

M.S. with a Major in Systems Engineering

Candidates must satisfy a total of 30 credit hours (CH) with a minimum G.P.A. of 3.000 on a 4.000 scale.

All students must complete 21 credit hours (CH) of the core curriculum.

EMIS 7300 Systems Analysis Methods

Introduction to modeling and analysis concepts, methods, and techniques used in systems engineering, design of products and associated production, and logistics systems and analysis of operational system performance. Specific topics include probabilistic and statistical methods, Monte Carlo simulation, optimization techniques, applications of utility and game theory, and decision analysis.

OR

EMIS 7370 Probability and Statistics for Scientists and Engineers

An introduction to fundamentals of probability, probability distributions, and statistical techniques used by engineers and physical scientists. Topics include basic concepts and rules of probability, random variables, probability distributions, expectation and variance, sampling and sampling distributions, statistical analysis techniques, statistical inference estimation and tests of hypothesis, correlation and regression, and analysis of variance.

Prerequisite: Knowledge of calculus required.

OR

EMIS 8360 Operations Research Models

A survey of models and methods of operations research. Deterministic and stochastic models in a variety of areas will be covered. Credit is not allowed for both EMIS 3360 and EMIS 8360. *Prerequisites:* Knowledge of linear algebra and introductory probability and statistics.

EMIS 7301 Systems Engineering Process

The discipline, theory, economics, and methodology of systems engineering is examined. The historical evolution of the practice of systems engineering is reviewed, as are the principles that underpin modern systems methods. The economic benefits of investment in systems engineering and the risks of failure to adhere to sound principles are emphasized. An overview perspective distinct from the traditional design and analytical-specific disciplines is developed.

EMIS 7303 Integrated Risk Management

An introduction to risk management based upon integrated trade studies of program performance, cost, and schedule requirements. Topics include risk planning, risk identification and assessment, risk handling and abatement techniques, risk impact analysis, management of risk handling and abatement, and subcontractor risk management. Integrated risk management methods, procedures, and tools will be examined.

EMIS 7305 Systems Reliability and Availability Analysis

This course is an introduction to systems reliability, maintainability, supportability and availability (RMS/A) modeling and analysis with an application to systems requirements definition and systems design and development. Both deterministic and stochastic models are covered. Emphasis is placed on RMS/A analyses to establish a baseline for systems performance and to provide a quantitative basis for systems trade-offs.

Prerequisite: EMIS 7300 or equivalent.

EMIS 7307 Systems Integration and Test

The process of successively synthesizing and validating larger and larger segments of a partitioned system within a controlled and instrumented framework is examined. System integration and test is the structured process of building a complete system from its individual elements and is the final step in the development of a fully functional system. The significance of structuring and controlling integration and test activities is stressed. Formal methodologies for describing and measuring test coverage, as well as sufficiency and logical closure for test completeness, are presented. Interactions with system modeling techniques and risk management techniques are discussed. The subject material is based upon principles of specific engineering disciplines and best practices, which form a comprehensive basis for organizing, analyzing, and conducting integration and test activities.

EMIS 7309 Systems Reliability Engineering

An in-depth coverage of processes, tasks, methods, and techniques for achieving and maintaining the required level of system reliability considering operational performance, customer needs, and affordability. Topics include establishing systems reliability requirements, reliability program planning, system reliability modeling and analysis, system reliability design guidelines and analysis, system reliability test and evaluation, and maintaining inherent system reliability during production and operation. *Prerequisite:* EMIS 7305.

EMIS 7311 Systems Engineering Design

An introduction to system design of complex hardware and software systems. Includes design concept, design characterization, design elements, reviews, verification and validation, threads and incremental design, unknowns, performance, management of design, design metrics and teams. Centers on the development of real-world examples. Prerequisite: EMIS 7301.

All students must complete 9 credit hours (CH) from one of the following tracks.

On-Campus/Distance Education Track

Satisfactory completion of any three of the following courses:

EMIS 7313 Integrated Logistics Support (ILS)

An introduction to concepts, methods and techniques for engineering and development of logistics systems associated with product production/manufacturing, product order and service fulfillment, and product/service/customer support, utilizing system engineering principles and analyses. Specific topics include logistics systems requirements, logistics systems design and engineering concurrently with product and service development, transportation and distribution, supply/material support, supply Web design and management and product/service/customer support. *Prerequisites:* EMIS 7300 and EMIS 7301 or permission of the instructor.

EMIS 7315 Systems Quality Engineering

An introduction to statistical quality-control methods that can be applied to meet the demand for ever-increasing levels of product and service quality. Basic methods and tools for analyzing, controlling and improving product and service quality are covered. Probabilistic and statistical techniques are applied to modeling and analysis of variability associated with product production and service processes. Topics include analysis of product design tolerances, six-sigma techniques, statistical analysis of process capability, statistical process control using control charts, quality improvement and acceptance sampling. *Prerequisite:* EMIS 4340 or 5370.

EMIS 7317 Systems Engineering Leadership

This course augments the management principles embedded in the systems engineering process with process design and leadership principles and practices. Emphasis is placed on leadership principles by introducing the underlying behavioral science components, theories and models. The course demonstrates how the elements of systems engineering, project management, process design, and leadership integrate into an effective leadership system. *Prerequisite:* EMIS 7301.

Or other elective courses from Systems Engineering, Engineering Management, Operations Research, or Computer Science as approved by the Systems Engineering Program Director.

Cohort Track

Satisfactory completion of any three of the following courses:

EMIS 7313 Integrated Logistics Support (ILS)

An introduction to concepts, methods and techniques for engineering and development of logistics systems associated with product production/manufacturing, product order and service fulfillment, and product/service/customer support, utilizing system engineering principles and analyses. Specific topics include logistics systems requirements, logistics systems design and engineering concurrently with product and service development, transportation and distribution, supply/material support, supply Web design and management and product/service/customer support. *Prerequisites:* EMIS 7300 and EMIS 7301 or permission of the instructor.

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EMIS 7319 Systems Architecture Development

A design-based methodological approach to system architecture development using emerging and current enterprise architecture frameworks. Topics include structured analysis and object-oriented analysis and design approaches; enterprise architecture frameworks, including the Zachman framework, FEAF, DoDAF, and ANSI/IEEE-1471; executable architecture model approaches as tools for system-level performance evaluation and tradeoff analyses; case studies in enterprise architecture development; and the integration of architecture design processes into the larger engineering-of-systems environment. *Prerequisites:* EMIS 7311 and EMIS 7313.

EMIS 7321 Systems Engineering Planning and Management

Provides a practical coverage of tasks, processes, methods, and techniques to establish the process of systems engineering and its role in the planning and management of programs. Explores the program manager's and systems engineer's tasks and roles for establishing program operations and a communications framework. Presents techniques for developing an integrated program and/or project plan by defining the role of the systems integrator and identifying useful tools for planning and managing systems integration of various sized projects. The student learns to prepare for and successfully complete key program milestone reviews by identifying essential material content and providing the design basis. Examines the systems development process by showing ways to plan for and manage change by implementing methods for configuration, change, and risk management. Also, how the program life cycle is concluded by planning the transition of systems engineering processes from development to production and field support. *Prerequisites:* EMIS 7301, EMIS 7311, and EMIS 7313.

EMIS 7323 Systems Life Cycle Cost and Affordability Analysis

Provides an understanding of Systems affordability concepts and the life cycle cost process. Examines the importance of using these concepts in optimizing engineering/business decisions, with emphasis being placed on the evaluation of alternatives, weighing costs, risks, reliability, maintainability, supportability, weight, performance, and other benefit/risk parameters. Topics include total ownership cost, estimating methods and techniques, cost analysis process, system trade studies, sensitivity analysis, risk analysis and simulation, and system cost effectiveness. *Prerequisites:* EMIS 7301, EMIS 7311, and EMIS 7313.

EMIS 7325 Systems Engineering Software Tools

Computerized tools perform the vital function of capturing and delivering Systems Engineering information throughout the product development life cycle. This course surveys the many tools, methods, and techniques that are applied to engineering systems from inception to disposal: scope/needs evaluation, requirements analysis, functional and physical allocation, optimization, test validation/verification, and product management. Hands-on use of systems engineering software will enable students to identify and apply appropriate tools through the life cycle of a product they develop. *Prerequisites:* EMIS 7301, EMIS 7311, and EMIS 7313.

Or other elective courses from Systems Engineering, Engineering Management, Operations Research, or Computer Science as approved by the Systems Engineering Program Director and management from the student's organization.