

Graduate School of Engineering and Management

Department of Systems and Engineering Management



**Curriculum and Program Guide
Graduate Information Resource Management
Class 12M**

**DEPARTMENT OF THE AIR FORCE
AIR EDUCATION AND TRAINING COMMAND (AETC)**

**Air Force Institute of Technology
Wright-Patterson Air Force Base, Ohio**

Enterprise Systems Integration (ESI) Program

I. Purpose

The Graduate School of Engineering and Management, Department of Systems and Engineering Management, offers the Master of Science in Information Resource Management (IRM) through the Enterprise Systems Integration (ESI) program with options for a concentration of study in strategic information management, information assurance, and/or computer networks.

The ESI program is designed to provide students with the perspective, knowledge, and skills needed to develop, manage, and integrate enterprise-wide information, knowledge, technological/cyber, and human/organizational systems of Air Force, DoD, and allied military organizations in future assignments as middle and upper-level managers and leaders. The program is designed primarily to reflect the needs of the officer and enlisted members of the Air Force Cyberspace Operations career field; however, it is currently open to members of other career fields as well. To address the requirements associated with the growing importance of cyber- and systems integration-related competencies as critical resources for all career fields, the program continues to expand as necessary as a result of the Air Force's and DoD's evolution to network and process-centric enterprises. Specifically, graduates should understand how to: integrate warfighting and mission support systems; shorten the decision cycle by networking air, space, terrestrial, and ground based communications assets; shape doctrine, strategy, and policy; and drive standards, governance, innovation, and enterprise architectures.

Many students are and have historically been officers in the Air Force communications and information career field; however, the degree program is open to members of other career fields and represents a comprehensive survey of technology and information-oriented topics and issues related to the management, oversight, and improvement of organizations, organizational processes and policies, and the accomplishment of organizational objectives and mission success. The degree is particularly well suited to other career fields such as Intelligence, Public Affairs, and Cyber Operations though the foundational study and consideration of personnel, information, financial, and technology-based resources are equally applicable to virtually any career field.

This program is also open to senior non-commissioned officers in career fields such as Knowledge Operations Management, Computer Operations, Intelligence, and Public Affairs. Program graduates are well-grounded in coursework related to follow-on assignments within the communications and information and other related career fields, as well as other assignments in support of enterprise-wide systems integration requirements at the base, MAJCOM, and higher levels. The output advanced academic degree (AAD) codes are 1AUY and 0IYY.

II. Objectives

All graduates of the program should be able to:

- Use effective oral and written communications.
- Understand and apply concepts and techniques of descriptive and inferential statistics to analyze problems under conditions of risk and uncertainty.
- Understand and apply concepts and techniques of action research, expert panels and other qualitative methods to analyze unstructured problems

- Understand and apply the concepts, methods, and tools related to planning, directing, and controlling resources (financial, human, information/knowledge) in an information resource management context.
- Understand how to take advantage of information and knowledge as a resource to improve organizational effectiveness, efficiency, decision making, and ultimately competitive advantage.
- Know how information technology affects information and knowledge as a resource and how it may modify existing organizational structure, strategy and processes.
- Know how to examine processes from beginning to end by employing innovative technologies, organizational resources, and strategies for improvement.
- Conduct strategic information planning to link the management of information, knowledge, information architectures, information technology, and systems to an organizations' mission and strategic business goals.
- Conduct and present methodical research to solve problems and support decisions.

III. Admission Standards and Procedures

General requirements for admission to the Information Resource Management Master of Science program in the Department of Systems and Engineering Management are:

- Baccalaureate degree or equivalent
- Cumulative undergraduate grade point average of at least 3.0 on a 4.0 scale
- Graduate Record Examination (GRE) score of 1100 with a minimum of 500 in each of math and verbal, or Graduate Management Admissions Test (GMAT) score of 550
- Mathematics through college algebra with a grade of C or higher.

Students in the Wright-Patterson area who do not meet these criteria may register for individual courses as a part-time student (space available) but are expected to meet the above criteria prior to being granted candidacy for the degree. For prospective students, waivers to the criteria and/or approvals for an extended program (beyond the 18-month program to include undergraduate preparatory work) may be granted a waiver (on an individual basis) by the Department of Systems and Engineering Management. Admission procedures are specified in the AFIT home page: <http://www.afit.edu/en/admissions>.

IV. Curriculum Description

The ESI program encompasses six academic quarters and a short term (18 total months) for DoD-sponsored, full-time students. The fall short term provides an orientation to the program, an introduction to the curriculum options, and a review of basic writing and mathematics skills.

The minimum curriculum satisfying the degree requirements consists of **7 core courses**, at least 1 **research methods** course, 2 **statistics courses**, 2 **management core courses**, and 12 hours of **thesis research**.

The **core courses** provide a thorough grounding in the concepts of enterprise information resources and systems engineering and management. The core courses include:

SENG 520 Introduction to Systems Engineering or IMGT 651 Systems Analysis and Design
IMGT 530 Conceptual Foundations of Information Resource Management
IMGT 657 Data Communications
IMGT 561 Database Management
SENG 640 Systems Architectures or IMGT 580 Enterprise Information Architecture
IMGT 690 Capstone Seminar in Information Resource Management

The **research methods** and **statistics courses** provide instruction and depth of study on techniques for conducting and accomplishing academic research. Additional coursework in qualitative methods and research design may be required based on faculty/academic advisor input and guidance.

RSCH 630 Research Methods
STAT 525 Applied Statistics for Managers I
STAT 535 Applied Statistics for Managers II

The **management core courses** provide important knowledge in areas that are fundamental to the study of Enterprise Systems Integration and information resource management. The management core courses are:

ORSC 542 Management and Behavior in Organizations
SENG 610 Project Management

The **thesis research**, which must address a problem in information resource management or closely-related area, provides the student an opportunity to draw on the concepts of the IRM coursework, and to demonstrate mastery of research methodology in pursuit of addressing a specific research question. Often, thesis topics are provided by DoD/USAF agencies interested in sponsoring student research in areas of practical concern. Specific elective courses may be required by the thesis advisor to adequately prepare for the required thesis research.

Quota students may choose a 3 to 4-course concentration from alternatives established by the ESI faculty and presented below in section VI. In addition to these degree requirements, all quota students are expected to complete additional thesis credit hours (799) with a research advisor in lieu of additional electives to more firmly establish a viable research agenda.

Generally, students can select any of the concentration sequences. Students with more advanced math backgrounds may be more qualified for the technically-oriented computer networks sequences, however, this can be discussed with a faculty advisor and decided on a case-by-case basis. Students may also elect to combine two different concentrations; for the most part, the class schedules are generally established in such a way as to support this dual concentration option. Each concentration sequence will present a unified direction and purpose and will build depth in a specific academic area related to the student's academic interests. Elective courses and additional coursework are offered and are designed to broaden the student's horizons and/or provide more in-depth knowledge in a specific area of interest.

V. Course Sequencing – ESI Class 12M (suggested full-time student program)

FALL 2010: 15 hours

STAT 525 Applied Statistics for Managers I (4)
IMGT 530 Conceptual Foundations of IRM (3)
SENG 520 Introduction to Systems Engineering (4)
ORSC 542 Management and Behavior in Orgs (4)
IMGT 695 IRM Colloquium (0)

WINTER 2011: 12-16 hours

STAT 535 Applied Statistics for Managers II (4)
IMGT 561 Database Management (4)
SENG 640 Systems Architecture (4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
IMGT 695 IRM Colloquium (0)

SPRING 11: 12-15 hours

IMGT 799 Thesis Research (0-4)
SENG 610 Project Management (4)
RSCH 630 Research Methods² (3)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
IMGT 695 IRM Colloquium (0)

SUMMER 11: 12-15 hours

IMGT 799 Thesis Research (0-4)
IMGT 657 Data Communications (4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
IMGT 695 IRM Colloquium (0)

FALL 11: 12-16 hours

IMGT 799 Thesis Research (4-12)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
IMGT 695 IRM Colloquium (0)

WINTER 12: 15-23 hours

TENV 799 Thesis Research (12)
IMGT 690 Capstone Seminar in IRM (3)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
XXXX nnn Concentration Sequence/Elective¹ (3-4)
IMGT 695 IRM Colloquium (0)

¹ Not part of degree requirements. Choose appropriate type and number of electives based on focus sequence(s) or certificate program requirements

² Required course; although may be offered in both winter and spring quarters, the GIR faculty STRONGLY encourage taking Research Methods in the spring

VI. Concentration Sequences within the Curriculum

A. Information Assurance Sequence (NSA 4012 Certification)

IMGT 688 Security and Ethics in the Information Age (*Spring*)

IMGT 684 Strategic Information Management (*Summer*)

IMGT 687 Managerial Aspects of Information Warfare (*Second Fall*)

The information assurance (IA) concentration provides students with an understanding of contemporary information security issues and prepares them for leadership roles within the information assurance/security realm. All students successfully completing IRM core and three courses (with a B or better in each course) will receive the National Security Agency endorsed CNSSI No 4012 certificate which is the national information assurance training standard for Senior Systems Managers of national security systems. Further, the curriculum will help prepare the students for earning certification as a Certified Information Security Manager (CISM) and/or a Certified Information Security Professional (CISSP) as required for all DOD IA professional by DOD Directive 8570.

The IA concentration educates students on a broad spectrum of technical and managerial security issues related to information assurance, information operations, information security, and information warfare. Students learn the process of managing organizational security by examining the vulnerabilities and threats to which an organization's information assets may be exposed; understand the interrelationships among mission, information assets, and infrastructure vulnerabilities; understanding and applying concepts and techniques of risk management to selecting control measures to protect information assets at a level commensurate with their value; and by a historical analysis of information security successes and failures.

Students taking the Information Assurance sequence often accomplish their thesis research in this area as well (however, this is not mandatory). Electives provide students with opportunities for exploration of related topics to the IA field. Topic areas such as security, ethics, and leadership offer students key insight into specific subsets of IA. The IA concentration complements the IRM and management core courses by building on concepts derived from research and successful practices.

B. Strategic Information Management Sequence

IMGT 680 Knowledge Management (*Spring*)

IMGT 684 Strategic Information Management (*Summer*)

IMGT 669 Business Process Improvement (*Second Fall*)

Information resource management has become a fundamental concept in modern-day management thinking. Many organizations, both public and private, now understand that information and knowledge are resources critical to their survival and success. As such, they have created mechanisms for the strategic management of their information and knowledge. The Strategic Information Management sequence provides an understanding of the major mechanisms organizations have to improve their information efficiency, effectiveness, and competitive advantage.

Strategic Information Management, (IMGT 684) is a central or foundational course for this sequence. It explores the relationships between organizational strategies and goals and the use of

strategic information management to help achieve those strategies and goals. In the Knowledge Management (IMGT 680) course, students will be introduced to the fundamental differences between data, information, and knowledge and explore how knowledge can be equated to the intellectual capital of organizations and leveraged to achieve or improve organizational performance. This course concentrates on the people, process, and technology-related issues associated with organizational knowledge creation and management and identifies critical links to promoting and sustaining innovation in organizations. Students complete this concentration sequence with IMGT 669, a course in Business Process Improvement (BPI), where they learn the underlying theoretical and conceptual foundations of this critical management concept and how to apply it to meet organizational needs and improve organizational functioning along a number of dimensions of mission success.

C. Computer Networks Sequence (NSA 4011 Certification)

CSCE 625 Info Sys Security, Assurance and Analysis I (*First Winter*)

CSCE 689 Distributed Software Systems (*First or Second Winter*)

CSCE 654 Computer Communication Networks (*Spring*)

CSCE 725 Info Sys Security, Assurance and Analysis II (*Spring*)

This sequence of courses introduces students to the fundamental techniques and algorithms associated with the design and development of computer communication networks. A mixture of hardware and software techniques related to network design and analysis are presented. Design techniques presented in class are reinforced through simulation design projects. Students in this sequence will be required to take CSCE 544, Data Security, as a substitute for IMGT 657 Data Communications (IRM core course). All students successfully completing (B or better in each course) these five courses will receive a Certificate for Information Systems Security Professionals under the National Training Standard NSTISSI No. 4011 from the NSA.

Students begin the Computer Networks sequence with a comprehensive introduction to information warfare and information networks. This sequence provides a background in information security, theories of information warfare, psychological operations, and threats to information security, hacking, and virus awareness. Students also receive a thorough understanding of how computer networks and distributed systems influence the nature of decision making in a command and control (C2) environment.

Students taking the Computer Networks sequence often accomplish their thesis research in this area as well (however, this is not mandatory). Students selecting this sequence should have a strong technical background with an undergraduate degree in computing desirable. If the student does not have the prerequisite courses for this sequence, several undergraduate courses may be required prior to beginning the sequence. These prerequisites include:

CSCE 431 – Fundamentals of Discrete Mathematics

CSCE 486 – Fundamentals of Data Structures and Program Design

CSCE 489 – Operating Systems

CSCE 492 – Computer Systems Architecture.

Questions about specific pre-requisites, course substitutions, and other concerns should be directed to the appropriate faculty in the Department of Electrical and Computer Engineering. The IA curriculum complements the IRM and management core courses by adding a great deal of technical depth to the program of study.

D. Systems Engineering Certificate

SENG 610 Project Management (*First Fall*)¹

SENG 640 Systems Architecture (*First Winter*)¹

SENG 520 Introduction to Systems Engineering (*First Fall*)¹

CSCE 590 Engineering Software-Intensive Systems (*Summer or Winter*)

Capstone Project or Thesis utilizing SE principles as approved by the SE Curriculum Chair.

Systems Engineering (SE) is the process by which a customer's needs are satisfied through the conceptualization, design, modeling, testing, implementation, and operation of a working system. There are a range of levels of systems engineering, from product systems engineering used for a standalone product or vehicle platform, to design and integration of so-called "systems of systems" (such as an air operations center or missile defense system), to enterprise-wide systems engineering that span an entire organization (such as mobility forces or space command)

The Systems Engineering Certificate courses concentrate on using the tools and techniques of both systems science and traditional engineering disciplines to approach and analyze complex problems, design feasible solutions, and select an appropriate solution.

E. Suggested Electives

The following suggested electives will complement any of the concentration sequences by providing depth and breadth of coverage in a number of areas and disciplines applicable to the study of IRM-related principles, issues, and topic areas. Students are free to choose any elective (not limited to the selections listed below) that may be relevant to their personal, professional, or academic interests or specific thesis studies. Questions concerning the content or appropriateness of a particular elective or elective sequence should be directed to your academic advisor, program director, or other departmental faculty as appropriate.

IMGT 663 Human Computer Interaction

IMGT 699 Cyberlaw

ORSC 638 Seminar in Leadership Theory

ORSC 647 Organizational Policy and Strategic Management

OPER 501 Quantitative Decision Making

QMG 680 Project Risk Analysis

SMGT 543 Systems Acquisition Management

SMGT 647 Acquisition Strategy

SENG 560 Introduction to Human Systems Integration

* CSCE 525 Introduction to Information Warfare

* CSCE 526 Secure Software Design and Development

* CSCE 527 Cyber Forensics

* CSCE 625 Information Systems Security, Assurance, and Analysis I

* CSCE 544 Data Security

* CSCE 725 Info Sys Security, Assurance and Analysis II

* CSCE 528 Cyber Defense and Exploitation

* CSCE 628 Cyber Defense and Exploitation II

* EENG 571 Satellite Communications

* EENG 651 Command, Control, Communications, and Computer (C4) Systems

* *These courses are offered through the Dept. of Electrical and Computer Engineering (ENG)*

VII. Program Faculty

A directory of departmental faculty members including their research interests and areas of expertise is maintained at: http://www.afit.edu/en/env/faculty_listing.cfm. Primary members of GIR faculty include:

Civilian:

Dr. Michael Grimaila

Dr. Alan Heminger

Military:

Lt Col Bryan Hasty (Program and Curriculum Director)

Lt Col Greg Schechtman

Lt Col Joseph Thomas (arriving Fall 2011)

Maj Darin Ladd

Maj Brent Langhals (arriving Fall 2011)