RENEWABLE ENERGY TECHNOLOGY
(BIOT 4241)

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) Tidal Energy is energy obtained through _____.
(a) Sunlight (b) Wind (c) Waves (d) All of the above

(ii) Which wind turbines have higher efficiency?
(a) Vertical axis wind turbines (b) Horizontal axis wind turbines
(c) Both (a) & (b) (d) None of (a), (b) and (c).

(iii) Which of the following is the most prospective renewable source of energy in India?
(a) Solar Energy (b) Wind Energy
(c) Geothermal energy (d) None of the above.

(iv) Why is transparent cover used in a flatbed collector?
(a) To maximise transmission of the incident sunlight into the box
(b) To minimise transmission of incident sunlight into the box
(c) To entirely reflect incident sunlight back
(d) To ensure partial transmission of the incident sunlight into the box.

(v) Why are antifreeze solutions used as coolants in freezing climates?
(a) To increase boiling point of water (b) To decrease boiling point of water
(c) Completeness (d) All of these.

(vi) Solar Impulse is a Swiss long-range experimental solar powered _____ project.
(a) Aircraft (b) Boat (c) Bus (d) Bicycle

(vii) Which component in a Biomass will be the easiest one to be pyrolysed?
(a) Cellulose (b) Lignin (c) Hemicellulose (d) Proteins.

(viii) Bio-char production is maximum in which Pyrolysis process?
(a) Slow (b) Fast (c) Flash (d) All of these.

(ix) Torrefaction is a part of which pyrolysis process?
(a) Slow (b) Fast (c) Flash (d) All of the above.

(x) B5 indicates a blend with
(a) 5% biodiesel and 95% diesel fuel (b) 95% biodiesel and 5% diesel fuel
(c) 50% biodiesel and 50% diesel fuel (d) none of these.

Fill in the blanks with the correct word

(xi) A solar cell converts _____ energy into _____ energy.

(xii) The majority of charge carriers in an N-type semiconductor are _____.

(xiii) Hydro power plants convert _____energy of falling water into electricity.

(xiv) Micro-organism used to synthesize bio-ethanol is _____.

(xv) The reaction used to synthesize bio-diesel is known as _____.

Group - B

2. (a) Enumerate the process of Torrefaction and Carbonization. *[(CO2)(Analyse/IOCQ)]*
(b) State the different methods of heat transfer to a pyrolysis reactor. *[(CO2)(Remember/LOCQ)]*

(4 + 4) + 4 = 12

3. (a) What do you mean by Moisture content in a Biomass? Design the process of measuring the Moisture content in a Biomass. *[(CO1)(Design/IOCQ)]*
(b) Explain the advantages of renewable energy over the conventional form of energy. *[(CO2)(Remember/LOCQ)]*

(2 + 4) + 6 = 12

Group - C

4. (a) Illustrate the different stages of biochemical processes of Biogas production. *[(CO3)(Illustrate/IOCQ)]*
(b) Describe the Microbial Electrolytic Cell for bio-hydrogen production. *[(CO2)(Describe/HOCQ)]*

6 + 6 = 12

5. (a) Design the two-stage phase of hydrogen production. *[(CO2)(Design/HOCQ)]*
(b) Comment on the processes of separating biodiesel from glycerol. *[(CO2)(Comment/IOCQ)]*

6 + 6 = 12

Group - D

6. (a) Analyze the basis behind hydrogen economy. *[(CO5)(Analyze/IOCQ)]*
(b) What is the basic principle behind working of solar pond? *[(CO5)(Understand/LOCQ)]*

(c) Distinguish between the working mechanism of convecting and non-convecting solar ponds. *[(CO5)(Analyze/IOCQ)]*

4 + 4 + 4 = 12

7. (a) Which is the most efficient solar cell? Justify your answer. *[(CO5)(Analyse/HOCQ)]*
   (b) Discuss about the various application of solar cells. *[(CO5)(Apply/IOCQ)]*
   (c) Decipher the three main stages of electricity production. *[(CO5)(Evaluate/HOCQ)]*

4 + 4 + 4 = 12

Group - E

8. (a) Distinguish between nuclear fission and fusion processes. *[(CO3)(Understand/LOCQ)]*
   (b) What is meant by binding energy? How can large nuclei and smaller nuclei gain stability? *[(CO4)(Apply/HOCQ)]*
   (c) Analyze the problems when fusion energy is used as energy source. *[(CO2)(Analyze/IOCQ)]*

4 + 4 + 4 = 12

9. (a) What are the different types of radioactive decay? *[(CO6)(Understand/LOCQ)]*
   (b) Discuss the various methods of measuring radiation decay. *[(CO6)(Remember/LOCQ)]*
   (c) Distinguish between linear and threshold model of radiation exposure. *[(CO6)(Apply/IOCQ)]*

4 + 4 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	27.1	47.9	25

Course Outcome (CO):

After the completion of the course students will be able to

(1) Distinguish the different types of biomass and explain its uses.
(2) Explain the conversion of biomass to clean fuels and also conversion of petrochemical substitutes to useful products by physiochemical/fermentation processes.
(3) Explain how ethanol and methane can be produced from biomass to produce bio-ethanol.
(4) Describe how biopolymer and biosurfactants can be used for microbial recovery of petroleum.
(5) Describe and understand how solar energy can be harnessed for useful purposes such as production of photovoltaic cells and for chemical storage purposes.
(6) Analyze and understand how other renewable energy sources can be harnessed for other productive purposes.

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