SRM University

M.Tech Automotive Hybrid Systems Engineering

(Collaborative program with NFTDC, Hyderabad)

(Proposed syllabus from the academic year 2015-16)

Optional / elective courses (program electives)

		L	T	P	C
AH2122	**THERMAL MANAGEMENT OF HYBRID SYSTEMS**	**3**	**0**	**0**	**3**
	Total Contact Hours-45				
	Prerequisites				
	Nil				
PURPOSE					
To study thermal management of hybrid systems.					

Brief Review of Thermodynamics, Fluid Mechanics, and Heat Transfer: First Law of Thermodynamics for open and closed systems; internal energy, enthalpy, and specific heat - Second Law of Thermodynamics for closed systems; Tds equations, Gibbs function - Fluid mechanics: laminar vs. turbulent flow, internal flow relationships, Navier Stokes equations - Heat transfer: simple conduction, convection, and radiation relationships; Nusselt number relationships for convective heat transfer; energy equation.

Thermal Management of Motors: Motor Sizing vs Heat Generation - Operational Temperature Limitations of Electrical Insulation - Design concepts for Heat Extraction in Motors for xEV systems - Modelling and simulation of heat transfer in motors - Rendering of Heat extraction solutions - Sensors and Protection solutions.

Thermal Management for Batteries and Power Electronics: Introduction - Thermal control in vehicular battery systems: battery performance degradation at low and high temperatures - Passive, active, liquid, air thermal control system configurations for HEV and EV applications - Battery Heat Transfer - Introduction to battery modeling: tracking current demand, voltage, and State of Charge as functions of time for given drive cycles - Development of thermodynamic relationships for cell heat generation - Lumped cell and pack models for transient temperature response to drive cycles - Model parametric study results

Thermal Management Systems: Overall energy balance to determine required flowrates - Determination of convection and friction coefficients for air and liquid systems in various geometric configurations: flow around cylinders, flow between plates, flow through channels - Development of a complete thermal system model and parametric study results - Temperature control and heat transfer using phase change materials - Thermal Management of Power Electronics.

References:

1. Nag.P.K, "*Engineering Thermodynamics"*, 5th Edition, Tata McGraw Hill Education, New Delhi, 2013.
2. Jerry Sergent, Al Krum, "*Thermal Management Handbook: For Electronic Assemblies Hardcover*", 1998, Mc Graw- Hill.
3. *" Vehicle thermal Management Systems Conference Proceedings*", 1st Edition; 2013, Coventry Techno centre, UK

4. Younes Shabany," *Heat Transfer: Thermal Management of Electronics Hardcover*" 2010 , CRC Press.
5. T. Yomi Obidi**, "***Thermal Management in Automotive applications*", 2015, SAE International.