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Total No. of printed pages = 3

PG/1st Sem/PGET 1105

2021

SOLAR THERMAL ENERGY CONVERSION

Full Marks – 100

Time – Three hours

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

Answer any *five* questions.

1. (a) What is irradiance ? How it is differ from irradiations ? 10

   (b) Discuss different types of solar irradiation. 10

2. (a) What do you mean by drying and discuss mechanism of drying ? 10

   (b) Determine the local solar time corresponding to 14.30 hrs. (IST) on July 1st, at Mumbai (latitude of 19° 07′ N longitude 72° 51′E). 2

   (c) Explain about heat storage methods in solar applications with suitable examples. 8

[Turn over

3. Write short notes on : 5×4=20

(i) Solar distillation

(ii) Solar Pond

(iii) Solar concentrator

(iv) Solar cooker.

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4. (a) What are the important applications of solar dryer ? 10

(b) What are the different drying methods used in agricultural processing with respect to heat transfer ? 10

5. (a) (i) Calculate the reflection of one surface of glass for an angle of incidence of 65°. Also calculate the reflectance for the normal incidence. Assume n = 1.526. 7

(ii) Calculate the transmittance for a single glass cover of part (i), neglect any absorption. 3

(b) Calculate the transmittance-absorptance product (τ, α), of a flat plate collector with two glass covers each 5 mm thickness. The incident angle is 35° and the value of the extinction coefficient K is 0.10/cm. Take the value of α for the absorber plate = 0.86 and the refractive index μ = 1.526. 10

6. (a) Define the basic sun earth angles with neat sketch. 8

(b) (i) Determine the altitude and azimuth angle at 3:15 PM (IST) on June 21 for Mumbai ($\varphi = 18° 54' N$, longitude = $72° 49' E$).

(ii) For the above location, determine the angle of incidence over a south facing with tilt angle of 15° with the horizontal.

(iii) Also calculate the hour of the sunrise and the length of the day. 4×3=12

7. (a) Determine the value of H_{av} over a horizontal surface of August 8, at the altitude of $18°29' N$ (Pune); if $a = 0.31$, $b = 0.43$ and ratio of average daily hours of bright sun shine to maximum daily hours of bright sun shine = 0.58. 8

(b) Explain the design procedure for a solar based force convective type dryer. 12

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