

**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) 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.
- (ii) The process of transesterification is related to the production of  
 (a) bioethanol (b) biodiesel  
 (c) biogas (d) hydrogen.
- (iii) The process of methanogenesis in the production of biogas is sensitive to  
 (a) both high & low pH values (b) low pH values  
 (c) high pH values (d) is insensitive to pH.
- (iv) What are the two sets of enzymes that Cyanobacteria uses?  
 (a) Acetogenase & Methanogenase  
 (b) Nitrogenase & Hydrogenase  
 (c) Invertase & Alcohol Dehydrogenase  
 (d) None of the above.
- (v) What does the method MEOR stand for?  
 (a) Producing bioethanol by fermentation  
 (b) Producing biodiesel by transesterification  
 (c) Producing hydrogen by photovoltaic cells  
 (d) Producing residual petroleum from depleted oil wells.
- (vi) Cell structure may be damaged during centrifugal recovery of microalgal biomass because of  
 (a) high gravitational & shear forces generated during centrifugation  
 (b) excessive heat generated during centrifugation

- (c) high power consumption  
 (d) all of the above
- (vii) Under certain conditions cyanobacteria can produce hydrogen by  
 (a) fermentation processes  
 (b) esterification processes  
 (c) water-splitting photosynthetic processes  
 (d) anaerobic digestion processes.
- (viii) Photovoltaic energy is the conversion of sunlight into  
 (a) chemical energy (b) biogas  
 (c) electricity (d) geothermal energy.
- (ix) Fuel cells are  
 (a) carbon cell (b) hydrogen battery  
 (c) nuclear cell (d) chromium cell.
- (x) Boiling water reactor and pressurised water reactors are  
 (a) nuclear reactor (b) solar reactor  
 (c) biogas reactor (d) OTEC.

**Group - B**

2. (a) Name some biomass used for the production of (i) 3<sup>rd</sup> generation biofuels and (ii) hydrogen.  
 (b) Discuss the role of different enzymes in the process of fermentation for the production of bioethanol.  
 (c) What is life cycle analysis (LCA) for a fuel?

**2 + 6 + 4 = 12**

3. (a) What are the major feedstocks used for first and second-generation biofuels?  
 (b) How is bio gas produced from an anaerobic digestion of municipal solid waste?  
 (c) State some uses of biogas?

**3 + 6 + 3 = 12**

**Group - C**

4. (a) Why are microalgae considered to be a promising source of biofuels? Compare with terrestrial plants.

- (b) What are the different types of photobioreactors used for the cultivation of microalgae. Discuss the advantages and disadvantages of using a photobioreactor as against an open pond.
- (c) Discuss the methods of harvesting and extraction for production of biodiesel from microalgae.

**3 + 3 + 6 = 12**

5. (a) What is MEOR?
- (b) What are the roles of biosurfactants and biopolymers in oil recovery processes?
  - (c) What are the methods of conducting MEOR?
  - (d) State some advantages of MEOR over other EOR technologies.
  - (e) Discuss some of the problems of MEOR.

**2 + 2 + 3 + 3 + 2 = 12**

**Group - D**

6. (a) Describe how solar photovoltaic cell converts sunlight directly into electricity.
- (b) Compare the efficiency and disadvantages of solar panels.
  - (c) Discuss the different applications of solar cells.

**5 + 5 + 2 = 12**

7. (a) What are the different types of solar cells and their efficiency?
- (b) Describe the different types of solar ponds in use.
  - (c) What are the advantages and disadvantages of solar ponds?

**5 + 5 + 2 = 12**

**Group - E**

8. (a) Describe the different wave power designs.
- (b) What are chain reactions and how it can be contained?
  - (c) What is BETZ's law?

**5 + 5 + 2 = 12**

9. (a) Discuss the harmful effects of using geothermal energy.
- (b) Describe the size and major components of wind turbine (including description of horizontal and vertical axis).

**6 + 6 = 12**