Birla Institute of Technology and Science, Pilani
ME F433 Solar Thermal Process Engineering
Mid Sem (Open Book)

Time: 90 minutes   Weightage: 30%   Date: 08 / 10 / 2016

Note: Assume suitable data wherever necessary.
Underline the answers and the assumptions you make.

Q.1. Determine the number of sunshine hours for New Delhi(28.56°N, 77.12° E) on December 22 and June 22, 2013.

[8]

Q.2 Draw an equivalent thermal-circuit diagram of liquid flat plate collector with two glass covers with thermal resistance of glass cover.

[6]

Q.3. Determine the overall heat-transfer coefficient (U_L) for a FPC system inclined at 45 °C to the horizontal and facing due south for the following parameters:

- The average ambient air temperature for the day is 20 °C;
- The observed glass and absorber-plate temperatures are 45 and 69 °C respectively;
- The system is provided with 6 cm thick insulation (glass wool) at the bottom;
- The thermal conductivity of the insulation is 0.04 W/m°C;
- The air space between the absorber plate and the glass cover has an optimum thickness of 75 cm; and
- The emissivity of the glass and the plate is 0.88 and 0.95, respectively.

[18]

Q.4. Which kind of Solar thermal system can be installed in Shiv Ganga at Pilani campus and why? If we would like to

generate power from the same, which heat transfer fluid and practical thermodynamic cycle should be used? Explain with neat sketch. What may be the possible efficiency of the same? [8]

Q.5 Can we find beam radiation by using Pyranometers only? Justify your answer. [4]

Q.6. The figure shows the cross section of heat collector element
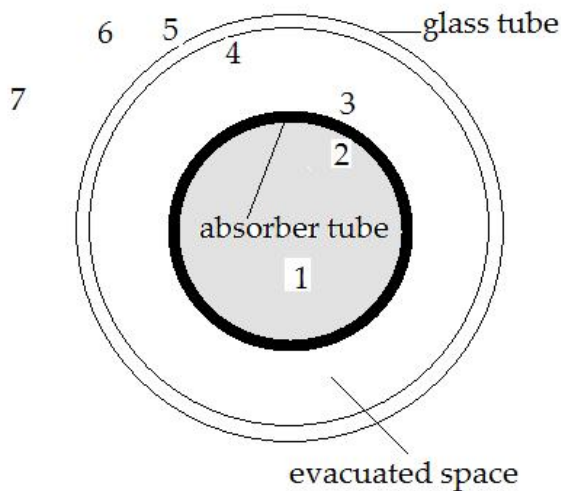
(HCE) of parabolic trough collector. 1- heat transfer fluid, 2- absorber tube inner surface, 3-absorber tube outer surface, 4-glass tube inner surface, 5-glass tube outer surface, 6-surrounding air, 7-sky. Draw the figure in answer book and a) represent one-dimensional heat transfer processes on the same, b) draw its thermal resistance circuit c) write one dimensional steady state energy balance equations at each surface. Include thermal resistances of glass cover and absorber tube [16]

*****BEST LUCK******