RENEWABLE ENERGY TECHNOLOGY
(BIOT 4241)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Which of the statements is correct about solar energy?
(a) It is renewable and conventional source of energy
(b) It is non-renewable and non-conventional source of energy
(c) It is renewable and non-conventional source of energy
(d) None of the above.

(ii) Which Uranium isotope is used in nuclear power plants?
(a) U-235 (b) U-234
(c) U-215 (d) U-218.

(iii) Why is a transparent cover used in a flat plate collector?
(a) To maximize transmission of the incident sunlight into the box
(b) To minimize transmission of the incident sunlight into the box
(c) To entirely reflect the incident sunlight back
(d) To ensure partial transmission of the incident sunlight into the box.

(iv) Which one of the following energy resources produces radioactive waste?
(a) Nuclear (b) Solar
(c) Wind (d) All of the above.

(v) Main mechanisms of MEOR are
(a) increasing the porosity and permeability of the media in the reservoir
(b) lowering oil viscosity
(c) reducing the interfacial tension at the oil-water interface
(d) all of the above.

(vi) The process of transesterification is related to the production of
(a) Bioethanol (b) Biodiesel
(c) Biogas (d) Hydrogen.

(vii) Anaerobic digestion of Biomass for the production of Biogas involves which of the following processes?
(a) Hydrolysis (b) Acidogenesis
(c) Methanogenesis (d) All of the above.

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

(ix) B95 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.

(x) Carbonization is a part of which pyrolysis process?
(a) Slow (b) Fast
(c) Flash (d) All of these.

Group - B

2. (a) What do you mean by Renewable Energy? What are the different types of Renewable Energy? *[(CO1)(Understand/LOCQ)]*
(b) Describe the barriers to Renewable Energy Technology. *[(CO1)(Remember/LOCQ)]*
(c) What do you mean by Volatile Matter in a Biomass? Illustrate it's role in combustion of biomass? *[(CO1)(Illustrate/IOCQ)]*
(d) Design the process of measuring the Volatile Matter in a Biomass? *[(CO1)(Design/IOCQ)]*

(1 + 2) + 2 + (1 + 2) + 4 = 12

3. (a) Enumerate the Fast pyrolysis. *[(CO2)(Enumerate/IOCQ)]*
(b) Illustrate the process of determining the heat of combustion of a Biomass. *[(CO1)(Illustrate/IOCQ)]*

6 + 6 = 12

Group – C

4. (a) Briefly describe the mechanism of Microbial Enhanced Oil Recovery. *[(CO4)(Describe/IOCQ)]*
(b) Comment on the advantages of MEOR over conventional methods? *[(CO4)(Comment/IOCQ)]*
(c) What is the need of bio-hydrogen? *[(CO2)(Remember/LOCQ)]*

7 + 3 + 2 = 12

5. (a) Draw and describe the basic design of a typical Biogas plant. *[(CO3)(Design/IOCQ)]*
(b) Comment on the advantages of Biogas production? *[(CO3)(Comment/IOCQ)]*

8 + 4 = 12

Group - D

6. (a) What is hydrogen fuel cell and explain the mechanism of working of Hydrogen fuel cell. *[(CO5)(Remember/LOCQ)]*
   (b) Analyse the process of working of Lead Acid battery. *[(CO5)(Analyse/IOCQ)]*

(2 + 4) + 6 = 12

7. (a) Illustrate the working principle of a solar pond? *[(CO5)(Illustrate/IOCQ)]*
   (b) Discuss in detail the various applications of solar ponds. *[(CO5)(Evaluating/HOCQ)]*
   (c) Analyse the difference between working of a fuel cell and chemical batteries. *[(CO5)(Analyze/IOCQ)]*

4 + 4 + 4 = 12

Group – E

8. (a) How can geothermal energy be used to generate electricity? *[(CO6)(Remember/LOCQ)]*
   (b) What are chain reactions and explain how it can be contained. *[(CO6)(Understand/LOCQ)]*
   (c) How can radiation be measured and what are its units? *[(CO6)(Analyse/IOCQ)]*

4 + 4 + 4 = 12

9. (a) Differentiate between 1st and 2nd generation tidal power plants. *[(CO6)(Remembering/LOCQ)]*
   (b) State advantages and disadvantages of wave power energy. *[(CO6)(Remembering/LOCQ)]*
   (c) Derive the equation $C_p = \frac{P_T}{\frac{1}{2}\rho_a A_T V^3}$ *[(CO6)(Evaluating/HOCQ)]*

4 + 4 + 4 = 12

Cognition Level	*LOCQ*	*IOCQ*	*HOCQ*
Percentage distribution	*30.21*	*61.46*	*8.33*

Course outcomes (CO):

At the end of this 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*