

**NON-CONVENTIONAL ENERGY  
(BIOT 4222)**

**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 following is not an example of non-conventional energy?  
(a) Nuclear energy    (b) Solar energy  
(c) Gasoline    (d) Geothermal energy.
- (ii) The electron have to overcome this type of energy to conduct electricity.  
(a) Valence band energy    (b) Conduction band energy  
(c) Band gap energy    (d) All of the above
- (iii) Which of the following is not a biochemical process?  
(a) Transesterification    (b) Combustion  
(c) Composting    (d) Fermentation.
- (iv) Example of indirect-gain passive solar system is  
(a) Heliostat    (b) Trombe wall  
(c) Parabolic trough collectors    (d) none of the above
- (v) The bacteria which are used to produce biogas are  
(a) Aerobic    (b) Facultative  
(c) Anaerobic    (d) Pathogenic.
- (vi) Bioethanol is mixed with \_\_\_\_\_ to prepare transport fuel.  
(a) oil    (b) petrol  
(c) kerosene    (d) diesel
- (vii) What typical catalyst is used to make biodiesel?  
(a) Base catalyst    (b) Ultraviolet light  
(c) Platinum    (d) Nickel.
- (viii) Which of the following is not a biofuel?  
(a) Ethanol    (b) Methanol  
(c) Natural gas    (d) Butanol.

- (ix) The term biomass most often refers to \_\_\_\_\_.
- (a) inorganic matter (b) organic matter  
(c) chemicals (d) ammonium compounds (d).
- (x) What chemical reaction makes biodiesel?
- (a) Transesterification (b) Sublimation  
(c) Fermentation (d) Polymerization.

### **Group- B**

2. (a) An offshore wind turbine with three 60m blades rotates at a leisurely 12 rpm. The wind is whipping along at 18m/s. What is the tip speed ratio for this turbine? How does this compare to the optimal tip speed ratio of this turbine?  
[[CO1](Analyze/IOCQ)]
- (b) Write a short note on direct solar heating. [[CO1](Remember/LOCQ)]  
**7 + 5 = 12**
3. (a) Why is direct production of electricity better than the other two methods of harnessing solar energy?  
[[CO1](Understand/LOCQ)]
- (b) How much collector area would a 800MW solar farm require if the individual efficiencies of the collector system, turbine and generator are 40, 25 and 80% respectively?  
[[CO1](Analyze/IOCQ)]  
**5 + 7 = 12**

### **Group - C**

4. (a) Write a note on production of biogas by anaerobic digestion.  
[[CO3](Remember/LOCQ)]
- (b) Define the terms solvolysis and pyrolysis. [[CO3](Remember/LOCQ)]  
**10 + 2 = 12**
5. (a) How is bioethanol produced commercially? [[CO4](Understand/LOCQ)]
- (b) Why is pretreatment required in Bioethanol production?  
[[CO2](Understand/IOCQ)]  
**10 + 2 = 12**

### **Group - D**

6. (a) Draw the flow chart of biodiesel production from methanol.  
[[CO3](Critical/HOCQ)]
- (b) State the advantages of the use of biodiesel. [[CO2](Analyse/IOCQ)]  
**8 + 4 = 12**
7. (a) A fuel contains by mass 88% carbon, 8% H<sub>2</sub>, 1% Sulphur and 3% ash (silica).  
(i) Calculate the stoichiometric air required.

- (ii) If the air supplied is 20% excess more than stoichiometric value, find the analysis of the dry products by mass. [(CO4)(Evaluate/HOCQ)]
- (b) Define octane number and cetane number of fuel. [(CO2)(Remember/LOCQ)]
- 8 + 4 = 12**

### Group - E

8. (a) Write short note on cryogenic storage of hydrogen. [(CO6)(Analyse/IOCQ)]
- (b) Describe the working principle of microbial fuel cell. [(CO3)(Critical/HOCQ)]
- 6 + 6 = 12**
9. (a) Is Partial Oxidation method suitable for hydrogen production in automobile fuel cell? [(CO6)(Analysis/IOCQ)]
- (b) Name and describe any two types of fuel cell based on type of electrolyte. [(CO2)(Analyse/IOCQ)]
- 6 + 6 = 12**

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	37.5	39.58	22.92

#### Course Outcome (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

