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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION – JAN 2023

Course Code: MEC 330

Course Name: Renewable Energy Systems (OE-II)

Program: B.Tech All Branches

Date: 27-JAN-2023

Time: 1.00 PM to 4.00 PM

Max Marks: 100

Weightage: 50 %

Instructions:

- (i) Read the all questions carefully and answer accordingly.
- (ii) Use of a Scientific calculator is permitted.

Part A [Memory Recall Questions]

Answer both the Questions. The questions carries THIRTY marks.

(30M)

1. Answer all the questions.

(12Qx2M=24M)

- i. Solar Energy is received on the earth's surface in the form of _____. (CO1)[Knowledge]
- ii. The approximate distance of earth from sun is _____ kms. ($150 \times 10^6 / 120 \times 10^6 / 100 \times 10^6$). (CO1)[Knowledge]
- iii. Solar Constant is defined as the rate at which solar energy arrives at the earth's surface. (True/False) (CO2)[Knowledge]
- iv. The variation in the distance between earth and sun follows a _____ behaviour. (Linear/Sinusoidal/Exponential) (CO2)[Knowledge]
- v. Air mass does not depend on the path length covered by the sun's rays through the atmosphere. (True/ False) (CO2)[Knowledge]
- vi. The Flat Plate type of collector is not a concentrating type of collector.(True/ False) (CO2)[Knowledge]
- vii. Concentrating types of collectors do not have the facility to track the sun. (True/False) (CO2)[Knowledge]
- viii. Solar Distillation is one of the direct applications of solar energy. (True/False) (CO2)[Knowledge]
- ix. Biomass conversion technologies play an important role in producing fuels. Which premium fuel is produced from the anaerobic digestion process? (CO3)[Knowledge]
 - a. Methane b. Ethanol c. Diesel d. Hydrocarbon liquids
- x. Vertical axis wind turbine is better in overall performance than horizontal axis wind turbine. (True/False) (CO3)[Knowledge]
- xi. Wind flows from _____ pressure region to _____ pressure region. (High, Low) (CO3) [Knowledge]
- xii. Wind vanes attached to the Wind turbines help to face the wind direction. (True/False) (CO3) [Knowledge]

2. Match the pair for the below conversion process and their principle output.

[3Qx2M=6M]
(CO3) [Knowledge]

Conversion process	Principle output
1. Anaerobic Digestion	a. Mixture of Oils
2. Hydrogenation	b. Charcoal
3. Liquefaction	c. Methane

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SIX marks.

(5Qx6M=30M)

- How biogas plants are classified? Explain them briefly. (CO3)[Comprehension]
- List out minimum six factors to be considered to decide the optimum size of a biogas plant. (CO3)[Comprehension]
- Explain the photo voltaic effect using p-n junction semiconductor. Draw a neat sketch. (CO2)[Comprehension]
- Explain the working of parabolic trough collector with a neat sketch. Also mention its two features. (CO2)[Comprehension]
- Explain in detail the generation of wind globally and locally. (CO3)[Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TEN marks.

(4Qx10M=40M)

- The following data are given for a family biogas digester suitable for the output of four cows: the retention time is 30 days, temperature 35°C, dry matter consumed per day per cow= 6 kg, biogas yield is 0.24 m³ per kg. The efficiency of the burner is 60%, methane proportion is 0.78. The heat of combustion of methane = 35 MJ/m³. Calculate: i) the volume of the biogas digester in m³/day; ii) the power available from the digester in MJ/day. Take the density of cow dung = 50 kg/m³. (CO3)[Application]
- Wind at 1 standard atmospheric pressure and 15°C has an inlet velocity of 15 m/s and exit velocity of 7 m/s. Given: Turbine diameter = 120 m, and turbine operating speed = 40 RPM. The propeller-type wind turbine is considered. Calculate: a) the total power density in the wind stream in W/m², b) the maximum obtainable power density in W/m², c) Axial Thrust in N. (1 atmospheric pressure = 1.01325 * 10⁵ Pa) (CO3)[Application]
- Determine the local solar time (in the form of hours, minutes, and seconds) and declination at a location latitude 23° 15' N, longitude 77° 30' E at 12.30 IST on July 1. The equation of a time correction is given from the standard table = (-ve) 3' 01". (CO2)[Application]
- Calculate the angle made by beam radiation with the normal to a flat collector on February 14, at 10.00 AM., solar time for a location at 28° 35' N. The collector is tilted at an angle of 30°, with the horizontal and is pointing due south. Take local solar noon = 12.00 Noon. (CO2)[Application]