

VASAVI COLLEGE OF ENGINEERING (Autonomous)

ACCREDITED BY NAAC WITH 'A++' GRADE IBRAHIMBAGH,
HYDERABAD – 500 031

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

INTRODUCTION TO BATTERIES AND BATTERY MANAGEMENT SYSTEM (GENERAL POOL)

Open Elective-IV SYLLABUS FOR
B.E. VI SEMESTER

L: T: P (Hrs/Week):3:0:0	SEE Marks: 60	Course Code:U22OE610EE
Credits:3	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVES The course will enable the students to:	COURSE OUTCOMES On completion of the course, students will be able to
The objective of this course is to introduce learner to batteries, its parameters, modeling and charging requirements. The course will help learner to develop battery management algorithms for batteries.	<ol style="list-style-type: none">1. Interpret the role of battery management system.2. Identify the requirements of Battery Management System.3. Interpret the concept associated with battery charging / discharging process.4. Calculate the various parameters of battery and battery pack.5. Design the model of battery pack

UNIT -I: Introduction to Battery Management System:

Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging.

UNIT -II: Battery Management System Requirement:

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of-charge estimation, Cell total energy and cell total power.

UNIT -III: Battery State of Charge and State of Health Estimation, Cell Balancing:

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ionaging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing.

UNIT –IV: Modelling and Simulation:

Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, simulating an electric vehicle, Vehicle range calculations, simulating constant power and voltage, Simulating battery packs.

UNIT -V: Design of battery BMS:

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system.

Learning Resources:

1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. ArtechHouse, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.
3. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L. "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.
4. Davide Andrea, " Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010.

The break-up of CIE : Internal Tests+Assignments+Quizzes

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| 1. No. of Internal Tests | : | <input type="text" value="2"/> | Max. Marks for each Internal Test | : | <input type="text" value="30"/> |
| 2. No. of Assignments | : | <input type="text" value="3"/> | Max. Marks for each Assignment | : | <input type="text" value="5"/> |
| 3. No. of Quizzes | : | <input type="text" value="3"/> | Max. Marks for each Quiz Test | : | <input type="text" value="5"/> |

Duration of Internal Tests : 90 Minutes