**ENGINEERING AND SCIENCE MANAGEMENT (ESM)**

**ESM F422  Engineering Decisions**  
3 Credits  
Offered Spring  
Risk and uncertainty in engineering decisions. Basic applied probability and statistics, data analysis, regression analysis and time series. Practical applications of decision tools: linear programming, inventory analysis, queuing, network models and utility theory. Engineering judgment and uncertainty. Public safety and ethics.  
**Recommended:** Graduate standing.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F450  Economic Analysis and Operations (W)**  
3 Credits  
Fundamentals of engineering economy, project scheduling, estimating, legal principles, professional ethics and human relations. Note: Undergraduate engineering students who are taking graduate ESM courses as technical electives should have completed or be concurrently enrolled in ESM F450. Note: Not offered for credit toward the M.S. degree in Engineering Management or Science Management.  
**Prerequisites:** WRTG F111X; WRTG F211X or WRTG F213X; ES F201 or CS F201; senior standing in engineering; or permission of instructor.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F492  Engineering Mgt Seminar**  
1 Credit  
**Lecture + Lab + Other:** 0 + 0 + 0

**ESM F492P  Engineering Mgt Seminar**  
1 Credit  
**Lecture + Lab + Other:** 0 + 0 + 0

**ESM F601  Managing and Leading Engineering Organizations**  
3 Credits  
Offered Fall Even-numbered Years  
Leadership knowledge and skills as applied to motivation, direction and communication within engineering and technical organizations, and their relations with other organizations and the public. Leadership training complements management knowledge and activities such as organizational structures, planning, monitoring, directing and controlling. The general tools of management are reviewed including management theory, communications, conflict management and resolution.  
**Recommended:** B.S. degree in engineering or physical science or permission of instructor.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F605  Engineering Economic Analysis**  
3 Credits  
Offered Spring Even-numbered Years  
The economic basis of engineering decisions. Graduate level studies of capital investment analysis techniques, including present worth, annual cash flow and rate of return. Applications to replacement problems, benefits/cost analysis and capital budgeting. Consideration of impacts of depreciation accounting, income taxes and inflation. Risk and uncertainty in economic decisions. Simulation.  
**Recommended:** Graduate standing.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F608  Legal Principles for Engineering Management**  
3 Credits  
Offered Fall Odd-numbered Years  
Those aspects of law specifically related to technical management. Contracts, sales, real property, business organization, labor, patents and insurance.  
**Recommended:** Graduate standing.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F609  Project Management**  
3 Credits  
Offered Spring Even-numbered Years  
Organizing, planning, scheduling and controlling projects. Use of CPM and PERT; computer applications. Case studies of project management problems and solutions.  
**Recommended:** Graduate standing or permission of instructor.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F620  Statistics for ESM**  
3 Credits  
Offered As Demand Warrants  
Forecasting applications and techniques—technological, time series, judgmental and regression; decision trees; Bayesian statistics; utility theory with trade-offs between expected value and risk in decision making; bidding strategies; and data analysis.  
**Recommended:** MATH F253X; STAT F200X.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F621  Operations Research**  
3 Credits  
Offered As Demand Warrants  
Mathematical techniques for aiding technical managers in decision making. Linear programming, transportation problem, assignment problem, network models, PERT/CPM, inventory models, waiting line models, computer simulation, dynamic programming. Emphasis on use of techniques in actual technical management situations. Computer applications.  
**Recommended:** MATH F253X; STAT F200X.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F622  Engineering Decisions**  
3 Credits  
Offered Spring  
Risk and uncertainty in engineering decisions. Basic applied probability and statistics, data analysis, regression analysis and time series. Practical applications of decision tools: linear programming, inventory analysis, queuing, network models, utility theory. Engineering judgment and uncertainty. Public safety and ethics. A class project and paper are required.  
**Recommended:** Calculus through MATH F302.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F684  Engineering Management Project**  
3 Credits  
Offered Spring Even-numbered Years  
Comprehensive study of an actual engineering management problem resulting in reports and presentations which include recommendations for action.  
**Prerequisites:** Graduate standing in Engineering Science Management or permission of instructor.  
**Lecture + Lab + Other:** 3 + 0 + 0

**ESM F692  Engineering Mgt Seminar**  
1 Credit  
**Lecture + Lab + Other:** 0 + 0 + 0
ESM F698 Non-Thesis Research/Project
1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

ESM F699 Thesis
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 0