

Audience: All those interested and responsible for the processes related to the ownership and operation of the engineering - economic systems (e.g. electric power system, chemical industries, transport infrastructures, banks, defence industry and activities, etc.), in their efforts to ensure the systems engineering design and operational purpose of such complex systems. All relevant decision makers, both at national and international levels, are made aware of the research findings and have the opportunity to access a full range of deliverables in relation to their specific infrastructure. Students to develop a comprehensive set of techniques and methods to design, maintain, and evolve the systems engineering function in support of strategic enterprise objectives and operations.

1. The domain of **System Engineering**: Complex systems and the current environment for design, operation, maintenance and decommissioning of technical and service – oriented systems
2. **Why Systems Engineering**: basic definitions on system and system engineering, the system life cycle, system science, system analysis, the advent of system – of – systems engineering concept: a Glossary for Systems Engineering Management
3. The **Systems Engineering Process**: current definitions and their deficiencies, system feasibility analysis, system operational requirements, the maintenance and support concept, performance concept and prioritization of engineering-economic options, functional analysis, design integration, system test and evaluation, etc.
4. Theoretical approaches to **coherent** multifunctional engineering **structures and systems**
5. Balancing **Principles and Pragmatism**: business excellence, challenges, guidelines for managers, a GPS for Leaders
6. Principles for **Business and Engineering Processes**: Systems thinking; The new elements for systems engineering; Object oriented approach in dealing with modelling and systems engineering ; Component and service design (good patterns and design patterns)
7. Advanced models for dealing with **Principles** implementation and integrated systems engineering: Maturity models; Frameworks and reference models; Regulation and laws; The risk management; Governance; Six SIGMA paradigm; Needs and caveats for standards
8. **Methods and Techniques**: quality management; project management; organization improvement; cost/benefit, metrics, reuse, tests, SWOT Analysis, general techniques
9. **Pragmatism**: what is pragmatism, human factors, time to change for new approaches in systems engineering management and business processes, basic / essential concepts e.g. risk, compliance, performance, change, emotional intelligence
10. **Balance Principles - Pragmatism**: Corporate development: overview, the managed lifecycle, an axiomatic approach for systems engineering actions, a road map for managers, decision support systems tools and technical implementation aspects: Enterprise description: account cluster, delivery model, business model, resource models, information models; Multi-project management: change models; Knowledge libraries: definitions, models, templates, GAP related aspects, roadmaps; Applied instruments for systems engineering management: performance management, risk management, compliance management, analysis and diagnosis, business excellence control system, change management, business rule engineering, service management, legacy transparency, quality management, vulnerability management and governance: An object-oriented analytical and management approach; Use of specialized Decision Support Systems; DSS: excellence competence centre, service management, modeling guidelines, transformation template
11. Modeling for **systems engineering maintenance management**: Markov models for multifunctional systems maintenance modeling; Semi-Markov models for maintenance of complex systems; Risk sensitive decision models for maintenance optimization
12. Large scale systems and engineering management: **risk engineering**, mapping and assessment for critical infrastructure systems: Risk prioritization and systems engineering modeling ; Fuzzy sets modeling for prioritizing risks; the use of multi-attribute indicators
13. **Risk and vulnerability** concepts and instruments for systems engineering management **for complex situations**: use of *cellular automata* models; use of *Agent Based Models* for management of critical infrastructures

14. **Engineering Design Methods and Tools**; conventional design practice; new analytical methods; computer aided disaster management; living assessment and management in complex situations
15. **Probabilistic resilience** concept, and models in systems engineering management
16. **System of systems engineering** management: foundations; analytical approaches; new generation of models and associated tools: Systems engineering program planning: Organization for system engineering; challenges for the advent of the system of systems engineering concept and operational instruments; Ranking option for system engineering activities by use of *multi criteria decision analysis*; Use of *rough sets* for systems analysis and management in complex engineering systems
17. **Economics** for systems (and system of systems) engineering management
18. **Systems (of systems) engineering Governance**
19. System engineering **program evaluation**: evaluation requirements, benchmarking, evaluation of the system engineering organizations