RENEWABLE ENERGY I
(REEN 5102)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i)   When a catalyst increases the rate of chemical reaction, the rate constant
(a) decreases   (b) increases
(c) remains constant   (d) becomes infinite.

(ii)   The bio ethanol obtained in the fermentation process has _____ purity.
(a) 99%   (b) 99.2%   (c) 99.4%   (d) 99.7%

(iii) The wind intensity can be described by
(a) Reynolds number   (b) Froude number
(c) Prandlt number   (d) Beaufort number.

(iv)   SCADA systems used in wind turbines, stands for
(a) Supervisory Control And Digital Algorithm
(b) Specific Control And Data Acquisition
(c) Supervisory Control And Data Acquisition
(d) Specific Control And And Digital Algorithm.

(v)   Adjustable runner blades are found in
(a) Francis turbine   (b) Propeller turbine
(c) Pelton turbine   (d) Kaplan turbine.

(vi)   Which of the following is not used as biomass?
(a) Hybrid poplar   (b) Willow algae
(c) Iron nails   (d) Trap grease.

(vii) The zenith angle is the angle made by the sun's rays with the _____ to a _____ surface.
(a) normal, horizontal   (b) tangent, horizontal
(c) normal, vertical   (d) tangent, vertical

(viii) A liquid flat plate collector is usually held tilted in a fixed position, facing _____ if located in the northern hemisphere.
(a) North   (b) South   (c) East   (d) West

(ix)   If the velocity of the incoming wind is doubled, the available wind power for a wind turbine is
(a) doubled   (b) increased by 4 times
(c) increased by 8 times   (d) increased by 59.3%.

(x)   Specific speed is higher for
(a) Francis turbine   (b) Pelton turbine
(c) Axial flow turbine   (d) None of these.

Group – B

2. (a)   Describe the important of bioreactor. Describe the different phase of a cell growth curve of a batch bioreactor.

    (b)   What is doubling time? Derive the expression of Monod growth model for a bio reactor using usual assumption.

                                        (2 + 4) + (1 + 5) = 12

3. (a)   The following data was determined in a batch reactor for the yeast Saccharomyces Cerevisiae.

Time (h)	Cells, C_c (g/dm³)	Glucose, C_s (g/dm³)	Ethanol, C_P (g/dm³)
0	1	250	0
1	1.37	245	2014
2	1.87	238.7	5.03
3	2.55	229.8	8096

Determine $Y_{S/C}$, $Y_{C/S}$, $Y_{S/P}$, $Y_{P/S}$, $Y_{P/C}$. Assume no lag and neglect maintenance at the start of the growth where there are just few cells.

    (b)   Derive the performance equation of continuous stirrer tank reactor with considering the usual assumptions.

                                        9 + 3 = 12

Group – C

4. Describe the classification of gasification. Describe the Fermentation process bioethanol production with net flow diagram.

                                        (4 + 8) = 12

5. Describe the working principle of twin-fire gasifier and cross-draft gasifier.

                                        (6 + 6) = 12

Group – D

6. (a) Briefly explain the working principles of different types of anemometer used for wind measurement.

   (b) What are the environmental benefits and problems of wind energy conversion systems?

   6 + 6 = 12

7. (a) Draw an airfoil and show the important parameters on it. What is the significance of the digits for 'NACA 2415'?

   (b) What is meant by "Tip-Speed Ratio"? How it affects the performance of a wind turbine?

   (3 + 3) + (2 + 4) = 12

Group – E

8. (a) Briefly discuss on the essential elements of a hydroelectric power plant.

   (b) Explain the application and significance of a typical Discharge vs. Time hydrograph.

   6 + 6 = 12

9. (a) Describe the methodologies for the selection of hydraulic turbines.

   (b) Write short notes on (i) Penstock (ii) Surge chamber.

   6 + 6 = 12