Exam Date & Time: 10-Jan-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SEVENTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, JAN 2024

Non-Conventional Energy Systems [MME 4078]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Sketch and explain the construction and functioning of a solar global radiation measuring instrument (3)

A)

B) Explain the solar power generation techniques, providing a detailed sketch that illustrates the key components involved. (3)

C) Calculate monthly average hourly global and hourly diffuse radiation during the month of January on a horizontal surface at Mumbai (19.07° N, 72.8° E) with the given data. (4)

Time 10:30 PM to 11:30 PM (LAT). The average number of sunshine hours per day is 10 ;

a = 0.27 b = 0.43 for Monthly average daily solar radiation. Klein's recommendation for the month of June is 11. For Monthly average hourly radiation;

a = 0.409+0.5016 sin (ω_s - 60)

b = 0.6609-0.4767 sin (ω_s - 60).

Equations required to do the calculation.

$$\cos\theta = \sin\emptyset\,(\sin\delta\cos\beta + \cos\delta\cos\gamma\cos\omega\sin\beta) + \cos\emptyset\,(\cos\delta\cos\omega\cos\beta - \sin\delta\cos\gamma\sin\beta) + \cos\delta\sin\gamma\sin\omega\sin\beta$$

$$\delta = 23.45\,sin\left(\frac{360}{365}(284+n)\right)$$

$$\omega_s = \cos^{-1}(-\tan\varphi\tan\delta)$$

$$\mathbf{LAT} = \mathbf{Standard\ time} \pm 4(\mathbf{Standard\ time\ longitude} - \mathbf{longitude\ of\ location}) + (\mathbf{Equation\ of\ time\ correction})$$

$$I_0 = I_{sc}\left(1 + 0.033cos\frac{360n}{365}\right) * (\sin\varphi\sin\delta + \cos\varphi\cos\delta\cos\omega)$$

$$H_0 = \frac{24}{\pi} I_{sc}\left(1 + 0.033cos\frac{360n}{365}\right) * (\omega_s\sin\varphi\sin\delta + \cos\varphi\cos\delta\sin\omega_s)$$

$$\frac{\overline{H_g}}{\overline{H_0}} = a + b\left(\frac{\bar{S}}{\bar{S}_{max}}\right)$$

$$\frac{\overline{H_d}}{\overline{H_g}} = 1.416 - 1.696\left(\frac{\overline{H_g}}{\overline{H_0}}\right)$$

$$\frac{\overline{I_g}}{\overline{H_g}} = \frac{\overline{I_0}}{\overline{H_0}}(a + b\cos\omega)$$

$$\frac{\overline{I_d}}{\overline{H_d}} = \frac{\overline{I_0}}{\overline{H_0}}$$

2) Explain the working of the horizontal axis wind turbine. (3)

A)

B) Differentiate between the floating drum and fixed dome-type biogas plant. (3)

C) Explain the various methods of conversion of biomass into a useful form of energy. (4)

3) Compare the Solar water heater design and Solar air heater design in the context of solar thermal energy systems. (3)

A)

B) Explain the working of tube type and Bulb type turbine (3)

C) A neat sketch of Solar- Earth Geometry demonstrates the various angles required to measure the solar radiation intensity at a particular location (4)

4) Categories the various techniques of extracting the geothermal energy (3)

A)

B) Explore and discuss the diverse applications of Ocean thermal energy conversion (OTEC) power generation. (3)

C) How are the tides forming? Derive an expression for power output from a tide having an amplitude “R” (4)

5) Explain the working of the Thermionic power generation techniques (3)

A)

B) Explain the working of Closed cycle MHD power generation system (3)

C) Sketch and explain the working of Dolphin type wave energy conversion device (4)

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