NON CONVENTIONAL ENERGY SOURCES
(AEIE 3132)

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) The cause of Greenhouse effect is
(a) depletion of ozone layer (b) decrease in N_2
(c) increase in CO_2 (d) depletion of H_2O layer.

(ii) Example of conventional energy source is
(a) Coal (b) Wind (c) Tidal (d) Solar.

(iii) Tidal power is directly proportional to
(a) Square root of tidal range (b) Square of tidal range
(c) Logarithm of tidal range (d) Proportional to the tidal range.

(iv) Fossil fuel will soon be exhausted because
(a) it has limited storage (b) it is renewable
(c) it is commercially used (d) thermal power plants use it.

(v) Bio-diesel can be mixed with which of the following?
(a) Petrol (b) Diesel (c) Kerosene (d) All of these.

(vi) Bio-gas consists of
(a) only methane (b) methane and carbon dioxide
(c) only ethane (d) ethane and carbon monoxide.

(vii) The temperature at the center of the earth is
(a) > 7000 k (b) < 3000 k (c) 2000 k (d) None of these.

(viii) Gravitational pull due to moon/ Gravitational pull due to sun
(a) 2.33 (b) 1/2.33 (c) 2 (d) 0.702.

(ix) Concentrating ratio is
(a) $\frac{1}{\sin \emptyset_{max}}$ (b) $\sin \emptyset_{max}$ (c) $\tan \emptyset_{max}$ (d) $\cos \emptyset_{max}$.

(x) The gross mechanical power extracted from OTEC is proportional to the
(a) $(\Delta T)^3$ (b) $(\Delta T)^2$ (c) (ΔT) (d) $(\Delta T)^5$.

Fill in the blanks with the correct word

(xi) If concentration ratio is 5.66, what will be the value of angle of acceptance _____.

(xii) Resources that are unlimited is _____ resources.

(xiii) Characteristics curve of a solar cell fall in the _____quadrant.

(xiv) _____ resources are available in a limited quantity.

(xv) When biomass rots, it forms a gas called _____ that we can use for energy.

Group - B

2. (a) Explain the role of energy auditor and the things to be considered while auditing. *[(CO6)(Analyse/IOCQ)]*

(b) Compare the conventional and non-conventional energy sources. *[(CO1)(Analyse/IOCQ)]*

(c) Name the various types of fossil fuel in the world. *[(CO1)(Remember/LOCQ)]*

5 + 4 + 3 = 12

3. (a) List the types of renewable energy sources. *[(CO1)(Remember/LOCQ)]*

(b) What are the needs of energy planning and audit? *[(CO6)(Remember/LOCQ)]*

(c) Discuss the need for hybrid system and its types. *[(CO1)(Analysis/IOCQ)]*

4 + 3 + 5 = 12

Group - C

4. (a) A solar cell (1.8 cm^2) receives solar radiation with photons of 1.8 eV energy having an intensity of 0.9 mW/cm^2. Measurements show open–circuit voltage of 0.6 V/cm^2, short circuit current of 10mA/cm^2, and the maximum current is 50% of the short circuit current. The efficiency of the cell is 25%. Calculate the maximum voltage that the cell can give and find the 'fill factor'. *[(CO3)(Analyse/IOCQ)]*

(b) What length of wavelength is suitable for the production of electricity from solar cell? Explain graphically with suitable numerical data related to E_g of semiconductor material. *[(CO2)(Remember/LOCQ)]*

(c) Derive the maximum current expression (I_m) of solar cell. *[(CO2)(Apply/IOCQ)]*

4 + 4 + 4 = 12

5. (a) Construct a water heating arrangement system using solar collector concept. Hence derive the efficiency of the designed system. *[(CO3)(Analyse/HOCQ)]*

(b) What is AM is solar radiation? If AM = 1.5, what is the value of zenith angle? *[(CO3)(Remember/LOCQ)]*

(c) Calculate the declination angle of Earth with respect to Sun on June 1, 2023. *[(CO3)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Group - D

6. (a) Explain with neat sketch the working principle of cross-draught type biomass gassifier. *[(CO3)(Analyse/HOCQ)]*

   (b) Discuss the advantages and disadvantages of wind power generation. *[(CO5)(Remember/LOCQ)]*

6 + 6 = 12

7. (a) What are the constituents of producer gas? What do you mean by cogeneration? *[(CO3)(Understand/LOCQ)]*

   (b) Derive the relation between extracted wind power and unperturbed wind speed by Betz Model. *[(CO5) (Analyse/IOCQ)]*

(2 + 2) + 8 = 12

Group - E

8. (a) If R1 and R2 are the practical range of the lower and upper water height in the dam. What will be the extracted amount power from the tidal energy from two basin arrangement if the efficiencies of the turbine, generator and other factors are to be encountered in the design of tidal power plant as η_T, η_G and η_o. *[(CO2)(Analyse/HOCQ)]*

   (b) Write down advantages and environmental impact of OTEC. *[(CO4)(Remember/LOCQ)]*

   (c) With proper sketch briefly describe floating point type wave energy device used to extract energy. *[(CO2)(Apply/IOCQ)]*

4 + (2+2) + 4 = 12

9. (a) With neat diagram explain single flash steam system in case of geothermal based energy harnessed system. *[(CO3)(Analyse/IOCQ)]*

   (b) Tidal power plant has reservoir of area 60 *10^6 m^2. The tidal has a range of 8 m. The minimum range 3 m or more is required to operate the turbine to get desired efficiency 80%. Calculate the total power per hour. *[(CO2)(Apply/HOCQ)]*

   (c) What are the environmental impacts of geothermal based power plant? *[(CO4)(Remember/LOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	40	42	18

Course Outcome (CO):

1. Understand the issue of fuel availability, analyze the supply and demand of fuel in the world.
2. Identify the different sources of renewable energy and innovative technologies in harnessing energy from renewable sources.
3. Explain production of electricity from clean resources.
4. Study the environmental impacts of a power plant with various resources.
5. Apply the wind energy for human usage.
6. Learn the conception of the economical use of renewable energy resources over conventional energy sources.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*