MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EE-704D

RENEWABLE AND NON-CONVENTIONAL ENERGY

Time Allotted: 3 Hours   Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions.   10×1 = 10

(i) Global warming is mainly caused due to

(A) emission of heat from engine

(B) emission of CO_2 due to burning of fossil fuels

(C) use of nuclear energy

(D) air pollution

(ii) A typical open circuit voltage of a solar cell is

(A) 0.45 V DC   (B) 3 V DC

(C) 1.5 V DC   (D) 0.05 V DC

(iii) Bio gap consists of

(A) only methane   (B) methane and carbon dioxide

(C) only ethane   (D) all of these

(iv) The range of wind speed suitable for power generation is

(A) 0 to 6 m/sec   (B) 5 m/sec to 25 m/sec

(C) 25 m/sec to 50 m/sec   (D) 50 m/sec to 70 m/sec

(v) Maximum theoretical efficiency of a wind turbine is

(A) 80 %   (B) 68 %

(C) 59 %   (D) none of these

(vi) Temperature of inner core of earth is

(A) 1000°C   (B) 4000°C

(C) 40000°C   (D) none of these

(vii) Capacity of a micro hydel power plant is

(A) up to 100 kW   (B) 101 to 1000 kW

(C) 1 to 25 mW   (D) none of these

(viii) Which material has the highest solar cell efficiency?

(A) Amorphous Silicon   (B) Poly Crystalline Silicon

(C) Thin Filmed Silicon   (D) Single Crystalline Silicon

(ix) Most commonly used wind turbine is

(A) simple impulse type   (B) propeller type

(C) reaction type   (D) reversible type

(x) A solar thermal water pump

(A) uses solar thermal energy to evaporate water

(B) uses solar thermal energy to circulate hot water

(C) uses electric powered pump to circulate water heated by solar energy

(D) uses solar thermal energy for production of power to drive the pump

(xi) The energy radiated by sun on a bright sunny day is about

(A) 200 W/m^2 (B) 500 W/m^2

(C) 1 kW/m^2 (D) 2.5 kW/m^2

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GROUP B
(Short Answer Type Questions)

Answer any *three* questions. $3 \times 5 = 15$

2. Discuss different renewable sources of energy with reference to Indian context.

3. Discuss different systems used for generating power using Geothermal energy, in brief.

4. Explain the principle of production of Biogas.

5. A tedal power plant of single basin type has a basin area of 15×10^6 m². The tide has a range of 12 m. The turbine however, stops operating when the head on it falls below 2m. Calculate the energy generated in one filling process in kWh if the turbine generator efficiency is 80% (Density of sea water = 1025 k/m²).

6. Derive the equations for the voltage and power output of the MHD generator.
$3+8$

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. $3 \times 15 = 45$

7. (a) With the help of basic block diagram, explain the working of a solar photo voltaic power plant. $5+5+5$
   (b) Define
      (i) solar constant
      (ii) earth sun angles
   (c) Derive the expression of maximum current from solar cell.

8. (a) Using Betz model of wind turbine, derive the expression for power extracted from wind. What is Betz criterion? $9+6$
   (b) A propeller type wind turbine has the following data:
      Speed of free wind at a height of 10m is 12m/s, air density is 1.226 kg/m³, α = 0.14, height of tower is 100m, diameter of rotor is 80m, wind velocity at the turbine reduces by 20 %, generator efficiency is 85 % .
      Find
      (i) total power available in wind
      (ii) power extracted by the turbine
      (iii) electrical power generated
      (iv) axial thrust on the turbine
      (v) maximum axial thrust on the turbine

9. (a) What is the basic principle of MHD power generation? $6+5+4$
   (b) Describe the open cycle system of MHD power generation.
   (c) Calculate the open circuit voltage with following specifications
      Plate area = 0.2 m²
      Distance between plates = 0.4 m
      Flux density = 2 wb/m²
      Average gas velocity = 1000 m/s
      Conductivity of the gas = 10 mho/m

10.(a) What is a fuel cell? $3+4+8$
   (b) What are the potential applications of a fuel cell?
   (c) Explain the working principle and constructional details of a hydrogen fuel cell.

11. Write short notes on any *three* of the following: 3×5
   (a) Hydrogen energy
   (b) Kyoto protocol
   (c) Solar pond
   (d) Wave energy.