RENEWABLE ENERGY SYSTEMS
(MECH 4126)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) Global warming is mainly caused due to
(a) emission of heat from engines
(b) emission of CO2 due to burning of fossil fuels
(c) use of nuclear energy
(d) air pollution.

(ii) The change in entropy for a reversible adiabatic process is
(a) zero (b) minimum
(c) infinite (d) unity.

(iii) For 1 degree change in longitude, the change in solar time
(a) 4 minutes (b) 4 seconds
(c) 1 minute (d) 1 hour.

(iv) In evacuated tube collectors
(a) both conduction and convection losses are suppressed
(b) only conduction losses are suppressed
(c) only convection losses are suppressed
(d) only radiation losses are suppressed.

(v) Thermal radiation includes the following bands
(a) entire ultra violet and visible light
(b) entire infra-red, visible light and ultra violet
(c) entire infra-red, visible light and part of ultra violet
(d) none of these

(vi) What is responsible for the movement of carriers after creation of an electron-hole pair due to radiation?
(a) Diffusion process (b) Drift process
(c) Built-in electric field across the junction (d) External voltage.

(vii) Tip speed ratio of a wind turbine is the ratio between
(a) blade tip speed and rotor angular speed
(b) blade tip speed and incoming wind speed
(c) rotor angular speed and incoming wind speed
(d) rotor angular speed and downstream wind speed

(viii) Biogas is predominantly
(a) hydrogen (b) carbon monoxide
(c) carbon dioxide (d) methane.

(ix) The turbine used in a tidal range plant is
(a) Francis turbine (b) Propeller turbine
(c) Kaplan turbine (d) Pelton turbine

(x) Linear velocity of a particle at the crest of a wave is
(a) $a\omega$ (b) a/ω
(c) ω/a (d) $a+\omega$

Fill in the blanks with the correct word

(xi) A 1 MW capacity electricity plant runs on full capacity. The energy (in units) it will generate during one year is _____.

(xii) Energy that comes from sources that will not run out is called _____ energy.

(xiii) The percentage of the incoming radiation reflected to space by the earth is _____.

(xiv) For efficient wind turbine site selection, areas with high average wind speed and minimal _____ should be chosen.

(xv) The difference between the high tide and the low tide is called _____.

Group - B

2. (a) What are the different aspects of 'Energy Conservation'? *[(CO1)(Understand/LOCQ)]*
(b) Briefly discuss various methods of mechanical energy storage systems. *[(CO2)(Analyse/IOCQ)]*

6 + 6 = 12

3. (a) Explain various aspects of energy conservation and its significance. *[(CO1)(Understand/LOCQ)]*
(b) Briefly discuss various methods of energy storage systems with suitable examples. *[(CO2)(Analyse/IOCQ)]*

6 + 6 = 12

Group - C

4. (a) What is the future prospect of solar water desalination systems? *[(CO3)(Analyse/IOCQ)]*

(b) The following observations were made at a site: Theoretical maximum possible sunshine hours = 9.5 h. Average measured length of a day during April = 9.0 h. Solar radiation for a clear day = 2100 kJ/m^2/day. Constants: a = 0.27, b = 0.50. Calculate the average daily global radiation. *[(CO3)(Evaluate/HOCQ)]*

6 + 6 = 12

5. (a) What do you understand by the earth's *albedo*? *[(CO3)(Understand/IOCQ)]*
   (b) Propose a geometry and shape of an efficient solar collector and justify. *[(CO3)(Create/HOCQ)]*

4 + 8 = 12

Group - D

6. (a) Discuss the aerodynamic principles that influence the design and functioning of wind turbine blades. *[(CO2)(Understand/LOCQ)]*
   (b) How do these principles impact the efficiency of wind turbines? *[(CO2)(Analyze/IOCQ)]*

6 + 6 = 12

7. (a) Differentiate between vapour-dominated and liquid-dominated geothermal systems. *[(CO4)(Analyze/IOCQ)]*
   (b) Explain the processes involved in harnessing geothermal energy from vapour-dominated and liquid-dominated systems. *[(CO4)(Understand/LOCQ)]*

6 + 6 = 12

Group - E

8. (a) State *four* advantages and *four* limitations of biomass energy use. Explain the desirable properties of bio-ethanol that makes it suitable as automobile fuel. *[(CO5) (Understand/LOCQ)]*
   (b) With a neat sketch explain biomass gasification? *[(CO5) (Apply/IOCQ)]*

8 + 4 = 12

9. (a) What are the major limitations and challenges associated with harnessing tidal energy on a large scale? *[(CO4)(Analyze/IOCQ)]*
   (b) Evaluate the current status and future potential of wave energy technology in the global renewable energy. *[(CO4)(Evaluate/HOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.33	45.83	20.84