HYDROGEN AND FUEL CELL TECHNOLOGY
(REEN 5241)

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) Inert gases should be present for what?
(a) Prevents heat
(b) Prevents explosion
(c) High energy
(d) All of the mentioned

(ii) Hydrogen can be produced from hydrocarbon by which method?
(a) Thermal decomposition (b) Partial oxidation
(c) Steam reforming (d) All of the mentioned

(iii) Catalytic reforming produces what percentage of hydrogen?
(a) 30-55 (b) 45-70 (c) 75-95 (d) 100-150

(iv) Which type of reaction is catalytic reaction?
(a) Endothermic (b) Exothermic
(c) Neutral (d) None of the mentioned

(v) A fuel cell is used to convert chemical energy into _____
(a) Mechanical energy (b) Solar energy
(c) Electrical energy (d) Potential energy

(vi) Select the incorrect statement from the following option.
(a) Fuel cells have high efficiency
(b) The emission levels of fuel cells are far below the permissible limits
(c) Fuel cells are modular
(d) The noise levels of fuel cells are high

(vii) _____and suitable catalyst are required to promote high rate of electrode processes.
(a) Lower temperature (b) Higher temperature
(c) Moderate temperature (d) Very low temperature

(viii) The type of reactions in a fuel cell is not determined by
(a) fuel and oxidizer combination
(b) composition of electrolyte
(c) materials of anode and cathode
(d) catalytic effects of reaction container

(ix) Which of these should not be a properties of fuel cell electrodes?
(a) good electrical conductors
(b) highly resistant to corrosive environment
(c) should perform charge seperation
(d) take part in chemical reactions

(x) Which of these gases or liquids are not used as source of hydrogen in fuel cells?
(a) C_2H_6 (b) C_2H_2 (c) C_6H_6 (d) C_2H_5OH

Group – B

2. (a) Define fossil fuels. Write the disadvantages of fossil fuels.

(b) Describe the different technologies for the hydrogen production.

6 + 6 =12

3. (a) Why hydrogen is most clean fuel? Describe the reaction pathways for the aqueous phase reforming.

(b) Write a short note on auto-thermal reforming. Describe the economic aspect of hydrogen production.

(2 + 4) + (3 + 3) = 12

Group – C

4. (a) Define Metal–Organic Framework (MOF). How the MOF is used for the hydrogen storage?

(b) Describe the use of hydrogen in decolonization of the economy.

(2 + 4) + 6 = 12

5. (a) What is the difficulties in the hydrogen storage using metal borohydrides?

(b) Describe the current DOE target for the hydrogen storage. Define the impact of the utilization of hydrogen on the environmental aspect.

5 + (3 + 4) = 12

Group – D

6. (a) Define Activation loss, Ohmic loss, and Mass transport loss in the power curve of a fuel cell.

(b) What is the efficiency of microbial fuel cell? Describe the schematic diagram of double chamber microbial fuel cell.

6 + (2 + 4) =12

7. (a) Define the advantages and disadvantages of the proton exchange membrane fuel cell.

(b) Define the polarization curve of fuel cell and describe all the parameters with respect different losses.

6 + (4 + 2) =12

Group – E

8. (a) Describe the application of fuel cell in the stationary and portable sector.

(b) Describe the application of fuel cell in the transport sector.

8 + 4 = 12

9. (a) Describe the backfire and pre-ignition of hydrogen.

(b) Define fuel carburetion method. Describe the emission curve for the hydrogen engine.

4 + (3 + 5) = 12

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