# Pre-Approved Electives for Systems Engineering M.Eng.

**Degree Requirements**

1. All core courses must be completed
2. At least one elective that fulfills an Applications component must be completed
3. At least one elective that fulfills a Modeling & Analysis component must be completed
4. No more than one elective that fulfills a Management componenet may be applied toward your degree
5. No more than one seminar may be taken each semester (for a maximum of two)
6. A minimum of 30 credit hours taken for a letter grade must be completed
7. All courses taken during your degree must be approved by your advisor
8. Electives not included on this list may be petitioned to be included in your your degree plan
9. **Check the Class Roster online (classes.cornell.edu) for the most up-to-date class listings available each semester. The courses cited below are based on historical offerings and are subject to change.**

**Core Courses**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| SYSEN 5100, CEE 5240, ECE 5120,  MAE 5910, ORIE 5140 | Model Based Systems Engineering | 4 | Fall | Core |  |
| SYSEN 5200, CEE 5252, MAE 5920,  ORIE 5142 | Systems Analysis Behavior and Optimization | 3 | Spring | Core |  |
| CEE 5900 | Project Management | 4 | Fall, spring | Core |  |
| SYSEN 5900, SYSEN 5700 | Systems Engineering Project | 6-8 | Fall, spring | Core |  |
| CEE 6910 | Principles of Project Leadership | 4 | Fall, spring | Core |  |

**Pre-Approved Electives by Departmen**t

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **BEE Courses** | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| BEE 5530 | CAE: Applications to Biological Processes | 3 | Spring | Modeling & Analysis |  |
| BEE 6710 | Introduction to Groundwater | 3 | Spring | Application |  |
| BEE 5750 | Environmental Systems Analysis | 3 | Fall | Modeling & Analysis |  |
| BEE 5330 | Engineering Professionalism | 1 | Spring | Maangement |  |
| BEE 6550 | Biologically Inspired Microsystems Engineering | 2-3 | Fall | Application | Next Offered: 2019-2020 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CEE Courses** | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| CEE 5420 | Energy Technologies and Subsurface Resources | 3 | Spring | Application |  |
| CEE 5930 | Engineering Management Methods | 4 | Fall | Management |  |
| CEE 5950 | Construction Planning and Operations | 3 | Fall | Management |  |
| CEE 5980 | Introduction to Decision Analysis | 3 | Fall | Management |  |
| CEE 6200 | Water-Resources Systems Engineering | 3 | Spring | Application |  |
| CEE 6648 | Sustainable Transportation Systems Design | 3 | Fall | Application |  |
| CEE 6750 | Concrete Materials and Construction | 3 | Spring | Application |  |
| CEE 6790 | Time Series Data Analysis for Civil, | 3 | Fall | Modeling & Analysis |  |
|  | Mechanical & |  |  |  |
|  | Geophysical |  |  |  |
|  | Applications |  |  |  |
| CEE 7740 | Advanced Structural Concrete |  |  |  |  |
| CHEME 6800, SYSEN 6800 | Computational Optimization | 4 | Fall, Spring | Modeling & Analysis |  |
| CHEME 6880, SYSEN 6880 | Industrial Big Data Analytics and Machine Learning | 4 | Spring | Application or Modeling & Analysis |  |
| CHEME 6662 | Solar Energy Module | 1 | Spring | Application or Modeling &  Analysis |  |

**Updated 2/28/2024**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CS Courses** | **Course Name** |  | **Semester** | **Group** | **Comments** |
| CS 5820 | Introduction to Analysis of Algorithms | 4 | Summer,  Fall, Spring | Modeling & Analysis |  |
| CS 5150 | Software Engineering | 4 | Fall | Application |  |
| CS 5320 | Introduction to Database Systems | 3 | Fall | Application |  |
| CS 5412 | Cloud Computing | 4 | Spring | Application |  |
| CS 5420, ECE 5750 | Advanced Computer Architecture | 4 | Fall | Application |  |
| CS 5670, | Introduction to Computer Vision | 3-4 | Spring | Application |  |
| CS 5740 | Natural Language Processing | 3-4 | Fall, Spring | Application |  |
| CS 5780 | Machine Learning for Intelligent Systems | 4 | Fall | Modeling & Analysis |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ECE Courses** | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| ECE 5130 | Systems Analysis Behavior and Optimization | 3 | Spring | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ECE 5271 | Evolutionary Processes, Evolutionary Algorithms, Evolutionary Games | 3 | Spring | Application |  |
| ECE 5740 | Computer Architecture | 4 | Fall | Application |  |
| ECE 5730 | Digital Systems Design Using Microcontrollers | 4 | Fall | Application |  |
| ECE 5210 | Network Systems and Games | 3 | Spring | Modeling & Analysis |  |
| ECE 5725 | Design with Embedded Operating Systems | 4 | Fall, spring | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ECE 5750 | Advanced Computer Architecture | 4 | Fall | Application |  |
| ECE 5760 | Advance Microcontroller Design | 4 | Fall | Application |  |
| ECE 5830 | Introduction to Technical Management | 3 | Fall | Management |  |
| ECE 5880 | Energy Seminar II | 1 | Spring | Seminar |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **MAE Courses** | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| MAE 5020 | Wind Power | 3 | ~~Fa~~ll | ~~Application~~ |  |
| MAE 5065 | Introduction to Spaceflight Mechanics | 3 | Fall | Application |  |
| MAE 5160 | Spacecraft Technology and Systems Architecture | 4 | Spring | Application |  |
| MAE 5230 | Intermediate Fluid Dynamics | 4 | Spring | Application |  |
| MAE 5340 | Innovative Product Design via Digital Manufacturing | 3 | Fall | Application |  |
| MAE 5510 | Aerospace Propulsion | 3 | Spring | Application |  |
| ECE 5840 | Introduction to Controlled Fusion: Principles and Technology | 3 | Spring | Application |  |
| ENGRG 5330 | Entrepreneurship For Engineers | 3 | Spring | Application |  |
| MAE 5700 | Finite Element Analysis for Mechanical and Aerospace Design | 3 | Fall | Modeling & Analysis |  |
| MAE 5730 | Intermediate Dynamics and Vibrations | 3 | Fall | Modeling & Analysis |  |
| MAE 5780 | Feedback Control Systems | 4 | Fall | Modeling & Analysis |  |
| MAE 5860 | Automotive Engineering | 3 | Spring | Modeling & Analysis |  |

**Updated 2/28/2024**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MAE 5120 | 3D Printing Parts that Don’t Break: From Processing to Performance | 4 | Spring | Application |  |
| MAE 5010 | Future Energy Systems | 3 | Spring | Application |  |
| MAE 5180 | Autonomous Mobile Robots | 4 | Spring | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MAE 5459 | Energy Seminar I | 1 | Fall | Seminar |  |
| MAE 5469 | Energy Seminar II | 1 | Spring | Seminar |  |
| MAE 5770 | Engineering Vibrations  Non-Linear Dynamics and Chaos | 3 | Spring |  |  |
| MAE 5790 | 4 | Spring | Modeling & Analysis |  |
| MAE 5780 | Feedback Control Systems | 3 | Fall | Modeling & Analysis |  |
| MAE 5949 | Enterprise Engineering Colloquium | 1 | Spring | Seminar |  |
| MAE 6230 | Computational Fluid Dynamics | 4 | Spring | Modeling & Analysis |  |
| MAE 6310 | Turbulence and Turbulent Flows | 4 | Spring | Modeling & Analysis |  |
| MAE 6510 | Advanced Heat Transfer | 4 | Spring | Application |  |
| MAE 6730 | Introduction to Robotic Mobile Manipulation | 4 | Spring | Application |  |
| MAE 6760 | Model-Based Estimation | 4 | Fall | Modeling & Analysis |  |
| MAE 6780 | Multivariable Control Theory | 4 | Spring | Modeling & Analysis |  |
| MAE 6800 | Advanced Dynamics  Design for Manufacture and Assembly | 3 | Spring |  | Next offered 2022-202  3 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| MAE 5260 | Polymer Mechanics Polymer Mechanics | 1 | Spring | Application |  |
| MAE 5670 | 3 | Spring |  |  |
| MAE 6810 | Methods of Applied Mathematics I | 3 | Fall | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ORIE Courses** | **Course Name** | **Credits** | **Semester** | **Group** | **Comments** |
| ORIE 5630 | Operation Research Tools for Financial Engineering | 4 | Fall | Application |  |
| ORIE 5126 | Principles of Supply Chain Management | 4 | Spring | Application |  |
| ORIE 5270 | Big Data Technologies | 4 | Spring | Application |  |
| ORIE 5310 | Optimization II | 4 | Spring | Modeling & Analysis |  |
| ORIE 5370 | Optiminization Modeling in Finance | 3 | Spring | Application |  |
| ORIE 5510, ORIE 3510 | Introduction to Engineering Stochastic Processes I | 4 | Spring | Modeling & Analysis |  |
| ORIE 5582 | Monte Carlo Methods in Financial Engineering | 2 | Spring wks 8-14 | Application |  |
| ~~ORIE 6580~~ | ~~Simulation~~ | 4 | ~~Spring~~ | ~~Modeling~~ ~~&~~ ~~Analysis~~ | ~~Next~~ ~~offered~~: ~~2019-20~~  ~~20~~ |
| ORIE 5581, ORIE 5580, ORIE 4580 | Monte Carlo Simulation | 2 | Fall wks 1-7 | Modeling & Analysis |  |
| ~~ORIE 4152, ENGRG 4610, MAE 4610~~ | ~~Entrepreneurship For Engineers~~ | 3 | ~~Spring~~ | ~~Manage~~ ~~ment~~ |  |
| ~~ORIE 5330~~ | ~~Discrete Models~~ | 4 | ~~Fa~~ll | ~~Modeling~~ ~~&~~ ~~Analysis~~ |  |
| ~~ORIE 4350~~ | Introduction To Game Theory | 4 | ~~Fa~~ll | ~~Modeling~~ ~~&~~ ~~Analysis~~ |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ORIE 5580 | Simulation Modeling and Analysis | 4 | Fall | Modeling & Analysis |  |
| ~~ORIE 5741~~ | ~~Learning with Big Messy Data~~ | 4 | ~~Fa~~ll | ~~Modeling~~ ~~& Analysis~~ | ~~Next~~ ~~offered~~: ~~2019-202~~  0 |
| ORIE 5100 | Design of Manufacturing Systems | 4 | Fall | Application |  |
| ORIE 5230 | Quantitative Trading Strategies | 3 | Fall | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ORIE 5240 | Bond Mathematics and Mortgage-Back Securities | 3 | Fall | Application |  |
| ORIE 5300 | Operations Research I: Optimization I | 4 | Fall | Modeling & Analysis |  |
| ORIE 5500 | Engineering Probability and Statistics II | 4 | Fall | Modeling & Analysis |  |
| ORIE 5530 | Modeling Under Uncertainty | 3 | Fall | Modeling & Analysis |  |
| ORIE 5550 | Applied Time-Series Analysis | 4 | Spring | Modeling & Analysis |  |
| ORIE 5580 | Simulation Modeling and Analysis | 4 | Fall | Modeling & Analysis |  |
| ORIE 6500 | Applied Stochastic Processes | 4 | Fall, Spring | Modeling & Analysis |  |

**Updated 2/28/2024**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **SYSEN Courses** |  |  |  |  |  |
| SYSEN 6100 | Systems Seminar Series | 1 | Fall, spring | Seminar |  |
| SYSEN 5220, SYSEN 6220 | Systems Dynamics | 3 | Fall | Application |  |
| SYSEN 5300, SYSEN 6300, MAE 5930 | Systems Engineering and Six Sigma for the Design and Operation of Reliable Systems | 3-4 | Fall | Application or Modeling & Analysis |  |
| SYSEN 5400, MAE 5950, SYSEN 6400 | Theory and Practice of Systems Architecture | 3 | Spring | Application or Modeling & Analysis |  |
| SYSEN 5500 | SysML | 3 | Spring | Application or Modeling & Analysis |  |
| SYSEN 5800 | Computational Optimization | 4 | Fall | Application or Modeling & |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  | Analysis |  |
| SYSEN 5880 | Industrial Big Data Analytics and Machine Learning | 4 | Spring | Application or Modeling & Analysis |  |
| SYSEN 6800 | Computational Optimization | 4 | Fall, Spring | Application or Modeling & Analysis |  |
| SYSEN 6880 | Industrial Big Data Analytics and Machine Learning | 4 | Spring | Application or Modeling & Analysis |  |
| SYSEN 5180 | Sociotechnical Systems and Policy | 3 | Fall | Modeling & Analysis |  |
| SYSEN 5190 | Project Management of Complex Systems | 3 | Fall | Application |  |
| SYSEN 5240 | Search and Optimization with Metaheuristics | 3 | Summers | Modeling & Analysis |  |
| SYSEN 5500 | SysML | 2 | Spring | Application or Modeling & Analysis |  |
| SYSEN 5740 | Design Thinking for Complex Systems | 2 | Spring | Application |  |
| SYSEN 6800 | Computational Optimization | 4 | Fall, Spring | Application or Modeling & Analysis |  |
| SYSEN 5170 | Energy Policies for Systems Transition | 3 | Spring | Application |  |
| SYSEN 5250 | Systems Integration, Verification, and Validation | 3 | Spring | Application |  |
| SYSEN 5260 | Software Systems Engineering/ Learn How software is designed, developed, and delivered in the modern enterprise | 3 | Fall | Application |  |
| SYSEN 5270 | Sociotechnical Systems Modeling and Simulation | 3 | Spring | Application |  |
| SYSEN 5140 | Economic and Financial Decisions for Engineers | 3 | Spring | Management |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Other Courses** | **Course Name** | **Credits** | **Semester** | **Group** |  |
| AEM 6061 | Risk Simulation and Montre Carlo | 3 | Spring | Application |  |
| ~~ASTRO 4445, PHYS 4445~~ | I~~ntroduction to General Relativity~~ | 4 | ~~Fal~~l | ~~Application~~ |  |
| EAS 4010, EAS 5010 | Fundamentals of Enrgy and Mineral Resourses Fundamentals of Database Management and Data | 3 | Spring | Modeling & Analysis/ Application |  |
| HADM 6740 | Analysis | 3 | Spring | Application |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NBA 5070 | Entrepreneurship For Scientists & Engineers | 3 | Fall, spring | Management |  |
| NBA 5150 | Leadership Theory and Practice | 3 | Fall, spring | Management |  |
| NBA 5380 | The Business Idea Factory | 1.5 | Fall, Spring | Management |  |
| NBA 5530 | Accounting and Financial Decision Making | 3 | Spring | Management |  |
| NBA 5640 | Entrepreneurship and Business Ownership | 3 | Fall, Spring | Management |  |
| NBA 6390 | Data-Driven Marketing | 1.5 | Fall | Management |  |
| NBA 6630 | Managerial Decision Making | 3 | Fall | Management |  |
| NBA 6650 | Managing Technology and Innovation | 3 | Spring, Summer | Management |  |
| NBA 6910 | Physical Product Entrepreneurship | 1.5 | Spring | Management |  |
| ILROB 5200 | Organizational Behavior and Analysis | 3 | Fall, Spring | Management |  |
| INFO 5355 | Human Computer Interaction Design | 4 | Fall, Spring, Summer | Application |  |
| INFO 6220, CS 4852, ECON 3825,  INFO 4 |  | 3 | Spring | Modeling & Analysis |  |
| INFO 4400, COMM 4400 | ~~Advanced Human Computer Interactive Design~~ | 3 | ~~Spring~~ | ~~Application~~ |  |
| NCC 5500 | Financial Accounting | 3 | Fall, Spring | Management |  |
| NCC 5560 | Managerial Finance | 3 | Fall, spring | Management |  |
| ENMGT 5930 | Data Anaylytics and Product Management | 4 | Fall |  |  |
| ENMGT 5920 | 3 | Spring | Management |  |
| NCC 5090 | Strategy | 2.5 | Summer, Fall | Management |  |
| STSCI 5740 | Data Mining and Machine Learning | 4 | Fall |  |  |
| STSCI 5040 | R Programming for Data Science Structures and Materials for Sustainable Energy | 4 | Fall | Modeling & Analysis |  |
| MSE 5150 | Systems | 3 | Spring | Modeling & Analysis |  |

Updated 2/22/2022

# Pre-Approved Electives for Systems Engineering M.Eng.

**Degree Requirements**

1. All core courses must be completed
2. At least one elective that fulfills an Applications component must be completed
3. At least one elective that fulfills a Modeling & Analysis component must be completed
4. No more than one elective that fulfills a Management componenet may be applied toward your degree
5. No more than one seminar may be taken each semester (for a maximum of two)
6. A minimum of 30 credit hours taken for a letter grade must be completed
7. All courses taken during your degree must be approved by your advisor
8. Electives not included on this list may be petitioned to be included in your your degree plan
9. **Check the Class Roster online (classes.cornell.edu) for the most up-to-date class listings available each semester. The courses cited below are based on historical offerings and are subject to change.**

**Core Courses**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Course Name** | **Credits** | **Semester** | **Group** |
| SYSEN 5100, CEE 5240, ECE 5120,  MAE 5910, ORIE 5140 | Model Based Systems Engineering | 3 | Fall | Core |
| SYSEN 5200, CEE 5252, MAE 5920,  ORIE 5142 | Systems Analysis Behavior and Optimization | 3 | Spring | Core |
| CEE 5900 | Project Management | 4 | Fall or Spring | Core |
| SYSEN 5900, SYSEN 5700 | Systems Engineering Project | 6 to 8 | Fall and Spring | Core |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course Department** | **Course Name** | **Credits** | **Semester** | **Group** |
| ASTRO 4431 | Introduction to Astrophysics and Space Sciences I | 4 | Fall | Application |
| ASTRO 4433 | Introduction to Cosmology | 4 | Fall | Application |
| ASTRO 4445 | Introduction to General Relativity | 4 | Fall | Application |
| ASTRO 6509 | General Relativity | 4 | Fall | Application |
| ASTRO 6560 | Theory of Stellar Structure and Evolution | 4 | Fall | Application |
| ASTRO 6575 | Planetary Atmospheres | 4 | Fall | Application |
| BEE 4590 | Biosensors and Bioanalytical Techniques | 3 | Fall | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CEE 6210 | Stochastic Hydrology | 3 | Fall | Application |
| CS 4420, ECE 4750 | Computer Architecture | 4 | Fall | Application |
| CS 4744 | Computational Linguistics | 4 | Fall | Application |
| CS 5150 | Software Engineering | 4 | Fall | Application |
| CS 5413 | High Performance Systems and Networking | 4 | Fall | Application |
| CS 5420 | Advanced Computer Architecture | 4 | Fall | Application |
| CS 5660 | Signal Processing | 3 | Fall | Application |
| CS 5780 | Machine Learning for Intelligent Systems | 4 | Fall | Application |
| CS 5830 | Cryptography | 4 | Fall | Application |
| CS 5860 | Introduction to Formal Methods | 4 | Fall | Application |
| ECE 4130 | Introduction to Nuclear Science and Engineering | 3 | Fall | Application |

**Pre-Approved Electives by Group**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ECE 4271 | Evolutionary Processes, Evolutionary Algorithms, Evolutionary Games | 3 | Fall | Application |
| ECE 4450 | Computer Networks and Telecom | 4 | Fall | Application |
| ECE 4750 | Computer Architecture | 4 | Fall | Application |
| ECE 4760 | Digital Systems Design Using Microcontrollers | 4 | Fall | Application |
| ECE 4800 | Optimal Systems Analysis and Design | 4 | Fall | Application |
| ECE 5370 | Computer Vision | 4 | Fall | Application |

Updated 1.3.17

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ECE 5750 | Advanced Computer Architecture | 4 | Fall | Application |
| ECE 5775 | High-Level Digital Design Automation | 4 | Fall | Application |
| MAE 5020 | Wind Power | 3 | Fall | Application |
| MAE 5065 | Introduction to Spaceflight Mechanics | 3 | Fall | Application |
| ~~MAE 4130, MAE 4131~~ | ~~Mechanics of Composite Structures~~ | ~~3 to 4~~ | ~~Fal~~l | ~~Application~~ |
| MAE 5340 | Innovative Product Design via Digital Manufacturing | 4 | Fall | Application |
| ~~MAE 4580~~ | I~~ntroduction to Nuclear Science and Engineering~~ | 3 | ~~Fal~~l | ~~Application~~ |
| ~~MAE 4660~~ | ~~Biomedical Engineering Analysis of Metabolic and Structural Systems~~ | 3 | ~~Fal~~l | ~~Application~~ |
| MAE 5430 | Combustion Processes | 3 | Fall | Application |
| MAE 5680 | Soft Tissue Biomechanics | 3 | Fall | Application |
| MAE 6240 | Physics of Micro and Nanoscale Fluid Mechanics | 4 | Fall | Application |
| MAE 6480 | Air Quality and Atmospheric Chemistry | 3 | Fall | Application |
| MAE 6510 | Advanced Heat Transfer | 4 | Fall | Application |
| MAE 6790 | Intelligent Sensor Planning and Control | 3 | Fall | Application |
| MAE 6810 | Methods of Applied Mathematics I | 3 | Fall | Application |
| ~~ORIE 4600~~ | I~~ntroduction to Financial Engineering~~ | 3 | ~~Fal~~l | ~~Application~~ |
| ~~ORIE 4800~~ | I~~nformation Technology~~ | 4 | ~~Fal~~l | ~~Application~~ |
| ORIE 5100 | Design of Manufacturing Systems | 4 | Fall | Application |
| ORIE 5230 | Quantitative Trading Strategies | 3 | Fall | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ORIE 5240 | Bond Mathematics and Mortgage-Back Securities | 3 | Fall | Application |
| SYSEN 5220 | Systems Dynamics | 3 | Fall | Application |
| ~~BEE 4870~~ | ~~Sustainable Bioenergy Systems~~ | ~~3~~ | ~~Fall (alt~~ ~~years)~~ | ~~Application~~ |
| CEE 6920 | Special Topics in Engineering Management | 3 | Fall, Spring | Application |
| CS 5320 | Introduction to Database Systems | 3 | Fall, Spring | Application |
| CS 5434 | Defending Computer Networks | 4 | Fall, Spring | Application |
| CS 5450 | Computer Networking | 3 to 4 | Fall, Spring | Application |
| ~~ASTRO 4432~~ | I~~ntroduction to Astrophysics and Space Sciences II~~ | ~~4~~ | ~~Spring~~ | ~~Application~~ |
| ASTRO 6511 | Physics of Black Holes, White Dwarfs and Neutron Stars | 4 | Spring | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ASTRO 6516 | Calactic Structure and Stellar Dynamics | 4 | Spring | Application |
| ASTRO 6578 | Planet Formation and Evolution | 4 | Spring | Application |
| ASTRO 7690 | Computational Physics | 3 | Spring | Application |
| ~~BEE 4010~~ | ~~Renewable Energy Systems~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~BEE 4500~~ | ~~Bioinstrumentation~~ | ~~3 to 4~~ | ~~Spring~~ | ~~Application~~ |
| ~~BEE 4710~~ | I~~ntroduction to Groundwater~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~BEE 4740~~ | ~~Water and Landscape Engineering Application~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~BEE 4760~~ | ~~Solid Waste Engineering~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~BEE 4800~~ | ~~Our Changing Atmosphere: Global Change and Atmospheric Chemistry~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| BEE 6550 | Biologically Inspired Microsystems Engineering | 2 to 3 | Spring | Application |
| BEE 6740 | Ecohydrology | 3 | Spring | Application |
| BEE 7540 | Water Management in an Era of Growing Water Scarcity | 2 to 3 | Spring | Application |
| CEE 5970 | Risk Analysis and Management | 3 | Spring | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CEE 6200 | Water Resource Systems Engineering | 3 | Spring | Application |
| CEE 6750 | Concrete Materials and Construction | 3 | Spring | Application |
| CHEME 4700 | Process Control Strategies | 3 | Spring | Application |
| CHEME 6610 | Air Pollution Control | 3 | Spring | Application |
| ~~CS 4758~~ | ~~Robot Learning~~ | 4 | ~~Spring~~ | ~~Application~~ |
| CS 5152 | Open-Source Software Engineering | 4 | Spring | Application |
| CS 5232 | Physical Computing | 4 | Spring | Application |
| CS 5300, INFO 5300 | The Architecture of Large-Scale Information Systems | 4 | Spring | Application |
| CS 5412 | Cloud Computing | 4 | Spring | Application |
| CS 5430 | System Security | 4 | Spring | Application |
| CS 5670 | Introduction to Computer Vision | 4 | Spring | Application |
| CS 5752 | Robotic Manipulation | 4 | Spring | Application |
| CS 5840 | Algorithms for Markets | 4 | Spring | Application |
| ~~ECE 4758~~ | ~~Robot Learning~~ | 4 | ~~Spring~~ | ~~Application~~ |

Updated 08/30/2022

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ECE 5660 | Fundementals of Networks | 4 | Spring | Application |
| ECE 5760 | Advance Microcontroller Design | 4 | Spring | Application |
| ECE 5770 | Resilient Computer Systems | 4 | Spring | Application |
| INFO 4400 | Advanced Human Computer Interactive Design | 3 | Spring | Application |
| ~~MAE 4120, MAE 4121~~ | ~~Community Wind Energy Research~~ | ~~3 to 4~~ | ~~Spring~~ | ~~Application~~ |
| MAE 5160 | Spacecraft Technology and Systems Architecture | 4 | Spring | Application |
| MAE 5230 | Intermediate Fluid Dynamics | 4 | Spring | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ~~MAE 4320~~ | ~~Micro & Nano Sensors & Systems: Bridging the Physical & Digital Worlds~~ | 4 | ~~Spring~~ | ~~Application~~ |
| MAE 5510 | Aerospace Propulsion | 3 | Spring | Application |
| MAE 5560 | Bioastronautics and Human Performance | 3 | Spring | Application |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ~~MAE 4590~~ | I~~ntroduction to Controlled Fusion: Principles and Technology~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~MAE 4640, MAE 4641, MAE 5640~~ | ~~Orthopedic Tissue Mechanics~~ | ~~3~~  t ~~o~~ ~~4~~ | ~~Spring~~ | ~~Application~~ |
| ~~MAE 4650, MAE 4651, MAE 5650~~ | ~~Biofluid Mechanics~~ | ~~3~~  t ~~o~~ ~~4~~ | ~~Spring~~ | ~~Application~~ |
| MAE 4860, MAE 4861, MAE 5860 | Automotive Engineering | 3  t o 4 | Spring | Application |
| MAE 5010 | Future Energy Systems | 3 | Spring | Application |
| MAE 5070 | Dynamics of Flight Vehicles | 3 | Spring | Application |
| MAE 5130 | Mechanical Properties of Thin Films | 3 | Spring | Application |
| MAE 5180 | Autonomous Mobile Robots | 4 | Spring | Application |
| MAE 6160 | Advanced Composite Materials | 4 | Spring | Application |
| MAE 6620 | Biomedical Technologies for Point-of-Care Diagnostics & Global Health | 3 | Spring | Application |
| MAE 6650 | Principles of Tissue Engineering | 3 | Spring | Application |
| MAE 6680 | Cancer for Engineers and Physicists | 3 | Spring | Application |
| MAE 6730 | Introduction to Robotic Mobile Manipulation | 4 | Spring | Application |
| MAE 7070 | Professional Product Design Studio | 3 | Spring | Application |
| ~~ORIE 4154~~ | ~~Revenue Optimization and Marketplace Design~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~ORIE 4360~~ | ~~A Mathematical Examination of Fair Representation~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ~~ORIE 4630~~ | ~~Operation Research Tools for Financial Engineering~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |
| ORIE 5122 | Inventory Management | 3 | Spring | Application |
| ORIE 5126 | Principles of Supply Chain Management | 3 | Spring | Application |
| ORIE 5130 | Service System Modeling and Design | 3 | Spring | Application |
| ORIE 5260 | Machine Learning for Finance | 4 | Spring | Application |
| ORIE 5270 | Big Data Technologies | 4 | Spring | Application |
| ORIE 5370 | Optiminization Modeling in Finance | 3 | Spring | Application |
| SYSEN 5500 | SysML | 3 | Spring | Application or Modeling & Analysis |
| SYSEN 5740 | Design Thinking for Complex Systems | 2 | Spring | Application |
| ~~BEE 4350~~ | ~~Principles of Aquaculture~~ | ~~3~~ | ~~Spring~~ | ~~Application~~ |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ORIE 5280 | Financial Data Practicum | 3 | Spring | Application |
| ~~ORIE 4710~~ | ~~Applied Linear Statistical Models~~ | ~~2~~ | ~~Spring wks~~ ~~1-7~~ | ~~Application~~ |
| ~~ORIE 4711~~ | ~~Experimental Design~~ | ~~2~~ | ~~Spring wks~~ ~~8-14~~ | ~~Application~~ |
| ORIE 5582 | Monte Carlo Methods in Financial Engineering | 2 | Spring wks 8-14 | Application |
| SYSEN 5300, MAE 5930 | Systems Engineering and Six Sigma for the Design and Operation of Reliable | 3  o r 4 | Fall | Application or Modeling & Analysis |
| SYSEN 5400 | Theory and Practice of Systems Architecture | 3 | Fall | Application or Modeling & Analysis |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ~~BEE 4890~~ | ~~Entrepreneurial Management for Engineers~~ |  | ~~Fall~~ | ~~Management~~ |
| BEE 5400 | Engineering Ethics and Professional Practice |  | Fall | Management |
| CEE 5930 | Engineering Management Methods |  | Fall | Management |
| CEE 5950 | Construction Planning and Operations |  | Fall | Management |
| CEE 5980 | Introduction to Decision Analysis |  | Fall | Management |
| CHEME 5720 | Managing Business Development Solutions |  | Fall | Management |
| ECE 5830 | Introduction to Technical Management |  | Fall | Management |
| HADM 7110 | Organizational Behavior |  | Fall | Management |
| ILROB 7240 | The Psychology of Creativity |  | Fall | Management |
| ILROB 7780, SOC 7780 | Solidarity in Groups |  | Fall | Management |
| NBA 5380 | The Business Idea Factory | 1  . 5 | Fall | Management |
| NBA 5640 | Entrepreneurship and Business Ownership |  | Fall | Management |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NBA 6630 | Managerial Decision Making | 3 | Fall | Management |
| NBA 6660 | Negotiations | 3 | Fall | Management |
| ~~ORIE 4152, EngrG 4610, MAE 4610~~ | ~~Entrepreneurship For Engineers~~ | ~~3~~ | ~~Fall~~ | ~~Management~~ |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NBA 5070 | Entrepreneurship For Scientists & Engineers | 3 | Fall and Spring | Management |
| NBA 5150 | Leadership Theory and Practice | 3 | Fall and Spring | Management |
| NCC 5090 | Business Strategy | 3 | Fall and Spring | Management |
| NCC 5560 | Managerial Finance | 3 | Fall and Spring | Management |
| NCC 5580 | Managing Operations | 3 | Fall and Spring | Management |
| ILROB 5200 | Organizational Behavior and Analysis | 3 | Fall or Spring | Management |
| BEE 5330 | Engineering Professionalism | 1 | Spring | Management |
| I~~LROB 4230~~ | ~~Leadership in Organizations~~ | ~~4~~ | ~~Spring~~ | ~~Management~~ |
| ~~MAE 4610, EngrG 4610, ORIE 4152~~ | ~~Entrepreneurship For Engineers~~ | ~~3~~ | ~~Spring~~ | ~~Management~~ |
| NBA 5530 | Accounting and Financial Decision Making | 3 | Spring | Management |
| NBA 6390 | Data-Driven Marketing | 3 | Spring | Management |
| NBA 6650 | Managing Technology and Innovation | 3 | Spring | Management |
| NBA 6910 | Physical Product Entrepreneurship | 1  . 5 | Spring | Management |
| NCC 5500 | Financial Accounting | 3 | Spring | Management |
| ~~BEE 4600~~ | ~~Deterministic and Stochastic Modeling in Biological Systems~~ | ~~3~~ | ~~Fall~~ | ~~Modeling & Analysis~~ |
| CEE 5290, CS 5722, ORIE 5340 | Heuristic Methods for Optimization | 3  t o 4 | Fall | Modeling & Analysis |
| CEE 6620 | Urban Transportation Network Design and Analysis | 3 | Fall | Modeling & Analysis |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CEE 6640 | Microeconometrics of Discrete Choice | 3 | Fall | Modeling & Analysis |
| CEE 6790 | Time Series Data Analysis for Civil, Mechanical & Geophysical Applications | 3 | Fall | Modeling & Analysis |
| ~~CHEME 6640~~ | ~~Energy Economics~~ | ~~3~~ | ~~Fall~~ | ~~Modeling & Analysis~~ |
| CHEME 6660 | Analysis of Sustainable Energy Systems | 3 | Fall | Modeling & Analysis |
| CHEME 6800, SYSEN 6800 | Computational Optimization | 4 | Fall | Modeling & Analysis |
| CS 5761 | Hybrid Systems | 4 | Fall | Modeling & Analysis |
| CS 5846 | Decision Theory I | 4 | Fall | Modeling & Analysis |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ECE 5210 | Theory of Linear Systems | 4 | Fall | Modeling & Analysis |
| ECE 5555 | Stochastic Systems: Estimation and Control | 4 | Fall | Modeling & Analysis |
| MAE 5700 | Finite Element Analysis for Mechanical and Aerospace Design | 4 | Fall | Modeling & Analysis |
| MAE 5730 | Intermediate Dynamics and Vibrations | 3 | Fall | Modeling & Analysis |
| MAE 5780 | Feedback Control Systems | 3-4 | Fall | Modeling & Analysis |
| ~~ORIE 4300~~ | ~~Optimization Modeling~~ | ~~3~~ | ~~Fall~~ | Modeling & Analysis |
| ~~ORIE 4320~~ | ~~Nonlinear Optimization~~ | ~~4~~ | ~~Fall~~ | Modeling & Analysis |
| ~~ORIE 4330~~ | ~~Discrete Models~~ | ~~4~~ | ~~Fall~~ | Modeling & Analysis |
| ORIE 5350 | Introduction To Game Theory | 4 | Fall | Modeling & Analysis |
| ~~ORIE 4520~~ | I~~ntroduction to Engineering Stochastic Processes I~~I | ~~4~~ | ~~Fall~~ | ~~Modeling & Analysis~~ |
| ORIE 5580 | Simulation Modeling and Analysis | 4 | Fall | Modeling & Analysis |
| ~~ORIE 4740~~ | ~~Statistical Data Mining~~ | ~~3~~ | ~~Fall~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 4741~~ | ~~Learning with Big Messy Data~~ | ~~4~~ | ~~Fall~~ | ~~Modeling & Analysis~~ |
| ORIE 5300 | Operations Research I: Optimization I | 4 | Fall | Modeling & Analysis |
| ORIE 5340, CS 5722, CEE 5290 | Heuristic Methods for Optimization | 3  t o 4 | Fall | Modeling & Analysis |
| ORIE 5500 | Engineering Probability and Statistics II | 4 | Fall | Modeling & Analysis |
| ORIE 5520 | Introduction to Engineering Stochastic Processes II | 4 | Fall | Modeling & Analysis |
| ORIE 5530 | Modeling Under Uncertainty | 3 | Fall | Modeling & Analysis |
| ORIE 5550 | Applied Time-Series Analysis | 3 | Fall | Modeling & Analysis |
| ORIE 5580 | Simulation Modeling and Analysis | 4 | Fall | Modeling & Analysis |
| ORIE 6330 | Graph Theory and Nework Flows | 3 | Fall | Modeling & Analysis |
| ORIE 6500 | Applied Stochastic Processes | 4 | Fall | Modeling & Analysis |
| ORIE 5581 | Monte Carlo Simulation | 2 | Fall wks 1-7 | Modeling & Analysis |
| ~~BEE 4530~~ | ~~CAE: Applications to Biological Processes~~ | ~~3~~ | ~~Spring~~ | ~~Modeling & Analysis~~ |
| BEE 6880 | Applied Modeling and Simulation for Renewable Energy Systems | 3 | Spring | Modeling & Analysis |
| CS 5223 | Numerical Analysis : Linear and Non-linear Problems | 4 | Spring | Modeling & Analysis |

Updated 1.3.17

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CS 5820 | Introduction to Analysis of Algorithms | 4 | Spri ng | Modeling & Analysis |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CS 5722, CEE 5290, ORIE 5340 | Heuristic Methods for Optimization | 3 to 4 | Spring | Modeling & Analysis |
| ~~ECE 4730~~ | ~~Digital Feedback Controls~~ | 4 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ECE 5220 | Nonlinear Systems | 4 | Spring | Modeling & Analysis |
| INFO 6220 | Networks II: Market Design | 3 | Spring | Modeling & Analysis |
| MAE 5790 | Non-Linear Dynamics and Chaos | 4 | Spring | Modeling & Analysis |
| MAE 6140 | State Variable Modeling | 4 | Spring | Modeling & Analysis |
| MAE 6230 | Computational Fluid Dynamics | 4 | Spring | Modeling & Analysis |
| MAE 6310 | Turbulence and Turbulent Flows | 4 | Spring | Modeling & Analysis |
| MAE 6700 | Advanced Dynamics | 3 | Spring | Modeling & Analysis |
| MAE 6780 | Multivariable Control Theory | 4 | Spring | Modeling & Analysis |
| MAE 6820 | Methods of Applied Mathematics II | 3 | Spring | Modeling & Analysis |
| ~~ORIE 4820~~ | ~~Spreadsheet-Based Modeling and Data Analysis~~ | 3 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 5150, ORIE 4150~~ | ~~Economic Analysis of Engineering Systems~~ | 4 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 5310~~ | ~~Optimization I~~I | 4 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ORIE 5380 | Optiminization Methods | 3 | Spring | Modeling & Analysis |
| ~~ORIE 5510~~ | I~~ntroduction to Engineering Stochastic Processes I~~ | 4 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ORIE 5650 | Quantitative Methods of Financial Risk Management | 3 | Spring | Modeling & Analysis |
| ~~ORIE 6180~~ | ~~The Design of Online Marketplaces~~ | 3 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 6350~~ | ~~Foundations of Game Theory and Mechanism Design~~ | 3 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 6580~~ | ~~Simulation~~ | 4 | ~~Spring~~ | ~~Modeling & Analysis~~ |
| ~~ORIE 4712~~ | ~~Regression~~ | 2 | ~~Spring wks~~ ~~8-14~~ | ~~Modeling & Analysis~~ |
| SYSEN 5240 | Search and Optimization with Metaheuristics | 3 | Alternate | Modeling & Analysis |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| ECE 5870 | Energy Seminar I | 1 | Fall | Seminar |
| MAE 5459 | Energy Seminar I | 1 | Fall | Seminar |
| SYSEN 6100 | Systems Seminar Series | 1 | Fall, Spring | Seminar |
| ECE 5880 | Energy Seminar II | 1 | Spring | Seminar |
| MAE 5469 | Energy Seminar II | 1 | Spring | Seminar |
| MAE 5949 | Enterprise Engineering Colloquium | 1 | Spring | Seminar |