Sample Programs of Study
Systems Engineering Track
MS in SE, with focus in
Industrial Mathematics

Credits: 17 from SE core courses; up to 14—16 from Math.

Semester 1
- ISYE 5XXX Systems Engineering I, 2 cr.
- ISYE5XXX Introduction to Operations research, 3 cr.
- ISYE 5541 Project Management, 4 cr.

Semester 2
- ISYE 5XXX Systems Engineering II, 4 cr.
- ISYE 5551 Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- Computational Methods
  One of:
  Math 5485 Introduction to Numerical Methods I, 4 cr.
  Math 8441 Numerical Analysis and Scientific Computing I, 3 cr.

- Complex Systems
  One (or more) of:
  Math 5535 Dynamical Systems and Chaos, 4 cr.
  Math 5587 Elementary Partial Differential Equations I, 4 cr.

Semester 4
- Advanced Computational Methods
  One of:
  Math 5486 Introduction to Numerical Methods II, 4 cr.
  Math 8442 Numerical Analysis and Scientific Computing II, 3 cr.

- Random Systems
  One (or more) of:
  Math 5651 Basic Theory of Probability and Statistics, 4 cr.
  Math 5652 Introduction to Stochastic processes, 4 cr.
MS in SE, with focus in
EE (Communication)

Credits: 17 from SE core courses, 9-15 from EE, 0-4 from IE

Semester 1
- ISYE 5XXX Systems Engineering Principles, 2 cr.
- ISYE 5XXX Introduction to Operations Research, 3 cr.
- ISYE 5541 Project Management, 4 cr.

Semester 2
- ISYE 5XXX Systems Engineering Practices, 4 cr.
- ISYE 5551 Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- EE 5381 Telecommunication Networks, 3 cr.
- One of the following two:
  - EE 5531 Probability and Stochastic Processes, 3 cr.
  - ISYE 8532 Stochastic Processes and Queueing Systems, 4 cr.
  - EE 5581 Information Theory and Coding, 3 cr.

Semester 4
- EE 5501 Digital Communication, 3 cr.
- EE 5542 Adaptive Digital Signal Processing, 3 cr.

* Note that if a student takes ISYE 8532, then (s)he need only take three courses from among EE 5381, 5581, 5501, and 5542 to reach 30 credits.
MS in SE, with focus in EE (Computation)

Credits: 17 from SE core courses, 12 from EE, 1-4 from IE

Semester 1
- ISYE 5XXX Systems Engineering Principles, 2 cr.
- ISYE 5XXX Introduction to Operations Research, 3 cr.
- ISYE 5541 Project Management, 4 cr.

Semester 2
- ISYE 5XXX Systems Engineering Practices, 4 cr.
- ISYE 5551 Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- EE 5364 Advanced Computer Architecture, 3 cr.
- EE 5391 Computing with Neural Networks, 3 cr.
- XX XXXX Elective, 1-4 cr.

Semester 4
- EE 5239 Introduction to Nonlinear Optimization, 3 cr.
- EE 5371 Computer Systems Performance Measurement and Evaluation, 3 cr.
MS in SE, with focus in EE (Control Systems)

Credits: 17 from SE core courses, 12 from EE, 1-4 from IE

Semester 1
- ISYE 5XXX Systems Engineering Principles, 2 cr.
- ISYE 5XXX Introduction to Operations Research, 3 cr.
- ISYE 5541 Project Management, 4 cr.

Semester 2
- ISYE 5XXX Systems Engineering Practices, 4 cr.
- ISYE 5551 Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- EE 5231 Linear Systems and Optimal Control, 3 cr.
- EE XXXX Elective from EE, 3 cr.
- XX XXXX Elective, 1-4 cr.

Semester 4
- EE 5235 Robust Control System Design, 3 cr.
- EE 5821 Biological System Modeling and Analysis, 3 cr.
MS in SE, with focus in Operations Management

Credits: 17 from SE core courses; up to 15 from OMS.

Semester 1
- **ISYE 5XXX**
  Systems Engineering Principles, 2 cr.
- **ISYE5XXX**
  Introduction to Operations research, 3 cr.
- **ISYE 5541**
  Project Management, 4 cr.

Semester 2
- **ISYE 5XXX**
  Systems Engineering Practices, 4 cr.
- **ISYE 5551**
  Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- **MBA6220**
  OM Core (3 credits)
- **OMS 6059**
  Quality Management and Six Sigma (4 Credits)

Semester 4
- **OMS 6059**
  Managing Supply Chain Operations (4 Credits)
- **OMS 6072**
  Managing Technology in Supply Chains (4 credits)
MS in SE, with focus in Health Informatics

Credits: 17 from core courses; 9 from Health Informatics Stream; 4 from electives.

Elective credits could come from BioInformatics Minor program, MHA program, or from the Health Informatics Topics course (HInf 5494). See attachments for details.

Semester 1

- ISYE 5XXX
  Systems Engineering Principles, 2 cr.
- ISYE5XXX
  Introduction to Operations research, 3 cr.
- ISYE 5541
  Project Management, 4 cr.

Semester 2

- ISYE 5XXX
  Systems Engineering Practices, 4 cr.
- ISYE 5551
  Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3

- HInf 5430
  Health Informatics I (4 credits)
- One (or more) BioInformatics core course:
  See UM Minor in BioInformatics for more information

Semester 4

- HInf 5431
  Health Informatics II (4 credits)
- HInf 5436
  Health Informatics Seminar (1 credits)
- One (or more) of BioInformatics core course:
  See UM Minor in BioInformatics for more information
MS in SE, with focus in Bio-Medical Engineering

Credits: 17 from core courses; 16 from BMEn
Possible foci in bio-mechanical device design, bio-electrical device design, or bio-instrumentation.

Semester 1
- **ISYE 5XXX**
  Systems Engineering Principles, 2 cr.
- **ISYE5XXX**
  Introduction to Operations research, 3 cr.
- **ISYE 5541**
  Project Management, 4 cr.

Semester 2
- **ISYE 5XXX**
  Systems Engineering Practices, 4 cr.
- **ISYE 5551**
  Simulation, 4 cr.
- **Research Ethics and Professional Conduct**, 0 cr.

Semester 3
- **BMEn 8630**
  Bio-medical Engineering Graduate Seminar, 1 cr.
- **BMEn/ME 8221**
  New Product Design & Development I, 4 cr.
- **One (or more) BMNe core course:**
  - **BMEn 5101** Advanced Bioelectricity/Instrumentation, 3 cr. *or*
  - **BMNE 5201** Advanced Biomechanics, 4 cr.

Semester 4
- **BMEn/ME 8222**
  New Product Design & Development II, 4 cr.
  (prerequisite ME 8221)
- **One (or more) of:**
  - **BMEn 5102** Bioelectric Measurements and Therapeutic Devices
  - **BMEn 5501** Biology for Biomedical Engineers
  - **Phsl 5061** Principles of Physiology for Biomedical Engineering
MS in SE, with focus in Nano-Engineering

Credits: 17 from core courses; 15 from Nanoparticle Science and Engineering

Semester 1
- *ISYE 5XXX*
  Systems Engineering Principles, 2 cr.
- *ISYE 5XXX*
  Introduction to Operations research, 3 cr.
- *ISYE 5541*
  Project Management, 4 cr.

Semester 2
- *ISYE 5XXX*
  Systems Engineering Practices, 4 cr.
- *ISYE 5551*
  Simulation, 4 cr.
- Research Ethics and Professional Conduct, 0 cr.

Semester 3
- *NPSE 8101*
  Nanoparticle Science and Engineering Seminar, 1 cr.
- *NPSE 8001*
  Introduction to Nanoparticle Science and Engineering, 3 cr.
- *EE 5171*
  Microelectronic Fabrication, 4 cr.
  Or any of the electives listed on the Nanoparticle Science and Engineering webpage: http://www.nanoigert.umn.edu/Education.htm

Semester 4
- *PHYS 5701*
  Solid State Physics for Engineers and Scientists, 4 cr.
  Or any of the electives listed on the Nanoparticle Science and Engineering webpage: http://www.nanoigert.umn.edu/Education.htm
- *NPSE 8002*
  Nano-particle Science and Engineering Laboratory, 3 credits,
  (requires NPSE8001)
MS in SE, with focus in Computer Science

Credits: 17 from core courses; 13 from CSci

[Minor in Computer Science requires 9 credits in CSci, must have at least one CSci level course with a 5xxx level (or higher) pre-requisite]

Semester 1 (Fall year 1)
- **ISYE 5XXX**
  Systems Engineering Principles, 2 cr.
- **ISYE5XXX**
  Introduction to Operations research, 3 cr.
- **ISYE 5541**
  Project Management, 4 cr.

Semester 2 (Spring year 1)
- **ISYE 5XXX**
  Systems Engineering Practices, 4 cr.
- **CSci**
- **CSci 5109**
  Visualization, 3 cr. Offered fall (pre-req 4041: Algorithms and Data structures)
  Or **CSci 5421**
  Advanced Algorithms and Data Structures. 4 cr. Offered sp and fall (pre-req 4041)
- Research Ethics and Professional Conduct, 0 cr.

Semester 3 (Fall year 2)
- **CSci 5707**
  Principles of Database Systems, 3 cr., offered spr., fall, summer (pre-req 4041)
- **CSci 5115**
  User Interface Design, 3 cr. Offered fall (pre-req 4041)
  pre-req CSci 4041

Semester 4 (Spring year 2)
- **ISYE 5551**
  Simulation, 4 cr., offered spring.
- **CSci 5116**
  GUI toolkits and Their Implementation, 3 cr., offered spring (pre-req: CSci 5115)
Students may build custom programs (requires DGS approval) with a variety of electives from other departments around the campus. A list of possible electives (which is not exhaustive) is provided below.

**Aerospace Engineering and Mechanics**
AEM 5431 Trajectory Optimization (3 cr)
AEM 5451 Optimal Estimation (3 cr)
AEM 8421 Robust Multivariate Control Design (3 cr)

**New Product Development**
ME 8221 & 8222 New Product Design & Development (8 cr)
ME 5221 Computer Assisted Product Realization (4 cr)
ME 5241 Computer Aided Engineering (4 cr)
ME 5243 Advanced Mechanism Design (4 cr)

**Supply Chain Management**
IE 5551 Production Planning and Inventory Control (4 cr)
MKTG 6060 Distribution and Supply Chain Systems (4 cr)
OMS 6056 Managing Supply Chain Operations (4 cr)
MKTG 6020 Advanced Logistics and Supply Chain management (2 cr)
MKTG 6065 Strategic Supply Chain Management (2 cr)

**Operations Research**
IE 5531 Engineering Optimization I (4 cr)
IE 5545 Decision Analysis (4 cr)
IE 8532 Engineering Optimization II (4 cr)
IE 8532 Stochastic Processes and Queueing (4 cr)

**Human Factors**
IE 5511 Human Factors (4 cr)
IE 5513 Engineering Safety (4 cr)
IE 8541 Decision Support Systems (4 cr)

**Engineering Management**
IE 5522 Quality Engineering and Reliability (4 cr)
IE 5441 Engineering Cost Accounting (4 cr)
IE 5545 Decision Analysis (4 cr)
IE 5551 Production Planning and Inventory Control (4 cr)