

Enrollment No.....



Faculty of Engineering
End Sem (Even) Examination May-2019
EE3EE01 / EX3EE01 Solar Energy System
Programme: B.Tech. Branch/Specialisation: EE/EX

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.

- Q.1 i. Renewable energy is known as “green energy” because 1
 (a) It is green in colour
 (b) It is produced from green plants only
 (c) It is produced from wet fuels
 (d) It does not produce harmful pollutants
- ii. What is the % share of fossil fuel in global consumption of primary energy? 1
 (a) 82% (b) 50% (c) 10% (d) 99%
- iii. Terrestrial radiation has a wavelength in the range of 1
 (a) 0.2 μ m to 4 μ m (b) 0.2 μ m to 0.5 μ m
 (c) 0.380 μ m to 0.760 μ m (d) 0.29 μ m to 2.3 μ m
- iv. What is the standard value of solar constant? 1
 (a) 1kW/m² (b) 1.5kW/m²
 (c) 1.367kW/m² (d) 1.355kW/m²
- v. At the inclination angle of 30°, what will be magnitude of zenith angle? 1
 (a) 30° (b) 120° (c) 150° (d) 60°
- vi. On September 21st, the declination angle will be 1
 (a) Zero (b) +23.45° (c) -23.45° (d) 180°
- vii. The value of concentration ratio of flat plate collector is 1
 (a) 1 (b) 10 (c) 100 (d) 1000
- viii. Conversion of solar thermal energy into electrical energy using reflecting mirrors is called 1
 (a) Diffuser (b) Heliostat
 (c) Reflector cookers (d) Solar cell array

P.T.O.

	ix.	The efficiency of commercial solar cell lies in range (a) 0-10% (b) 10-20% (c) 20-30% (d) 50-60%	1				
	x.	At maximum power point of the solar cell (a) Current is maximum (b) Voltage is maximum (c) Both current and voltage are maximum (d) The product of current and voltage are maximum	1				
Q.2	i.	What are primary and secondary energy sources?	2				
	ii.	What are the advantages and limitations of renewable energy sources?	3				
	iii.	Define and explain the term energy sources. Write down the expectations of world energy, in terms of Indian energy scenario.	5				
OR	iv.	Discuss different renewable sources of energy with special reference to Indian context. Comment on the growth of energy sector in India.	5				
Q.3	i.	Define the following terms: (a) Depletion of solar radiation (b) Irradiance (c) Solar constant (d) Solar time (LAT)	4				
	ii.	What is extra-terrestrial and terrestrial solar radiation? Does the extra-terrestrial solar radiation vary with time?	6				
OR	iii.	Explain the construction and working principle of a pyranometer and pyrliometer.	6				
Q.4	i.	Define the terms: (a) Declination angle (b) Hour angle (c) Angle of incidence (d) Altitude angle	4				
	ii.	Calculate the angle of incidence of beam radiation on a plane surface, tilted by 45° from horizontal plane and pointing 30° west of south located at Mumbai at 01:30PM (IST) on 15 th November. The longitude and latitude of Mumbai are 72°49′ E and 18°54′ N respectively. The standard longitude for IST is 81°44′ E.	6				
OR	iii.	For New Delhi (28°35′ N, 77°12′ E), calculate the zenith angle of the sun at 02:30PM on 20 th February 2015. The standard longitude for IST is 81°44′ E.	6				
				Q.5	i.	With the help of a schematic diagram, explain the working of solar water heating.	4
					ii.	Classify different types of solar thermal collector and show constructional details of a flat plate collector. What are the main advantage and limitations of a flat plate collector?	6
				OR	iii.	With the help of schematic diagram explain the working of solar vapour compression refrigeration.	6
				Q.6	i.	Describe the principle of solar photovoltaic energy conversion. Explain the V-I and P-V characteristics of a solar cell.	4
					ii.	Give the block diagram of a rooftop mounted system which should be able to supply the power to the load for 24 hours. What are the advantages of the system?	6
				OR	iii.	Design a PV water pumping system, which is required to draw 25000 liters of water every day from a depth of 10 meters. Solar PV module 75W, 0.75 operating factor and 0.85 mismatch factor are used.	6

Marking Scheme
EE3EE01 / EX3EE01 Solar Energy System

Q.1	i.	Renewable energy is known as “green energy” because	1
		(d) It does not produce harmful pollutants	
	ii.	What is the % share of fossil fuel in global consumption of primary energy?	1
		(a) 82%	
	iii.	Terrestrial radiation has a wavelength in the range of	1
		(d) 0.29μm to 2.3μm	
	iv.	What is the standard value of solar constant?	1
		(c) 1.367kW/m ²	
	v.	At the inclination angle of 30°, what will be magnitude of zenith angle?	1
		(d) 60°	
Q.2	vi.	On September 21 st , the declination angle will be	1
		(a) Zero	
	vii.	The value of concentration ratio of flat plate collector is	1
		(a) 1	
	viii.	Conversion of solar thermal energy into electrical energy using reflecting mirrors is called	1
		(b) Heliostat	
	ix.	The efficiency of commercial solar cell lies in range	1
		(b) 10-20%	
	x.	At maximum power point of the solar cell	1
		(d) The product of current and voltage are maximum	
Q.3	i.	Primary energy sources	1 mark
		Secondary energy sources	1 mark
	ii.	Advantages of renewable energy sources	2 marks
		Limitations of renewable energy sources	1 mark
	iii.	Energy sources	2 marks
OR		Different ways of their classification	2 marks
		Mention at least 2 ways of their classification	1 mark
	iv.	Renewable sources of energy with special reference to Indian context	5
			2.5 marks
		Growth of energy sector in India.	2.5 marks
Q.3	i.	Define the terms	1 mark * 4)
			4
	ii.	Extra-terrestrial solar radiation	2 marks
		Terrestrial solar radiation	2 marks
		Extra-terrestrial solar radiation vary with time	2 marks
			6

OR	iii.	Construction and working principle of a pyranometer	3 marks	6
		Construction and working principle of a pyrhelimeter.	3 marks	
Q.4	i.	Define the terms	1 mark for each	4
	ii.	n = 319	1 mark	6
		δ = -19.148°	1 mark	
		Solar time = 13 : 9 hrs	1 mark	
		Hour angle = - 17.27°	1 mark	
		γ = 30° , ϕ = 18.9°	1 mark	
		θ _i = 37.23°	1 mark	
OR	iii.	Calculate the zenith angle of the sun at 02:30PM on 20 th February 2015.		6
		n = 51	1 mark	
		δ = -11.58°	1 mark	
		Solar time = 1 : 57 hrs	1 mark	
		Hour angle = - 14.39°	1 mark	
		ϕ = 28° 35	1 mark	
		θ _i = 42.55°	1 mark	
Q.5	i.	Solar water heating		4
		Schematic diagram	2 marks	
		Working	2 marks	
	ii.	Classification types of solar thermal collector	1 mark	6
		Constructional details of a flat plate collector	3 marks	
OR		Advantage and limitations of a flat plate collector	2 marks	
	iii.	Solar vapour compression refrigeration.		6
		Schematic diagram	2 marks	
		Working	4 marks	
Q.6	i.	Principle of solar photovoltaic energy conversion	2 marks	4
		V-I and P-V characteristics of a solar cell.	2 marks	
	ii.	Block diagram of a rooftop mounted system	2 marks	6
		Working	2 marks	
		Advantages of the system	2 marks	
OR	iii.	TDH = 12.6 mt	1 mark	6
		Hydraulic energy= 857.5 Wh/day	1 mark	
		nu of PV panel	2 marks	
		motor power = 1 hp	2 marks	
