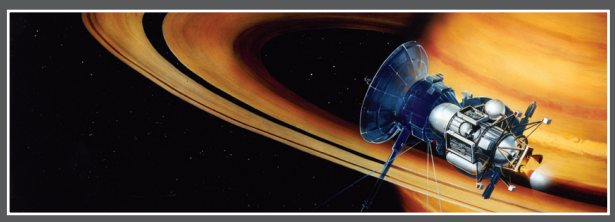
SYSTEMS ENGINEERING

GRADUATE PROGRAMS *in* SYSTEMS ENGINEERING *at* UMBC



The **Systems Engineering (SE) Program** at UMBC is designed to teach practical systems engineering skills that can be immediately applied on-the-job to accelerate the professional development of systems engineers. Students learn how to develop operable systems that meet customer requirements while successfully navigating the complexities of the systems engineering life cycle.

Courses are taught by senior systems engineers from area companies and agencies. They bring extensive experience working on large scale systems for defense and intelligence applications, aeronautical communications and navigation and information processing.

PROGRAMS OFFERED

- Graduate Certificate in Systems Engineering
- Master of Science in Systems Engineering
- Systems Engineering Tracks in Other Engineering Majors:
    - M.S. Electrical Engineering (33 credits)
    - M.S. Computer Science (33 credits)
    - M.S. Engineering Management (30 credits)

ADMISSION REQUIREMENTS

Requirements for Master of Science and Graduate Certificate in Systems Engineering programs:

- B.S. degree in Engineering, Information Systems, or Computer Science
- Minimum undergraduate G.P.A. of 3.0 in a 4.0 scale. (Students with a G.P.A. less than 3.0 may be admitted to the M.S. program provisionally or to the Graduate Certificate program.)
- Graduate Record Examination (GRE) scores are required if not a graduate from an accredited U.S. university with a GPA of 2.0 or above.

APPLICATION INFORMATION

Applications for admission are accepted year round for the fall or spring semesters. Students may enter the program as a Master's degree student, a certificate student, or as someone who simply wants to take a course for their own professional development (non-degree student).

COSTS AND FINANCIAL AID

Maryland Resident
Tuition per credit: $445 (Plus mandatory fees)*

Non-Resident
Tuition per credit: $736 (Plus mandatory fees)*

This program does not offer merit-based financial aid. For more information on tuition and fees, please visit: ***www.umbc.edu/bursar/tuition.***

**For Academic Year 2009/2010*

FOR MORE DETAILS
umbc.edu/se

Contact Us:
Ted Foster, Assistant Dean
UMBC College of Engineering & Information Technology
410-455-1564
tfoster@umbc.edu

UMBC
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MRP20100104

SYSTEMS ENGINEERING

Master of Science in Systems Engineering (30 Credits)

The Master of Science in Systems Engineering provides the knowledge and skills required of systems engineers to assume a leadership role in the management of complex systems. This 30-credit, non-thesis program consists of a broad core curriculum and a set of comprehensive electives. The core curriculum equips students with the processes, techniques and tools required to practice systems engineering. Students choose electives from an engineering specialization to meet specific learning needs.

Degree Requirements

- Core Courses (15 credits)
- Systems Engineering Electives (6 credits)
- Specialized Electives (9 credits)

Required Courses (15 credits)*

ENEE 660: Systems Engineering Principles
This course provides the foundational framework to understand the system engineering (SE) process, selection of specialized SE tools and the execution of SE under differing design or acquisition philosophies.

ENEE 661: System Architecture and Design
This course covers the development of a system architecture and hardware/software system design within the overall systems engineering (SE) process.

ENEE 662: Modeling, Simulation, and Analysis
This course addresses simulation architectures. Topics addressed include cost and risk analysis; experimental design; simulation control and interfaces; requirements and architecture definition; simulation design and implementation; verification, validation, and accreditation; estimating, planning, and controlling simulation efforts.

ENEE 663: System Implementation, Integration & Test
This course covers the translation of design specifications into product elements, integration of these elements into a system, and the verification that the resulting system performs as intended in its operational environment.

ENEE 670: Systems Engineering Project
This capstone course is a group project in SE. The project requires a sequence of tasks to achieve an end result that incorporates the use of multiple EE domains, disciplines and tools.

**All five-core courses can be applied toward the Graduate Certificate in SE or Master of Science in Engineering Management.*

Elective Courses
6 credits

Students choose two courses from a range of systems engineering and related courses.

Specialized Electives
9 credits

Students choose three courses from the following specialization:

- Engineering Management
- Electrical Engineering
- Computer Engineering
- Computer Science
- Mechanical Engineering

Graduate Certificate in Systems Engineering (15 Credits)

The five-course (15 credit) Graduate Certificate in Systems Engineering provides the core processes, techniques and tools required to manage complex systems.

Required Courses

ENEE 660: Systems Engineering Principles
ENEE 661: Systems Architecture and Design
ENEE 662: Systems Modeling, Simulation and Analysis
ENEE 663: Systems Implementation, Integration and Test
ENEE 670: Systems Engineering Project (Capstone Project)

All certificate courses can be applied toward the Master of Science in Systems Engineering or Engineering Management.

SYSTEMS ENGINEERING

Systems Engineering Course Listings

Core Courses:

ENEE 660: Systems Engineering Principles

This course provides the foundational framework to understand the system engineering (SE) process, selection of specialized SE tools and the execution of SE under differing design or acquisition philosophies. The course addresses: (1) SE principles (2) SE processes and methodologies (3) integration of technical disciplines and (4) SE management.

ENEE 661: System Architecture and Design

This course covers the development of a system architecture and hardware/software system design within the overall systems engineering (SE) process. Major topics include development of an operational concept, functional decomposition, requirements allocation and partitioning, interface definition, inclusion of integrity, reliability, and maintainability within the design concept, validation and verification, technical performance budgeting, quality function deployment techniques, and statistical and linear models.

ENEE 662: Modeling, Simulation, and Analysis

This course addresses simulation architectures. Topics addressed include cost and risk analysis; experimental design; simulation control and interfaces; requirements and architecture definition; simulation design and implementation; verification, validation, and accreditation; estimating, planning, and controlling simulation efforts.

ENEE 663: System Implementation, Integration & Test

This course covers the translation of design specifications into product elements, integration of these elements into a system, and the verification that the resulting system performs as intended in its operational environment.

ENEE 670: Systems Engineering Project

This capstone course is a group project in SE. Students apply the knowledge gained in previous SE courses to demonstrate a working level of SE. The project requires a sequence of tasks to achieve an end result that incorporates the use of multiple EE domains, disciplines and tools.

Elective Courses:

ENEE 667: Advanced Systems Architecture

This course emphasizes the many partitioning alternatives that can be employed when developing generic physical systems architectures. Heuristics collected from experienced systems architects are presented throughout the course.

ENEE 672: Decision and Risk Analysis

This course provides an overview of decision and risk analysis techniques. It focuses on how to make rational decisions in the presence of uncertainty and conflicting objectives. It covers modeling uncertainty, the principles of rational decision-making, representing and solving decision problems using influence diagrams and decision trees, sensitivity analysis, Bayesian decision analysis, deductive and inductive reasoning, objective and subjective probabilities, probability distributions, regression analysis, defining and calculating the value of information, modeling risk attitudes and utility functions. Concepts will be illustrated through case studies and practiced by students through homework.

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SYSTEMS ENGINEERING & ENGINEERING MANAGEMENT

Faculty Profiles *at* UMBC

Ted Foster

Program Director

- **B.S., Electrical Engineering, University of Virginia**
- **Ph.D., The Johns Hopkins University**

Dr. Foster is Assistant Dean of the UMBC College of Engineering and IT and is the Graduate Program Director of the Engineering Management and the Systems Engineering programs. He joined UMBC in 2000 after a 36-year career at Westinghouse/Northrop Grumman Electronic Systems. He served in various levels of management in advanced development or applied research in electronics, primarily for radar systems. For seven years he served as General Manager of the Electronics, Information, and Sciences Division at the Westinghouse Research Laboratory, in Pittsburgh, PA and Director of the Northrop Grumman Science and Technology Center. Other responsibilities included: Manager of Electro-Optical Surveillance, Targeting, and Missile Warning at Northrop Grumman, Manager of the Microwave Design Department, Manager of Very High Speed Integrated Circuits Programs, and Engineering Manager of Surveillance Radar Systems.

Dr. Foster is a Senior member of IEEE, a member of Tau Beta Pi and Sigma Xi, and serves as an Evaluator for ABET accreditation of EE and Computer Engineering programs.

Robert Fenton

- **B.S., General Engineering, U.S. Coast Guard Academy**
- **M.S., Electrical Engineering, U.S. Naval Postgraduate School**
- **M.E.A., Engineering Administration, George Washington University**
- **M.S., Management (Sloan Fellow), MIT**
- **M.A., International Affairs, Salve Regina University**

Mr. Fenton is currently Director of Technical Operations at BAE Systems, where he serves as Project Leader in business planning, strategy support, and operations research. He has more than 30 years experience in technical management in the U.S. Coast Guard, Lockheed Martin, TRW and BAE. He served as Adjunct Senior Lecturer of Engineering Management at Catholic University before coming to UMBC.

His experience includes: Chairman, U.S. Delegation to U.N. International Maritime Organization (IMO); Chairman, U.S. Delegation to U.N. International Telecommunications Union (ITU) International Radio Consultative Committee (CCIR); Co-Chairman, Navy/Coast Guard C3 Planning Group to permit interoperability of ships and aircraft in pursuit of the U.S. Drug War; AFCEA Honor Award Citation; FAA Significant Contributor to System Engineering Award, 1992; Operational Performance Award, Lockheed Martin, 1988; Top Graduate, Naval Postgraduate School; DoT Deputy Program Manager, NAVSTAR Global Positioning System (GPS); Worked in GPS Joint Program Office on behalf of DoT, FAA, and the Coast Guard; with Joint Chiefs of Staff, developed GPS Selective Availability Policy; Certified Project Management Professional, Project Management Institute.

Anita E. Griner

- **B.A., Organizational/Personnel Psychology, UMBC**
- **M.B.A., University of Baltimore**

Ms. Griner specializes in project management consultation and instruction and is a Project Management Professional (PMP), certified through the national Project Management Institute. She serves as a Project Manager for the Federal Government's Centers for Medicare and Medicaid Services (CMS) and manages large information technology projects relating to the national Medicare program.

She has trained and consulted with private, State and Federal government clients and has managed highly complex, multi-million dollar projects in the information technology, systems engineering and health care industries. Her approach to project management instruction leverages her educational background, project management training and real-world experiences as a Project Manager.

Ms. Griner is a member of the Project Management Institute and actively serves on various project management focus groups and practice teams to develop and implement project management guidelines and standards.

Illysa Izenberg

- **B.A., English and American Literature with minor in Secondary Education**
- **M.B.A., Harvard University**

Ms. Izenberg is a professional development educator and business strategist. She founded Strategy and Training Partners, LLC in 1994 where she works with clients to better understand their employees, customers, and other constituents for a more productive and profitable future. She conducts culture audits and needs analyses, devises strategies and action plans, facilitates diversity and harassment prevention, implements change, coaches employees, and also conducts leadership and management and inter-group communication workshops.
Ms. Izenberg has consulted with corporations, government agencies, and not-for-profit organizations in the U.S. and Canada. She has presented to or trained over 10,000 employees, from front-line production workers to highly-educated professionals managers/supervisors, and executives in a broad range of industries including technology, health care, financial services, and retail. She is a frequently sought speaker and writer on business issues.

Ms. Izenberg has over 15 years experience in strategic planning and implementation. She is trained and certified by the Minds At Work Immunity to Change Institute, A World of Difference, and the National Conference Dismantling Racism Project as a workshop facilitator.
She draws upon her MBA education and management experience, including profit-and-loss responsibility with a Fortune 500 multinational firm, to understand corporate perspectives and business needs.
Additionally, she has assisted several government organizations to work toward greater inclusion - both as a citizen selected to a city government task force that tackled community-wide ethnic diversity challenges and as a paid consultant and workshop facilitator.

She serves as President Elect and Programs Chair for the Howard County Human Resources Society (HoCo HRS), an affiliate of the Society for Human Resources Management (SHRM).

Julie Lenzer Kirk

- **B.S., Computer Science, Texas A & M University**

Julie Lenzer Kirk is the CEO of Path Forward International which helps companies leverage technology to drive consistency, alignment, and innovation by connecting people and ideas. An award-winning technology entrepreneur herself, Kirk has taught programs on business, entrepreneurship, and leadership on 4 continents and she is a founding instructor of the award-winning ACTiVATE program at UMBC. She is the author of "The ParentPreneur Edge: What Parenting Teaches About Building a Successful Business" (John Wiley & Sons) and has been quoted in Entrepreneur Magazine, Business Week, and a variety of print and on-line news sources.

John MacCarthy

- **B.A., Physics, Carleton College**
- **M.S., Systems Engineering, George Mason University**
- **Ph.D., Physics (Biophysics and Biochemistry), University of Notre Dame**

Dr. MacCarthy has over 20 years of systems engineering leadership experience with Northrop Grumman and TRW. He has led systems engineering activities associated with a variety of large, complex programs. This experience includes serving as manager of TRW's Waste

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Acceptance, Storage and Transportation Systems Engineering Department for DoE's Office of Civilian Radioactive Waste Management Yucca Mountain Program; as deputy director of TRW's Center for Advanced Technology; and as a senior technology, technical management and policy advisor. He has extensive experience in all aspects of systems engineering, systems architecting, and systems engineering management as well as in the development of a variety of hardware, software, and communications systems and systems of systems.

Dr. MacCarthy's teaching experience includes graduate courses in systems engineering and in communications at UMBC and UMUC as well as five years as an assistant professor of Physics at Muhlenberg College. Dr. MacCarthy's principal areas of academic interest include decision theory, computational science, modeling and simulation, software engineering, communications engineering, sensor and C3 systems, theoretical biology, system and system of systems architectures, and all aspects of systems engineering.

He is a member of IEEE, INCOSE, APS, AAAS, and AFCEA.

Paul Martin

- **B.S., Engineering, Widener University**
- **M.S., Systems Engineering (with a Certificate in Software Systems Engineering), George Mason University**
- **DAWIA Level III Certification in Systems Planning, Research, Development and Engineering**
- **Certified Systems Engineering Professional (CSEP) via International Council on Systems Engineering (INCOSE)**

Mr. Martin has more than 20 years experience as an engineer specializing in Systems Development and Procurement in the Defense Acquisition community. In the past he has worked with NAVSEA, NIMA (now NGA), and NSA. Presently he supports an Army Program Office as a Lead Systems Engineer. He has extensive experience in the overall system engineering process, including: concept, requirements definition, design, production, testing, and acceptance. He's one of the Program Directors for the Chesapeake chapter of INCOSE.

Michael Oliver

- **B.S., Case Western Reserve**
- **J.D., University of Baltimore**

Mr. Oliver has been in the private practice of law for 19 years, currently concentrating his practice in technology based transactions, private merger and acquisition, and intellectual property rights management issues.

For the first eight years of his practice Mr. Oliver engaged in commercial litigation, eventually focusing on: patent, trademark and trade secret cases. He has been lead or second counsel in numerous jury and non jury trials in federal and state courts.

Mr. Oliver has taught numerous courses, seminars and workshops including: Introduction to Intellectual Property and Cyberspace Law at the University of Maryland School of Law, and is a regular speaker for the Maryland Institute of Continuing Professional Education for Lawyers and for the Pennsylvania Bar Institute.

Mr. Oliver has authored or co-authored numerous articles and seminar materials that have been published by the American Bar Association and in the Maryland Bar Journal.

Mr. Oliver is also active in local community organizations, including playing a key role in organizing the Maryland State Bar Association's Intellectual Property Section, and regularly assisting low income artists for the Maryland Lawyers for the Arts.

In his off time Mr. Oliver enjoys playing classical guitar — being a past president of the Baltimore Classical Guitar Society, writing database and ecommerce based software, and digital photography.

Sandy Peterson

- **B.S., Accounting, Kent State University**
- **M.B.A., Loyola College**
- **Certified Public Accountant for the State of Maryland**

Ms. Peterson is Manager of Family Office Services for Arthur Bell, Certified Public Accountants in Hunt Valley, MD.
For over 20 years, she has worked in the fields of Finance and Accounting in various industries, including public accounting, for-profit industry, non-profit, and government, which includes contract work for the U.S. Department of State in Washington DC.

Ms. Peterson is a member of the American Institute of Certified Public Accountants and has worked with them to develop questions for their online version of the CPA exam. She has taught Graduate-level Finance for Non-Finance Professionals courses and has run one-day Non-Profit Accounting seminars for undergraduate accounting students.

Richard Taylor

- **B.A., Mathematics, State University of New York at Binghamton**

Mr. Taylor recently retired after a distinguished 38-year career at Lockheed Martin Mission Systems. As a certified senior systems architect, Mr. Taylor was the systems architect of a wide range of large systems, including the Data Capture System for the U.S. 2000 Decennial Census, U.S. Customs Modernization, Classified Intelligence System, Operational Control System for the Global Positioning System, Wide Area GPS System Augmentation, Identification, Tasking, and Networking for FBI fingerprinting, Collection Management System for Smithsonian Institution and National Gallery of Art, Insurance processing for USAA Insurance Company, Gate Scheduling System for British Airways and Credit card processing for American Express. He has made numerous presentations on systems architecting at international conferences and has published several articles on system architecting in trade journals. He has received five outstanding achievement awards from IBM and Lockheed Martin. GCN magazine recognized the Decennial Census 2000 program, for which he was the architect, as one of the three most outstanding government programs developed in 2000.

Richard L. Wilson

- **M.A., Philosphy**

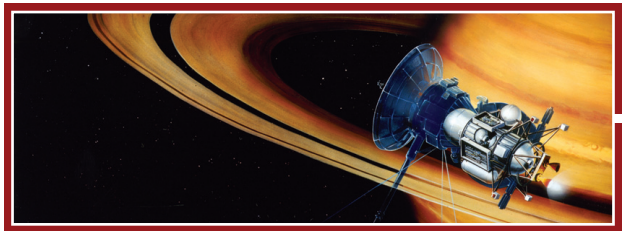
Mr. Wilson has been teaching philosophy for 30 years with a focus in applied ethics for 20 years. Currently, he is a full time member of the UMBC philosophy department. Mr. Wilson has developed a series of ethics courses and is currently teaching: Ethical Issues in Science, Engineering and Information Technology; Ethical Issues in Information Technology; and, Business Ethics at UMBC.

For the last 20 years, Mr. Wilson has taught traditional topics in applied ethics focusing on Medical and Bioethics, Business Ethics, and Environmental Ethics. He has been an ethics trainer for the Department of Justice with a focus on ethical issues in Police and Law Enforcement Agencies for the last eight years.

Mr. Wilson has taught numerous courses, seminars and ethics training Mr. Wilson has also authored a number of books including Logic: Deductive, Inductive and Informal Reasoning; Logic, Values and Ethical Analysis; and Business Ethics and Contemporary Issues.

In his off time Mr. Wilson is currently the Chairman of the Board of Directors and ethics advisor for Family Building Center, Inc., a licensed child placement agency, and a board member of the Baltimore Museum of Art's Print, Drawing and Photography Society (PDPS) of the Baltimore Museum of Art.

Mr. Oliver has been in the private practice of law for 19 years, currently concentrating his practice in technology based transactions, private merger and acquisition, and intellectual property rights management issues.



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COURSE OFFERINGS

COURSE	INSTRUCTOR	FALL	SPRING
ENEE 660 – Systems Engineering Principles	John MacCarthy	X	X
ENEE 661 – System Architecture and Design	Richard Taylor		X
ENEE 662 – Modeling, Simulation and Analysis	John MacCarthy	X	
ENEE 663 - Systems Implementation, Integration and Test	Paul Martin		X
ENEE 667 - Advanced Systems Architecture	Richard Taylor	X	
ENEE 670 - Systems Engineering Project	Fred Highland	X	X
ENEE 672 – Decision and Risk Analysis	John MacCarthy		X

FOR MORE DETAILS
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Contact Us:
Nancy Clements, Program Specialist
UMBC, 1000 Hilltop Circle ACIV–B Room 446
Baltimore, MD 21250
phone: 410-455-5536
e-mail: nancyc@umbc.edu

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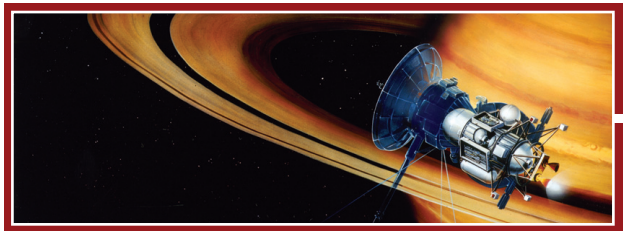

GRADUATE PROGRAMS *in* SYSTEMS ENGINEERING *at* UMBC

TIPS FOR APPLYING

M.S. SYSTEMS ENGINEERING

1. Complete application form.

- Download paper application at **www.umbc.edu/gradschool/docs/forms/**
  OR
- Online at **www.umbc.edu/gradschool/admissions/apply.html**

**We strongly encourage all interested applicants to apply online.*

2. Your application packet should include:

- Completed application and residency form (determines in-state tuition eligibility)
- Statement of academic goals
- Correct program code - M.S. Systems Engineering (**SYST**)
- *Official* Transcript(s) from each college and university attended
- An application fee ($50 online/$70 paper)

3. Mail application and supporting documents to:

UMBC
Graduate School, M.S. Systems Engineering
1000 Hilltop Circle
Baltimore, MD 21250

SYSTEMS ENGINEERING CERTIFICATE

1. Complete application form.

- Download paper application at **www.umbc.edu/gradschool/docs/forms/**
  OR
- Online at **www.umbc.edu/gradschool/admissions/apply.html**

**We strongly encourage all interested applicants to apply online.*

2. Your application packet should include:

- Completed application and residency form (determines in-state tuition eligibility)
- Correct program code - Systems Engineering (**CENS**)
- *Official* transcript(s) from each college and university attended
- An application fee ($50 online/$70 paper)

3. Mail application and supporting documents to:

UMBC
Graduate School, Systems Engineering Certificate
1000 Hilltop Circle
Baltimore, MD 21250

FOR MORE DETAILS
umbc.edu/se

Contact Us:
Nancy Clements, Program Specialist
UMBC, 1000 Hilltop Circle ACIV–B Room 446
Baltimore, MD 21250
phone: 410-455-5536
e-mail: nancyc@umbc.edu

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