


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Solar Thermal Technology Program: M Tech Renewable Energy Engg. Course Code: EPEC-7016		Semester : II Time : 03 hrs. Max. Marks: 100	
Instructions: Attempt all questions. Internal choice is given in question number 11.			
SECTION A (5Qx4M=20Marks)			
S. No.	Statement of question	Marks	CO
Q 1	Define solar time in reference to solar geometry.	4	CO1
Q2	With the help of neat diagram, label all components of solar air heater.	4	CO2
Q3	Briefly discuss the principle of thermochemical storage system.	4	CO3
Q4	Which type of solar water heater you will prefer for your hostels and why.	4	CO4
Q5	Calculate R_b for a surface at latitude 40° N at a tilt 30° toward the south for the hour 9 to 10 solar time on February 16.	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q6	Calculate the monthly average hourly radiation falling on a flat plate collector facing south with a slope of 15° , given the following data Location : Chennai ($114^\circ 00' N$) Month: October Time: 1100-1200 h (LAT) I_g : 2408 kJ/m ² -h I_d : 1073 kJ/m ² -h Assume ground reflectivity to be 0.2	10	CO1
Q7	Classify different types of solar thermal collectors and show the constructional details of a flat plate collector. What are its main advantages?	10	CO2
Q8	Describe the basic methods for storing thermal energy.	10	CO3
Q9	Give a neat diagram of a central tower receiver power plant and explain its operation. Give the details of an operational plant if such a plant exists anywhere in the world.	10	CO5
SECTION-C (2Qx20M=40 Marks)			
Q 10	A flat plate collector, facing due south, having two glass covers is located at Ahmadabad (23.03° N, 72.58° E), have the following data: Standard longitude for IST: 82.5° E	20	CO2

	<p>Date: December 22 Time : 3:00 P.M. Collector tilt angle latitude: + 15° Beam radiation, I_b (on horizontal surface): 650 W/m² Diffuse radiation, I_d (uniformly distributed over the sky): 150 W/m² Reflectivity of surrounding : 0.2 Plate absorptivity of solar radiation : 0.94 Extinction coefficient of glass : 20 per m Thickness of each glass cover: 4 mm Refractive index of glass with respect to air: 1.5</p> <p>Calculate: (i) Angle of incidence of beam radiation on the collector (ii) Total solar flux incident on the collector (iii) The incident flux absorbed by the absorber plate</p>		
Q11	<p>a. Explain the spectral distribution of extraterrestrial solar radiation and list the wavelength on which solar thermal systems operate b. Calculate the monthly average, total daily radiation falling on a flat plate collector facing south and tilted by 30° from ground, at New Delhi (28° 35' N, 77° 12' E) for the month of November. Assume ground reflectivity as 0.2.</p>	<p>10 10</p>	CO1
OR			
Q11	<p>a. Explain the concept of air mass in detail. b. For Coimbatore (11.0183° N, 76.9725° E, and elevation of 411 m above sea level), estimate the value of average daily global radiation on horizontal surface during the month of March. The average sunshine hours per day for the month of March may be assumed as 9.5 h.</p>	20	CO1