Michigan Alliance for Greater Mobility Advancement

Course Title: Automotive Systems

Course Length: 3 days

Time Online: 24 hours*

Time in Class: N/A

Time in Lab: N/A

Class Size: Minimum 6 / Maximum 50

Price Per Student: $930.00**

Location: Virtual

Course Description:

Automotive systems for light duty vehicles are examined from the perspectives of requirements, design, technical, and economic analysis for advanced mobility needs. The course critically examines past, current, and future mobility trends. Content includes connected and autonomous vehicle functions and their impacts on the vehicle subsystems, human-machine interfaces, and human-machine interactions. U.S. federal regulations and standards will be examined including safety, security, and fuel economy. Power, communication, and computational requirements for the full vehicle system will be examined. Vehicle integration topics including propulsion system matching, NVH, drive quality, mass, cost, and others will be discussed. Concepts for advanced mobility will be probed and analyzed.

This course can be taken as either a standalone course, or as a pre-requisite for the laboratory activities that accompany this course and are delivered on-site at the customers location (see the course titled "Automotive Systems Lab").

This course is well suited to engineers, managers, technicians, and other staff including those with primary roles in marketing, service, etc.

Lab Projects Description

Hands-On Experimental Lab projects are not included in this course, however, a separate course accompanies this course and provides extensive hands-on learning opportunities. See course title "Automotive Systems Lab". However, this course does include interactive demonstrations of vehicle simulation, and other engineering tools.

Course Learning Objectives

*If desired, the course can be scheduled such that the 20 hours of instructional time is spread over a longer duration (even several weeks) to provide increased flexibility to the customer.

**Price based on minimum enrollment, subject to change

- Recognize current and future trends driving automotive systems development
- Identify the requirements that drive systems level decisions

- Be able to distinguish automotive architectures and platforms
- Critique automotive architectures and platforms on the basis of security, human factors, energy efficiency, and financial acumen
- Identify an appropriate drive cycle, and analyze total energy consumption over a given drive cycle

Course Content/Syllabus

Part 1: Introduction to Systems Engineering

- Course Overview (Learning Objectives, Introductions, Outline, etc.)
- Systems Engineering
    - System of Systems – Design and Decomposition – Automotive Subsystems
    - Stakeholders; OEM's, Suppliers, Internal & External Customers
- Status of the Automotive Industry – Trends and Disruptors
    - Mobility Overview Past, Present, & Future
- Automotive Regulations
    - Fuel Consumption
    - Emissions
    - Safety
    - On-Board Diagnostics
    - Others; noise, human factors, etc.

Part 2: Automotive Sub-Systems

- Automotive propulsion systems
    - Intro to propulsion systems
    - Propulsion System Architecture
    - Engines
    - Motors & Power Electronics
    - Energy Storage and Batteries
    - Transmissions and Axles
    - Powertrain Hybridization
- Vehicle Dynamics
- Braking Systems
- Automotive NVH
- Safety Systems
    - Introduction to Safety Systems
    - NHTSA FMVSS
    - Functional Safety ISO 26262
    - Collision Considerations
    - Air Bags and Restraint Systems
- Control Systems
    - Control Fundamentals
    - Embedded Control Systems
    - On-Board Diagnostics

- Connected and Autonomous Vehicles
    - Inter & Intra Vehicle Communication Systems
    - V2X Connected Vehicles
    - Autonomous Systems including SAE Levels
    - ADAS Systems
    - Collision avoidance
    - Path routing
- HVAC Systems
- Infotainment
- Human Factors
- Automotive Cyber Security

Part 3: Systems Engineering; Putting it All Together

- The Vehicle Development Process
- Quality
    - Reliability
    - Perceived quality
    - Drive quality assessment ratings
- Failure Mode Engineering Analysis (FMEA) & Design for Six Sigma (DFSS)
- Purchasing & The Supply Chain
- The Future of Mobility (an interactive discussion)
- Student Assessment (Exam)
- Course Evaluations