

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Semester: 1

Hydrogen and Fuel Cell Technologies

Type of course: Major Elective - I

Prerequisite: -- Enthusiasm to learn the course.

Rationale: The course is designed to provide the fundamental concept of hydrogen and fuel cell and relevant engineering and technologies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No	Content	Total Hrs	% Weightage
1	Hydrogen – Fundamentals: Hydrogen as a source of energy, physical and chemical properties, salient characteristics, relevant issues and concerns	4	5%
2	Hydrogen Storage and Applications: Production of hydrogen, steam reforming, water electrolysis, gasification and woody biomass conversion, biological hydrogen production, photo dissociation, direct thermal or catalytic splitting of water, hydrogen storage options, compressed gas, liquid hydrogen, hydride, chemical storage, safety and management of hydrogen, applications of hydrogen	15	40%
3	Fuel Cells- Types: Brief history, principle, working, thermodynamics and kinetics of fuel cell process, types of fuel cells; AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits, performance evaluation of fuel cell, comparison of battery Vs fuel cell	13	30%
4	Fuel Cells -Application And Economics: Fuel cell usage for domestic power systems, large scale power generation, automobile, space applications, economic and environmental analysis on usage of fuel cell, future trends of fuel cells	10	25%

Reference Books:

1. Viswanathan, B and M Aulice Scibioh, Fuel Cells – Principles and Applications, Universities Press
2. Rebecca L. and Busby, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Corporation, Oklahoma
3. Bent Sorensen (Sorensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier Academic Press, UK
4. Kordes, K and G. Simader, Fuel Cell and Their Applications, Wiley-Vch, Germany
5. Hart, A.B and G.J. Womack, Fuel Cells: Theory and Application, Prentice Hall, New York Ltd., London
6. Jeremy Rifkin, The Hydrogen Economy, Penguin Group, USA

Course Outcome:

After learning the course the students should be able to:

- Understand fundamental concept and working of various fuel cells, their relative advantages / disadvantages and hydrogen generation/storage technologies.