

**NON-CONVENTIONAL ENERGY
(BIOT4222)**

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) Which of the following has the potential to fulfil all our energy requirements
 - (a) Nuclear energy
 - (b) Bioenergy
 - (c) Solar energy
 - (d) Geothermal energy
- (ii) Solar Impulse is a Swiss long-range experimental solar powered _____ project
 - (a) Aircraft
 - (b) Boat
 - (c) Bus
 - (d) Bicycle
- (iii) Hydrothermal energy is a type of
 - (a) Geothermal energy
 - (b) Hydroelectric power
 - (c) Tidal energy
 - (d) Wave energy
- (iv) The principal organism for alcoholic fermentation is
 - (a) *Aspergillus niger*
 - (b) *Pseudomonas putida*
 - (c) *Saccharomyces cerevisiae*
 - (d) None of these
- (v) Which of the following is a substrate for biogas production?
 - (a) Municipal and residential waste
 - (b) E-waste
 - (c) Metallic waste
 - (d) Gaseous effluent
- (vi) In terms of green house gas emissions, how good or bad is hydrogen fuel?
 - (a) Major contributor of greenhouse gas emissions
 - (b) Zero-emission fuel
 - (c) Lowest contributor of greenhouse gas emissions
 - (d) Hydrogen cannot be used as fuel
- (vii) What are the main raw materials (feedstock) for transesterification?
 - (a) Triglycerides + Alcohol
 - (b) Alcohol + Glycerol
 - (c) Diesel + Triglycerides
 - (d) Water + Oil

- (viii) The fuel cell is considered a battery in which _____ is continuously replaced
 (a) fuel only (b) oxidizer
 (c) both fuel and oxidizer (d) none of the mentioned
- (ix) Which of the following is not used as biomass?
 (a) Hybrid poplar (b) Willow algae
 (c) Iron nails (d) Trap grease
- (x) Which of the following is the most popular application of hydrogen fuel cell
 (a) Fuel cell vehicles (b) Fuel cell energy power plants
 (c) Fuel cells stand-alone power supplies (d) Fuel cells spacecraft

Fill in the blanks with the correct word

- (xi) A wind mill converts _____ energy of a wind to electrical energy.
- (xii) In B20 fuel, 20 indicates percentage of _____.
- (xiii) Chemical energy is converted to _____ energy by a fuel cell
- (xiv) Biodiesel is produced by _____ reaction
- (xv) Name of cell where microbes produce hydrogen is _____.

Group - B

2. (a) Write notes on Darrieus wind turbine. [[CO2](Analyse/IOCQ)]
 (b) Illustrate the process of generating power from tidal waves. [[CO1](Illustrate/HOCQ)]
 (c) Comment on the advantages of wave energy. [[CO1](Comment/LOCQ)]
4 + 4 + 4 = 12
3. (a) Comment on Tip Speed Ratio. [[CO2](Analyse/IOCQ)]
 (b) Illustrate the process of generating power from Geothermal energy. [[CO1](Illustrate/HOCQ)]
 (c) An offshore wind turbine with three 4 m blades rotates at 42 RPM. The wind is moving at 6 m/s. What is the tip speed ratio of this turbine? How does this compare to the “optimal” tip speed ratio for this turbine? [[CO2](Calculate/HOCQ)]
3 + 4 + 5 = 12

Group - C

4. (a) Design a process flow sheet to produce biogas from vegetable and fruit peels. Justify your choices wherever required. [[CO4](Analyse/HOCQ)]
 (b) State the composition of a typical biogas. [[CO4](Remember/LOCQ)]
8 + 4 = 12
5. (a) What is silviculture? What are the different types of silviculture practised? Which type of silviculture is best for production of bioenergy and why? [[CO3](Remember, Analyse/IOCQ)]
 (b) Describe the process of production of ethanol by alcoholic fermentation. [[CO4](Remember/LOCQ)]
(1 + 3 + 2) + 6 = 12

Group - D

6. Calculate the energy content of 1 m³ of stoichiometric mixture of methane with air at 1 atmosphere pressure (101 KPa) and 298 K. LHV of methane is 50 MJ/kg. [[C04](Compute/HOCQ)]
12
7. (a) Describe the chemical reaction involved in biodiesel production [[C04](Understand/IOCQ)]
(b) Define (i) Higher Heating value and (ii) Lower Heating value. [[C04](Remember/LOCQ)]
8 + 4 = 12

Group - E

8. (a) Describe the method use of acid electrolyte for hydrogen production [[C06](Remember/LOCQ)]
(b) Write down the advantages and disadvantages of compressed hydrogen as hydrogen storage method. [[C06](Compare/HOCQ)]
6 + 6 = 12
9. Write short note on:
(i) Dark fermentation for biohydrogen production.
(ii) Steam reforming of alcohols for hydrogen fuel production. [[C06](Understand/IOCQ)]
(6 + 6) = 12
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	25	34.4	40.6

