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Course ID	Course Title
SYSENGM	**Systems Engineering: Methodology, Best Practices, and Management**
Course Duration	
4 days	

Related Courses

- Systems Engineering: An Intermediate Tutorial and Workshop (SYSENG, 2 days)
- Software Engineering: An Advanced Tutorial (SWENG2, 3 days)
- Principles of Software Engineering (SWENG1, 2 days)
- Project Management Workshop (PROJMGT2, 2 days)
- Project Management: A Comprehensive Course and Simulation (PROJMGT5, 5 days)
- Controlling Project Risk: Managing Threats and Promoting Opportunities (RISK, 3 days)
- Succeeding at Technical Management: Do's and Don'ts for the Technical Manager (DOS&DONTS, 1 day)
- Cost Reduction: Opportunities and Strategies (COSTRED, 2 days)
- Design of Experiments: A Comprehensive Course and Workshop (DOE2, 2 - 3 days)
- Design of Experiments: An Overview (DOE1, 1 day)
- Industrial Statistics: A Tutorial (INDSTAT, 2 days)
- Thinking Out of the Box: A Systems Engineering Imperative (OUTOFBOX, 2 days)
- Root Cause Failure Analysis: Workshop and Simulation (RCFA5, 5 days)

Aimed At

Systems engineers, software and hardware engineers, maintenance personnel, and system engineering managers in commercial or military settings.

Group Size

5-25

Prerequisites

The course can be taught at levels ranging from novice to advanced, and no specific prerequisites are required.

Course In a Nutshell

Systems engineering is an interdisciplinary approach that enables the successful implementation of large and complex systems, whether in the commercial or military arenas. It focuses on defining customer needs and required functionality early in the development cycle; documenting requirements; designing and constructing the system; validating and deploying the system; and maintaining and evolving the system during its operational lifetime. This course explores the system engineering process and its benefits to customers, users, managers, and maintainers, with the concepts reinforced by student workshops. A special DoD-oriented version of this course addressing the needs of those involved in the development of weapons systems is available.

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Customize It!   Customize this course to your own requirements at little-to-no additional cost. We can teach distinct versions of this course tailored for audiences such as systems engineers, systems engineering management, or those needing a less technical "executive overview" of the subject. The course can furthermore be taught in versions catering to commercial or military systems. The course duration can accordingly be customized to range from a one-day overview to a 3-5 day comprehensive course and workshop.

Learn How To
- Understanding systems and systems engineering
- How to construct system engineering requirements.
- How to perform a functional analysis
- How to develop a system architecture
- How to perform system design and development
- How to validate and deploy a system
- How to maintain a system

Course Outline

Module 1: Introduction

- Objectives
- Definitions
  - ° System
  - ° System engineering
- Understanding systems and systems engineering
  - ° Systems and systems engineering in the project/program environment
  - ° The system development life cycle
  - ° The systems engineering process
- Need for systems engineering
  - ° Meet complex requirements
  - ° Ensure interoperability
  - ° Reduce implementation risk
  - ° Ensure sustainability
- System life cycle phases
  - ° Concept exploration
  - ° Program definition and risk reduction
  - ° Engineering and manufacturing development
  - ° Production, deployment, and operational support
- System engineering infrastructure
  - ° Project management
  - ° Configuration management
  - ° Quality assurance
- System engineering standards
  - ° INCOSE
  - ° IEEE
  - ° NASA
- Summary and best practices

Module 2: Requirements Analysis

- Concepts
  - ° Requirements analysis process overview
  - ° Objectives
  - ° Inputs and outputs
  - ° Requirements analysis views
  - ° Analytical questions to ask
  - ° Requirements types
  - ° Properties of good requirements
- Process activities
  - ° Establish customer expectations and constraints
  - ° Produce operational scenarios and measures of effectiveness
  - ° Define system boundaries and interfaces
  - ° Preliminary assessment of recommended concept (cost, schedule, …)
  - ° Elicit functional and performance requirements
  - ° Articulate operational environments
  - ° Specify life cycle process concepts and environment profile
- Requirements engineering
  - ° Definitions
  - ° Relationship of requirements to other work products
  - ° Specification structure, audience, and standards
  - ° Gathering information
  - ° Using the context diagram
  - ° *Workshop: defining a context diagram*
- Functional and performance requirements
  - ° Definitions
  - ° Functions, modes, and states
  - ° Use case properties
  - ° Types of non-functional requirements
  - ° Response time, throughput, availability, and capacity
  - ° *Workshop: specifying functional and performance requirements*
- Summary and best practices

Module 3: Functional Analysis and Allocation

- Concepts
  - ° Process objectives
  - ° Inputs and outputs
- Process activities
  - ° Lower-level decomposition
  - ° Define and refine functional architecture
  - ° Allocate requirements
  - ° Define and refine functional interfaces
  - ° Conduct trade-off studies
- Functional analysis
  - ° Functional decomposition
  - ° Functional partitioning

- ° Functional analysis tools
- ° ***Workshop: functional decomposition***
- Allocation
  - ° Allocation process
  - ° Requirements allocation
  - ° Trade-off analysis
  - ° ***Workshop: trade-off study***
- Summary and best practices

Module 4: Design Synthesis

- Concepts
  - ° Process objectives
  - ° Inputs and outputs
  - ° Decision database
  - ° Modular design
- Process activities
  - ° Group and allocate functions
  - ° Identify solution alternatives
  - ° Assess safety and environmental hazards
  - ° Assess lifecycle quality factors
  - ° Assess technology requirements
  - ° Define design and performance characteristics
  - ° Define physical interfaces
  - ° Identify standardization opportunities
  - ° Identify available off-the-shelf hardware or software
  - ° Identify make or buy alternatives
  - ° Develop models and prototypes
  - ° Assess failure modes, effects, and criticality
  - ° Assess testability needs
  - ° Assess design capacity to evolve
  - ° Finalize design and initiate evolutionary development
  - ° Produce integrated data package
  - ° Establish design architecture
  - ° ***Workshop: design alternatives***
- Summary and best practices

Module 5: Systems Analysis and Control

- Concepts
  - ° Process objectives
  - ° Inputs and outputs
- Process activities
  - ° Measure progress
  - ° Perform cost effectiveness and risk analyses
  - ° Select preferred alternatives
  - ° Control and manage
  - ° Retirement
  - ° Trade-off studies and analyses

- ° Analysis of alternatives
- Tools and techniques
  - ° Modeling and simulation
  - ° Technical reviews and audits
  - ° Work breakdown structure
  - ° Configuration management
  - ° Metrics
  - ° Risk management
  - ° *Exercises: simulation; work breakdown structures; measures of effectiveness; earned value analysis.*
- Summary and best practices

Module 6: Loops

- Concepts
  - ° Objectives
  - ° Loop termination criteria
- Requirements loop
  - ° Requirements evaluation process
  - ° What to look for
- Design loop
  - ° Criteria for revisiting functional architecture
  - ° Design traceability
- Verification loop
  - ° Objectives
  - ° Verification process
  - ° Verification techniques
  - ° *Workshop: specifying verification techniques*
- Summary and best practices

Wrap-up: Course Recap, Discussion, Evaluation

How You Will Learn	
	- You will learn from an instructor who combines extensive experience in systems engineering and management with consulting and training.
	- Along with the lecture, we will use exercises and interesting group activities to enable hands-on application, drive home the important points, and draw on the participant experience and concerns to enrich the class.
	- If your background is less technical, we will use meaningful examples and analogies to simplify the complex subject matter.
	- The Participant Handbook will provide you with a framework to which you can add the information and insight provided in real-time, turning it into a valuable reference resource you can take back to your job.

Revised   *Sept 30, 2010f*