

**B.E DEGREE EXAMINATIONS: NOV / DEC 2014**

(Regulation 2009)

Seventh Semester

**AUTOMOBILE ENGINEERING**

AUE128 : Fuel Cells Technology

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. What is meant by Cogeneration
  - a) Combined Heat,Work,Cooling
  - b) Combined Heat,force,Ventilation
  - c) Combined Heat, Power, Cooling.
  - d) Combined Power,Work,Force
2. Oxidation Means
  - a) Gain of electrons
  - b) Loss of protons
  - c) Loss of electrons
  - d) Gain of protons
3. Which one is low temperature fuel cell
  - a) Alkaline fuel cell
  - b) Phosphorus fuel cell
  - c) Molten carbonate
  - d) Solid oxide fuel cell
4. What is Enthalpy
  - a)  $H = V+PV$
  - b)  $H = V+PV$
  - c)  $H = U+PV$
  - d)  $H = U+PV$
5. The optimum pressure for storing Hydrogen gas is
  - a) 100 bar to 150 bar
  - b) 60 bar to 90 bar
  - c) 250 bar to 350 bar
  - d) 150 bar to 240 bar
6. Where is Hydrogen connected in fuel cells
  - a) Cathode
  - b) Anode
  - c) Partial cathode & catalyst
  - d) Chemisorptions
7. The temperature of Cryogenic Hydrogen State is around
  - a) 253 degree Celsius
  - b) 50 degree Celsius
  - c) -50 degree Celsius
  - d) -253 degree Celsius
8. The material used in membrane electrode assembly is

- a) Aluminum
  - b) Chromium
  - c) Carbon Nano tubes
  - d) Teflon
9. Which is the easiest method of storing hydrogen in onboard fuel cell
- a) Compressed Hydrogen
  - b) Liquefied Hydrogen
  - c) Metal Hydride
  - d) Solid oxide
10. What is the unit of Volumetric Capacity?
- a) kW/L
  - b) Kwh/L
  - c) kWh/L
  - d) Wh/L

**PART B (10 x 2 = 20 Marks)**

11. Differentiate: Fuel cell and Battery.
12. Determine the efficiency of fuel cell and Enumerate the suitable types of fuel cell for automobile application.
13. a) Draw the Curve for Power density in fuel cells along with units.  
b) What is meant by fuel stacks?
14. Calculate the Reversible potential 'E' where.  
(1) Gibbs Energy = -229KJ/Mol. (2)  $n = 2$  (3)  $F = 96500$  c/g mole of electron
15. What is a mass transport loss?
16. Write the basic terminologies used in fuel cell design.
17. What is current density?
18. What is Catalyst Poisoning?
19. Write the different methods of producing Hydrogen.
20. What is Partial Oxidation?

**PART C (5 x 14 = 70 Marks)**

21. a) (i) Compare the different types of fuel cells based on Anode, Cathode Operating temperature efficiency, advantages, disadvantages and application. (10)  
(ii) Define volumetric and gravimetric energy density along with units. (4)
- (OR)**
- b) Describe in detail about Solid oxide Fuel cell with neat diagram and design types of solid oxide fuel cell.
22. a) (i) Explain clearly about the thermodynamics of fuel cells with appropriate equations? (10)

(ii) Write short notes on fuel control system. (4)

**(OR)**

b) Design a Fuel cell to provide the voltage and therefore Power required for driving a vehicle? (Assume any number of stacks to produce voltage ) Hint: The Newest Honda fuel car FCX Clarity provides 100KW Power.

23. a) (i) Explain the fuel stack system in automotive application. (7)

(ii) Write in detail about onboard hydrogen storage. (7)

**(OR)**

b) Elaborately explain the automotive components of fuel cell.

24. a) Describe the Actual performance of fuel cell in detail with neat curves.

**(OR)**

b) Explain the components of Membrane Electrode assembly.

25. a) Explain the components of battery powered vehicle and Hybrid electric vehicle.

**(OR)**

b) Explain in detail about Metal Hydride Hydrogen.

\*\*\*\*\*