



Systems Engineering: Theory & Practice

ABOUT THE COURSE:

Systems engineering is a discipline that utilizes an inter-disciplinary problem-solving approach across the entire technical effort irrespective of whether the systems or the systems of systems are for military, industrial, commercial or civil applications. This course will provide an overview of both theory and practice of the systems engineering discipline along with systems engineering design approach. The aim of the course is also to equip students with capability to develop system solutions that optimally fulfill customer objectives with available resources. Focus will be on creating know-how on solving open-ended problems, utilizing creativity, problem formulation, generation of need statements, requirements analysis, alternative solutions generation and examination, concurrent engineering design, enforcing various realistic aspects such as safety, reliability, manufacturability, operations, aesthetics, ethics, and sustainability.

COURSE LAYOUT:

Week 1 :

Systems engineering – what is, origin, and examples
Systems engg as a profession
Power of systems engg and examples
Systems engg viewpoint, perspectives, domains
Systems engg fields, approaches, activities, and products

Week 2 :

Complex system structure-building blocks, hierarchy, interfaces
Complex system structure-environment, interactions, complexity
System development process – life cycle, evolutionary characteristics
Systems engg method
Systems testing throughout development

Week 3 :

Managing systems development, risks, work breakdown structure (WBS), systems engg management plan (SEMP)
Systems risk management, organizing for systems engg
Need analysis – originating, operations, functional, and feasibility
Need validation, systems ops requirement
System requirements development, performance requirements

Week 4 :

Implementing concept exploration, validating requirements
Concept definition – selection and validation, functional analysis and allocation
Systems architecture, system modeling languages, Model-Based Systems Engg (MBSE)
Decision making, modeling for decisions
Simulation, Trade-off analysis

Week 5 :

Engg development stage – program risk reduction, prototype development for risk mitigation
Development testing, risk reduction
Revision of functional analysis and design
Overview of probability data analysis
Hypothesis testing

Week 6 :

Engineering design – implementing system building blocks, component design
Design validation, change management

Concepts of reliability, redundancy
Concepts of maintainability, availability, producibility
User interface design and GUI

Week 7 :

Integration, testing and evaluating total system
Test planning and preparation, system integration
Developmental and operational test and evaluation
Engineering for production, transition from development to production
Production operations - 1

Week 8 :

Production operations - 2
Installation, maintenance and upgrading
Installation testing
In-service support
Upgrades and modernization