Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: RENEWABLE ENERGY SYSTEMS (MME-447)

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A) With neat sketch of Solar Earth geometry, explain the various angles required for solar radiation measurement. **(03)**

1B) With neat sketch explain the working of Forced circulation direct and indirect gain type solar dryers. **(03)**

1C) Estimate the monthly average daily global radiation on a horizontal surface at Vadodara (22°00′N, 73°10′E) during the month of April if the sunshine hours per day is 8.5.Assume values of a= 0.28 and b= 0.48. Klein's recommendation for the April month is April 15. **(04)**

2A) Explain the factors which effects the generation of biogas? **(03)**

2B) Explain the importance of i) Heat removal factor ii) Collector efficiency factor iii) Transmissivity-Absorptivity product. **(03)**

2C) In a New Delhi ($\phi=28^0 53'$) a 2 m^2 solar flat plate collector is used to heat water. The collector is installed facing south and inclined at 40^o to horizontal on April 1 .This collector is tested for instantaneous efficiency at 11:00 am solar time. The flow rate through the collector was maintained at 70 kg/hour-m^2.The inlet water temperature was 40^0C while the ambient temperature was 30^0C, at the same time solar meter with shading ring mounted horizontally gave a reading of 900 W/m^2 and with shading ring gave a reading of 120 W/m^2. Take Cp=4.2 kJ/kgK; Transmissivity-absorptivity product=0.84, collector heat removal factor= 0.822, collector efficiency factor=0.58 and overall loss coefficient=5.5 W/m^2K. Neglect the reflected radiation from the surroundings and calculate the instantaneous efficiency of the collector and outlet temperature of the collector. **(04)**

3A) With neat sketch explain the working of Fixed Dome Type Biogas plant with emphasis on the various processes of biogas generation. **(03)**

3B) A multi blade wind mill lifts 1.03 m^3/hr of water through a head of 28m. Where the wind speed is 3.3 m. Calculate the power coefficient of the rotor, if Diameter of the rotor is 4.5m transmission efficiency is 95% and pump efficiency is 70 %. **(03)**

3C) Derive the expression for maximum power obtainable from a horizontal axis wind turbine. **(04)**

4A) With neat sketch explain the process of ocean thermal energy conversion using Anderson cycle. **(03)**

4B) Ocean waves on an Indian coast had an amplitude of 1.2 m with a period of 6 seconds measured at the surface of the water 110 m deep. Taking water density as 1025 kg/m^3, calculate the following- (a) Wave velocity (b) Energy density (c) Power density of the wave. **(03)**

4C) It is desired to set up a power plant to covert the ocean tidal energy into electricity. The plant should consist of single basin and generates power only during high tides. Derive the expression for power output for the proposed power plant in terms of range of the tide. **(04)**

5A) With neat sketch explain the working of a suitable energy conversion device that makes use of hydrogen as fuel with byproduct as water. **(03)**

5B) With neat sketch explain the working of a suitable system that makes use of magneto hydrodynamic principle with exhaust gas as working fluid. **(03)**

5C) A thermoelectric generator operates between the temperature limits of 923 K and 323 K. The cross sectional areas and lengths of n and p type elements are: A_1= 2.3cm^2, l_1= 1.5cm and A_2= 1.303cm^2, l_2= 0.653cm, respectively. Calculate the maximum generator efficiency. The following properties may be used. **(04)**

Properties	**n-type**	**p-type**
Seebeck coefficient (α_s) volt/°C	-190x10-6	190x10-6
Specific resistivity (ρ) ohm-m	1.45x10-5	1.8x10-5
Figure of merit (z) K^{-1}	2x10-3	1.7x10-3

6A) Explain with neat sketches the bulb type and tube type turbines used in small scale hydroelectric power plants. **(03)**

6B) With neat sketch explain the working of thermionic power generation system. **(03)**

6C) Write short notes on the following: **(04)**

(a) Spring tide and neap tide (b) Pyranometer