GUJARAT TECHNOLOGICAL UNIVERSITY

ENERGY ENGINEERING (39)
BATTERIES AND FUEL CELL
SUBJECT CODE: 2743902
M.E. 4TH SEMESTER

Type of course: Elective-V

Prerequisite: None.

Rationale: This course is design for students interested in the scientific challenges of electrochemical power sources like batteries and fuel cells.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Energy storage in Batteries** fundamentals of batteries, their history and development, applications, Primary Batteries, Rechargeable batteries, zinc and lithium based primary batteries, thermal batteries, lead acid batteries, automotive batteries, alkaline batteries, Li-ion batteries and Advanced rechargeable battery,	**22**	50
2	**Fuel Cells** Basic Concept, electrochemistry and thermodynamics of fuel cells, molten carbonate fuel cells, solid oxide fuel cells, Acid Alkaline Fuel Cells, Proton Exchange Membrane Fuel Cell, Direct Methanol and other non-hydrogen fuel cells, Applications of fuel cells ,	**23**	50

Reference Books:

1. Linden, D.; Reddy, T.B , Handbook of Batteries, McGraw-Hill, 2002
2. Ronald Dell, David Anthony James Rand, Understanding Batteries, Royal Society of Chemistry, 2001
3. James Larminie, Andrew Dicks, Fuel cell Systems Explained, John Wiley & Sons, 2003
4. Bent Sørensen, Hydrogen and Fuel Cells, Academic Press, 2012
5. *Xianguo Li, Principles of Fuel Cells, by, Taylor & Francis, 2006*
6. Shripad T. Revankar, Pradip Majumdar, Fuel Cells, Principles, Design and Analysis, CRC Press, 2014

Course Outcome:
After learning the course the students should be able to:

1. To understand Electrochemical energy conversion (fuel cells) and storage (batteries)
2. To develop system which can convert chemical energy to electrical energy more efficiently and quietly than internal combustion engines
3. To engage students in engineering design issues related to the battery and fuel cell technologies

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.