ENGINEERING MANAGEMENT
GRADUATE STUDENT HANDBOOK

ONLINE LEARNING PROGRAM 2022-23
The rules and regulations stated in this handbook are for information only and in no way constitute a contract between a student and Cornell University. The University reserves the right to change any regulations or requirements at any time.

Cornell University's history of diversity and inclusion encourages all students, faculty, and staff to support a diverse and inclusive university in which to work, study, teach, research, and serve. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally protected status or subjected to prohibited discrimination involving, but not limited to, such factors as race, ethnic or national origin, citizenship, and immigration status, color, sex/gender, pregnancy or pregnancy-related conditions, age, creed, religion, actual or perceived disability (including persons associated with such a person), arrest and/or conviction record, military or veteran status, sexual orientation, gender expression and/or identity, an individual's genetic information, domestic violence victim status, familial status or marital status. Cornell University is an affirmative action/equal opportunity employer.

The Office of Institutional Equity and Title IX (OIE/TIX) responds to bias incidents and protected-status harassment involving staff and faculty, and sexual and related misconduct involving students, faculty, and staff. OIE/TIX can provide information about and referrals to resources, implement supportive measures, and conduct incident response education for accused individuals. OIE/TIX also has the authority to investigate and adjudicate claims of misconduct under Policy 6.4. If you have any questions, please email OIE/TIX at titleix@cornell.edu (for sexual harassment or other sexual misconduct) or equity@cornell.edu (for other protected-status harassment, prohibited discrimination, or bias), and/or visit titleix.cornell.edu.
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SECTION 1 - INTRODUCTION

Welcome to Cornell University and the Engineering Management Program. This handbook gives a comprehensive overview of our Master of Engineering degree and our policies.

1.1 The Engineering Management Program

The Engineering Management program at Cornell has been training technical leaders since 1988. Each year we attract top students from a variety of engineering fields including mechanical, biomedical, civil, electrical, computer science, industrial/operations research, chemical, applied and engineering physics, and environmental engineering. We have more than 1000 Engineering Management alumni who hold leading positions in engineering, product management, finance, consulting, research and development, manufacturing, sales, education, construction management, and government in the U.S. and around the world.

Faculty and others responsible for administering the program include:

- **Director** Patrick Reed, 211 Hollister Hall, patrick.reed@cornell.edu
- **Program Coordinator** TBD, 215A Hollister Hall, email TBD
- **Student Services Program Manager** Celia Szczechura, 215 Hollister Hall, cs249@cornell.edu

The Engineering Management program is administered by the School of Civil and Environmental Engineering (School). Faculty and others responsible for administering the School include:

- **Director** Linda Nozick, 311 Hollister Hall
- **Director of Administration** Joe Rowe, 220 Hollister Hall

1.2 The Master of Engineering Degree in Engineering Management

The Master of Engineering (M.Eng.) degree in Engineering Management (EM) gives students business skills while increasing their technical depth through coursework, team projects, and dynamic class discussions. The degree requires 30 credit hours consisting of coursework in major and supporting areas as well as a capstone project. A maximum of two credit hours graded on an S/U basis may be included.

The Online Learning program is a part-time program for working professionals designed to be completed in two years. The program is designed to appeal to students from different disciplinary backgrounds with varying career goals, the core tools taught in the program are augmented by a set of specialized courses that allow students to develop expertise in particular application areas.

By the end of your Engineering Management program, you will develop strong competencies in the following areas:
Our curriculum focuses on three main areas: leading people, advancing your business, and disrupting your field. Students learn to identify problems, analyze data, and interpret the results of analyses for managerial action.

1.2.1 Preparation in Probability and Statistics

Students from all fields of engineering are welcome. The core elements of the program do not require specific knowledge from any particular engineering discipline. However, we require that all incoming students have a basic background in probability and statistics. This knowledge is generally obtained in a one-semester undergraduate class. At Cornell, the typical courses used by undergraduates to satisfy this requirement are ENGRD 2700, CEE 3040, or ECE 3100. Appendix B describes the material that you should understand to meet this background requirement.

If you have not had a course in probability and statistics as an undergraduate, you may arrange to take such a course over the summer preceding enrollment as an M.Eng. student.

1.2.2 Program Requirements

All students need at least 30 credits to graduate.

Required Courses:

ENMGT 5900 - Project Management (Fall and Spring, 4 credits)
ENMGT 5910 - Engineering Management Project (Fall and Spring (must be taken in final semester), 4 credits)
ENMGT 5930 - Data Analytics (Fall (must be taken in the first semester), 4 credits)
ENMGT 5940 - Economics and Finance for Engineering Management (Spring, 4 credits)
ENMGT 5980 - Decision Framing and Analytics (Fall, 3 credits)
ENMGT 6020* - Managing a Culture of Innovation (Fall, 3 credits)
ENMGT 5080 - Introduction to Python Basics (Summer, 1 credit)
ENMGT 6001 - **Residential Session 1 (Summer (first), 1 credit)
ENMGT 6002 - **Residential Session 2 (Summer (second), 1 credit)

To petition to opt out of a required course, students must submit an EM General Petition and provide justification and back up.
**Electives:**
Beyond the above requirements, students must select and take at least two of the following electives.

ENMGT 5200 - Economics of the Energy Transition (Fall, 3 credits)
ENMGT 5920 - Product Management (Spring, 3 credits)
ENMGT 5960* - Negotiations and Contracts for Engineering Managers (Fall, 3 credits)
ENMGT 5990* - Contemporary Challenges for Engineering Managers (Fall, 3 credits)
ENMGT 6030 - Learning to Lead (Spring, 3 credits)
CEE 6065 - Special Topics in Transportation: Managing Transportation Systems (Spring, 3 credits)
CEE 6640 - Microeconomics of Discrete Choice (Spring, 3 credits)
CEE 6800 - Engineering Smart Cities (Fall, 3 credits)
SYSEN 5740 - Design Thinking for Complex Systems (Spring, 2 credits)

*ENMGT 5960 or ENMGT 5990 may be substituted for ENMGT 6020 as a required course, all three fulfill the requirement for one organizational behavior course.*

**Participation in the Residential Sessions, one each summer, is required. The sessions normally take place on Cornell’s campus and students are responsible for travel to and from Ithaca, New York, as well as course tuition. Sessions are for one week in June and specific dates will be shared during the Fall semesters. If sessions cannot take place on campus, the session will be delivered virtually during the same week.**

We encourage you to seek guidance from your advisor and other faculty members. An important aspect of the M.Eng. program is interaction between each student and their faculty advisor. Your advisor will work with you to develop a program consistent with your career goals and the intent of the M.Eng. program.

**Capstone Project:**
All students must complete a capstone project and register for ENMGT 5910 in their final semester. Management responsibilities in a technical environment (and increasingly in many business environments) are often focused on *projects*, where a combination of resources (people, equipment, money, etc.) must be brought together to achieve a specific outcome within both, schedule and budget constraints. The importance of projects is reflected in this program through a strong focus on project management – the combination of “people skills” and “technical skills” necessary for successful project completion.

Project topics and sponsors are presented to students in ENMGT 5910 early in the semester. Students rank their preferences and teams are formed. Some project sponsors require Assignments of Intellectual Property Rights and/or Non-disclosure Agreements (NDAs) in order to participate in their projects.

**1.2.3 Auditing Courses and Additional Electives**
Online Learning students cannot audit courses without incurring a per credit tuition charge. That being said, some courses and seminars (such as ENMGT 6091 Seminar: Project Management) that require registration for On-Campus students may be available to Online Learning students at no charge. These opportunities will be emailed to students and posted in Canvas. You can also browse open lectures on Canvas by using the search tool in Canvas Commons. The Cornell Events Page is an additional resource for open events and lectures.

Elective courses will be periodically added to the program. All available courses, including any new electives, will be emailed to students before open enrollment each semester.
SECTION 2 – PROGRAM PLANNING and POLICIES

2.1 Assignment of Advisor
You will be assigned an advisor prior to orientation to help you design a program of study, and to generally assist and advise you throughout your degree program. You may request to change your advisor to another eligible faculty member with the permission of the faculty member whom you would like to serve as your new advisor.

After orientation, set up an appointment with your advisor. Program planning is done with the aid of the M.Eng. Proposal Form for Engineering Management (see Appendix C), register for all required courses by the add/drop deadline.

2.2 Course Registration
Course registration is done online by logging onto Student Center with your Cornell NetID*. Online learning students are automatically enrolled in some courses. For detailed instructions see how to add a class, or make changes to your class requests. Please refer to the registrar’s calendar for specific dates each term.

Any changes in your course registration after the deadlines (i.e., add/drop, credit hour changes, etc.) require submission of a Course Enrollment Petition to the Engineering Registrar’s office within the College of Engineering. The petition must be signed by both your advisor and the course instructor. Please note that petitions are not automatically approved.

*Cornell NetID: You should have received your Cornell NetID and information from Cornell Information Technologies (CIT) prior to enrolling. If you did not, please contact the CIT Office at HelpDesk@cornell.edu. Please be sure to check your Cornell email regularly.

2.3 Filing and Approval of Your Course Program
After a “final” program of courses for the entire year is agreed upon with your advisor, please submit your Proposal Form to the Program Coordinator by the first Friday in September for the Fall term and the first Friday in February for the Spring term. It will then be forwarded to the Director of the Engineering Management Program for final approval. A copy of the approved program is returned to both you and your faculty advisor. You are responsible for resubmitting if there are any agreed upon changes and updates to your proposal (e.g., any changes made to your course plan at any time during your program).

Link to proposal form: https://cornell.box.com/v/OLstudentresources
Link to submit form for approval: https://cornell.box.com/s/yg49zwirdqc956azrj00gyfds5utzjp
2.3.1 One Possible Program Plan

You may schedule classes in a variety of ways. Here is a typical timeline for courses that may help you with your planning:

2-YEAR CURRICULUM TIMELINE

<table>
<thead>
<tr>
<th>Summer 1</th>
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<th>Summer 2</th>
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<td>ENMG 5080</td>
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<tr>
<td>Introduction to Python Basics (1 credit)</td>
<td>Data Analytics (4 credits)</td>
<td>Project Management (4 credits)</td>
<td>Residential Session II (1 credit)</td>
<td>Data Analytics (4 credits)</td>
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<tr>
<td>Residential Session I (1 credit)</td>
<td>Decision Framing and Analytics (3 credits)</td>
<td>Economics and Finance for Engineering Management (4 credits)</td>
<td>Decision Framing and Analytics (3 credits)</td>
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<td>ENMG 6020</td>
<td>ENMG 6020</td>
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<tr>
<td>Managing a Culture of Innovation (3 credits)</td>
<td>Managing a Culture of Innovation (3 credits)</td>
<td>Engineering Management Project (4 credits)</td>
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</tbody>
</table>

Anticipated Fall Electives
- ENMG 5200: Economics of the Energy Transition (3 credits)
- ENMG 5960: Negotiations and Contracts for Engineering Managers (3 credits)
- ENMG 5990: Contemporary Challenges for Engineering Managers (3 credits)
- CEE 6800: Engineering Smart Cities (3 credits)
- NBA 5070: Entrepreneurship for Scientists and Engineers (3 credits)

Anticipated Spring Electives
- ENMG 5920: Product Management (3 credits)
- ENMG 6030: Learning to Lead (3 credits)
- CEE 6601: Special Topics in Transportation: Managing Transportation Systems (3 credits)
- CEE 6640: Microeconomics of Discrete Choice (3 credits)
- SYS6N 5740: Design Thinking for Complex Decisions (2 credits)

2.4 Program Changes

All changes to your approved M.Eng. program must take the form of a revised proposal. Revised proposal forms must also be approved by your advisor and the Engineering Management Director. Revised proposal forms follow the same process described above in Section 2.3.

It is important that any changes in your program be submitted and approved promptly because the current version of your proposal form that is on file serves as a checklist for determining compliance with graduation requirements.

2.5 Petitions

Cornell University has a long-standing tradition of considering petitions from students relative to special situations or circumstances that could justify exceptions to the normal rules or requirements. Petitions are
considered by the Engineering Management Director. While we are not encouraging use of a petition to circumvent requirements, we do want to point out the existence of this process.

2.5.1 Leave of Absence

A leave of absence may be voluntary, health-related, or required. A description of each follow:

Voluntary Leave

Students sometimes find it necessary to suspend their studies. To do this, they must petition for a leave of absence for a specified period (at least one semester and not more than one year) by writing to the Program Coordinator and must receive written approval.

To rejoin from a leave of absence, students must (1) satisfy any conditions established at the time the leave was granted, and (2) notify the Program Coordinator in writing at least six weeks before the beginning of the semester of their intentions to rejoin articulating how they satisfied any conditions established at the time the leave was granted. Students must obtain written approval to extend their leave before it has expired, or they will be considered withdrawn from the program and would be required to reapply for admission.

A leave of absence granted during a semester goes into effect on the day it is requested. If a leave is requested after the 57th day of a semester, the courses in which the student was registered at the time of the request are treated as having been dropped (i.e., a “W” will appear on the transcript for each course). Students are responsible for any outstanding tuition or other university charges owed through that date.

Health Leave

Health leaves are granted by the college only upon recommendation of a physician or therapist. Although circumstances may vary, such leaves are generally granted for at least one full academic year with the understanding that the student may return at the beginning of any semester after the medical condition in question has been resolved. Students must satisfy Cornell Health that the condition has been corrected before they may return. The student’s academic standing will also be subject to review both at the time the leave is granted and upon the student’s return.

Required Leave

A required leave of absence may be imposed by the department in cases in which a student fails to meet the requirements for good standing. Leaves are given when the probability of success is increased substantially by deferring the student’s return by one semester (or, in unusual circumstances, one year). Required leaves take precedence over voluntary leaves.

Students wishing to rejoin the program should contact the Program Coordinator to determine what materials will be required of them to be considered for reentry. This must be done at least six weeks before the beginning of the semester in which the student wishes to return.

2.5.2 Withdrawal

A withdrawal from the College of Engineering may be voluntary or required. Following is a description of each:

Voluntary Withdrawal
Students who voluntarily withdraw from the program sever their connection with the college. Students who wish to withdraw should notify the Program Coordinator.

A withdrawal granted during a semester goes into effect on the day it is requested. If a withdrawal is requested after the 57th day of a semester, the courses in which the student was registered at the time of the request are treated as having been dropped (i.e., a “W” will appear on the transcript for each course). Students are responsible for any outstanding tuition or other university charges owed through that date.

**Required withdrawal**

A department may require a student to withdraw from the program only when their overall record indicates that they are either incapable of completing the program or not sufficiently motivated to do so. This action severs their connection and withdraws them from only the M.Eng. program. It does not, in and of itself, adversely affect their ability to transfer and complete a degree in another program at Cornell. Required withdrawals take precedence over voluntary withdrawals.

### 2.5.3 Transfer Credits

Students may transfer up to nine credit hours of Master’s-level coursework if they have not been used toward a conferred degree and upon program approval. Transfer requests must be submitted and approved within 30 days of enrollment in the first academic semester of your program. Students must submit a Transfer Credit Application Form, transcript, a course description, and a syllabus for any credit hours to be considered. Transfer credits are only accepted from accredited institutions/universities. In addition, a grade equivalent of 2.5 or above is required for each course transferred from outside Cornell. The Director reviews all transfer requests and reserves the right to accept or reject any credits.

Students enrolled in Lockheed Martin’s ELDP can transfer up to nine TDC credits toward the degree with approval by the Director.

### 2.6 Online Learning Tuition and Billing

Online Learning students are charged tuition based on the number of credit hours in which they enroll each semester. Thus, their bill is generated at the time they register for classes. The exact rate per credit hour may vary each year based on the tuition rate set by the Cornell Board of Trustees. For international Online Learning students, the total to certify should be the amount that the students need to certify for their entire program. This means that the tuition would be the per credit charge times the number of credits (30) they will take over the duration of their program.

Please refer to the [billing deadlines website](#) from the Office of the Bursar to determine when their bill will be generated and due.

### 2.7 Fellowships

There are two fellowships available to Engineering Management Distance Learning students: the Lester B. Knight Fellowship and the McMullen Diversity Fellowship. Renewal of financial support each semester is contingent upon academic performance constituting good standing by meeting the minimum 2.5 GPA in the program.
2.8 Grade Requirements

The College requires a minimum grade point average of 2.5 for graduation from the Master of Engineering program. Students admitted on a Provisional Basis must achieve a 3.0 average during their first term in the M.Eng. program to continue in the second term. Typical graduate student grade point averages are much higher than this. At Cornell, decimal grade points are assigned to grades with (+) or (-), i.e., A+ = 4.3, A = 4, A- = 3.7, B+ = 3.3, etc. A grade of less than C- in a course will result in no credit being granted toward satisfaction of the 30-credit hour minimum requirement. However, these courses are included in calculating grade point averages.

2.9 Career Services

We are confident that the background you receive in your M.Eng. program in Engineering Management will lead to new career opportunities and prepare you for your next job search. Advisors, faculty, and staff are available to discuss your career goals and assist you.

The College of Engineering also supports career development for M.Eng. students. To discuss job search strategies, networking, job offer negotiations, or other general career questions, please visit their office in 201 Carpenter Hall or review resources on their website.

2.10 Transferring from Online Learning to On-Campus

Students who wish to transfer from the On-Campus program to the Online Learning program must complete at least one semester as an On-Campus student. It is best to discuss this option with your advisor as soon as possible and final approval will be granted by the Director. Please note that the Online Learning program is a part-time, two-year program.

A general petition must be submitted to switch between programs. If approved, you will receive an updated acceptance letter which will include a new expected graduation date. The change will also be reflected in your bursar account. Tuition for the Online Learning program is charged per credit hour whereas tuition for the On-Campus program is charged per semester.

Students can only make this change one time and cannot switch back to the On-Campus program once they have enrolled in the Online Learning program.

2.11 Program Timeline

The Online Learning program is a part-time program for working professionals designed to be completed in two years. A student may take up to six years to complete the program. You must take at least one course each term or request a leave of absence (see Section 2.6.1). Note that some required courses are offered only once per year.

2.12 Attending Classes On-Campus

Online Learning students are welcome to attend enrolled classes in-person or participate in events on Ithaca’s main campus if campus is open to visitors (check Cornell’s COVID-19 web page for more information about current policies). Students should let the faculty member know in advance if they plan to attend their class on campus instead of participating virtually.

SECTION 3 - PROFESSIONAL CONDUCT and SPECIAL NEEDS
3.1 Academic Integrity and Plagiarism

Absolute integrity is expected of every Cornell student in all academic undertakings. Integrity entails a firm adherence to values most essential to an academic community, including honesty with respect to the intellectual efforts of oneself and others. Both students and faculty at Cornell assume the responsibility of maintaining and furthering these values. A Cornell student’s submission of work for academic credit indicates that the work is their own. All outside assistance should be acknowledged, and the student’s academic position should always be reported truthfully. In addition, Cornell students have the right to expect academic integrity from each of their peers. It is plagiarism for anyone to represent another’s work as their own. As stated in the University Code of Academic Integrity, “The maintenance of an atmosphere of academic honor...is the responsibility of the student and faculty...”.

Gray areas sometimes exist when students study and work together. It is important that faculty make clear what is expected and that students understand what authorship citations an instructor expects. To become better acquainted with academic integrity responsibilities, each student should have a copy of the Policy Notebook for Students, Faculty, and Staff (available in the Dean of Students’ Office). Also, a copy of the Cornell Code of Academic Integrity is included in the Handbook of Engineering Students, available from the College of Engineering’s Office of Admissions and Undergraduate Programs online at http://cuinfo.cornell.edu/aic.cfm.

3.2 Curriculum, Grading, and Exams

Students will be evaluated in each course based on a combination of graded assignments, discussions, projects, and exams. Instructors will determine evaluation and grading policies for their courses and will set clear expectations for work.

General curriculum policies for the program are outlined below.

*Due Dates*: The due dates for the discussions, projects, and assignments within your courses are in place to help you manage your time and to ensure an optimal learning experience. Penalties for failing to meet assigned due dates for discussions and project assignments will be specified by your instructors.

*Review of Draft Work*: Instructors are always willing to answer specific questions that students have about an assignment. However, draft versions of assignments or parts of assignments will not be reviewed prior to submission. Instead, instructors will provide detailed feedback on assignments when they are submitted for grading.

*Requesting an Extension*: Extensions of up to 48 hours beyond a due date can be requested from the instructor. Please note that extensions will only be considered if requested before the due date and if there are clear extenuating circumstances.

3.3 Student Disability Services

Cornell University is committed to assisting those who have special needs. Please consider registering with SDS if you require an accommodation. Also, a brochure describing services for persons with disabilities may be obtained from the Office of Equal Opportunity, Cornell University, 234 Day Hall, Ithaca, New York 14853-2801.
APPENDICES

A Engineering Management Program Faculty and Their Interests

John Albertson, Professor (Ph.D. University of California, Davis): turbulent transport, air quality sensing and surveillance, Smart City applications in water, energy, and transportation.

Ricardo A. Daziano, Assistant Professor (Ph.D. Université Laval): pro-environmental preferences, sustainable travel behavior, renewable energy, environmentally friendly energy sources.

Andrea Ippolito, Lecturer (M.S. Massachusetts Institute of Technology): engineering management, entrepreneurship, innovation, product management, healthcare systems.

Jacob P. Mays, Assistant Professor (Ph.D. Northwestern University): applications of optimization and statistical learning in energy systems, design and analysis of electricity markets.

Robert Newman, Senior Lecturer (MBA Baker College): engineering management, business development, organizational and team development, emotional intelligence, entrepreneurship.

Linda K. Nozick, Professor (Ph.D. University of Pennsylvania): systems engineering, transportation and logistics, engineering management.

Patrick M. Reed, Professor (Ph.D. University of Illinois): environmental and water resources systems, multi-objective planning and management, evolutionary computation, high-performance computing, decision making under uncertainty.

Samitha Samaranayake, Assistant Professor (Ph.D. University of California, Berkeley): systems engineering, transportation

Dirk Swart, Lecturer (M.A. Tufts University): embedded systems, engineering management, project management, product management, asymmetric negotiations, entrepreneurship.

Francis M. Vanek, Senior Lecturer (Ph.D. University of Pennsylvania): energy, environment, transportation.

Donnell T. Walton, Adjunct Professor (Ph.D. University of Michigan): engineering management, innovation leadership, lab-to-market leadership and dynamics.
B  Prerequisite Skills in Probability and Statistics

Engineering Management requires that an engineer deal with variation, variability, and uncertainty. Illustrative issues of concern include estimates of the time to complete tasks in project planning and scheduling; the prices for goods and services; the demand for goods and services; and the performance of a range of systems and other forces that effect an organization. Therefore, Engineering Management students need to know how to use the language of probability to describe variability and uncertainty, and to help resolve the challenges faced by their organization. They need to understand how statistical concepts help them resolve what information can be extracted from available data, and how to determine and describe the precision of estimated quantities.

Our Engineering Management courses provide examples of these issues and reinforce and advance these skills. We depend upon all the Engineering Management students to begin the program with a basic understanding of probability and statistics, consistent with what would be included in an undergraduate treatment of the subject. Specific concepts and ideas students should have when entering the program include the basic concepts and methods of probability, along with an understanding of the idea of statistical estimation, construction of confidence intervals, hypothesis testing, and linear regression analysis. If the student does not complete a course with this material prior to entering, they will be required to take a course while in the program. This course will require additional course work beyond the 30 credit hours required and may delay completion of the program.

As a refresher, we recommend the following open online courses and resources:

- MIT Open Statistics Course, and/or
- Khan Academy Statistics Background Material.

Essential concepts and brief descriptions are also provided below. [For clarification we provide references to sections in Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 9th edition, Duxbury, Belmont, CA, 2015. See also http://allpsych.com/stats/index.html]

1. Students should know the 3 basic axioms for probability. [Devore §2.1-2.2]
   \[
   \{ P(A) \geq 0; \ P(S) = 1; \text{ for A and B disjoint, } P[A \cap B] = P[A] + P[B] \} 
   \]

2. Students should know how to calculate the probability of events consisting of unions [A \cup B], intersections [A \cap B], and complements [A' = S - A], of events of known probability. They should be able to use the Total Probability Theorem and Bayes Theorem to calculate probabilities and conditional probabilities of different events \[ P(A | B) = P(A \cap B)/P(B) \]. [Devore §2.2-2.5]

3. Students should know definitions of the cumulative distribution function (cdf) \( F_X(x) \) and probability density function (pdf) \( f_X(x) \) for continuous univariate random variables; the properties of each; and how to use these functions to calculate the probabilities for events such as \( P( a \leq X \leq b ) \). [Devore §4.1-4.2]

4. Students should know the definitions and properties of the mean \( \mu \), variance \( s^2 \), and correlations \( r \); how to compute the univariate “moments” given a pdf; and how to compute the mean and variance for linear functions and linear combinations of random variables. [Devore §5.1-5.2, 5.5]

5. Students should know some properties of a Normal distribution, the form of the pdf, and how to calculate quantiles and the probability of events such as \( a \leq X \leq b \) for \( X \sim N(\mu, \sigma^2) \). Students should be able to state the Central Limit Theorem and know when it applies. [Devore §4.3, 5.4]
6. Students should know the mean, variance and probability mass function for the discrete binomial and the Poisson distributions and be able to use those relationships to compute probabilities for a range of events. [Devore §3.1-3.4, 3.6]

7. Students should know the concept of an estimator, and the sampling properties of the sample mean $\bar{X}$ for a set of data. [Devore §5.4, 6.1-6.2]

8. Students should know how to construct confidence intervals for the mean of a Normal distribution with small samples. [Devore §7.1-7.3]

9. Students know how to structure a statistical decision problem as a choice between two hypotheses and how that choice relates to probabilities of type I (denoted $\alpha$) and II (denoted $\beta$) errors; students should know how to perform a simple one-sample or two-sample t test. [Devore §8.1-8.2]

10. Students should know why statisticians sometimes summarize results by a P-value, as well as what a P-value is, and how to calculate it. [Devore §8.4]

11. Students should understand the form of and assumptions employed with the basic linear model $Y = \beta_0 + \beta_1 x + \varepsilon$, with independent additive normal errors $\varepsilon$. [Devore §12.1]

12. Students should be able to calculate least-squares estimators of the two coefficients $\beta_0$ and $\beta_1$, and construct hypothesis tests on the parameters. Students should know the definition of $R^2$, what it represents, and how to calculate it. Students should know the definition and meaning of the correlation coefficient, and be able to calculate its estimator $r$. [Devore §12.2-12.5]
C Proposal Form for M.Eng. Degree in Engineering Management

Below is the link to the EM Proposal form that you must complete with your advisor and submit for approval. Please note that any changes made to your proposal form during the course of your degree program must be agreed upon with your advisor and resubmitted for approval.

Link to proposal form: [https://cornell.box.com/v/OLstudentresources](https://cornell.box.com/v/OLstudentresources)
Link to submit form for approval: [https://cornell.box.com/s/yg49zwirdqc956azrj00gyfds5utzlpn](https://cornell.box.com/s/yg49zwirdqc956azrj00gyfds5utzlpn)
D Courses of study for ENMGT and other key resources

ENMGT 5080: Introduction to Python Basics
Summer, 1 credit
An introduction to the Python programming language focusing on practical coding skills and building strong programming habits. Students will learn how to install and run Python, work with expressions, utilize variables and functions, write conditional statements, design and implement test function, write and visualize loops and learn the basics of programming concepts such as recursion. Applicable to students interested in learning to work with Python or improving basic programming skills, no prior programming experience is required.

ENMGT 5200 Economics of the Energy Transition
Fall, 3 credits
In response to the risks posed by global climate change, many states and countries have set emissions reductions goals necessitating a rapid transition toward zero-carbon energy resources. Achieving these goals entails unprecedented investment in civil infrastructure systems combined with large-scale consumer and industry adoption of clean energy solutions. This course will explore the economic challenges and opportunities associated with this transition, with an emphasis on the electric power sector. The course is broken into two halves. The first focuses on the economic viability of individual projects. The second develops system level models and considers interactions between competing energy sources.

ENMGT 6001 and ENMGT 6002: Residential Intensive 1 and 2
Summer, 1 credit each session
In these intensive, residential courses, Engineering Management Master of Engineering students will learn the skills and competencies surrounding forming and leading high velocity teams, including the following topics:
• Assessing your leadership skills
• Learning leadership styles
• Understanding and developing team cultures
• Dealing with team conflict and adversity
• Engaging in negotiations

ENMGT 5900: Project Management
Fall and Spring, 4 credits
Core graduate course in project management for people who will manage technical or engineering projects. Focuses both on the “technical” tools of project management (e.g., methods for planning, scheduling, and control) and the “human” side (e.g., forming a project team, managing performance, resolving conflicts), with somewhat greater emphasis on the latter.

ENMGT 5910: Engineering Management Project
Fall and Spring, 4 credits
As Engineering Managers, you need to embrace both technical and business skills to tackle complex, sociotechnical challenges, while staying on top of the current pace of technological change. In this Engineering Management project course, we are bridging from your coursework to your role as an engineering manager. To get there, you will practice the tools, themes, and techniques learned in your Engineering Management coursework through the scaffolding of a large project. In ENMGT 5910, you will work in teams to participate in a project in collaboration with an industry partner. You will perform an intensive evaluation of some mixture of
the technological and management aspects of a major engineering project or system, conducted with a team of students. This project typically incorporates some combination of economic and financial analysis, integration of components into a large-scale system, or technology feasibility.

**ENMGT 5920 Product Management**  
Spring, 3 credits  
Product Management is one of the fastest growing careers in engineering and technology-based industries. In this course, you will learn the foundations of product management including (i) preparing for success as a product manager, (ii) identifying and targeting customer needs, (iii) prioritizing your project needs, and (iv) designing, developing, and deploying your product across the product life cycle. Using skills developed through course lectures and discussions, you will complete a project where you will practice the sprint model utilized in most product teams. This course is for students interested in pursuing a career as a product manager in engineering or technology-based companies, learning about the product management competency, or working in a non-traditional tech setting to apply these skills on complex systems.

**ENMGT 5930: Data Analytics**  
Fall, 4 credits  
Prerequisites: CEE 3040 or equivalent.  
Methods for managing data and transforming data into information. Modeling as a means to synthesize information into knowledge that can form the basis for decisions and actions. Application of statistical methods and optimization to managerial problems in project design, scheduling, operations, forecasting, and resource allocation.

**ENMGT 5940: Economics and Finance for Engineering Management**  
Spring, 4 credits  
An engineering case-based exploration of economic models and methods used in analysis, comparisons, and decision making by engineers and engineering teams. Emphasis will be placed not only on the important calculations, but also on understanding, communicating, and recording their findings, related assumptions, risks, external considerations and situational awareness.

**ENMGT 5960 Negotiations and Contracts for Engineering Management**  
Fall, 3 credits  
An exploration of negotiation types, skills, and tactics relevant to engineers and engineering managers, and a study in contract types, details, and clauses common to engineering fields. Studies will include human factors and behavior in negotiations, understanding and managing the end game, and legal terminology engineers should know.

**ENMGT 5980: Decision Framing and Analytics**  
Fall, 3 credit.  
Prerequisite: introduction to probability and statistics course such as CEE 3040, ENGRD 2700, IRLST 2100, BTRY 3010, or AEM 2100.  
Framework to structure the way we think about decision situations that are complicated by uncertainty, complexity, and competing objectives. Specific decision analysis concepts and tools, such as decision trees, sensitivity analysis, value of information, and utility theory. Applications to all areas of engineering and life. Includes a group project to analyze a real-world decision.
ENMGT 5990: Contemporary Challenges for Engineering Managers  
Fall, 3 credits  
This course will focus on major modern challenges faced by Engineering Managers, and how our responses are guided and confined by our value systems, external pressures, and available resources. The topics covered will be of a contemporary nature looking at the factors that have affected managers in the recent five years, and that will affect us in the next five to ten years. Key areas will include Climate Change, Sustainability, Diversity, Remote work forces, Technology Strategy, Data Privacy, Ethics in Global Engineering, and others.

ENMGT 6020 Managing a Culture of Innovation  
Fall, 3 credits  
Innovation is not just ideas, but getting ideas to measurable impact for your customers or employees. While the word ‘innovation’ is pervasive throughout engineering and business, developing and managing a culture of innovation has only been mastered by a few organizations. In fact, no company has remained on the Dow Jones Industrial Average since its inception. Why? Because implementing a culture of innovation is very difficult and is moored by a lack of understanding of proven innovation strategies, competencies, and tools. In this course, you will learn a systematic approach for developing and managing a culture of innovation. You will learn how to develop an innovation strategy to better meet your organization’s goals and customer needs. In addition, we will take time to dive into innovation competencies, such as design thinking, lean start-up, and making, along with learn several innovation tools including hackathons, open innovation strategies to deliver impact for your customers and organization.

ENMGT 6030 Learning to Lead  
Spring, 3 credits  
This course is designed for engineers transitioning into their first management experience. It is for individuals who are from one year before to up to five years (-1 to 5 years) into their first management assignment. The course materials will be research and evidence based. Students will learn how to recognize and develop behaviors and actions needed to successfully transform from individual to manager, leverage self and peer coaching to hone their leadership skills, as well as understand the foundational aspects of leveraging diversity and integrity to optimize producing, innovating, creating, and collaborating.

CEE 6065 Special Topics in Transportation: Managing Transportation Systems  
Spring, 3 credits  
Introduces technological, economic, and social aspects of transportation. Emphasizes design and functioning of transportation systems and their components. Covers supply-demand interactions; systems planning, design, and management; traffic flow, intersection control and network analysis; institutional and energy issues; and environmental impacts. Students will develop understanding of analytical models used for traffic flow, intersection delay, transit line operations and urban transportation planning; of how engineering and economic criteria interact to guide decisions regarding system design and operation; increased awareness of transportation's role with respect to energy usage, environmental quality and the economy; and develop understanding of how transportation systems are financed, the role of public policy, and potential alternative funding methods.

CEE 6095: Independent Study
Students who would like to complete an independent study need to identify a faculty member to oversee the project and agree to provide continuing supervision of the work. An independent study can be for one, two, or three credits and does not count toward program requirements.

To submit an independent study request, work with the faculty advisor to come up with a 30 character or less subtitle that is unique to the project and will appear on the transcript. You must also create a syllabus with a list of deliverables and milestones. These requests are processed by the Undergraduate Coordinator in Civil and Environmental Engineering, and requests are due no later than the last day of the add period of the semester the study will take place.

**CEE 6640 Microeconomics of Discrete Choice**  
Spring, 3 credits  
Understanding individual choice behavior is critical for several disciplines that need to account for demand dynamics. Discrete choice models represent the cognitive process of economic decisions and are widely used in transportation analysis, applied economics, marketing, and urban planning. Discrete choice analysis is used to forecast demand under differing pricing and marketing strategies and to determine how much consumers are willing to pay for qualitative improvements. In transportation engineering, these models allow researchers, firms, and policymakers to predict demand for new alternatives and infrastructure (e.g., light rail or a new highway), to analyze the market impact of firm decisions (e.g., merger of two airline companies), to set pricing strategies (e.g., road pricing, toll definition, revenue management), to prioritize research and development decisions (e.g., ultra-low emissions vehicles), as well as to perform cost benefit analyses of transportation projects (e.g., building a new bridge).

**CEE 6800 Engineering Smart Cities**  
Fall, 3 credits  
This course prepares students to tackle the technical challenges of designing and operating smart and dynamic infrastructure systems. Students will learn to combine data and models to control overall system performance in the face of uncertainty. The class will focus on smart city infrastructure systems that are self-aware, with continual surveillance of the built and natural environment and an autonomous capacity to control resource allocation. This course will build upon fundamental engineering principles (for systems such as transportation, energy, and water resources) and teach students to employ emerging sensor technologies, accompanying data analytics, resource demand forecasting, and model predictive control theory. Students will learn to couple engineering models of infrastructure with data-driven probabilistic models of resource demand and the approaches to control these integrated hybrid systems for optimal and equitable resource allocation with improved resilience to exogenous disturbances. Finally, the class will explore cases studies in urban flooding, energy supply, transportation and air quality, and water supply.

**SYSEN 5740 Design Thinking for Complex Systems**  
Spring, 2 credits  
This course prepares students to tackle the technical challenges of designing and operating smart and dynamic infrastructure systems. Students will learn to combine data and models to control overall system performance in this project-based class, interdisciplinary teams will combine design thinking and systems engineering techniques to define and solve complex systems and organization problems.
Throughout the entire design process (from fieldwork to brainstorming, prototyping, and testing) students will benefit from systems engineering tools in capturing and organizing essential information.

Direct interaction with real sponsors, stakeholders, and final users is an important part of this class.