

Two Day Proficiency Improvement Programme on Electric and Hybrid Vehicle Engineering

Course Content:

The course curriculum is divided into 10 modules.

Theory Modules

1. Refresher Session on Basic Electrical and Electronics

Introduction and physical basics

- Setup of an electric drive
- Electromagnetism, Hysteresis & Electrodynamics rules
- Components of an electric circuit

2. Hybrid Components and Architectures

- Basics of Vehicle Architecture
- IC Engine Vs E-Motor Characteristics.
- Major components in hybrid powertrain
- Controls integration
- Component sizing and integration tradeoffs

3. Electric Motors and Drives

Types of electric motors

- Setup of an electric motor
- DC motor, Synchronous, Asynchronous motor & Reluctance motor
- Types of position sensors

4. Hardware elements of the power electronics

- Setup of a voltage converter
- Evolution of a complex DC/DC converter - from the half bridge to the push-pull converter
- Components of the inverters
- IGBT vs. MOSFET
- Gate driver

5. Battery Management Systems

Introduction

- Battery System Requirements
- Electrochemical Storage Systems
- Battery Types & Storage Technologies (Rechargeable)
- Battery Components

Lithium Battery Systems

- Function Principle
- Materials & Construction
- Costs and Life cycle

Safety Management

- Potential hazards of electrochemical storage systems
- Hazards & Failure mechanisms of Li-Ion system
- Protective Measures & Potential to increase safety

Battery Management (BMS) & Charging

- Battery State Detection
- Safety Monitoring & Cell Balancing
- Thermal Management

6. Safety, Testing, Regulations, and Standards

- Description of the (hybrid) electric vehicle [(H)EV] system
- Dangers posed by the individual components, topology and driving behavior of (H)EV
- Relevant standards, in particular ISO 6469 (Electric road vehicles - Safety Specifications)
- Functional safety concept with Practical examples
- Vehicle and Charging Standards
- Regulations & Certification Requirements from ARAI/CIRT/CMVR
- Electric Vehicle Supply Equipment (EVSE) Descriptions

7. Control Techniques of Electric Vehicles

- EV system overview
- Communication interface & VCU software architecture
- Coordination high-voltage system
- EV torque path & Driver demand
- VCU hardware & Thermo management
- EV monitoring concept

8. Modelling and Simulation of Electric and Hybrid Vehicles

9. Case Study of Toyota Prius / Chevrolet Volt / Honda Civic / Tesla Models Development.

10. Vehicle Dynamics of Electrified Vehicles – An Overview

- Adaptation of Chassis systems to electric driving and engine start/stop.
- Adaptation of Chassis systems to Regenerative Braking.
- Conventional and De-Coupled braking system.
- Usage Scenario's of Regenerative Versus Friction Braking.
- Specific Considerations for a Hybrid –Electric vehicle
- Integration of a Hybrid system with Vehicle Dynamics Controls and All-Wheel drive

In Addition there will be a Note lecture on Career and Entrepreneurship Opportunities in this field delivered by a Professional from a Top OEM.

Practical & Demo Sessions:

- Range and Power Calculations -
 - Calculations on vehicle parameters as well as component sizing
 - Demo on a model-based solution with Open Source Software's.
- Battery Pack Layout with Battery management System Diagnosis and Troubleshooting
- Demo of the EV architecture with the E-Bike Kits from the Company
- Simulation of EV Systems in software Environment.

Key Take Away:

- ✓ Certificate of Proficiency after successful completion of the training.
- ✓ An exclusive Kit filled with E-Books and case studies Relevant to the field will be distributed to individual Participants.
- ✓ Lifetime Access to the Company's forum where students can reach for Technical and Career related enquiries.