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Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)



Ph.D. (Second Semester-Summer) Examinations, April – 2026
23SPPEEE2013 – Fuel Cell and Hydrogen Energy
(EEE)

Time: 3 hrs

Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer ANY FIVE Questions.**(14 x 5 = 70 Marks) Marks**

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| 1.a. | Explain hydrogen as an energy carrier with its key properties. | 8 |
| b. | Calculate the mass of hydrogen required to deliver 800 MJ of useful energy if the system efficiency is 60%. Take LHV of hydrogen as 120 MJ/kg. | 6 |
| 2.a. | Describe material-based hydrogen storage methods using metal hydrides and chemical hydrides. | 7 |
| b. | Explain hydrogen transportation, safety issues, and codes of practice. | 7 |
| 3.a. | Explain polarization losses in fuel cells. | 7 |
| b. | A PEM fuel cell stack has 60 cells, each producing 0.7 V at 90 A. Calculate the total power output. | 7 |
| 4.a. | Describe fuel cell components: electrodes, electrolytes, catalysts, and membranes. | 7 |
| b. | Compare PEMFC and SOFC based on operating temperature, efficiency, and applications. | 7 |
| 5.a. | A hydrogen purification system processes 150 kg/h of gas containing 78% hydrogen. Calculate the pure hydrogen output per hour. | 7 |
| b. | Explain fuel processing techniques for hydrogen-rich fuels. | 7 |
| 6.a. | Discuss benefits of CHP systems using fuel cells. | 7 |
| b. | A CHP fuel cell system delivers 250 kW electrical and 180 kW thermal power from a fuel input of 550 kW. Calculate the overall efficiency. | 7 |
| 7.a. | Explain the role of fuel cells in microgrids and backup power systems. | 8 |
| b. | Discuss techno-economic challenges in fuel cell deployment. | 6 |
| 8.a. | Explain emerging research areas such as green hydrogen and solid-state hydrogen carriers. | 7 |
| b. | Explain hydrogen's role in decarbonization strategies. | 7 |

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