Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A Constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END Semester EXAMINATIONS, DEC 2021

SUBJECT: RENEWABLE ENERGY ENGINEERING [CHE-4070]

REVISED CREDIT SYSTEM

Time: 75 Minutes MAX. MARKS: 20

Instructions to Candidates:

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

1A.	Find the solar altitude angle when L = 15 N (+), l_{local} = 85.37 W (+), and l_{st} = 92 W (+) on April 1 at 2 p.m. Also find the sunrise and sunset times on this day.	**3**
1B.	a) Calculate the main dimensions of the wind machine rotor with number of blades= 15, blade length= 2m, and solidity=0.4 operating at a speed of 25 kmph. The machine operates a wind pump having a capacity of 6 m^3/h and lift of 20 m. Consider the density of water as 996 kg/m^3. Pump efficiency and transmission efficiency as 0.5 and 0.8 respectively. Take the density of air as 1.2kg/m^3 and $\lambda = 0.8$. b) Draw a neat diagram of horizontal axis wind mill.	**4(3+1)**
1C.	a) Describe about types of hydro power plants based on their size. b) Explain about types of solar water heating systems.	**3 (2+1)**
2A.	A biogas gasifier is used to run a compression ignition engine. The engine operates in the dual fuel mode with 76% diesel replacement. The biomass feeding rate for the gasifier is 320 kg/h. Calculate the power produced by engine, if the efficiency is 45% and calorific value of biomass is 16800kJ/kg. Consider the efficiency of gasifier as 0.65.	**3**
2B.	Explain the necessity of turbine blades, yaw control, spacing between the towers and speed control systems in the operation of windmill.	**4**
2C.	Clearly explain various stages in producing biogas.	**3**