Total number of printed pages:02 **PG/2nd/MGE202**

2025

SOLAR ENERGY UTILIZATION

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a.	Describe the various factors that affect the intensity of solar radiation at the Earth's surface, including atmospheric conditions, geographical location, and time of day?	10
	b.	Classify the different types of solar energy measuring equipment. What is the difference between a pyrheliometer and a pyranometer?	10
2.	a.	Brief the efficiency of a flat plate collector. What are the parameters on which it depends?	10
	b.	Determine the intercept factor and CR for a parabolic concentrator and receiver with (r/R1) = 0.02 and 0.03, if h=60 and the system is axially symmetric.	10
3.	a.	Why is sun tracking necessary for concentrating collectors? What are the methods used for sun tracking?	10
	b.	Data for a Flat-plate collector used for heating are given below Calculate: i) Solar altitude angle ii) Incident angle iii) Collector efficiency.	10

Factors	Specification
Location and latitude	Guwahati 11°00′N
Day and time	25 march ,14.00-15.00 LST
Average intensity of solar radiation	560W/m^2
Collector tilt	27°
No. Of glass cover	2
Heat removal factor for collector	0.82
Transmittance of glass	0.88
Absorptance of the plate	0.93
Top loss coefficient,U_L for collector	7.95W/m^2°C
Collector fluid temperature	80°C
Ambient temperature	30°C

<table>
<tr><td>4.</td><td>a.</td><td>Describe the various designs of solar dryers. What are the main applications of a solar dryer?</td><td>10</td></tr>
<tr><td></td><td>b.</td><td>A cylindrical parabolic concentrator unit of 3 m width and 12 m length has a reflective lining with a specular reflection of 0.85. The receiver is a cylindrical, painted flat back and surrounded by a glass cylindrical envelope. The absorbing cylinder has a diameter of 6cm and the transparent envelope has a diameter of 9cm. Other optical properties of this system are estimated as $(\tau\alpha)_e = 0.77$, $\gamma=0.94$. The collector is designed to heat a fluid entering the absorber at 120 ℃ and at a flow rate of 400 kg/hr. The fluid has Cp=1.26 kj/kg℃. The appropriate heat transfer co-efficient are estimated to be as follows;
From the fluid inside to the surroundings U_o = 7.0 W/m^2 ℃
From the absorber outer surface to the surrounding U_L=8.0 W/m^2 ℃.
If the incident beams radiation on the aperture of the collector is 900 W/m^2 and the ambient temperature 30℃. Calculate the useful gain, exit fluid temperature and efficiency of the collection of beam radiation.</td><td>10</td></tr>
<tr><td>5.</td><td>a.</td><td>Explain the process of hydroxide storage concept in thermal energy storage application?</td><td>10</td></tr>
<tr><td></td><td>b.</td><td>Calculate the sensible heat storage per unit volume for the following heat storage medium, where their temperature is increased by 15 °C
i) For water ($\rho_s = 1000\,\frac{kg}{m^3}, C_p = 4186\,\frac{J}{kg\,°C}$)
ii) For rock ($\rho_s = 2240\,\frac{kg}{m^3}, C_p = 879\,\frac{J}{kg\,°C}$)
iii) For methyl alcohol ($\rho_s = 810\,\frac{kg}{m^3}, C_p = 2512\,\frac{J}{kg\,°C}$)</td><td>10</td></tr>
<tr><td>6.</td><td></td><td>Write a short note on the following topics:
i) Solar distillation
ii) Solar heating of buildings
iii) Solar Pond
iv) Solar photovoltaic (PV) array</td><td>20</td></tr>
</table>

END