Marks	BL	CO
21.	Draw the block diagram of a typical vertical axis and horizontal axis turbines, name its parts.	4	1	1
22.	Design an appropriate PV array of 160 W, 16 A with the given 10 W (10V, 4 A) PV panel for the given load	4	3	2
23.	Explain the working principle of a fuel cell and draw its characteristic curve	4	1	1
24.	Explain with suitable diagram the role of bidirectional DC DC converter in a standalone PV system	4	2	2
25.	Draw and explain the working of a single phase matrix converter and mention its advantages	4	1	3
26.	a. Classify the fuel cell in accordance to the nature of electrolyte (2 marks) b. What type of dc- dc converters are preferred for fuel cell interfaces? Justify (2 marks)	4	2	4
27.	Assume that the load current needed in a PV - Diesel hybrid system is 10 A, when both sources are capable of feeding 10 A, which of the two sources is preferred? how it is ensured?	4	3	5

		Marks	BL	CO
	PART - C (5 × 12 = 60 Marks) Answer **all** Questions			
28.	(a) Discuss in detail the current energy scenario in India with respective to solar, wind and biomass	12	1	1
	(OR)			
	(b) (i) Which renewable energy source deployment is more advisable in India? Justify. (6 Marks) (ii) With necessary data, discuss the scenario of renewable energy power resources in India. (6 Marks)			
29.	(a) Explain any two MPPT techniques applied for PV system with necessary flow charts	12	2	2
	(OR)			
	(b) Explain the working of buck boost converter in a PV standalone system feeding a variable load			
30.	(a) Derive necessary expressions for deducing Betz limit in a wind electric conversion system and state your inferences.	12	1	3
	(OR)			
	(b) Explain with neat diagrams the various parts of wind energy conversion system			
31.	(a) i) Discuss in detail the working of PEMFC with necessary equations. (6 Marks) ii) Explain the working of a fuel cell interfaced boost converter. (6 Marks)	12	2	4
	(OR)			
	(b) Why does a fuel cell need a MPPT system? Develop an MPPT system for a fuel cell stack of 180 W. Assume one stack composition is 12V, 10A. Apply appropriate dc-dc converter and use P&O algorithm.			
32.	(a) i) With a neat diagram explain the working of hybrid energy system along with a suitable hybrid controller (8 marks) ii) Mention the advantages and disadvantages of hybrid energy systems (4 marks)	12	2	5
	(OR)			
	(b) i) Explain various synchronization issues in a grid tied hybrid system (6 marks) ii) Explain the advantage of multi-port converter and also explain how a multi-port buck-boost structure can be derived from a basic buck boost converter. (6 marks)			

* * * * *