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# 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.*

### GROUP A
### (Multiple Choice Type Questions)

1. Answer *all* questions. $10 \times 1 = 10$

(i) Which is not renewable energy source?
(A) hydropower (B) tidal power
(C) geothermal (D) fuel cell

(ii) Which process is responsible for production of energy in sun?
(A) nuclear fission (B) nuclear fusion
(C) exothermal reaction (D) all of these

(iii) Tidal power plants are built on
(A) seashore (B) creeks
(C) plates (D) mountain range

(iv) Wave energy is harnessed in the form of
(A) electrical energy (B) thermal energy
(C) chemical energy (D) mechanical energy

(v) MHD utilizes
(A) direct conversion of heat to electricity
(B) conversion of heat to steam
(C) conversion of heat to force
(D) none of these



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(vi) Tidal energy utilizes
(A) kinetic energy of water
(B) potential energy of water
(C) both kinetic and potential energies of water
(D) none of these

(vii) Horizontal axis windmills of modern design can
(A) always turn towards the direction of the wind
(B) never adjust the energy output
(C) never turn towards the direction of the wind
(D) none of these

(viii) In rural areas, the locally generated gas from cow dung used for cooking and lighting is called
(A) biogas (B) oxygen
(C) ammonia (D) carbon dioxide

(ix) A solar cell is basically
(A) a voltage source controlled by flux of radiation
(B) a current source controlled by flux of radiation
(C) an uncontrolled current source
(D) an uncontrolled voltage source

(x) Solar photo-voltaic panel consists of photo-voltaic cells connected in
(A) parallel (B) series-parallel
(C) series (D) none of these

### GROUP B
### (Short Answer Type Questions)

Answer any *three* questions.

2. Define latitude, declination, hour angles with proper diagram. Calculate the day length in Srinagar on 1st July, 2012. The latitude of Srinagar is 34°05'N.



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3. Explain the types of generators used with wind turbines for producing electricity. 5

4. Write down the advantages and disadvantages of a tidal barrage scheme as a source of electrical power. 5

5. What are the main advantages and disadvantages of biomass energy? Explain the process of photosynthesis. 3+2

6. Explain in brief the auxiliaries of a micro-hydropower plant. 5

## GROUP C
## (Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Draw the equivalent circuit of a solar cell. 2
   (b) Explain how we can get maximum power from a solar cell and deduce expression for that. 5
   (c) What is fill factor? 2
   (d) A solar cell of active area 6 $cm^2$ gave the following results: 6
   $V_{oc}$ = 400 mV, $I_{sc}$ = 200 mA, incident intensity 80 $mW/cm^2$. What is the energy conversion efficiency of the device? (Assume fill factor of 80%)

8. (a) Define 'Betz Limit' and derive expression for maximum power coefficient for wind turbine. 7
   (b) Wind speed is 10 m/s at the standard atmospheric pressure. Calculate : 8
   (i) total power density in wind stream, (ii) total power produced by a turbine of 100 m diameter with an efficiency of 40%. Air density = 1.226 J/kg-K/$m^3$.

9. (a) Describe in brief the operation of a Molten Carbonate Fuel Cell (MCFC). 6
   (b) Calculate the open circuit voltage and maximum power output for an MHD generator having the following data : 9
   Plate area = 0.25 $m^2$, distance between electrodes = 0.50 m, flux density = 1.8 $Wb/m^2$, average gas velocity = 1200 m/s, gaseous conductivity = 10 mho/m.



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10.(a) Derive the expression of total energy content of hot dry rock resource.
   (b) (i) Explain single-basin, single-effect tidal energy conversion scheme.
   (ii) A single-basin type tidal power plant has a basin area of 2 $km^2$. The tide has an average range of 13 m. Power is generated only during the ebb cycle. The turbine stops operating when the head on it falls below 3 m. Calculate the average power generated by the plant in single-emptying process of the basin if the turbine generator efficiency is 0.7. Estimate the average energy generation of the plant.

11. What is fuel cell? Discuss different types of fuel cell? What are the advantages of fuel cell energy? Discuss on alkaline fuel cell and hydrogen fuel cell. 2+



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