	<u>Utech</u>
Name:	
Roll No.:	As Again (Vi Executing and Explana)
Inviailator's Sianature :	

RENEWABLE ENERGY SOURCES

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A (Multiple Choice Type Questions)

- 1. Choose the correct alternatives for the following: $10 \times 1 = 10$
 - i) Solar constant is equal to
 - a) 1387 W/m^2
- b) 1353 W/m^2
- c) 1567 W/m^2
- d) 1657 W/m^2 .
- ii) Wind energy contained
 - a) kinetic energy
- b) potential energy
- c) wave energy
- d) heat energy.
- iii) Doping Materials used to made silicon solar cell are
 - a) Ge and B
- b) P and Bo
- c) Te and Cd
- d) Cu and Ga.

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- iv) The speed at which the wind turbine starts delivering shaft power
 - a) cut in speed
- b) cut out speed
- c) rotor speed
- d) rated wind speed.
- v) Tip speed ratio of a wind turbine is defined as
 - a) $\lambda = 3\pi RN/2V_{\infty}$
- b) $\lambda = 2\pi RN/V_{\infty}$
- c) $\lambda = \pi RN/V^3_{\infty}$
- d) $\lambda = 4\pi RN/V_{\infty}$.
- vi) Clarity index of solar radiation lies between
 - a) 2 to 3

- b) 0.8 to 0.9
- c) 5.7 to 6.8
- d) 0.1 to 0.7.
- vii) Biomass gasification is the process of
 - a) Converting a solid into a gaseous fuel with any solid carbonaceous fuel
 - b) Converting a solid or liquid into a gaseous fuel with any solid carbonaceous residue
 - c) Converting a solid or liquid into a gaseous fuel without leaving any solid carbonaceous residue
 - d) Converting a solid into a liquid fuel without leaving any solid carbonaceous residue.

- viii) Anaerobic digestion is the process involves microbial digestion of biomass and is done in the
 - a) presence of oxygen b) absent of oxygen
 - c) presence of nitrogen d) absent of nitrogen.
- ix) A hydro electric scheme operates at a head of 100 m and the water flow rate is $2000~\text{m}^3/\text{s}$. The power potential is
 - a) 1962 MW
- b) 2000 MW
- c) 1500 MW
- d) 1200 MW.
- x) Which turbine is used to power conversion for hydro plant by
 - a) Pelton turbine
- b) Keplon turbine
- c) Francis turbine
- d) all of these.

GROUP - B

(Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$

 Discuss the different types of solar cell according to manufacturing process. Also discuss efficiency of different generation of solar cell.

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- 3. The annual average wind velocity at a height of 10 m over a flat terrain is 8 m/s. The boundary layer exponent is x = 0.14. Find the annual average power density (W/m²) in the wind at a height of 25 m. Assume the Rayleigh distribution over the terrain and 1.425 kg/m^3 as the density of air.
- 4. What is the anaerobic digestion ? What are the end products ? Explain the process of gasification and combustion of bio mass. 2 + 1 + 2
- Draw and discuss the equivalent circuit of solar cell. Explain the V-I and P-V characteristics of Photovoltaic Modules. 2 + 3
- 6. Explain in brief the following : 5×1
 - a) Tip speed ratio
 - b) Solidity
 - c) Power coefficient
 - d) Angle of incidence
 - e) Angle of inclination.

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GROUP - C

(Long Answer Type Questions)

Answer any three of the following.

 $3 \times 15 = 45$

- 7. Give the classification of hydro power plant. Draw the a) layout block diagram for micro hydro power plant. Explain each component in brief. A hydro power plant with 950 MW output has an b) efficiency of 83%. The plant load factor is 75%. It operates at a constant head of 80 m. Calculate the maximum flow rate required i) the quantity of water to be stored behind a dam to ii) cater for a year's load requirement. 7 8. Discuss the different types of solar photovoltaic system. a) 9 Explain each of them using block diagram.
 - b) How to measure the solar radiation? Discuss any one ofthe solar radiation measuring equipment.6
- 9. a) What is biomass? How is it useful? 4
 - b) What are the factors affecting the generation of biogas? Discuss each of them in brief.

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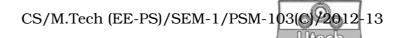
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c) Discuss briefly different types of biogas plant. Compare the fixed dome type plant and movable drum type plant.

3 + 3

- 10. a) Discuss the Aerodynamics of wind rotors. Also find out the total thrust and aerodynamic power developed in a three blade wind turbine using blade element theory.
 - b) Find the required diameter of a wind turbine to generate 4kW at a wind speed of 8m/s and a rotor speed of 120 rpm. Assume power coefficient is 0.4; efficiency of mechanical transmission is 0.9 and efficient of Generator is 0.95.
 - c) Calculate the angle made by beam radiation with the normal to a flat plate collector, pointing the south location in New Delhi (27° 30'N, 760 42' E) at 10.00 hour solar time on October 29th. The collector is tilted at an angle of 35° with the horizontal. Also calculate the day length.

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- 11. Discuss in short any *five* of the following :
 - a) Horizontal axis wind energy turbine
 - b) Local Solar Time
 - c) Mud Jar Biogas Plant
 - d) Pelton Turbine
 - e) Pyrohiliometer
 - f) Angle of declination.

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