

GUJARAT TECHNOLOGICAL UNIVERSITY
ME- SEMESTER II- EXAMINATION – SUMMER 2015

Subject Code: 2722108**Date: 28/05/ 2015****Subject Name: Solar Energy Engineering****Time: 2:30 PM – 5:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of property tables is permitted.

- Q.1** (a) Calculate the angle of incidence of beam radiation on a plane surface tilted by 45° from the horizontal plane and pointing 30° west of south located at Mumbai ($72^\circ 49'$ E, $18^\circ 54'$ N) at 1:30 PM (IST) on 15th November. The standard longitude for IST is $81^\circ 44'$ E. **07**
- (b) Give a brief note about the instrument used for measurement of solar beam radiation with neat sketch. **07**
- Q.2** (a) Discuss the parameters affecting the performance of solar flat plate collectors. **07**
- (b) Discuss about testing procedures of liquid flat plate solar collectors. **07**
- OR**
- (b) Calculate the overall loss co-efficient for flat plate collector with two glass cover with following data:
 Size of absorber plate-0.9x1.9m, spacing between plate and first glass cover-0.04m, spacing between first and second glass cover-0.04m, plate and glass emissivity-0.9 & 0.88 resp., tilt - 15° , Mean plate temp- 72° , Ambient temp - 24° , wind speed ϕ 2.4m/s, back and side insulation thickness- 0.08 & 0.04m resp., $K_{\text{insulation}} \phi$ 0.05 W/mK. Assume first cover temp- 326.5K and second cover temp-307.6K **07**
- Q.3** (a) Discuss in brief classification of concentric solar collectors. **07**
- (b) Calculate the exit temp. of the fluid and instantaneous collection efficiency for compound parabolic collector oriented with its aperture plane sloping at an angle of 40° for the following data:
 CR - 6.5, Length and width of absorber plate - 2m & 0.06m resp., specific heat of fluid - 2.35 KJ/kgK, Inlet fluid temp- 125°C , tilt factor-1.42, I_g - 0.573 kW/m², I_d -0.165 kW/m², Tube OD - 0.018m, Tube ID - 0.014m, transmissivity of glass cover ϕ 0.88, reflectivity of concentrator-0.86, absorptivity of absorber surface-0.92, Overall loss co-efficient ϕ 10.4 W/m²K, heat transfer co-efficient on inside absorber tube ϕ 232 W/m²K, Mass flow rate of fluid - 1.25 kg/min, Ambient temp - 21°C . **07**
- OR**
- Q.3** (a) Discuss about thermal performance testing of cylindrical parabolic concentrator. **07**
- (b) Differentiate between concentric and non-concentric type solar collectors. **07**
- Q.4** (a) With the help of neat sketch explain the passive solar water heating system. **07**
- (b) Give a brief note on solar drier. **07**
- OR**
- Q.4** (a) Explain the principle of solar absorption cooling with neat sketch. **07**

- (b) Write a short note on solar chimney. 07
- Q.5** (a) Discuss daily and hourly utilizability for solar active systems. 07
- (b) Explain the f -chart method for designing solar active systems. 07
- OR**
- Q.5** (a) Give a brief note on thermo-chemical storage system of solar energy. 07
- (b) Explain the construction and working of solar pond with the help of neat sketch. 07
