

SYSTEMS ENGINEERING, MSE

The MSE Program in Systems Engineering (SE) is best positioned to give students a broad foundation across data science, systems modeling, and optimization and decision-making with applications in societal systems (energy, transportation, health operations).

The MSE Program in Systems Engineering (SE), grounded in the intersection of electrical and systems engineering, is best positioned to give students the in-depth theoretical foundation and interdisciplinary skills required by the growing complexity of technological systems. Our flexible curriculum allows you to tailor your studies to your personal interests and goals, from signal processing, optimization, simulation, control and cybernetics to complex adaptive systems, stochastic processes and decision sciences.

For more information: <http://www.ese.upenn.edu/current-students/masters/sys-eng.php>

Curriculum

10 course units are required for the MSE in Systems Engineering.¹

| Code | Title | Course Units |
|--|---|--------------|
| Foundation Courses | | 6 |
| Choose at least one course from each area of Data Science, Systems Modeling and System Design and Optimization | | |
| <i>Data Science</i> | | |
| CIS 5190 or CIS 5200 | Applied Machine Learning Machine Learning | |
| ESE 5280 | Estimation and Detection Theory | |
| ESE 5420 | Statistics for Data Science | |
| ESE 5450 | Data Mining: Learning from Massive Datasets | |
| ESE 5460 | Principles of Deep Learning | |
| <i>Systems Modeling</i> | | |
| ESE 5000 | Linear Systems Theory | |
| ESE 5010 | Networking - Theory and Fundamentals | |
| ESE 5030 | Simulation Modeling and Analysis | |
| ESE 5120 | Dynamical Systems for Engineering and Biological Applications | |
| ESE 5310 | Digital Signal Processing | |
| <i>System Design and Optimization</i> | | |
| ESE 5040 | Intro to Linear, Nonlinear and Integer Optimization | |
| ESE 5050 | Feedback Control Design and Analysis | |
| ESE 5430 | Human Systems Engineering | |
| ESE 6050 | Modern Convex Optimization | |
| ESE 6190 | Model Predictive Control | |
| Leadership Electives | | 1 |
| Select 1 Leadership Elective: | | |
| ESE 5400 | Engineering Economics | |

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|--|---|-----------|
| ESE 5440 | Project Management | |
| EAS 5450 | Engineering Entrepreneurship I | |
| EAS 5460 | Engineering Entrepreneurship II | |
| EAS 5070 | Intellectual Property and Business Law for Engineers | |
| EAS 5120 | Engineering Negotiation | |
| Technical Elective | | 1 |
| Select 1 Technical Elective: | | |
| EAS 5100 | Technical Communication and Academic Writing for Non-native Speakers of English | |
| EAS 5120 | Engineering Negotiation | |
| EAS 5450 | Engineering Entrepreneurship I | |
| EAS 5460 | Engineering Entrepreneurship II | |
| EAS 5950 | Foundations of Leadership | |
| Any 5000 or 6000 level course in ENM, ESE, CIS, CIT or MEAM | | |
| **ESE 5990 can only be used in this category | | |
| Application Area | | 2 |
| Choose ESE 5970 or any two graduate level courses from one approved Application Area | | |
| Total Course Units | | 10 |

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Curriculum

- Students must complete ten (10) course units at the graduate level (5000+)
- Students must be registered in the 5000-level section in a cross-listed course. Any cross-listed section at the 4000-level or below is ineligible towards the degree.

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Application Area Electives:

- Select 2 course units of approved electives from graduate courses offered at Penn in SEAS, SAS, Medicine, Law, Wharton MBA, Social Policy, and Education.
- These must have technical/scientific content and relevance to the student's program.
- Approval must be obtained from the ESE department prior to enrollment in the course.

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2022 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.