Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VI EXAMINATION – WINTER 2025

Subject Code:3160917 **Date:21-11-2025**

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)**	Give detailed classification of wind turbine types and differentiate between them.	**03**
	(b)	Explain the process of Electron-Hole pair generation by the Photon absorption.	**04**
	(c)	Elaborate the following applications of solar PV technology with necessary diagram. (i) Stand alone or off grid and (ii) Grid-interactive or Grid tied	**07**
Q.2	**(a)**	Draw the schematic layout of the Solar thermal power plant and classify the types of solar collector used in it.	**03**
	(b)	Draw the typical wind turbine power curve and show the following points on it. Also elaborate the significance of each point. Cut-in wind speed, Rated wind speed, Cut-out speed.	**04**
	(c)	With a neat diagram, draw the typical layout of a wind turbine power plant and explain the function of each component in brief.	**07**
		OR	
		Classify the types of solar cells in detail. Also compare mono-crystalline, Poly-crystalline and Amorphous silicon cell technologies.	**07**
Q.3	**(a)**	On a given sunny day at a particular location, the probability of wind flowing at a speed of (a) 5 kmph is 0.4, (b) 10 kmph is 0.4, (c) 12 kmph is 0.1 and (d) 0 kmph is 0.1. Find the average wind velocity on that day using discrete wind histogram.	**03**
	(b)	What is flicker? How the issue of flicker is aggravated with usage of wind turbine power plants?	**04**
	(c)	Draw and explain the functionality of DFIG with partial scale frequency converter for application in Wind turbine power plants.	**07**
		OR	
Q.3	**(a)**	Air density (ρ) at 15°C and 1 atm pressure is 1.225 kg/m^3, find the Air density (ρ) at 30°C.	**03**
	(b)	Draw the curves showing (i) wind velocity probability distribution function and (ii) wind velocity cumulative distribution function. Also differentiate the features of both functions.	**04**
	(c)	Calculate the amount of wind energy at 15°C and 1-atm pressure that passes through 1 m^2 of cross sectional area for the following wind regimes: A. 100 h of 6 m/s winds (13.4 mph) B. 50 h at 3 m/s plus 50 h at 9 m/s (i.e., an average wind speed of 6 m/s)	**07**

Q.4 **(a)** Draw the I-V and P-V characteristics of solar cells and define the term "Fill factor". **03**

(b) Explain Solar Passive cooling system. **04**

(c) Under certain ambient conditions, a particular PV module has its maximum power point at $V_m = 30$ V and $I_m = 6$ A. What duty cycle should be provided to a buck–boost converter if the module is to deliver 12 V to charge a battery? How many amperes would be delivered to the battery? If the ambient were to cool off some without a change in insolation, should the duty cycle be increased or decreased? **07**

OR

Q.4 **(a)** Find Extra-terrestrial Radiation, I_{ext} on 31 march in w/m^2. Take Solar constant $I_{sc} = 1367$ w/m^2. **03**

(b) Enlist the type of generators and suitable power electronic converters according to speed control technique used in wind turbine power plant. **04**

(c) Which power quality issues are aggravated while integrating solar PV and wind power plants into the grid? Why? **07**

Q.5 **(a)** Differentiate between solar cell, Module and Array. **03**

(b) Explain low voltage ride through capability. **04**

(c) Explain the behaviour of solar PV and wind farms during grid disturbances. **07**

OR

Q.5 **(a)** Explain the application of bypass diodes in solar pv technology. **03**

(b) Explain the working of the Solar Pond electric power plant in brief with a neat layout . **04**

(c) Find the optimum tilt angle for a south-facing photovoltaic module for a location having latitude 32.1^o at solar noon on March 1. **07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3160917 Date:02-12-2024

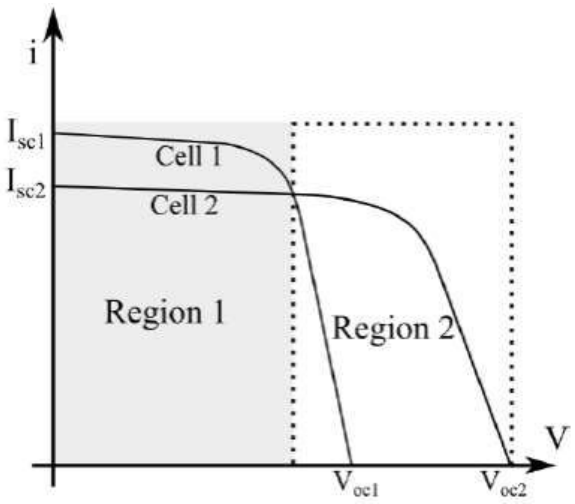
Subject Name: Wind And Solar Energy

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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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – WINTER 2023

Subject Code:3160917 Date:11-12-2023

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)	Define : Tip Speed Ratio (TSR)	**03**
	(b)	How solar water pump works?	**04**
	(c)	What is Betz limit? Also explain significance of Betz limit.	**07**
Q.2	(a)	What is grid code and why it is required?	**03**
	(b)	Explain stall and pitch control of wind turbines.	**04**
	(c)	Write short notes on types of generators used in Wind Turbines.	**07**
		OR	
	(c)	Explain V-I characteristics of a solar cell.	**07**
Q.3	(a)	Write short note on DFIG type of Wind Generator.	**03**
	(b)	Explain Converter control techniques in case of Wind power	**04**
	(c)	Write short notes on solar water pumps.	**07**
		OR	
Q.3	(a)	What is solar pond?	**03**
	(b)	Write short notes on Solar water heater.	**04**
	(c)	Explain working of standalone solar PV system.	**07**
Q.4	(a)	What are the types of power converters used in wind generator system ?	**03**
	(b)	List out application of solar –thermal systems	**04**
	(c)	Explain construction and working of solar cooker.	**07**
		OR	
Q.4	(a)	Explain fixed –speed wind turbines with neat sketch.	**03**
	(b)	Differentiate Grid-Connected System and Standalone system	**04**
	(c)	Explain various types of solar collectors in details.	**07**
Q.5	(a)	Define : (i) Solar Azimuth Angle, (ii) Zenith Angle, (iii) Hour Angle	**03**
	(b)	Explain solar passive heating and cooling system.	**04**
	(c)	Explain solar Refrigeration and Air conditioning System.	**07**
Q.5	(a)	What is Solar Day Length?	**03**
	(b)	Write short note on Solar thermal power generation Technologies.	**04**
	(c)	What do you mean by solar cell, module, panel and array?	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022

Subject Code:3160917 Date:16-12-2022

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)**	Classify the solar radiation and define each term.	**03**
	(b)	Write Betz Law and mention betz limit value in case of wind turbine.	**04**
	(c)	List out various solar thermal applications & explain any one in detail.	**07**
Q.2	**(a)**	Explain solar cell, module and array.	**03**
	(b)	Explain stall control & pitch control of wind power.	**04**
	(c)	Explain fixed speed wind turbine with neat sketch. Also mention its advantages & disadvantages.	**07**
		OR	
	(c)	Explain construction and working of Doubly-Fed Induction Generators.	**07**
Q.3	**(a)**	Explain Wind Physics in detail.	**03**
	(b)	Define the following. 1) Azimuth angle 2) Latitude angle 3) longitude angle 4) Zenith angle	**04**
	(c)	Explain the importance & working of solar water pump.	**07**
		OR	
Q.3	**(a)**	Classify the generators used in wind power plant.	**03**
	(b)	Explain the operation of grid connected solar PV system.	**04**
	(c)	Explain the modeling of elements in hybrid PV-wind system briefly.	**07**
Q.4	**(a)**	Write the short note on battery sizing.	**03**
	(b)	List the advantage and limitation of Solar Energy.	**04**
	(c)	What is Maximum Power Point Tracking (MPPT) system? Explain P & O algorithm to track maximum power from solar PV System.	**07**
		OR	
Q.4	**(a)**	What are the grid code technical requirements?	**03**
	(b)	Describe various types of power quality issues.	**04**
	(c)	Explain solar passive heating & cooling system.	**07**
Q.5	**(a)**	Define : Cut in speed, Cut out speed & Tip speed ratio	**03**
	(b)	Explain the concept of central receiver.	**04**
	(c)	Classify the solar thermal collectors. Explain the construction & working of solar flat plate collector.	**07**
		OR	
Q.5	**(a)**	Define air mass & explain it.	**03**
	(b)	Write short note on box type solar cooker.	**04**
	(c)	Draw & explain the I-V and P-V characteristics of Solar cell.	**07**

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