



Course Title: Introduction to Systems Engineering – 1

Course Length: 2 days with a prior online component, online and in-person

Time Online: 6.5 hours

Time in Class: Day 1: 6.5 hours, Day 2: 7 hours (includes labs)

Time in lab: Day 1: 2 hours, Day 2: 2 hours

Class Size: Minimum 7 / Maximum 12

Price Per Student: \$2,310.00

Location: Genesee County *or* Company Site

Course Description:

Systems are becoming increasingly large and complex with many challenges in their design, development, and implementation. Systems engineering enables the successful completion of large and complex projects. In this course, you will be introduced to systems engineering (SE) with emphasis on model based SE (MBSE) using the SysML language. Your knowledge will be reinforced by carefully designed assignments, and lab projects involving automotive and autonomous vehicle systems.

Lab Projects Description:

Lab Project 1: Development of the structure, behavior, and requirements for ABS using SysML.

Lab Project 2: Development of the structure, behavior, and requirements for an AV obstacle detection and avoidance controller using SysML.

Course Learning Objectives:

- Articulate the concepts of system life cycle, requirements, and the various design activities
- Describe importance of verification and validation (V&V) of requirements
- Define and illustrate what is meant by model based system engineering (MBSE)
- Explain the main features of SysML as a SE language
- Develop the structure, behavior, and requirements of a specific sub-system using SysML
- Articulate the concept of a safety culture and the role of the system architect



## Course Content/Syllabus:

Online Component (throughout one week):

The course begins with a one week online component to be completed prior to classroom instruction. On this week, you'll take a Pre-Assessment to get a baseline of your understanding of the course material. After detailed information on the course, you will get a thorough introduction to systems engineering and systems lifecycle. This is followed by the characterization of requirements and various design activities and an introduction to requirements verification and validation (V&V). You will spend time on generating your own ideas about how to successfully complete large and complex projects. This component will end with a comprehensive assignment to be completed before the classroom instruction.

Topics:

- Knowledge Pre-Assessment
  - Welcome, Course schedule, Course collaboration tools, Learning objectives, Course syllabus.
  - Instructor, Training and delivery methodology, Assignments, Laboratories, Grading and completion criteria.
  - Introduction to course
  - Systems life cycle
  - Introduction to Systems Engineering
  - Requirements
  - Conceptual Design
  - Preliminary and Detailed Design
  - Construction, Production, and Utilization phases
  - SE Management
  - Introduction to V&V

Graded Assignment

- Detailed set of questions on system life cycle, requirements, and V&V.

Day 1:

On day 1 we review the online content material, answer your questions, and discuss the graded assignment of the online component. After defining systems thinking you will get an in-depth coverage of model based system engineering (MBSE). You will then be exposed to SysML as an example language for MBSE. Day 1 will end with a comprehensive assignment and completing a laboratory project.

Topics:

- Defining systems thinking
- Architecture of complex systems
- Model based systems engineering (MBSE)



- SysML as an example language for MBSE
- SysML: Structure, Behavior, Requirements, and parameters
- Demo of SysML

#### Graded Assignment

- Read, comment, and summarize a paper on SysML.

#### Laboratory Project 1

- Development of the structure, behavior, and requirements for ABS using SysML.

#### Day 2:

On day 2 we review the day 1 material, answer your questions, and discuss the graded assignment and lab project of day 1. You will then get an overview of ISO 26262 as an example of system engineering. You will then be exposed to SE management and the roles of the system architect and the safety manager. You will then work on a graded assignment and complete lab project 2. Day 2 will end with a course summary, main takeaways, a post assessment, and a course assessment.

#### Topics:

- Example of SE: Automotive safety standard ISO 26262
- SE Management
- Roles of system architect, safety manager

#### Graded Assignment

- Read, comment, and summarize a paper on MBSE.

#### Laboratory Project 2

- Development of the structure, behavior, and requirements for an AV obstacle detection and avoidance controller using SysML.
- Course Summary and Wrap-up
- Course Takeaways

#### Knowledge Post-Assessment

- Course Assessment

MAGMA short courses are held on a rolling basis, based on industry demand. Please complete this [short form](#) to express interest for yourself, or your organization.