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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: MEC 330

Course Name: Renewable Energy Systems

Program & Sem: B.Tech & VI sem

Date: 27th April 2022

Time: 10.00 AM to 11.00 AM

Max Marks: 30

Weightage: 15 %

Instructions:

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

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks.

(6Qx2M=12M)

- Solar energy has two forms which can be used to meet daily needs. _____ and _____ are the two forms of solar energy. (C.O.No.1) [Knowledge]
- A continuous burning of fossil fuels causes increase of CO₂ in environment. Name any two types of fossil fuels. (C.O.No.1) [Knowledge]
- Biomass energy is available free of cost. Name the two sources of biomass energy. (C.O.No.1) [Knowledge]
- Solar energy can be used in various applications. Name any two applications that you are aware of. (C.O.No.1) [Knowledge]
- Declination angle changes every day, with every season. The declination angle on 23rd September 2014 is _____. (C.O.No.2) [Application]
- The rate at which solar energy arrives at the top of the atmosphere is the solar radiation intensity. The solar radiation intensity on 27th April 2022 is _____. (C.O.No.2) [Application]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FOUR marks.

(2Qx4M=8M)

- Sun position changes throughout the day concerning a particular location. What is elevation and zenith angle concerned with sun position? Mention the relation between them. (C.O.No. 2) [Comprehension]
- Predicting accurate solar radiation intensity at a given location is a very complex task. However, the use of measurement instruments makes it slightly easy. Explain the function of Pyrheliometer. (C.O.No. 2) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. Question carries TEN marks.

(1Qx10M=10M)

9. You are sitting in the exam hall on the 27th of April 2022, writing a Renewable Energy Systems Paper. Suppose, you arrived at Part C of the question paper at 10:30 AM. Your exam hall is approximately situated at a location of 13.1679° N, 77.5335° E. Assume you can open the roof of your exam hall to receive the solar radiation. However, after a few minutes, you are very much upset with the scorching sun rays. Suddenly, you recollect the concept of the average value of solar radiation on a horizontal surface taught by your faculty in the classroom. You are keen to find out the actual amount of the intensity. What would it be? Assume the constants a and b for Bengaluru are given as equal to 0.18 and 0.64 respectively, and the ratio $\bar{n}/N = 0.6$. (Consider solar noon = 12:00 noon of clock time)

(C.O.No. 2) [Application]



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TEST 1

Winter Semester: 2021 - 22

Course Code: MEC 330

Course Name: Renewable Energy Systems

Program & Sem: B.Tech & VI sem

Date: 27th April 2022

Time: 10.00 AM to 11.00 AM

Max Marks: 30

Weightage: 15 %

Instructions:

(iii) Read the all questions carefully and answer accordingly.

(iv) Use of a Scientific calculator is permitted.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks.

(6Qx2M=12M)

- Solar constant is the amount of solar energy receives at the top of the atmosphere. Its value is _____ (W/m^2) or _____ $kcal/m^2$. (C.O.No.2) [Knowledge]
- Wind energy is a source of energy. There are two types of turbine used to harness the wind energy based on axis orientation. Name them. (C.O.No.1) [Knowledge]
- India has very scarce resources for geothermal reservoirs. List any two types of output from a geothermal reservoir. (C.O.No.1) [Knowledge]
- Hydrogen energy is a secondary source of energy. Fuel cell is used for solar hydrogen extraction. What is the desired output in decomposition process and combustion process in a fuel cell? (C.O.No.1) [Knowledge]
- Declination angle changes every day, with every season. The declination angle on 17th September 2013 is _____. (C.O.No.2) [Application]
- The rate at which solar energy arrives at the top of the atmosphere is the solar radiation intensity. The solar radiation intensity on 25th April 2022 is _____. (C.O.No.2) [Application]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FOUR marks.

(2Qx4M=8M)

- Local solar time is based on the definition of noon at a given location as being the instant when the Sun is at its highest position in the sky. It varies from location to location. What are the two corrections used in calculating the local solar time? (C.O.No. 2) [Comprehension]
- The duration of bright sunshine hours changes daily and with the seasons. Specify and explain the instruments which accomplished this task. (C.O.No. 2) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. Question carries TEN marks.

(1Qx10M=10M)

18. Your town is facing a frequent power cuts and it annoys you. One day you were reading a newspaper and found out about solar photovoltaic cells which can solve your long power cuts problem. You have made up your mind to go with this solution and decided to experiment with your knowledge of solar angles before purchasing.

You searched on the internet on the 27th of April and found the location of your home as 20.7047° N, 77.0049° E. You have taken a small flat Photo Voltaic panel to carry out the test and set it at an angle of latitude plus 11°. Later you observed that the sun path is mostly inclined in the sky and so pointed the panel due south. The entire setup got ready and you started the testing at 10:30 AM. Solar radiations are falling on the panel and started producing electricity. What must be the angle made by this radiation with the normal to the panel? (Take solar noon = 12:00 noon clock time) (C.O.No. 2) [Application]



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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: MEC 330 / MEC 2001

Course Name: Renewable Energy Systems (OE-II)

Program & Sem: B.Tech All Branches & VI Sem / IV Sem

Date: 1st July 2022

Time: 09.30 AM to 12.30 PM

Max Marks: 100

Weightage: 50 %

Instructions:

(vii) Read the all questions carefully and answer accordingly.

(viii) Use of a Scientific calculator is permitted.

Part A [Memory Recall Questions]

Answer both the Questions. The question carries THIRTY marks.

(30M)

1. Answer all the questions.

(12Qx2M=24M)

- i. The wavelength range for Solar energy is from 0.2 to 4.0 micrometres. (True/False)
(CO1)[Knowledge]
- ii. _____ radiation forms the minimum part of the entire spectrum of Solar radiation.
(Ultraviolet/Visible/Infrared) (CO1)[Knowledge]
- iii. The accepted value of Solar Constant is _____ W/m². (1343/1353/1363)
(CO2)[Knowledge]
- iv. The earth is closest to sun during _____ season. (Summer/ Winter) (CO2)[Knowledge]
- v. When the solar radiation strikes a solid/liquid, it is absorbed and transformed to _____ energy. (heat/magnetic/mechanical). (CO2)[Knowledge]
- vi. The sides and bottom of a flat plate collector is usually insulated to minimize heat loss. (True/False). (CO2)[Knowledge]
- vii. Device which converts sunlight to electricity by means of _____ effect is called as solar cells. (electrovoltaic/photovoltaic/chemovoltaic) (CO2)[Knowledge]
- viii. The hour angle is equivalent to _____ degrees per hour. (12/15/18) (CO2)[Knowledge]
- ix. Biogas plants are classified according to various plants. Which of the following gives intermittent gas production? (CO3)[Knowledge]
a. Continuous type b. Batch type c. Dome type d. Drum type
- x. The wind turbine power changes with change in diameter and wind speed. (True/False)
(CO3)[Knowledge]
- xi. Wind turbine extracts _____ energy of the wind to generate the power. (Kinetic / pressure) (CO3)[Knowledge]
- xii. Unlike water energy, wind energy needs storage capacity because of its irregularity. (True/False) (CO3)[Knowledge]

2. Match the pair for below conversion process and their principle output. [3Qx2M=6M]
(CO3)[Knowledge]

Conversion process	Principle output
1. Fermentation	a. Mixture of Oils
2. Gasification	b. Charcoal
3. Hydrogenation	c. Ethanol

Part B [Thought Provoking Questions]

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

3. Explain the continuous type of biogas plants in detail with a neat sketch. (CO3)[Comprehension]
4. Below are the few biomass conversion technologies. Explain in 3-4 sentences (process, principle output, and features) about these processes.
 a. Fermentation
 b. Pyrolysis
 c. Gasification (CO3)[Comprehension]
5. Explain the basic photovoltaic system for power generation in detail. (CO2)[Comprehension]
6. List out the factors to decide the optimum capacity of a solar storage system. (CO2)[Comprehension]
7. Classify the Wind Energy Conversion Systems according to i) axis of rotation, ii) size of the turbines based on electrical power output, iii) utilization of output. (CO3)[Comprehension]

Part C [Problem Solving Questions]

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

8. The following data are given for a family biogas digester suitable for the output of six cows: the retention time is 8 days, temperature 32°C, dry matter consumed per day per cow = 5 kg, biogas yield is 0.24 m³ per kg. The efficiency of burner is 60%, methane proportion is 0.8. Heat of combustion of methane = 30 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]
9. Wind at 1 standard atmospheric pressure and 15°C has an inlet velocity of 14 m/s and exit velocity of 6 m/s. Given: Turbine diameter = 100 m, and turbine operating speed = 40 RPM. 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]
10. Determine the declination angle and the average value of solar radiation on a horizontal surface for June 22, at the latitude of 15°N, if the constants a and b are given as 0.28 and 0.48 respectively, the ratio (\bar{n}/N) = 0.6. Use sunrise time. Take local solar noon = 12.00 Noon. (CO2)[Application]
11. Calculate the angle made by beam radiation with the normal to a flat collector on December 1, at 9.00 AM., solar time for a location at 28° 35' N. The collector is tilted at an angle of latitude plus 10°, with the horizontal and is pointing due south. Take local solar noon = 12.00 Noon. (CO2)[Application]