

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IITDM) KANCHEEPURAM

Course Title	Electrochemical energy conversion and storage	Course No	ELE5XXX			
Specialization	Electronics Engg	Structure (LTPC)	3	0	0	3
To be offered for	UG/PG	Status	Core <input type="checkbox"/>		Elective <input checked="" type="checkbox"/>	
Faculty Proposing the course	Dr. B Raja	Type	New <input checked="" type="checkbox"/>		Modification <input type="checkbox"/>	
Date of DAC	26-11-2018	Members Present in DAC	All Faculty Members of the Dept. External Member: Dr. Bobby George/Prof. S. Karmalkar, EE Dept, IIT-M			
Pre-requisite	Basic Electrical/Mechanical/Material Science and CoT	Submitted for approval	39 th Senate			
Learning Objectives	The objective of the course is to teach the fundamentals of working principles of electrochemical energy conversion and to teach the direct applications in devices.					
Learning Outcomes	The students will be able to gain knowledge about batteries, its working principles, performance, testing methods and evaluation. The course will also give the essentials of fuel cells and its different types.					
Contents of the course (With approximate break-up of hours)	<p>Fundamental : EMF, reversible and irreversible cells, STP Voltage, free energy, effect of cell temperature, thermodynamic calculation of the capacity of a battery, calculations of energy density of cells (6)</p> <p>Battery Performance: Factors affecting battery capacity, voltage level, current drain of discharge, types of discharge: continuous, intermittent, constant current, constant load, constant power, service life, voltage regulation, charging methods, battery age & storage condition. (7)</p> <p>Storage batteries: Principle, design, construction, performance characteristics, advantage and disadvantages. Primary batteries - Zn-MnO₂ carbon-zinc, carbon-zinc chlorides, and zinc-silver oxide. Secondary batteries - lead-acid, nickel-cadmium, nickel-metal hydride, silver oxide-zinc system, lithium-ion, lithium- polymer, safety issues -thermal runaway, fire/explosion hazard, Batteries for electric vehicle applications, BMS, Micro batteries. (12)</p> <p>Testing and Evaluation: Evaluation of active mass, surface area measurement - BET method. Internal resistance of cells - A.C. methods impedance method. Testing of capacity, retention of charge, vibration, life, efficiency, leakage for sealed cells, High rate discharge, testing of separators. (7)</p> <p>Fuel cells & super capacitor: Introduction to fuel cells, types of fuel cells and technology development. Polymer electrolyte and solid oxide fuel cells. Material related challenges. Stack engineering. Microbial fuel cells, flow batteries. Introduction to super capacitors, types of super capacitors. (10)</p>					
Text Books	<p>1. R,S.Liu, L.Zhang, X.Sun,H.Liu, J. Zhang, Electrochemical Technologies for Energy Storage and Conversion, John Wiley, 1st Edition, 2012</p> <p>2. O.H.Ryan, S.W.Cha, W.Colelle, F.B.Prinz, Fuel Cell Fundamentals, John Wiley, Edition, 2016.</p>					
Reference Books	<p>1. M. Mench, Fuel Cell Engines, John Wiley, New York, 2008.</p> <p>2. G.A.Nazri, "Lithium Batteries - Science and Technology, Springer, New York, 2009.</p> <p>3. D.Pavlov, Lead - Acid Batteries: Science and Technology, Elsevier, Amsterdam, 2011.</p>					