

MASTER OF SCIENCE
in
ENGINEERING MANAGEMENT

PROGRAM GUIDE

GEM 11M

GEM 12M

GEM 13M

I. Purpose

The Graduate School of Engineering and Management, Department of Systems and Engineering Management, offers the Master of Science in Engineering Management (GEM). The degree enjoys full ABET accreditation for those students who hold prerequisite qualifications for the ABET designation. The GEM program provides Air Force career professionals with relevant graduate education in the management of base, infrastructure, and facility resources and processes consistent with future duties across the spectrum of the Civil Engineer's mission. The curriculum expands typical engineering management programs to enable the student to incorporate environmental impact constraints into the decision-making process. Upon completion, students will be able to apply the concepts, methods, and tools related to planning, directing, and controlling resources (people, financial resources, property, environmental resources, and information) in an operations management context. Students will also be able to conduct and present methodical research to solve problems and support decisions. The core curriculum includes courses in organizational management and behavior, organizational systems analysis, statistics and research methods, decision analysis, engineering economics, process improvement, and project and risk management. In addition, students have the opportunity to concentrate in a specific area such as crisis engineering management, asset management, or construction management (including contingency operations). Additional course work is available in system dynamics, information management, environmental policy, and life cycle analysis. In Summary:

GEM Program Educational Objective:

After being posted in a headquarters staff position, graduates of the GEM program will be independent, trusted advisors in proposing, developing, and implementing policy as judged by their immediate supervisors in the areas of asset management, construction management, and/or crisis management as a result of excellent and consistent application of decision making and research tools to real issues confronting the staff.

GEM Program Outcomes: (Students should be able to)

1. Articulate a problem at hand in terms that communicate well and lead the listener/reader to the kind of solution that will resolve the issue
2. Challenge arguments that propose solutions to problems and demonstrate knowledge of analytical techniques and systems thinking (and the appropriate rigor applied) required to pursue an optimal solution
3. Understand the foundations of crisis management, asset management, or construction management sufficient to develop command decision and policy making skills while working within the AF Civil Engineer career field and applying outcomes 1 & 2 above.

Program graduates are well grounded in course work related to follow-on assignments within the Civil Engineer career field as well as other duties in support of facility and program management at the base, MAJCOM, and higher levels. The output academic degree code is 1AGY.

II. Admission Standards

The general requirements for admission to the Master of Science program in Engineering Management are:

1. An undergraduate degree in an appropriate area of engineering or science. Mathematics courses including one year of college level calculus.
2. A cumulative undergraduate GPA of 3.0 (on a 4.0 scale).
3. Scores on the Graduate Records Examination (GRE) of 500 (verbal) and 600 (quantitative).

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. Waivers to the criteria may be granted (on an individual basis) by the Department of Systems and Engineering Management upon the recommendation of the GEM Faculty Curriculum Committee.

III. Curriculum Description

The GEM program is conducted in six academic quarters and a short term (18 total months, beginning in September) for full-time students. The short term provides an orientation to curriculum options, a review of basic mathematics skills, an introduction to

the computer systems serving AFIT, and an overview of the engineering management program.

The minimum curriculum satisfying the degree requirements consists of 3 methods courses (including 2 statistics courses and 1 statistically based research methods course), 5 core courses, 3 courses from an approved focus sequence, and 12 hours of thesis research. The **methods courses** provide a strong background in probability for understanding and describing the nature of uncertainty in real world decision making along with a strong foundation in statistics and in scientific method to both prepare for research required within the degree and to prepare the student for rigorous problem solving as a senior leader in engineering management. The **core courses (integration and engr mgt)** provide a wide variety of quantitative and qualitative concepts concerned with the many facets of engineering management. (Air Force civil engineering officers on a full-time education quota will take a larger 9-course core satisfying aspects of career field education requirements beyond the 5-course minimum). The **focus sequence** provides depth of study in a focused area of engineering management and prepares the student for research in a related topic. Students must choose one 3-course focus sequence from alternatives established and approved by the GEM faculty curriculum committee (e.g. approved sequences in crisis management, construction management, or asset management). Provisions are available to tailor sequences to meet specific student and research requirements. In most cases, the sequence will have no more than one 500 level course with the remaining courses 600 level or higher. **Electives** are offered in addition to strict degree requirements and broaden the student's horizons and/or provide more in-depth knowledge in a specific area of interest. Electives may also be required by the thesis advisor in order to adequately complete the required thesis research. The **thesis** must address a real-world problem in an engineering management area (with a requirement to conduct follow-on research in each of the focus area research streams associated with each focus sequence course requirement). Principal purposes of the thesis are to demonstrate the student's ability to integrate concepts and techniques acquired through course work and to demonstrate scholarly pursuit of a focused research question, all of which leads to enhanced capability of the graduate to pursue strategic management issues creatively and effectively across a broad scope of career field functional areas. Typically, thesis topics are provided by GEM faculty working in one of the focus areas identified above, often with DOD/USAF agencies interested in sponsoring student research in topics of practical concern.

In addition to degree requirements, all DOD-sponsored full-time students must demonstrate full-time registration as an average over the total number of quarters in residence with no more than 12 hours of thesis registration.

IV. Course Sequence

ENGINEERING MANAGEMENT CLASS 11M, 12M, & 13M

(Suggested six-quarter program for the full-time student)

(Fall 09 quarter start for the 11M class)

FALL 09

EMGT 501 ¹	Intro to Engr Mgt Curriculum & Research	0
STAT 525	Applied Statistics for Managers I	4
OPER 501 ¹	Operations Research	3
ORSC 542	Mgt & Behavior in Organizations	4
IMGT 669	Business Process Re-engineering	<u>3</u>
		14

WINTER 10

EMGT 502 ¹	Approaches to Research	1
STAT 535	Applied Statistics for Managers II	4
EMGT 670	Organizational Systems Analysis	3
EMGT 642 ¹	System Dynamics Analysis	4
XXXX xxx ²	Focus Sequence ²	<u>3-4</u>
		15-16

SPRING 10

EMGT 503 ¹	Critical Review of Literature	0
RSCH 630	Research Methods	4
XXXX xxx ²	Focus Sequence ²	3-4
XXXX xxx ¹	Elective ¹	3-4
XXXX xxx ¹	Elective ¹	<u>3-4</u>
		13-16

SUMMER 10

EMGT 504 ¹	Research Colloquium	1
EMGT 550	Engineering Economics & Decision Analysis	3
IMGT 684 ¹	Strategic Information Management	3
XXXX xxx	Focus Sequence ²	3-4
XXXX 799	Thesis Research	<u>3</u>
		13-14

FALL 10

EMGT 505 ¹	Research Colloquium	1
XXXX 799	Thesis Research	<u>6</u>
		7

Approved Focus Sequences:

Crisis Mgt

EMGT 611	(Wtr)
EMGT 612	(Spr)
EMGT 713	(Sum)

Asset Mgt

EMGT 62X	(Wtr)
EMGT 62X	(Spr)
EMGT 72X	(Sum)

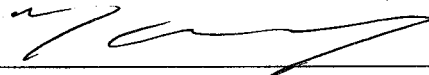
Construction Mgt

EMGT 63X	(Wtr)
EMGT 63X	(Spr)
EMGT 73X	(Sum)

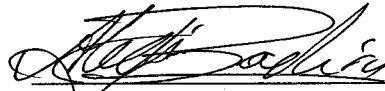
WINTER 11

EMGT 680	Adv Project Management with Risk Analysis	4
ENVR 511 ¹	Environmental Policy	3
XXXX 799	Thesis Research	<u>3</u>
		10 (Total = 72 - 77)
		(Avg Full-Time Status Required)

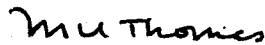
¹Not required for award of degree ²Three courses from an approved Focus Sequence required for degree



MICHAEL L. SHELLEY, Professor
GEM Curriculum Chair



ADEDEJI B. BADIRU, Professor
Head, Dept of Systems & Engr Mgt



M. U. THOMAS
Dean, Graduate School of Engineering
and Management
Air Force Institute of Technology

V. Example Focus Sequence within the Curriculum (student must choose one):

CRISIS MANAGEMENT SYSTEMS SEQUENCE

EMGT 611	Topics in Crisis Management	(Winter)
EMGT 612	Crisis Management Systems	(Spring)
EMGT 713	Crisis Project Management	(Summer)

Engineers advancing to middle organizational level executive positions must be able to integrate the challenges of their expertise with management skill sets specific to the environments they will encounter. Engineers in today's military will have to apply their technical skills and organizational leadership in crisis environments characterized by constrained resources, complexity, and stress which may directly impact their organization's mission and viability.

This sequence provides the student with the understanding necessary to apply a systems perspective of crisis environments to the organizational and technical challenges of managing technically intensive operational and project-driven organizations in such non-normal settings.

The **Topics in Crisis Management** course will provide the student with a broad background of the academic literature in this emergent area of research and theory. The course will focus on the frameworks and perspectives developed in the literature to aid practitioners in working in crisis environments. The student will come away from the course with a vocabulary and knowledge set ready to be applied to the specific environments they may encounter after they graduate.

The **Crisis Management Systems** course will then provide the student with examples of how such developed frameworks can be applied to real-world situations and aid the engineering management practitioner in functioning effectively in such situations. The course will be case study driven and will focus on the challenge of operationally managing military supporting infrastructure in crisis environments.

In addition to daily operations in crisis environments, engineers are likely to face the separate prospect of managing projects from start to finish in such settings. The **Crisis Project Management** course builds on the SMGT 546 Project Management course by applying a complex systems perspective to the operation, analysis, and evaluation of project management systems that a project-focused organization uses. In turn, this approach will also be applied to the specific cases of crisis environments. Examination of project failure modes, project design alternatives, intervention of and modeling of project management systems, strategic project program integration are other course themes. The course will also be case study driven.

The sequence builds upon courses in the core curriculum. Project management and organizational behavior in particular as well as operations research and systems dynamics more indirectly, lay a foundation for the sequence to build upon in providing engineering managers with these knowledge tools.