Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

VII SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DECEMBER 2023

RENEWABLE ENERGY [ELE 4306] (OPEN ELECTIVE)

REVISED CREDIT SYSTEM

Time: 3	3 Hours	Date: 12 DECEMBER 023	Max. Marks: 50
Instructions to Candidates:			
•	Answer ALL the questions		
•	Missing data may be suita	bly assumed.	
1A Determine the angle subtended by beam radiation with the normal to a flat-plate collector at 9 a.m. for the day on November 3, 2003. The collector is in Delhi (28° 35' N, 77° 12' E), inclined at an angle of 36° with the horizontal and is facing due south.			

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1B Explain the following with respect to solar geometry:a. Declination angleb. Hour anglec. Inclination angle

- **1C** Calculate the monthly average of the daily global radiation on a horizontal surface on March 21st, at the latitude of 12° N. The ratio of average sunshine hour per day and day length is 0.68. (Note: a = 0.28; b = 0.50)
- **2A** With the help of block diagram discuss the operation of stand-alone and Grid-Interactive solar PV systems.
- **2B** What is a concentrating collector? Discuss the need of orientation in concentrating collector?
- **2C** Discuss the following with respect to wind energy conversion systems.
 - a) Constant speed-constant frequency system
 - b) Variable speed-constant frequency system
- **3A** Using Betz model of a wind turbine, derive an expression for power extracted from wind.
- **3B** Compare briefly about Horizontal axis and Vertical axis wind turbine **3**

3C Determine the size of a cow-dung based biogas plant required for a house having the following requirements:

(a)Cooking for two adults and two children.

(b)Lighting for three hours daily, using three gas mantle lamps, each of 100 CP power.

(c)Also, calculate the number of cows required to feed the plant, Gas produced per day, daily feeding of cow dung, slurry volume added per day and required volume of digester for 50 day retention time.

(Note: Two children may be considered as equivalent to one adult for cooking energy purpose. Assume biogas required for cooking is 0.227 m3/person/day, gas required for lighting a 100 CP lamp is 0.126 m3/hour and weight of dry solid mass (18%) in cow dung, collectable cow dung (70%), slurry density is 1090 kg/m3)

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- **4A** Illustrate the concept of circulating fluidized and bubbling fluidized bed gasifiers with neat diagrams.
- **4B** Discuss the bio-chemical conversion process of anaerobic digestion and fermentation with neat diagrams.
- **4C** Explain the construction and working of floating drum type biogas plant with a neat diagram.
- **5A** Illustrate the working principle of closed or Anderson ocean thermal energy conversion (OTEC) technology with a neat diagram.
- **5B** Explain Linked-basin tidal-energy conversion scheme with a neat sketch.
- **5C** Discuss the 'Flash steam open system' used in geothermal power plant for power generation with the help of a schematic diagram.