

GANPAT UNIVERSITY										
FACULTY OF ENGINEERING & TECHNOLOGY										
Programme		Master of Technology				Branch/Spec.		Electrical (Renewable Energy)		
Semester		I				Version		1.0.0.0		
Effective from Academic Year				2025-2026		Effective for the batch Admitted in			July 2025	
Course code		3EE21PE8		Course Name		Battery and Fuel cell Technology				
Teaching scheme						Examination scheme (Marks)				
(Per week)		Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW						
Credit	3	0	1	0	4	Theory	40	60		100
Hours	3	0	2	0	5	Practical	30	20		50
Pre-requisites:										
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Course Outcomes:										
On successful completion of the course, the students will be able to:										
CO1	Understand the electrochemical principles for the functioning of batteries.									
CO2	Understand the fuel cell technology.									
CO3	Demonstrate the working of components of Fuel Cell.									
CO4	Elaborate the fuelling technology of Fuel Cell.									
Theory syllabus										
Unit	Content									Hrs
1	Primary Batteries: The chemistry, fabrication and performance aspects, Packing classification and rating of batteries. Zinc-carbon (Leclanche type), Zinc alkaline (Duracell), Zinc/air batteries; Lithium primary cells, Liquid cathode, Solid cathode and lithium-ferrous sulphide cells.									10
2	Secondary Batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), Nickel-cadmium, Nickel-zinc, Nickel-metal hydride batteries, Lithium ion batteries, Ultrathin lithium polymer cells (comparative account), Advanced Batteries for electric vehicles, Requirements of the battery, sodium-beta and redox batteries.									08
3	Fuel Cells: Introduction – working and types of fuel cell – low, medium and high temperature fuel cell, liquid and methanol types, proton exchange membrane fuel cell solid oxide, hydrogen fuel cells – thermodynamics and electrochemical kinetics of fuel cells.									08
4	Fuel Cell Components and their Impact on Performance: Fuel cell performance characteristics – current/voltage, Voltage efficiency and power density, Ohmic resistance, kinetic performance, Mass transfer effects, Membrane electrode assembly components, Fuel cell stack, Bi-polar plate, Humidifiers and cooling plates.									08
5	Fueling: Hydrogen storage technology, Pressure cylinders, Liquid hydrogen, Metal hydrides, Carbon fibers, Reformer technology, Steam reforming, Partial oxidation, Auto thermal reforming, CO removal, Fuel cell technology based on removal like bio-mass.									11
Practical content										
Practicals, assignments and tutorials are based on above syllabus.										
Text Books										
1.	Dell, Ronald M Rand, David A J, ‘Understanding Batteries’, Royal Society of Chemistry,									
2.	Fuel Cell Technology Handbook SAE International Gregor Hoogers CRC Press									
Reference Books										
1.	Fuel Cells for automotive applications – professional engineering publishing UK.									
2.	M. Aulice Scibioh and B. Viswanathan ‘Fuel Cells – Principles and Applications’, University Press, India									
ICT/MOOCs										
1.	https://www.youtube.com/playlist?list=PLaohA_uElPxrQEYR2BTIyDPsxeVF8XOW									
2.	https://www.youtube.com/watch?v=Eb7pv0oOf_k									

Mapping of CO with PO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	1	2	0	0	1	1	1	3	2	2
CO2	2	1	1	1	2	0	2	0	0	0	1	0	3	2	1
CO3	2	2	1	2	1	0	2	0	0	0	0	0	2	1	1
CO4	2	2	1	2	2	0	2	0	0	0	0	0	2	1	1