MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEMESTER M. TECH END SEMESTER EXAMINATIONS, MAY 2019

SUBJECT: RENEWABLE ENERGY TECHNOLOGY [MME 5286]
REVISED CREDIT SYSTEM

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

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

1A.	What are beam and diffused radiations? Discuss the role of beam radiation in energy conversion.	(3)
1B.	With a neat sketch explain the application of solar energy in photovoltaic energy conversion.	(4)
1C.	Determine Local Apparent Time (LAT) corresponding to 1030 h (IST) at Manipal (13.3605º N, 74º47' E) on May 7, 2019. The standard time is based on 82.50ºE.	(3)
	The time correction for May 7 is (+4) minutes.	
	Also calculate the declination (δ) for the same day.	
2A.	How ethanol is obtained from biomass? What are its energy applications?	(3)
2B.	How methane gas is produced from biomass waste?	(2)
2C.	A family consisting 3 adults and 2 children. Two children are equivalent to one adult. The family contains following cattles.	(5)

Cattle	Number	Average quantity of excreta available per cattle per day
Cow	1	10 kg
Buffalo	1	15 kg
Chicken	5	0.18 kg

Design a biogas plant for cooking and house lighting.

Gas required for cooking/person/day = 0.227 m^3

Gas required for lighting 50 C.P. lamp per hour = 0.063 m^3

The family is using two lamps of 50 C.P., which would burn 2 hours daily.

Assume the gas produced from 1 kg of gobar in winter (6 months) = 45 litres and in summer (6 months) = 55 litres. Retention period of slurry is 30 days. Density of slurry is 1090 kg/m³. Take diameter to depth ratio as 0.66.

3A. Prove that in case of horizontal axis wind turbine, maximum power can be obtained when: (5)

$$Exit\ velocity = \frac{1}{3}\ wind\ velocity$$

and

$$P_{max} = \frac{8}{27}\rho A V_i{}^3$$

3B. Discuss the main considerations in selecting a site for wind power plant. (3)

3C. How wind energy conversion systems are classified? (2)

4A. Discuss the advantages of fuel cells over internal combustion engines. (2)

4B. Explain the different technologies used to store hydrogen. (4)

4C. Explain the advantages of fuel flexibility of fuel cells (2)

4D. What are the applications of fuel cells? (2)

5A. With a neat sketch, explain the working of a closed OTEC (Ocean Thermal Energy Conversion) system. (4)

5B. Explain the basic principles of tidal energy conversion. (3)

5C. What are the advantages and limitations of wave energy? (3)