Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI (NEW) EXAMINATION – WINTER 2024

Subject Code:3160917 Date:02-12-2024

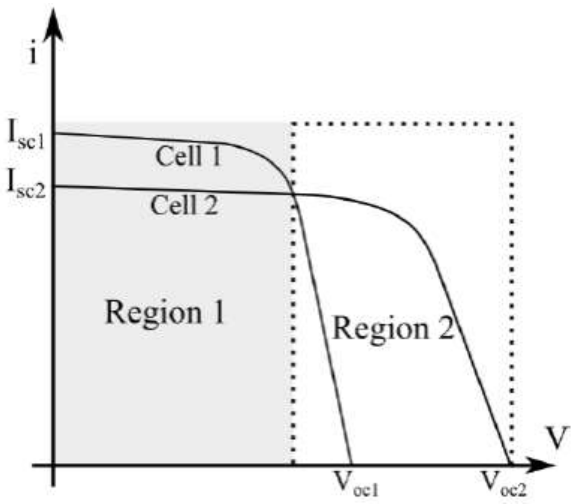
Subject Name: Wind And Solar Energy

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Draw I-V, P-V characteristics of PV. Indicate $V_{OC}, I_{SC}, V_{MPP}, I_{MPP}, P_{MPP}$ on the characteristics. Define fill factor for a PV panel.	**03**
	(b)	Explain the aerodynamic working principle of wind turbine.	**04**
	(c)	What is Betz limit? Derive the Betz limit for a wind turbine working on the aerodynamic principle.	**07**
Q.2	**(a)**	For a PV module $V_{OC} = 36.72\ V$, temperature co-efficient of V_{OC}, $\alpha_V = -0.34\,\%/^\circ K$. Calculate V_{OC} at $40^\circ C$.	**03**
	(b)	Compare horizontal axis and vertical axis wind turbines.	**04**
	(c)	What is an induction generator? Discuss its working and operating characteristics.	**07**
		OR	
	(c)	Explain different power electronic converter technologies used in wind energy conversion system.	**07**
Q.3	**(a)**	What is length of day on June 21 at Surat? (Surat Location is 21.1702° N, 72.8311° E)	**03**
	(b)	The I-V characteristics of two PV cells connected in series to deliver power to a load is shown in the figure below. Considering the variation in load explain the sourcing and sinking issue.	**04**



	(c)	A PV system with a battery is installed in a pumping station. The load profile of the pumping station is as follows: Load-1: 50W, 24V light load which runs for 14hrs during night time. Load-2: 96W, 24V water pump runs twice a day (once before sunrise and once during day). Each time the pump runs for 2hrs. Load-3: 40W, 24V fan load which runs for 24hrs. Design the battery size (Ah) that should be installed at the location. (Consider night load duration=14hrs, battery efficiency=0.7, Depth of discharge = 60% and days of autonomy(Sunlight and hence PV power not available)=1, PV module efficiency is 16%, Hatmin=4.57 kwh/sq.mt/day)	**07**
		OR	
Q.3	**(a)**	A PV panel delivers maximum power of 1kW at 200V. The efficiency of the panel is 20%. Assuming standard conditions, What is the area of the PV panel in square meter?	**03**
	(b)	Define 1) Azimuth angle 2) Latitude angle 3) longitude angle 4) Zenith angle	**04**
	(c)	Is buck converter capable of tracking entire I-V characteristics of a PV panel? Justify your answer.	**07**
Q.4	**(a)**	Write the grid code requirements for renewable energy integration to utility grid.	**03**
	(b)	Draw the control block diagram of grid connected PV system being controlled in d-q reference frame	**04**
	(c)	Draw and explain perturbed and observe MPPT algorithm.	**07**
		OR	
Q.4	**(a)**	Explain the fault ride-through for wind farms in brief.	**03**
	(b)	Draw the control block diagram of standalone PV system	**04**
	(c)	Draw and explain incremental conductance MPPT algorithm.	**07**
Q.5	**(a)**	Explain solar cooker with a neat sketch.	**03**
	(b)	List types of concentrating solar collector and explain any two in brief.	**04**
	(c)	Explain Solar Refrigeration and Air Conditioning in detail.	**07**
		OR	
Q.5	**(a)**	Explain solar water heater with a neat sketch.	**03**
	(b)	Write a brief note on passive solar heating	**04**
	(c)	Explain solar pond in detail	**07**

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