

# 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.ease.upenn.edu/current-students/masters/sys-eng.php>

## Curriculum

10 course units are required for the MSE in Systems Engineering.<sup>1</sup>

Code	Title	Course Units
<b>Foundation Courses</b>		<b>6</b>
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 5140	Graph Neural Networks	
ESE 5280	Estimation and Detection Theory	
ESE 5390	Hardware/Software Co-Design for Machine Learning	
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 5060	Introduction to Optimization Theory	
ESE 5050	Feedback Control Design and Analysis	
ESE 5430	Human Systems Engineering	
ESE 6050	Modern Convex Optimization	
ESE 6190	Model Predictive Control	
<b>Technical Electives</b>		<b>2</b>

### Select 2 Technical Electives:

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

Choose ESE 5970 or any two graduate level courses from one approved Application Area 2

**Total Course Units 10**

#### <sup>1</sup> 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.

#### <sup>2</sup> 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 2024 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.