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^{o}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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