Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
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I SEM. MTech. (ADVANCED THERMAL POWER AND ENERGY SYSTEMS)

DEGREE END SEMESTER EXAMINATIONS NOV/DEC 2015

SUBJECT: RENEWABLE ENERGY TECHNOLOGY (MME-549)

REVISED CREDIT SYSTEM

Time: 3 Hours. MAX.MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data, if any, may be suitably assumed

1A Discuss briefly the driving forces of world energy supply and demand **04**

1B List the various renewable energy policy initiatives in India **03**

1C Calculate the total solar radiation incident on a south facing surface inclined at 30^0 to horizontal at a latitude of 40^0 N at 3 pm on May Ist. Reflectivity of the ground is 0.6 **03**

Altitude angle : $\beta = \sin^{-1}\left(\cos l.\cos h.\cos d + \sin l.\sin d\right)$

Incident angle: $\cos^{-1}\left(\sin\beta\cos\Sigma + \cos\beta\cos\alpha\sin\Sigma\right)$

2A Using thermal network for a two cover flat plate solar collector, obtain an equation for top loss coefficient. State the assumptions made. **05**

2B Determine the overall heat transfer coefficient for a flat plate collector system inclined at 30^0 to horizontal and facing south. The absorber plate temperature is 75^0C and glass cover temperature is 50^0C. The system is provided with 8 mm thick insulation (K = 0.04 W/m^{0}C) at the bottom. The air space between the absorber plate and glass cover is 8 cm thick and the emissivity of glass and plate is 0.88 and 0.95. The Nusselt number may be taken as 5.6. The ambient temperature is 22^0C. **05**

3A Define the term collector heat removal factor. What is its significance in the performance of collector. Obtain an expression for it in terms of dimensionless collector capacitance. **05**

3B Calculate the heat removal factor for a collector having an over all heat transfer coefficient of 6 W/m^2 K and constructed of aluminium fins and tubes (K= 204 W/m K). Tube-to-Tube centre distance is 15 cm, fin thickness is 0.05 cm, tube diameter is 1.2 cm, Fluid-tube heat transfer coefficient is 1200 W/m^2 K. The cover transmittance to solar radiation is 0.9 and is independent of direction. The solar absorptance of absorber **05**

plate is 0.9, the collector is 1 m wide and 3 m long and the water flow rate is 0.02 kg/s. Water temperature is 57^0C.

$$F' = \frac{\frac{1}{U_L}}{W\left[\frac{1}{U_L[D+(W-D)F]} + \frac{1}{C_B} + \frac{1}{\pi D_i h_{f,i}}\right]}$$

4A Critically evaluate the merits and demerits of different types of concentrating collectors. **05**

4B Calculate the loss coefficient for a 70-mm cylindrical receiver at 300°C. The absorber surface has an emittance of 0.29. The absorber is covered by a glass tubular cover 90mm in outer diameter and 4mm thick. The space between the absorber and cover is evacuated. The wind speed is 6 m/s and the sky and air temperatures are 4 and 12°C, respectively. At an average of cover and ambient temperature, the properties of air are **05**

$K = 0.031 W/mK,\ \upsilon = 23.52\times10^{-6} m^2/s,\ P_r = 0.7,\ \rho = 1.23 kg/m^3$

5A List the different storage media used for solar energy storage. Compare their relative merits and demerits. **05**

5B Explain the working principle of evacuated tube heat pipe solar collector. Mention its advantages and disadvantages over other types of collectors **05**

6A What are the different forms of biomass available as biofuels. Explain the factors which affect performance of the biogas digester. **05**

6B What are the main considerations for selecting a site for wind turbine installation. Explain the Betz model of expanding air. Using this model obtain the maximum power that can be extracted from wind. **05**