# ENGINEERING SCIENCES AND APPLIED MATHEMATICS MS

## Degree Requirements

The following requirements are in addition to, or further elaborate upon, those requirements outlined in The Graduate School Policy Guide (https://catalogs.northwestern.edu/tgs/academic-policies-procedures/).

### Master's

**Total Units Required: 12**

| Course | Title |
|---|---|
| ES_APPM 314-0 | Advanced Methods for Differential Equations |
| ES_APPM 420-1 | Asymptotic and Perturbation Methods in Applied Mathematics |
| ES_APPM 446-1 | Numerical Solution of Partial Differential Equations |
| 1 unit from this list: | |
| ES_APPM 312-0 | Complex Variables |
| ES_APPM 322-0 | Applied Dynamical Systems |
| ES_APPM 345-0 | Applied Linear Algebra |
| ES_APPM 405-1 | Statistics and Data Science |
| ES_APPM 414-0 | Differential Equations of Mathematical Physics |
| ES_APPM 412-0 | Methods of Nonlinear Analysis |
| ES_APPM 420-2 | Asymptotic and Perturbation Methods in Applied Mathematics |
| ES_APPM 429-0 | Hydrodynamic Stability Theory |
| ES_APPM 440-0 | Integral Equations & Applications |
| ES_APPM 442-0 | Stochastic Differential Equations |
| ES_APPM 479-0 | Data Driven Methods for Dynamical Systems |
| ES_APPM 495-0 | Selected Topics in Applied Mathematics [*] |
| 2 units from this list: | |
| ES_APPM 344-0 | High Performance Scientific Computing |
| or ES_APPM 444-0 | High Performance Scientific Computing |
| ES_APPM 445-0 | Advanced Numerical Methods for Linear Algebra |
| ES_APPM 446-2 | Numerical Solution of Partial Differential Equations |
| ES_APPM 447-0 | Boundary Integral Method |
| ES_APPM 448-0 | Numerical Methods for Random Processes |
| ES_APPM 449-0 | Numerical Methods for Moving Interfaces |
| Mathematical Modeling Electives (approved; 3 units) | |
| Mathematical Content Electives (approved; 3 units) | |

*If approved by the adviser.

### Other MS Degree Requirements

- **Mathematical Content Electives Theme:** Courses selected to complete the Mathematical Content Electives must have mathematically focused content related by a defined theme chosen by the student.
- **Mathematical Modeling Electives Theme:** Courses selected to complete the Mathematical Modeling Electives must be application areas that use mathematical methods and be related by a defined theme chosen by the student.
- At least three of the six courses used to satisfy the mathematical content and mathematical modeling themes must be at the 400/500 level.
- **Master's Thesis (optional):** Up to two units of the Mathematical Modeling Electives Theme may be replaced with ES_APPM 590-0

Research for work culminating in a Master's thesis consisting of original research and approved by a thesis committee.