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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

MAKE UP EXAMINATION – JAN 2023

Course Code: MEC 2001

Course Name: Renewable Energy Systems (OE-II)

Program: B.Tech All Branches

Date: 27-JAN-2023

Time: 1.00PM 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]

1. Answer all the Questions. Each question carries TWO marks. (15Qx2M=30M)

- i. The direct part of the solar radiation constitutes almost 90% of the total. (True/ False) (CO2)[Knowledge]
- ii. During the Noon time, the value of Air- Mass is _____. (0.5/0/1) (CO2)[Knowledge]
- iii. Declination angle is zero at _____. (Summer Solstice/ Winter Solstice/ Equinoxes) (CO2)[Knowledge]
- iv. _____ angle is the complementary angle of sun's altitude angle. (Zenith/Declination/Azimuth) (CO2)[Knowledge]
- v. Solar Time and the Local Clock Time, both are not equal. (True/False) (CO2)[Knowledge]
- vi. In case of sensible heat storage, the material undergoes _____ change of phase. (no/total/partial) (CO2)[Knowledge]
- vii. Various categories of biomass resources are available. Which of the following is a traditional solid mass form of biomass? (CO3)[Knowledge]
a. Wood b. Liquid fuels c. Sugar crops d. None of the above
- viii. There are several types of horizontal axis wind turbines. Which of the following is the oldest design? (CO3)[Knowledge]
a. Propeller type b. Multibladed type c. Dutch type d. Sail type
- ix. Fats, starches, and proteins contained in biomass are broken into simple compounds in enzymatic hydrolysis process. (True/False) (CO3)[Knowledge]
- x. For the design of biogas digester, rectangular shape is preferred. (True/False) (CO3)[Knowledge]
- xi. What are the different feedstocks used as biomass? (CO3)[Knowledge]
- xii. The wind turbine power changes with change in diameter and wind speed. (True/False) (CO3)[Knowledge]
- xiii. Wind energy possesses various disadvantages. Which of the following are the disadvantages? (CO3)[Knowledge]
a. Dilute nature b. Fluctuating nature c. Noisy operation d. All of the above

- xiv. Biomass is organic matter produced by plants, both terrestrial, aquatic and their derivatives. (True/False) (CO1)[Knowledge]
- xv. Energy sources are available in the world. Which of the following are the conventional energy sources? (CO1)[Knowledge]
- a. Sun b. Wind c. Solid fuels d. Geothermal

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SIX marks. (5Qx6M=30M)

2. What exactly happens during the anaerobic digestion process? Explain in brief. (CO3)[Comprehension]
3. What are the features of the Deen Bandhu biogas plant? Explain its working with a neat sketch. (CO3)[Comprehension]
4. Draw the block diagram of Wind Energy Conversion Systems consists of various components and controls. (CO3)[Comprehension]
5. While considering phase change materials for the latent heat storage devices, what are the criteria that must be considered? (CO2)[Comprehension]
6. Define air mass. How do you measure day length with the sunshine recorder? Explain. (CO2)[Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TEN marks. (4Qx10M=40M)

7. The following data are given for a family biogas digester suitable for the output of four cows: the retention time is 10 days, temperature 35°C, dry matter consumed per day per cow= 2 kg, biogas yield is 0.2 m³ per kg. The efficiency of the burner is 60%, methane proportion is 0.7. 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]
8. Wind at 1 standard atmospheric pressure and 15°C has an inlet velocity of 12 m/s and an exit velocity of 5 m/s. Given: Turbine diameter = 80 m, and turbine operating speed = 35 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]
9. Determine the local solar time and declination angle at a location latitude 23° 15' N, longitude 77° 30' E at 10.30 IST on March 19. Equation of a time correction is given from the standard table = (-ve) 6' 15". (CO2)[Application]
10. Determine an average value of solar radiation on a horizontal surface for June 22, at the latitude of 10°N, if constants a and b are given as equal to 0.3 and 0.51 respectively, and the ratio $\frac{n}{N} = 0.55$. Use sunrise time. Take local solar noon = 12.00 Noon. (CO2)[Application]