Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

V SEMESTER B.TECH (MECHANICAL ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: NON CONVENTIONAL ENERGY SOURCES [MME 4025]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Describe with a neat sketch the process of conversion of solar energy into electricity using a suitable working fluid withstanding temperatures around 100^0 C. **4**

1B. With a neat sketch explain the working of an instrument used to measure global radiation. **3**

1C. Find the monthly average hourly global radiation on a horizontal surface at the location (20^0 35'N, 77^0E) for the time 0930-1000h (IST) using the following data:

Month: March 15th
Average sunshine hours per day = 9
Sunrise hour angle = 95.18^0
Equation of time correction = - 4min
Standard longitude for the location = 82.5^0E.
Monthly average solar radiation indicated by a pyranometer at the location is 600 W/m^2.Assume solar constant as 1367 W/m^2 and constants a=0.698 and b= 0.386. **3**

2A. A liquid flat plate collector with single glass cover has the following data:

Length of collector=1.2 m, Width of collector = 1.1 m
Extinction coefficient of glass = 12/m, Glass plate thickness = 2 mm
Refractive index of glass to air=1.526, Beam radiation flux = 450 W/m^2
Diffuse radiation flux = 200 W/m^2
Tilt factor for beam radiation=0.9384
Tilt factor for diffuse radiation=0.9741
Tilt factor for reflected radiation = 0.0052
Transmissivity based on reflection-refraction for beam radiation= 0.8445
Angle of refraction for beam radiation = 18.72^0
Angle of incidence for diffuse radiation = 60^0
Diffuse reflectivity of cover system = 0.2
Glass cover emissivity/absorptivity = 0.8
Find the incident solar radiation flux absorbed by the absorber plate. **4**

2B. Define and give the expressions for all types of tilt factors. 3

2C. What are the effects on performance of liquid flat plate collectors for the following factors:

i) Fluid inlet temperature

ii) Spacing

iii) Selective surfaces 3

3A. At a given site the wind velocity is measured as 12 m/s at a height of 15 m above the ground. At a height of 5 m from the ground, the wind velocity is found to be 50% less than that at 15m height. The density of air is 1.22 kg/m^3 at both sites. The wind turbine diameter is 90 m and the turbine speed is 100rpm. If the wind turbine is to be installed at both the heights, find:

I) Ratio of maximum axial force on the turbine at each site.

II) Ratio of maximum circumferential force on turbine at each site. 4

3B. Sketch and explain a hybrid power generating system that uses differential temperature available in very large water bodies. 3

3C. With neat sketch explain the working of an ocean wave energy converter that makes use of linear and oscillating motion of the ocean waves. 3

4A. With a neat sketch explain the working of an up draught gasifier with all the reactions. 4

4B. Explain in a biomass digester:

I) Why maintaining total solid content is critical

II) Diameter to depth ratio is important 3

4C. A certain petro- thermal process involves flashing of hot water to generate power. How would you modify this to include one more turbine that would run using flashed vapours. Explain with a neat sketch. 3

5A. Sketch and label the Magneto-hydrodynamic system for power generation in which combustion gas is passed through the magnetic field for power generation. Explain the principles used in MHD. 3

5B. How can Solid Oxide Fuel Cells be used or modified to generate energy more efficiently like Molten Carbonate Fuel Cells ? 3

5C. What is PEM? How can they be used in a fuel cell? Explain with a neat sketch. Also mention the desirable properties of a PEM. 4