

SRM University
M.Tech Automotive Hybrid Systems Engineering
 (Collaborative program with NFTDC, Hyderabad)
 (Proposed syllabus from the academic year 2015-16)

Core courses

		L	T	P	C
AH2103	AUTOMOTIVE ELECTRONICS FOR xEVs	3	0	2	4
	Total Contact Hours-75				
	Prerequisites				
	Nil				
PURPOSE					
To understand electronic control units (ECUs) for xEVs, Basics of motor Controller, Battery Management systems (BMS), Thermal Management ECU.					

UNIT I - Basics in Power Electronics

Introduction – Why Power Electronics? Overview of Power Density, Effects of air vs. liquid cooling, Effects of efficiency, Converter Topologies, Buck, boost, transformer, Inverter Topology, 6-pack inverter, Space Vector Control, Sources of Loss in Power Electronics, Conduction, switching, leakage, and control losses, Power Semiconductors, Insulated Gate Bipolar Transistor (IGBT), Metal-Oxide-Silicon Field Effect Transistor (MOSFET), Emerging technologies: Moore’s law, silicon carbide.

UNIT II - Power Electronics for Electric Drives

Semiconductor power diodes, transistors, Thyristors, Triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters

UNIT III - Convertors

Single and three phase AC-DC converters- Half wave and Full wave controlled rectifier with R, RL, RLE load – Continuous and discontinuous operation modes of operation, Harmonics and ripple. DC –DC converter; Principles of step-down and step-up converters –buck-boost and Cuk converters.

UNIT IV - Battery Management Systems

Block Diagram - Main Functions of a BMS, Sensing Requirements, Cell/module level: cell voltage, cell/module temperature, (humidity, smoke, air/fluid flow), Pack level: current, pre-charge temperature, bus voltage, pack voltage, isolation, Control Requirements, Contactor control, pre-charge circuitry, Thermal system control, Cell Balancing: Active versus passive, strategies, Estimation Requirements, Strategies: different approaches and benefits of model-based approach, How to create a model via cell tests, State of Charge estimation; State of Health estimation, Power estimation, Energy estimation (range estimation)

References:

1. Rashid, M.H., “*Power Electronics – Circuits, Devices and Applications*”, Prentice Hall of India, Third Edition, New Delhi, 2011.
2. Sen .P C, “*Power Electronics*”, Tata Mc Graw Hill Education, Twelfth Edition .

3. Bhimbra.P. S. "*Power Electronics*", Khanna publishers, Fifth edition, 2005.
4. Singh.M.D and Kanchandani-"*Power Electronics*"-Tata McGraw-Hill & Hill Publication Company Ltd New Delhi-2002.
5. Joseph Vithayathil, "*Power Electronics*", Mc Graw Hill series in Electrical and Computer Engineering , USA., 1995.
6. Dubey.G.K, Doradia.S.R, Joshi, A. and Sinha.R.M, "*Thyristorised Power Controllers*", New age International, New Delhi, 2002.
7. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "*Battery Management Systems -Design by Modelling*" Philips Research Book Series 2002.
8. Davide Andrea," *Battery Management Systems for Large Lithium-ion Battery Packs*" Artech House, 2010