

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

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any4 (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) The main pre-treatment steps in production of bioethanol is
 - (a) Partial hydrolysis
 - (b) Liquefaction
 - (c) Saccharification
 - (d) All the above
- (ii) Example of indirect-gain passive solar system is
 - (a) Heliostat
 - (b) Trombe wall
 - (c) Parabolic trough collectors
 - (d) None of the above
- (iii) The principal organism for alcoholic fermentation is
 - (a) *Aspergillusniger*
 - (b) *Pseudomonas putida*
 - (c) *Saccharomyces cerevisiae*
 - (d) None of these
- (iv) Solar Impulse is a Swiss long-range experimental solar powered _____ project
 - (a) Aircraft
 - (b) Boat
 - (c) Bus
 - (d) Bicycle
- (v) Increase in _____ in a biomass increases the spontaneous combustion
 - (a) Volatile matter
 - (b) Fixed carbon
 - (c) Moisture content
 - (d) Ash content

- (vi) Which of the following supplies maximum amount of hydrogen gas?
 (a) Natural gas
 (b) Anaerobic Digestion
 (c) Wastewater treatment
 (d) Electrolysis
- (vii) Which of the following does not affect the reactions in a fuel cell?
 (a) Electrolyte composition
 (b) Electrode composition
 (c) A combination of fuel and oxidiser
 (d) Catalytic effect of the reaction container
- (viii) Which of the following is not a potential biofuel
 (a) gasoline
 (b) hydrogen fuel
 (c) algae biodiesel
 (d) none of these
- (ix) Hydrogen can be produced from hydrocarbon by which method?
 (a) Thermal decomposition
 (b) Partial oxidation
 (c) Steam reforming
 (d) All of the mentioned
- (x) For production of biodiesel, which of the following is a potential reactant
 (a) methanol
 (b) ethanol
 (c) both (a) and (b)
 (d) None of these

Fill in the blanks with the correct word

- (xi) A type of a horizontal turbine is _____.
- (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) The full form of PEM is _____.

Group - B

2. (a) What do you mean by Moisture content in a Biomass? Design the process of measuring the Moisture content in a Biomass? [[CO2](Design/IOCQ)]
 (b) Illustrate the working principle of a wind mill. [[CO2](Illustrate/HOCQ)]
(2 + 4) + 6 = 12
3. (a) An offshore wind turbine with three 60 m blades rotates at 15 RPM. The wind is moving at 13 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](Numerical/HOCQ)]

- (b) What are the benefits of renewable energies over conventional form of energies?

[[CO1](Remember/LOCQ)]

6 + 6 = 12

Group - C

4. (a) Illustrate the production of bio-ethanol by alcoholic fermentation mentioning the operating conditions clearly. [[CO4](Analyse/HOCQ)]
- (b) Why is the operating temperature of bioethanol production kept within the given limit? [[CO4](Remember/LOCQ)]
- (c) When is pretreatment required for bioethanol production and why? [[CO4](Apply/IOCQ)]
- 7 + 2 + 3 = 12**
5. (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

Group - D

6. (a) Define the following:
- (i) Cetane number
 - (ii) Specific gravity of fuel
 - (iii) Flash point
 - (iv) Fire point. [[CO4](Remember/LOCQ)]
- (b) State the advantages of biodiesel compared to conventional diesel. [[CO5](Analysis/IOCQ)]
- (2 × 4) + 4 = 12**
7. The analysis of the fuel undergoing combustion has the following composition
Carbon=83%
Hydrogen=12%
Sulphur=2%
Ash=3%
Find out the composition of the product gases of combustion on mass basis, if 20% excess air is used. [[CO5](Compute/HOCQ)]

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Group - E

8. (a) State the advantages of hydrogen as renewable fuel. [[CO6](Analyse/HOCQ)]
- (b) Describe the process of partial oxidation method for hydrogen production. [[CO6](Remember/LOCQ)]

6 + 6 = 12

9. (a) State the advantages of dark fermentation for biological hydrogen generation. [[C05](Analyse/HOCQ)]
- (b) Name and describe any one type of fuel cell based on type of electrolyte. [[C04] (Remember/LOCQ)]
- 6 + 6 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	33.33	13.54	53.13

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.*