SYSTEMS ENGINEERING GRADUATE CERTIFICATE (ECE)

Banner Code: EC-CERG-SYST

Architecture-Based Systems Integration
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C4I & Cyber
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Engineering Resilient Enterprise Systems
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Financial Systems Engineering
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Tactical Computer Operations
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Admissions & Policies

Admissions

Concentration in Command, Control, Communications, Computing, Intelligence, and Cyber (C4IC)

The certificate with this concentration is available to students who hold bachelor's degrees in engineering and scientific disciplines or are in graduate status in such programs.

Concentration in Communications and Networking (CONE)

The certificate with this concentration in communications and networking is open to all students who hold BS degrees in scientific and engineering disciplines from accredited universities.

Concentration in Digital Engineering and Systems Architecture (DESA)

A bachelor's degree is required for admission to a certificate program.

Concentration in Engineering Resilient Enterprise Systems (ERES)

The certificate with this concentration is available to any student who holds a bachelor's degree in an engineering or scientific discipline or has graduate status in such a program. Math requirements include MATH 113 Analytic Geometry and Calculus I (Mason Core) (https://catalog.gmu.edu/mason-core/), MATH 114 Analytic Geometry and Calculus II, or their equivalents, and a probability and statistics course.

Concentration in Financial Systems (FNSY)

The certificate with this concentration will be open to all students who hold a BS degree in scientific and engineering disciplines from an accredited university program, with a minimum GPA of 3.0. Students who are already enrolled in a master's program must submit a secondary certificate form to enroll in this certificate with concentration program; all others must apply for graduate admission to this certificate with concentration program.

Concentration in Tactical Computer Operations (TCO)

Students applying to the certificate with this concentration must hold a bachelor's degree in either computer science or computer engineering. Prospective students without these specific degrees will need to have a technical bachelor's degree and show academic competence in the areas of: C (C++, C#, Objective C), Assembler, discrete mathematics, and computer networking. An undergraduate grade point average (GPA) of 3.0 or better (4.0 scale) is required.

Policies

The Systems Engineering Graduate Certificate may be pursued on a part-time basis only.

For policies governing all graduate certificates, see AP.6.8 Requirements for Graduate Certificates (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-8).

Requirements

Certificate Requirements

Total credits: 12-15

This certificate may be pursued on a part-time basis only.

Concentration in Command, Control, Communications, Computing, Intelligence, and Cyber (C4IC)

Administered by the Department of Systems Engineering and Operations Research (https://seor.gmu.edu/)

The certificate with concentration requires 12 credits (4 courses). Students must complete the following with an average grade of B or better.

Coursework

Code	Title	Credits
SYST 680	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	3

or ECE 670	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	
or SYST 687	Cyber Security Systems Engineering	
OR 542	Operations Research: Stochastic Models	3
or ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
Select two from the following:		6
ECE 542	Computer Network Architectures and Protocols	
ECE 630	Principles of Digital Communications	
ECE 642	Design and Analysis of Computer Networks	
OR 635	Discrete System Simulation	
SYST 584	Heterogeneous Data Fusion	
SYST 664	Bayesian Artificial Intelligence	
SYST 683	Modeling, Simulation, and Gaming	
Total Credits		**12**

The C4I concentration within the Systems Engineering certificate can be fully counted towards the Systems Engineering MS. Students who complete the C4I concentration can complete the Systems Engineering MS with 6 additional courses, as defined by the requirements of the Systems Engineering MS program (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/#requirementstext).

Concentration in Communications and Networking (CONE)

Administered by the Department of Electrical and Computer Engineering (https://ece.gmu.edu/).

The certificate with a concentration in Communications and Networking is awarded on completion of five graduate courses (15 credits) in communications and networking. A cumulative GPA of 3.00 is required and one course with a grade of C at most may be applied toward the certificate. The certificate courses comprise two required foundation courses and three electives.

Coursework

Code	Title	Credits
Foundation Courses:		
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	3
ECE 542	Computer Network Architectures and Protocols	3
Total Credits		**6**

Electives

After completing the foundation courses, students choose electives by taking three courses from the following:

Code	Title	Credits
Select three courses from the following:		9
ECE 527	Learning From Data	
ECE 535	Digital Signal Processing	
ECE 547	Applied Cryptography	
ECE 629	Wireless Networks	
ECE 630	Principles of Digital Communications	
ECE 632	Digital Communications	
ECE 633	Error Control Coding	
ECE 634	Detection and Estimation Theory	
ECE 635	Adaptive Signal Processing	
ECE 642	Design and Analysis of Computer Networks	
ECE 651	Advanced Learning From Data	
ECE 657	Probabilistic Machine Learning	
OR 635	Discrete System Simulation	
OR 643	Network Modeling	
OR 647	Queuing Theory	
Total Credits		**9**

Concentration in Digital Engineering and Systems Architecture (DESA)

Administered by the Department of Systems Engineering and Operations Research (https://seor.gmu.edu/)

Coursework

The following four courses must be completed with a grade of B or better:

Code	Title	Credits
SYST 505	Systems Engineering Principles *	3
SYST 520	System Engineering Design	3
SYST 618	Model-based Systems Engineering	3
SYST 621	Systems Architecture Design Evaluation	3
*SYST 505 may be replaced by an approved elective for students who have work experience in systems engineering or who have been enrolled in the undergraduate BSSE/BSSIE program at Mason. SYST 505, if taken, must be taken in the first semester of enrollment in the certificate program.		
Total Credits		**12**

Code	Title	Credits
Electives		**3**
Select one course from the following list:		
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	
OR 531	Introduction to Analytics and Modeling	
OR 541	Operations Research: Deterministic Optimization	
OR 542	Operations Research: Stochastic Models	
OR/SYST 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	
SYST 584	Heterogeneous Data Fusion	
SYST 664	Bayesian Artificial Intelligence	

The DESA concentration within the Systems Engineering certificate can be fully counted towards the Systems Engineering MS. Students who complete the DESA concentration can complete the Systems Engineering MS with 6 additional courses, as defined by the requirements of the Systems Engineering MS program (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/#requirementstext).

Concentration in Engineering Resilient Enterprise Systems (ERES)

Administered by the Department of Systems Engineering and Operations Research (https://seor.gmu.edu/).

To be eligible for a certificate with concentration in Engineering Resilient Enterprise Systems, students must complete two required courses (6 credits) plus two electives (6 credits) with an average grade of B or better.

Coursework

Code	Title	Credits
SYST 523	Engineering Resilient and Agile Enterprise Systems	3
SYST 618	Model-based Systems Engineering	3
Total Credits		**6**

Electives

The remaining two electives must be taken from the list below with the approval of the advisor. Courses designated as basic methods courses may also be used as an elective. Some certificate electives may require stronger math requirements.

Code	Title	Credits
Electives		**6**
Select at least one course from the following:		
SYST 514	Systems Thinking	
INFS 622	Information Systems Analysis and Design	
SWE 619	Object-Oriented Software Specification and Construction	
SYST 542	Decision Support Systems Engineering	
SYST 584	Heterogeneous Data Fusion	
SYST 630	Systems Engineering Management II	
Select the second course from the courses listed above or from the following:		
CS 555	Computer Communications and Networking	
ECE 542	Computer Network Architectures and Protocols	
INFS 612	Principles and Practices of Communication Networks	
Total Credits		**6**

Concentration in Financial Systems (FNSY)

Administered by the Department of Systems Engineering and Operations Research (https://seor.gmu.edu/).

To be eligible for the certificate with concentration in Financial Systems Engineering, students must complete three required courses (9 credits) plus one elective (3 credits) with an average grade of B or better.

Coursework

Code	Title	Credits
SYST/OR 538	Analytics for Financial Engineering and Econometrics	3
SYST/OR 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	3
SYST/OR 688	Financial Systems Engineering II: Derivative Products and Risk Management	3
Total Credits		**9**

Elective

Code	Title	Credits
Select one from the following:		3
OR 645	Stochastic Processes	
OR 682	Computational Methods in Engineering and Statistics	
SYST 584	Heterogeneous Data Fusion	
Total Credits		**3**

The FNSY concentration within the Systems Engineering certificate can be fully counted towards the Systems Engineering MS. Students who complete the FNSY concentration can complete the Systems Engineering MS with 6 additional courses, as defined by the requirements of the Systems Engineering MS program (https://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-ms/#requirementstext).

Concentration in Tactical Computer Operations (TCO)

Administered by the Department of Electrical and Computer Engineering (https://ece.gmu.edu/).

Students must meet prerequisites for courses by either taking the appropriate undergraduate courses or through instructor permission.

Coursework

Code	Title	Credits
CS 571	Operating Systems	3
ECE 511	Computer Architecture	3
DFOR 761	Malware Reverse Engineering	3
Total Credits		**9**

Electives

Code	Title	Credits
Select two courses from the following:		6
DFOR 767	Penetration Testing in Digital Forensics	
DFOR 769	Anti-Forensics	
DFOR 773	Mobile Application Forensics and Analysis	
DFOR 775	Kernel Forensics and Analysis	
ECE 547	Applied Cryptography	
ISA 564	Security Laboratory	
ISA 656	Network Security	
ISA 681	Secure Software Design and Programming	
ISA 763	Security Protocol Analysis	
Total Credits		**6**