

Enrollment No.....



Faculty of Engineering
End Sem Examination Dec-2023
OE00061 Solar Energy & its Utilization

Programme: B.Tech.

Branch/Specialisation: All

Duration: 3 Hrs.**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1 i. What is the primary unit of measurement for solar radiation? **1**
 (a) Watts per square meter (W/m^2)
 (b) Lumens per square meter (lm/m^2)
 (c) Kelvin (K)
 (d) Megawatts (MW)
- ii. Solar radiation can be divided into three main components. What are they? **1**
 (a) Ultraviolet, visible, and infrared
 (b) Direct, diffuse, and reflected
 (c) Shortwave, longwave, and gamma radiation
 (d) Conduction, convection, and radiation
- iii. What is the primary purpose of solar thermal conversion? **1**
 (a) To generate electricity directly from sunlight
 (b) To convert sunlight into heat energy
 (c) To store solar energy in batteries
 (d) To purify water using solar radiation
- iv. Which of the following is not a type of solar thermal collector? **1**
 (a) Parabolic trough (b) Solar panel
 (c) Solar tower (d) Flat-plate collector
- v. What is the primary purpose of solar tracking systems in PV installations? **1**
 (a) To improve the aesthetics of the system
 (b) To reduce maintenance costs
 (c) To increase energy production by tracking the sun's path
 (d) To protect the panels from hail and snow

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- vi. What is the purpose of Maximum Power Point Tracking (MPPT) controllers in a PV system? **1**
 (a) To protect against overvoltage
 (b) To maximize energy production by adjusting the panel's tilt
 (c) To track the maximum power point of the PV panels
 (d) To regulate the voltage of the electrical grid
- vii. What component of a photovoltaic system helps manage the charge and discharge of batteries in off-grid installations? **1**
 (a) Charge controller (b) Inverter
 (c) Junction box (d) Combiner box
- viii. What is the typical output voltage of a single photovoltaic cell? **1**
 (a) 12 volts (b) 120 volts (c) 1 volt (d) 0 volts
- ix. Which financial metric is commonly used to evaluate the profitability of a solar energy project over time? **1**
 (a) Return on Investment (ROI)
 (b) Photovoltaic Efficiency Ratio (PER)
 (c) Energy Payback Period (EPP)
 (d) Solar Cell Conversion Rate (SCCR)
- x. Which of the following is a key factor influencing the financial viability of a solar energy project? **1**
 (a) Solar panel color (b) Geographic location
 (c) Installation method (d) Time of day
- Q.2 i. Differentiate between direct and diffuse solar radiation. **2**
 ii. Explain the factors that influence variations in solar radiation at different geographical locations. **3**
 iii. Discuss the importance of a pyrliometer in measuring direct solar radiation. How does it differ from a pyranometer in terms of its application and design? **5**
- OR iv. Describe the components and working principles of a typical solar radiation measurement system. **5**
- Q.3 i. Explain the role of a heat exchanger in a solar water heating system. How does it transfer heat from the collector fluid to the domestic hot water supply? **3**
 ii. Explain the working principle of a solar concentrating collector, such as a parabolic trough. How does it focus sunlight onto a receiver and generate high-temperature heat? What are the advantages of this collector type? **7**

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- OR iii. Discuss the various types of solar collectors used in solar water heating systems, such as flat-plate collectors and evacuated tube collectors. What are the differences between these collector types, and when is each one suitable? **7**
- Q.4 i. Describe the fundamental working principle of a photovoltaic system. **3**
 ii. Discuss the various types of PV panel technologies, such as monocrystalline, polycrystalline, and thin-film. What are the advantages and disadvantages of each technology? **7**
- OR iii. Explain the concept of Maximum Power Point Tracking (MPPT) in PV systems. How does an MPPT controller optimize the performance of PV panels? **7**
- Q.5 i. Explain the role of charge controllers in off-grid PV systems. How do they manage the charge and discharge of batteries to ensure a reliable power supply? **4**
 ii. Describe the primary components of an off-grid PV system, including PV panels, charge controllers, batteries, and inverters. How do these components work together to provide electricity in remote locations? **6**
- OR iii. Explain the concept of net metering in on-grid PV systems. How does it enable homeowners to offset their electricity bills by exporting excess energy to the grid? **6**
- Q.6 Attempt any two:
 i. Describe the concept of "Return on Investment" (ROI) in the context of solar energy projects. How is it calculated, and what does a positive ROI indicate? **5**
 ii. Describe the factors that influence the economic competitiveness of solar energy compared to conventional energy sources, such as coal or natural gas. **5**
 iii. Explain the concept of "carbon credits". How do solar energy systems contribute to earning carbon credits? **5**

Marking Scheme

OE00061 Solar Energy & its Utilization

Q.1	i.	(a) Watts per square meter (W/m ²)	1
	ii.	(b) Direct, diffuse, and reflected	1
	iii.	(b) To convert sunlight into heat energy	1
	iv.	(b) Solar panel	1
	v.	(c) To increase energy production by tracking the sun's path	1
	vi.	(c) To track the maximum power point of the PV panels	1
	vii.	(a) Charge controller	1
	viii.	(a) 12 volts	1
	ix.	(a) Return on Investment (ROI)	1
	x.	(b) Geographic location	1

Q.2	i.	Explaining Difference.	2
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(As per explanation)

	ii.	Explain factors.	(1 Mark*3)	3
	iii.	Importance of a pyrheliometer	3 Marks	5
		Differ from design	2 Marks	
OR	iv.	Components and working principles	2 Marks	5
		Typical solar radiation measurement system.	3 Marks	

Q.3	i.	Explanation	(As per explanation)	3
	ii.	Working principle of a solar concentrating	2 Marks	7
		Generate high-temperature heat What are	3 Marks	
		The advantages of this collector type	2 Marks	
OR	iii.	Explaining different collector	4 Marks	7
		Explaining difference	3 Marks	

Q.4	i.	Fundamental..... system.	(As per explanation)	3
	ii.	Various types of PV panel technologies	4 Marks	7
		Monocrystalline, polycrystalline, and thin-film.	4 Marks	
		Advantages and disadvantages of each technology	3 Marks	
OR	iii.	The concept..... (MPPT) in PV systems.	4 Marks	7
		MPPT controllerof PV panels	3 Marks	

Q.5	i.	For explaining of charge controller	2 Marks	4
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		Managing reliable power supply	2 Marks	
	ii.	Each components controllers	3 Marks	6
		Explaining the working	3 Marks	
OR	iii.	Concept of net metering in on-grid PV systems.	4 Marks	6
		Explaining offset their the grid	2 Marks	
Q.6		Attempt any two:		
	i.	Concept of "Return on Investment"	(As per explanation)	5
	ii.	Factors natural gas.	(As per explanation)	5
	iii.	Concept carbon credits	(As per explanation)	5
