

2015-2016 STUDENT HANDBOOK

Master of Engineering Degree in ENGINEERING MANAGEMENT



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

It is the policy of Cornell University actively to support equality of education and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age, or handicap. The University is committed to the maintenance of affirmative-action programs that will assure the continuation of such equality of opportunity. Sexual harassment is an act of discrimination and, as such, will not be tolerated. Inquiries concerning the application of Title IX may be referred to Cornell's Title IX coordinator at the Office Workforce Diversity, Equity and LifeQuality, 160 Day Hall, Ithaca, New York 14853-2801 (Telephone: 607-255-3976).

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1 Introduction.....	3
1.1 The Engineering Management Program.....	3
1.2 The Master of Engineering Degree in Engineering Management.....	4
1.2.1 Preparation.....	5
1.2.2 Program Requirements.....	5
2 Planning and Registering for the M.Eng. Program.....	6
2.1 Assignment of Advisor.....	6
2.2 University Registration.....	6
2.3 Course Registration.....	7
2.4 Planning your M.Eng. Program.....	7
2.5 Approval of Your Course Program.....	8
2.6 Filing Your Course Program.....	8
2.7 Program Changes.....	8
2.8 Petitions.....	8
2.9 Financial Aid and Work Obligations.....	8
2.10 Grade Requirements.....	9
2.11 Office Space, Mail, etc.....	8
2.12 Job Placement.....	9
2.13 Miscellaneous.....	10
3 Professional Conduct and Special Needs.....	11
3.1 Academic Integrity and Plagiarism.....	11
3.2 Persons with Special Needs.....	11
APPENDICES	
A. Engineering Management Program Faculty.....	12
B. Master of Engineering and MBA Programs.....	13
C. Masters in Public Administration (M.P.A) from Cornell Institute for Public Affairs (CIPA).....	14
D. Prerequisite Skills in Probability and Statistics.....	15
E. Program Requirements and Forms for M.Eng. Degree in Engineering Management.....	17
F. Engineering Management Course Offerings: 2015-16.....	19
G. Overall Listing of CEE Course Offering information: 2015-16.....	22

SECTION 1 INTRODUCTION

Welcome to Cornell University and, in particular, to the College of Engineering, and the Engineering Management Program. We hope your year here will be both an academically rich and personally rewarding experience. This handbook has been prepared to simplify the orientation and registration process of new candidates for the Master of Engineering degree in Engineering Management, and help them develop their academic program. Additional information can be obtained from the graduate program office in 219 Hollister.

1.1 The Engineering Management Program

The Engineering Management program has a strong educational tradition. Since its inception in 1988, the program has attracted students with bachelor's degrees in all of the various engineering fields. Mechanical, civil, electrical, computer science, industrial/operations research, chemical, applied and engineering physics, and environmental engineering students have all participated in the program. We have more than 600 alumni who hold important positions in engineering, construction, research and development, manufacturing, sales, education, consulting, and government in the U.S. and around the world.

The Engineering Management program is housed in Hollister Hall, which is also home to the School of Civil & Environmental Engineering. Appendix A lists the Engineering Management program faculty and their particular specializations.

The two key individuals responsible who manage the Engineering Management program are

Chair, Master of Engineering Program in Engineering Management: Patrick Reed
211 Hollister, 255-6496, pmr82@cornell.edu

Graduate Program Coordinator: Tania Sharpsteen, 219 Hollister, 255-7560

General questions about graduate programs can be directed to Tania Sharpsteen and to

Director of Graduate Studies: James Jenkins, 217 Hollister Hall, jtj2@cornell.edu

Other individuals involved in the administration of the School of Civil and Environmental Engineering include:

Director, School of Civil & Environ. Engr.: Linda Nozick, 220 Hollister; 255-3690

Director of Administration: Joe Rowe, 220 Hollister, 255-0549

Administrative Assistant: Jeannette Little, 220 Hollister, 255-3690

With CEE Support Staff:

Administrative Assistant: Carl Cornell, 220 Hollister, 255-2542

Accounts Administrator: Christina Dovi, 220 Hollister, 255-3684

Accounts Coordinator: Alita Howard, 220 Hollister, 255-6192

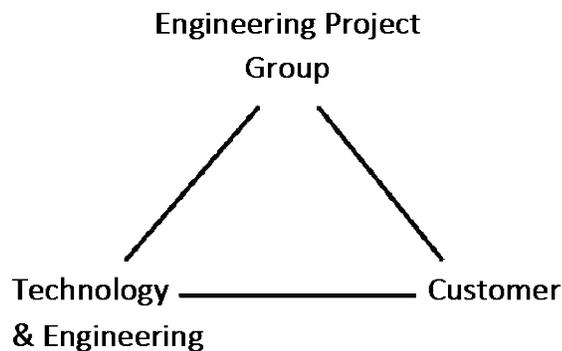
Building Coordinator: Paul Charles, B56 Hollister, 351-3210

Computer Operations Manager: Cameron Willkens, B55 Hollister, 351-6211

1.2 The Master of Engineering Degree in Engineering Management

The Master of Engineering degree is a coursework and project-oriented program. It requires thirty (30) credit hours consisting of coursework in major and supporting areas, and a project. This generally corresponds to 9 regular courses. The Master of Engineering degree can be completed in two semesters of intensive study, or in three semesters for students who want to include extra electives, make up deficiencies, or need time to adjust to study that departs significantly from their undergraduate experience.

The program is aimed at engineers who want to be leaders in a technical environment and who want to advance into managerial roles. The dominate organizational structure in engineering firms to accomplish engineering-based work is the project team. The core business of a project team is to organize themselves to use technology and engineering skills to meet the needs of a customer. That customer may be another engineering group within the same company, an external customer (either an individual or another company) or the general public. To develop skills to operate effectively in this environment, the course work and the project address management and planning methods, including considerations of risks and of multiple and competing objectives. They also include studies on the interpersonal dimensions of project work, including team dynamics and personal leadership styles. Given the importance of engineering skills within the project team, this program requires students to continue to build technical depth in the engineering domain that holds particular interest to them.



Specifically, students learn to identify problems, analyze data, and formulate models to understand these problems, and interpret the results of analyses for managerial action. Identifying problems often requires managing data, and transforming data into information. Such data and information can be used as the basis for modeling, and the models generate insights that help us to understand problems and identify opportunities. A foundation of making good managerial decisions is the thread: data → information → models → decisions. Managers also need to communicate the results of such analyses to their supervisors, to customers, and to other stakeholders who are concerned with decisions and take part in the decision making process.

The business context of the issues and decisions with which students will deal is important, and the program mixes courses from the Engineering College with courses from the Johnson Graduate School of Management and the School of Industrial and Labor Relations to provide that larger context.

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. This importance of projects is reflected in this program through a strong focus on project management – the combination of “people skills” and “technical skills” necessary to make projects successful.

Because the program is designed to appeal to students from different disciplinary backgrounds, and who are aiming at different career paths, the core tools taught in the program are augmented by a set of specialization courses that allow students to develop expertise in particular application areas. Some students select these specialization courses to focus on a disciplinary specialty (e.g., wireless communications in Electrical and Computer Engineering, construction operations in Civil & Environmental Engineering, software engineering in Computer Science, etc.). Other students focus more on a functional specialty (real estate development, management consulting, energy systems, infrastructure management, etc.). More detail on how these various program elements are reflected in specific curricular requirements is in section 1.2.2.

For some students (especially those whose career interests focus on engineering companies), the Master of Engineering degree in Engineering Management can be viewed as an effective alternative to an MBA degree because it is focused on the mix of technical skills and project management skills that are valued highly in many technical environments. However, for some other students, the combination of the M.Eng. degree *and* an MBA is attractive, and Cornell offers a joint program between the Engineering College and the Johnson Graduate School of Management leading to both degrees (usually after a total of five semesters). Additional details on this joint M.Eng./MBA program are provided in Appendix B.

1.2.1 Preparation

Students from all fields of engineering are welcome in the Master of Engineering program in Engineering Management. The core elements of the program do not require specific knowledge from any particular engineering discipline. However, in keeping with the data → information → models → decisions thread described above, we require that all entering students will have a basic background in probability and statistics. This is generally satisfied by a one-semester undergraduate class that many engineering programs require. At Cornell, the typical courses used by undergraduates to satisfy this requirement are ENGRD 2700, CEE 3040 or ECE 3100. Appendix C describes the material that you should understand to meet this background requirement and to do well in the program.

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, or you will have to take such a course (as an overload) during the first semester of your M.Eng. program. The credits for this course do not count toward the 30 credits required to complete the degree. We strongly encourage students to satisfy this preparation requirement prior to entering the program because it is used in fall courses, particularly the required course CEE 5930.

1.2.2 Major Program Requirements

Required Courses:

- CEE 5900 – Project Management (Fall or Spring, 4 credits)
- CEE 5910 – Engineering Management Project (Spring, 4 credits)
- CEE 5930 – Engineering Management Methods (Fall, 4 credits)
- CEE 5970 – Risk Analysis and Management (Spring, 3 credits), or
- CEE 5980 - Introduction to Decision Analysis (Fall, 3 credits)

One course in finance and/or accounting (many students take either NBA 5530 – Accounting and Financial Analysis for Engineers, ORIE 5150 – Economic Analysis of Engineering Systems, or NCC 5560 – Managerial Finance)

One course in individual and/or organizational behavior (many students take CEE 6900 – Creativity, Innovation and Leadership; NCC 5530 – Marketing Management; NCC 5540 – Mgmt. and Leading in Organizations; NBA 6630 – Managerial Decision Making; NBA 6660 – Negotiations; or ILROB 5200 – Organizational Behavior & Analysis)

Three specialization courses in either a disciplinary or functional area. Or if CEE 5970 or was taken as a required

program course, the other could be taken as an engineering management functional-area course.

A disciplinary specialization will usually be in the same field as your undergraduate degree. Functional specializations can vary widely. Appendix D provides examples of functional areas. *At least two of the three specialization courses must be technical in nature, and at least one of the three should be from Engineering.*

Appendix E provides course descriptions for the required courses and the most popular choices of courses in accounting/finance and organizational behavior. Appendix D provides the proposal form that must be completed by each student, listing the courses that will be used to satisfy degree requirements.

The information provided should help you make decisions, but 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 his/her 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.

SECTION 2 PLANNING and REGISTERING for the M.ENG. PROGRAM

Enrolling in the M.Eng. program in Engineering Management will take relatively little time for most of you. You will find the process a little more informal than undergraduate registration, with more freedom to change courses easily during the first three weeks of classes of each semester. The major steps in the process are described in the following sections.

2.1 Assignment of Advisor

You will have an advisor to help you design a program of study and generally to assist you during your stay at Cornell. Advisor assignments are made prior to you beginning your M.Eng. program. You may also change your advisor with the permission of the faculty member whom you would like to serve as your new advisor.

You should set up an appointment with your advisor shortly after arriving on campus. It is your responsibility to establish a relationship with your advisor who must approve the Engineering Management program you propose, as well as any subsequent changes. Please remember that the beginning of the semester is busy for everyone, and faculty members are responsible for both undergraduate and MS/PhD graduate students, as well as MEng students.

2.2 Graduate School Registration

Graduate registration at Cornell is a two-stage process. First, you must enroll with the Graduate School and second, you must enroll in courses. The former is on a fixed schedule, while the latter is accomplished over the first three weeks of each semester.

2.3 Orientation Programs for Students Entering in Fall 2015

International Student Orientation

Saturday, August 22nd – 3:00p -7:00p, Statler Hall.

For more information please visit <http://www.isso.cornell.edu/students/etc/orientation.php#1>.

Graduate School Orientation (all incoming students)

Monday, August 24, Barton Hall

(9:30am – 10:30am ID Distribution *The graduate school requests that M.Eng. students pick up their ID card between 9:30am – 10:30 am only*

The Graduate School Orientation from 10:30-12:30 on this day is not relevant to M.Eng. students

M.Eng. Career Orientation **Saturday, August 29, Duffield Hall**

2:00—2:30 Registration and refreshments

2:30—3:30 Session I

2:30—2:45 Break

2:45—3:45 Session II

4:45—5:00 Break

5:00—6:00 Session III

NetID: You should have received your NetID and information from Cornell Information Technologies (CIT) over the summer. If you did not, please contact the CIT Office at HelpDesk@cornell.edu. E-mail messages are one of the most effective forms of communication. **Please check your e-mail regularly** in the event that your advisor, your professors, your colleagues, or the GPC need to get in contact with you.

Social Security Card Application: A representative of the Social Security Administration may be at Bartels Hall to help international students who are receiving any kind of financial support from Cornell apply for a U.S. Social Security Number (SSN). Bring your passport, visa documents, and a letter from the ISSO office. You may also apply for a SSN at the local SSA Office at 127 E. State Street. Once you obtain your SSN, take the card to the Graduate Program Coordinator and the University Registrar's Office, B-7 Day Hall, to update your Cornell record.

2.4 Course Registration

Graduate students must register for courses online. You will receive details about online course enrollment upon registering with the Graduate School. Courses may be **added** online until September 11th. They may be **dropped** online until October 9th.

Any changes in your course registration after the deadlines (i.e., adds/drops, credit hour changes) requires submission of a Course Enrollment Petition to the Graduate School. The petition must be signed by both your advisor and the instructor of the course. Petitions are not automatically approved and, in fact, Graduate School personnel have indicated that they will be much stricter in approving petitions. Check *Just the Facts* often after your course schedule is online to verify that all information is correct, and do not wait until the last minute (2 days before classes end!) to submit a Course Enrollment Petition.

2.5 Planning Your M.Eng. Program

Please study the pertinent material in this handbook for both required courses and appropriate elective courses before seeing your advisor. It would be worthwhile to spend some time with the online course catalog to identify possible courses for both the Fall and Spring terms. Engineering Management courses for Fall 2015 and Spring 2016 are listed in Appendix E. Appendix F lists a larger set of courses offered by Civil and Environmental Engineering that are appropriate for MEng students. There normally are changes in course offerings made after the catalog copy is prepared, and updated information will be published online and posted by Departments. In addition, students will want to consult the course listing in the Johnson Graduate School of Management, the School of Industrial and Labor Relations, and various other departments within engineering.

Program planning is done with the aid of the M.Eng. Proposal Form for Engineering Management (see Appendix D). You will fill this form out with the help of your advisor, who must also sign the form showing his/her approval of your program. Extra proposal forms can be obtained from the GPC.

Except for seminars, which may be graded on an S/U basis, all courses that count towards the MEng degree must be

taken for a letter grade (A-F). With approval of both your advisor and the Engineering Management Director, a maximum of two S/U-graded credit hours may be allowed, provided the seminars are “participatory” (requires more than just attending the class).

2.6 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 GPC by **September 11th**. 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 your faculty advisor. You may pick up a copy from your student mail folder in 220 Hollister. Original forms stay on file with the GPC.

2.7 Filing Your Course Program

You have approximately three (3) weeks (until September 11, 2015) to enroll online for Fall 2015 classes. This time period allows you to sit in on an extra course or two, if you wish, for a couple of weeks to assist you in making up your mind about your exact program for the term.

2.8 Program Changes

Students often propose changes to their program at the start of their second semester that reflect changes in interests and/or course availability. 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, and turned into the GPC by September 11, 2015.

It is important that any changes in your program be approved promptly because the current version of your proposal form that is on file serves as a check list for determining compliance with graduation requirements. Program changes made after the Fall term to take effect in the Spring term should be submitted by February 5, 2016.

2.9 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. Most petitions are considered by the Engineering Management Director; others must be submitted to the College Master of Engineering Committee for a decision. The College Committee may also review petitions that are submitted to the Engineering Management Director that are not resolved to the satisfaction of the student. While we are not encouraging use of the petition route to get around requirements, we do want to point out the existence of this process. It gives everyone the opportunity of stating his/her case for special consideration, and therefore it is a very important part of the operational procedures for students attending Cornell University.

2.10 Financial Aid and Work Obligation

Financial aid administered by the College or School can be in the form of fellowships or half-time assistantships. If you have the latter, you will be given eight hours per week of teaching assistant-related duties. MEng students typically serve as graders, hold office hours, prepare class materials, etc. The faculty generally make assistantship assignments during the first two weeks of classes.

2.11 Grade Requirements

The College requires a minimum grade point average of 2.50 for graduation from the Master of Engineering program. Students who are admitted on a Provisional Basis must achieve a 3.00 average during their first term in the M.Eng. program in order 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-hour minimum requirement. However, these courses are included in calculating grade point averages.

2.12 Office Space, Mail, etc.

The Engineering Management students have space allocated in 404 Hollister. This space includes:

- Individual study carrels
- Group study areas
- Eight computer workstations
- Thirty-two individual lockers for storage of books, etc.
- Storage areas above study carrels and computer workstations (not lockable)
- Laptop charging table
- Printers (available via wireless access from your laptops or directly from the work stations)

We do not recommend leaving valuable items in the lockers or storage space above the workstations as they are not very secure.

Entrance into the M.Eng. office is via your ID card. Your ID will also open outside doors to Hollister Hall and the Graduate Student lounge in Hollister Hall.

Each student will be provided a folder bearing his or her name in the graduate student mail file located in the Main Office (220 Hollister). You should check your folder frequently, not only for incoming mail, but also for messages from the Engineering Management Chair, your advisor, or other Cornell sources such as the Graduate School. This mail folder is provided for campus mail and notices; you should have your personal mail sent to your local residential address.

The bulletin board outside of the GPC's office is specifically for announcements relative to all graduate students and concentrations within CEE. You should get into the habit of checking the bulletin board on a regular basis. We try to keep it updated with program topics, seminar speaker announcements, Graduate School notices, and other important messages.

2.13 Job Placement

We are confident that the background you receive in your M.Eng. program in Engineering Management will be of great assistance to you in the job market. Employers have always been enthusiastic about Cornell graduates with M.Eng. degrees in Engineering Management.

The Engineering Co-op and Career Services Office (201 Carpenter Hall) offers an extensive recruitment program with many interviewers coming to campus each year. You should visit this office early in the fall term and take advantage of the excellent opportunities it offers. The University Career Services Office has a series of special lectures on how to approach the job market, how to prepare resumes, how to take interviews, etc. Announcements of these lectures and meetings will be posted throughout Hollister Hall.

Many opportunities also are available with private engineering companies, industries, and agencies that do not routinely interview on campuses because they are relatively small. Do not hesitate to ask faculty with whom you work for advice on jobs. Many of the faculty have excellent connections to professional firms and will be happy to pass along notices they receive about jobs or help you identify potential employers. Job listings and descriptions are also posted on CEE's website: www.cee.cornell.edu. There are many routes to explore in seeking the right engineering position; the key point to remember is that you must take the initiative.

2.14 Miscellaneous

The Graduate School will place a “hold” on your diploma if certification of your undergraduate degree has not been received (official final transcript showing date undergraduate degree was awarded). Holds will also be placed on your diploma if you have any outstanding debts with the university or have not returned library books. Please make sure Bursar charges and library fines are paid, all Graduate School paperwork has been processed, and all library books are returned at least one week before Commencement.

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. However, 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 be reported truthfully at all times. 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 Student's Office). Also, a copy of the "University Code of Academic Integrity" is included in the *Handbook of Engineering Students* available from the Engineering College's Office of Admissions and Undergraduate Programs located near the north entrance of Hollister Hall.

3.2 Persons With Special Needs

Cornell University is committed to assisting those persons with disabilities who have special needs. 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. Other questions or requests for special assistance also should be directed to that office.

**APPENDIX A
ENGINEERING MANAGEMENT PROGRAM FACULTY
AND THEIR INTERESTS**

Paul G. Carr, Adjunct Associate Professor (Ph.D. Virginia Tech): construction engineering and management.

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

Huaizhu "Oliver" Gao, Associate Professor (Ph.D. California/Davis): transportation and air quality, systems engineering, statistical modeling.

Kenneth C. Hover, P.E., Professor (Ph.D. Cornell): concrete design, construction, and materials behavior.

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

Patrick M. Reed, Professor (Ph.D. Illinois): Environmental and water resources systems; multiobjective planning and management, evolutionary computation; high-performance computing; uncertainty in decision making.

Christine A. Shoemaker, Professor (NAE, Ph.D. Southern California): water resource and water quality systems; watershed modeling; groundwater contamination; optimization algorithms.

Jery R. Stedinger, Professor (NAE, Ph.D. Harvard): stochastic hydrology; water resource systems planning and operations; risk analysis and management.

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

APPENDIX B FIVE SEMESTER M.ENG./MBA PROGRAM

What is it?

A joint venture between the College of Engineering and the Johnson Graduate School of Management (JGSM) that allows students to acquire a Master of Engineering degree and an MBA degree in 5 semesters (usually based on Fall admission to the M.Eng. program). The dual-degree program consists of 75 credit hours, 30 of which comprise the regular two-semester M.Eng. program. For those admitted to the MBA program, the JGSM allows some (occasionally all) of these M.Eng. credits to be transferred to the MBA program, usually resulting in saving one semester's time over taking the M.Eng. and MBA degree programs separately.

What are the requirements?

Applicants must have already earned a baccalaureate degree in engineering, applied science, or equivalent from Cornell or elsewhere and be accepted for admission or presently enrolled in the M.Eng. program. **The two programs require separate application forms and review processes, and materials submitted to one program are not available to the other.** The JGSM places great emphasis on relevant work experience, and this will be taken into consideration when evaluating applications. All requirements of the Master of Engineering (EM) program are to be completed. No credit toward the M.Eng. degree is allowed for coursework done outside Cornell. All requirements of the Master of Business Administration curriculum are to be completed. Coursework done outside Cornell normally will not be credited toward the MBA degree.

If you are interested in this program, do the following (the following dates are based on Fall enrollment):

- a. If you have been admitted to or are attending the M.Eng. program, formally apply to the Johnson Graduate School of Management by the second semester of your M.Eng. program at the latest. You must fill out a separate JGSM application form and pay their application fee. You should also notify your M.Eng. advisor of your intention to do the MBA program so your advisor can take this into consideration when planning your M.Eng. program schedule.
- b. If you have not already done so, apply to take the GMAT or GRE (either acceptable) and is required by JGSM. January of your M.Eng. year as your last possible test date. Have the scores directed to JGSM

If you are admitted to the JGSM, your Master of Engineering degree will be awarded when all requirements of that degree are completed (usually after 2 semesters), and the Master of Business Administration degree will be awarded when all requirements of that degree are completed (usually after 3 more semesters). The two degrees can not be awarded simultaneously.

In general, financial aid is not awarded to those doing the MBA portion of the program except through the Knight Joint Degree Scholarship Program, which has very strict requirements. Information and an application to the Scholarship Program is available on the web at:

http://www.engineering.cornell.edu/student-services/orgspe/student-resources/fellowships-aid/upload/Knight_App.pdf

Questions about this Scholarship Program should be directed to the Office of Research and Graduate Studies, 222 Carpenter Hall, Cornell University, Ithaca, New York 14853 (607-255-7413; enr_grad@cornell.edu)

APPENDIX C

MASTERS IN PUBLIC ADMINISTRATION (M.P.A.) FROM THE CORNELL INSTITUTE FOR PUBLIC AFFAIRS (CIPA)

After the award of the M. Eng. degree, CEE M.Eng students who aspire to a leadership or management position in formulating, implementing or evaluating public policies can benefit from a program that offers an accelerated path to a Masters in Public Administration (M.P.A.) from the Cornell Institute for Public Affairs (CIPA,). CIPA offers a flexible and challenging two-year program of graduate professional studies in public affairs that prepares degree recipients for careers in public affairs, public administration, and public policy.

Concentration areas offered in CIPA include Environmental Policy; Science, Technology and Infrastructure Policy; Economic and Financial Policy; International Development; and Public and Nonprofit Management.

The two degree programs (MEng and M.P.A.) have separate admission processes; so you may apply to the Accelerated M.P.A. program upon completion of your first semester in the M.Eng program. The M.Eng students who possess an M.Eng. can obtain the M.P.A. degree in three additional semesters. Applicants should plan on meeting with the CIPA Director of Graduate Studies to discuss which M.Eng credits would be transferable for the MPA program.

Please contact the C.I.P.A. Office at 607-255-8018 or cipa@cornell.edu to set up an appointment. More information is available on the CIPA website at www.cipa.cornell.edu.

APPENDIX D

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. Thus EM 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 EM courses provide examples of these issues, and reinforce and advance these skills. But we depend upon all the EM 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.

Specifically we expect the following. [For clarification we provide references to sections in Jay L. Devore, *Probability and Statistics for Engineering and the Sciences*, 7th edition, Duxbury, Belmont, CA, 2008. See also <http://allpsych.com/stats/index.html>]

1. Students should know the 3 *basic axioms for probability*. [Devore §2.1-2.2]
{ $P(A) \geq 0$; $P(S) = 1$; for A and B disjoint, $P[A \cup B] = P[A] + P[B]$ }
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 μ , 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 the 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 α) and II (denoted β) 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* $Y = \alpha + \beta x + \varepsilon$, with independent additive normal errors ε . [Devore §12.1]
12. Students should be able to calculate *least-squares estimators* of the two coefficients α and β , 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]

(Students must submit a new form for approval when program changes are proposed)

NAME: _____ ADVISOR: _____

Student ID: _____ Project Title: _____

Duration of program (Number of semesters) _____

First Semester Term _____

Second Semester Term _____

Third Semester Term _____

REQUIRED COURSES		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments
CEE 5900	Project Management	4				
CEE 5910	Project - only available in second or third semester of program	4				
CEE 5930	Engineering Management Methods	4				
CEE 5970 OR CEE 5980	Risk Analysis and Management _____ Introduction to Decision Analysis _____	3				

FINANCE/ACCOUNTING ELECTIVE (1 required)¹		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments

BEHAVIOR ELECTIVE (1 required)²		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments

SPECIALIZATION ELECTIVES (3 required)³		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments

SEMINARS (Indicate if Participatory or Non-Participatory)⁴		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments
CEE 6095	Special Topics in Engineering Mgmt.	1				

ALL OTHER COURSES		Cr.	Semester# 1	Semester# 2	Semester# 3	Comments

Total Credits for all Courses⁵ _____

You must be registered for at least 12 credits each semester of your program

TOTAL M.Eng. PROGRAM CREDIT HOURS: _____ (must equal or exceed 30)

Advisor Signature: _____

Date: _____

EM Director Signature: _____

Date: _____

Notes:

¹ One course in Finance/Accounting is required. Suggested courses appropriate for a student's background in accounting and engineering economics are listed below.

<u>Student's Background</u>	<u>Suggested Courses</u>
No background in accounting	NBA 5530 – Finance & Accounting for Engineers
Some accounting, but no engineering economics	ORIE 5150 – Economic Analysis of Engr. Systems
Some background in both accounting and engineering economics	NCC 5560 – Managerial Finance

² One course in individual and/or organizational behavior is required. Suggested courses include:

CEE 6900 Creativity, Innovation and Leadership (**not offered Spring, 2016**)
NCC 5530 Marketing Management
NCC 5540 Management & Organizations
NBA 6630 Managerial Decision Making
NBA 6660 Negotiations
ILROB 5200 Organizational Behavior & Analysis

³ Each student's program must include three electives selected to provide an area of specialization. *At least two of the three courses must be technical in nature and at least one of the three should be from Engineering.* The student has an option of selecting either a disciplinary specialization or a functional specialization.

Johnson School courses that may be considered as technical specialization courses include:

NBA 5180 Data Mining for Marketing, Sales...
NBA 5270 Applied Price Theory
NBA 6000 Strategic Role of IT
NBA 6010 Electronic Commerce
NBA 6120 Disruptive Technologies
NBA 6390 Data-Driven Marketing
NBA 6410 Logistics and Manufacturing Strategy

Disciplinary specialization - The student can select three courses that form a natural extension to the technical work done in their undergraduate major, providing greater depth in that discipline. In most cases, these will be courses at the 5000 or 6000 level in the undergraduate major field. In some cases, courses in a related field will be most appropriate; for example, a student who was an undergraduate in electrical engineering might choose coursework in computer science or materials science. The student and their advisor are responsible for determining an appropriate selection of courses.

Functional specialization - Such a specialization will often involve courses selected from two, or even three, departments, but which focus on a particular area of application. The following illustrative functional specialization areas (with examples of appropriate courses for each) are intended to offer ideas that may be useful, but are not intended to be an exhaustive list of possibilities. The student and their advisor can create other options, subject to approval by the Director of the Engineering Management Program.

Decision Support and Systems Development

SYSEN 5100	Applied Systems Engineering
SYSEN 5200	System Architecture, Behavior and Optimization
SYSEN 5300	Design and Operation of Reliable Systems
CEE 5290	Heuristic Methods for Optimization
CRP 5080	Introduction to Geographic Information Systems
CS 4302	Web Information Systems
CS 4320	Introduction to Database Systems
CS 5150	Software Engineering
NBA 6010	Electronic Commerce
NBA 6120	Disruptive Technologies

Energy Systems Management

A&EP 4840	Controlled Fusion
A&EP 6330	Nuclear Reactor Engineering
ChemE 6610	Air Pollution Control
ChemE 6640	Energy Economics
ChemE 6650	Energy Engineering
ChemE 6660	Analysis of Sustainable Energy Systems
ECE 4510	Electric Power Systems I
ECE 4520	Electric Power Systems II
MAE 5010	Future Energy Systems
MAE 5020	Wind Power

Environmental Systems Management

CEE 6200	Water Resource Systems Engineering
CEE 6230	Environmental Quality Systems Engr.
CEE 5980	Introduction to Decision Analysis
CEE 6530	Water Chemistry for Environmental Engineering
CEE 6550	Transport, Mixing and Transformation in the Environment
CEE 6560	Physical/Chemical Processes
ChemE 6610	Air Pollution Control

Manufacturing Management

NBA 6410	Logistics and Manufacturing Strategy
OR&IE 5100	Design of Manufacturing Systems
OR&IE 5126	Supply Chain Management
OR&IE 5120	Production Planning and Scheduling Theory and Practice
OR&IE 5122	Inventory Management

Property Development and Construction

CEE 5950	Construction Planning and Operations
CEE 6750	Concrete Materials & Construction
CRP 5320	Real Estate Development Process
CRP 5330	Real Estate Marketing & Management
CRP 5560	Design in Real Estate Development
CRP 5530	Land Use Regulations
HADM 5240	Real Estate Location Analysis
HADM 6200	Principles of Real Estate
HADM 6280	Real Estate Finance and Investments

Systems Engineering

SYSEN 5100	Applied Systems Engineering
SYSEN 5200	System Architecture, Behavior and Optimization
SYSEN 5300	Design and Operation of Reliable Systems
CEE 5290	Heuristic Methods for Optimization
M&AE 4780	Feedback Control Systems
CS 5150	Software Engineering
OR&IE 5100	Design of Manufacturing Systems

⁴ Credit for seminars toward the MEng degree only count if the format of the seminar is “participatory” (i.e. requires more than attendance).

⁵ All courses you are taking should be listed whether or not they count in the MEng program. No more than 20 credits per semester (MEng and non-MEng) may be taken except by petition to the College Master of Engineering Committee.

APPENDIX F

2015-16 COURSES OF STUDY FOR CEE 59XX SERIES AND OTHER KEY COURSES

CEE Courses

CEE 5900: Project Management

Fall, Spring, 4 credits. Prerequisite: permission of instructor. F. J. Wayno.

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.

CEE 5910: Engineering Management Project

Fall, 4 credits. Prerequisite: permission of instructor. F. Vanek

Intensive evaluation of the management aspects of a major engineering project or system. Most students work on a large group project in the area of project management, but students may also work singly or in small groups on an engineering management topic of special interest to them.

CEE 5930: Engineering Management Methods: Data, Information, and Modeling

Spring, 4 credits. Prerequisites: CEE 3040 or equivalent. M. A. Turnquist.

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.

CEE 5950: Construction Planning and Operations

Fall, 3 credits.

Prepares students for responsibilities in overseeing the engineering and management of construction; on time—on budget. Emphasis is placed on the management processes for organizing, planning, and controlling the activities of complex development and construction programs. Students study the contracts for engineering, architecture, and construction; focusing on cost estimation and schedule control, responsibilities and risks, and the relationships among owners, designers, contractors, and suppliers. The potential for project disruption is discussed with special emphasis on dispute resolution methods.

CEE 5970: Risk Analysis and Management

Spring, 3 credits. Prerequisite: introduction to probability and statistics (e.g. CEE 3040, ENGRD 2700, ILRST 2100, or AEM 2100); two semesters of calculus; senior or graduate standing, or permission of instructor. J.R. Stedinger.

Develops a working knowledge of risk terminology and reliability engineering, analytic tools and models used to analyze environmental and technological risks, and social and psychological risk issues. Discus-

sions address life risks in the United States historical accidents, natural hazards, threat assessment, transportation risks, industrial accidents, waste incineration, air pollution modeling, public health, regulatory policy, risk communication, and risk management.

CEE 5980 - Introduction to Decision Analysis

Fall. 3 credits. Prerequisite: introduction to probability and statistics course such as CEE 3040 , ENGRD 2700 , ILRST 2100 , BTRY 3010 , or AEM 2100 . Enrollment is limited to: seniors and graduate students; or permission of instructor.

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.

CEE 6900: Creativity, Innovation, and Leadership (not offered Spring, 2015)

Spring. 3 credits. Prerequisite or corequisite: CEE 5900 or permission of instructor. F.J. Wayno

Graduate course designed to help aspiring engineering managers to better understand individual creativity and organizational innovation and to develop the skills required to play a productive role in fostering both. Not incidentally, the course will also help students who take it to become more creative themselves. The course is highly participatory and has a flow that moves from the individual → to the group → to the organization, with theory, research results, and practical skills-development woven seamlessly together.

Finance/Accounting Courses

NBA 5530: Accounting and Financial Analysis for Engineers

Spring. 3 credits. Course intended for non-Johnson School students only. J. D'Souza, M. Shackell-Dowell

This course focuses on basic financial and managerial accounting and the economic and financial concepts that have a bearing on managerial decisions. The goals of the course are: 1) to give students a working knowledge of the accounting process and the value and limitations of the data that comes out of the accounting information system; 2) to familiarize students with key concepts in managerial accounting and the application of cost information to pricing and operating decisions; and 3) to promote an understanding of the use of economic theory in the evaluation of capital investment projects. The teaching methods consist of lectures and cases. Students are evaluated on the basis of exams.

NCC 5560: Managerial Finance

Fall, Spring. 3 credits. Course intended for non-Johnson School students only.

An introduction to business finance through theory and case studies. Topics include stock and bond valuation, the capital-budgeting decision, portfolio theory, asset-pricing models, raising capital, capital structure, mergers and acquisitions, costs of capital, option pricing, and risk management. International applications are considered within each topic area. Letter grade only, based on exam, group case reports, homework and class participation.

ORIE 5150: Economic Analysis of Engineering Systems

Spring. 4 credits. Prerequisites: ORIE 3150.

Course topics include financial planning, including cash-flow analysis and inventory flow models; engineering economic analysis, including discounted cash flows and taxation effects; application of optimization techniques, as in equipment replacement or capacity expansion models, and issues in designing manufacturing systems. Includes a student group project.

Individual and Organizational Behavior Courses**NBA 6660: Negotiations**

Spring. 3 credits.

Judgment is the art and science of transforming perception into thought or opinion. Negotiation is the art and science of securing agreements between two or more independent parties. The purpose of this course is to understand the theory and processes of negotiation as it is practiced in a variety of settings. This course is designed to complement the technical and diagnostic skills learned in other courses. A basic premise of the course is that while a manager needs analytical skills to develop optimal solutions to problems, a broad array of negotiation skills are needed for these solutions to be accepted and implemented. The course highlights the components of an effective negotiation and teaches students to analyze their own behavior in negotiations. The course is largely experimental, providing students with an opportunity to develop their skills by participating in negotiations and integrating their experiences with the principles presented in the assigned readings and course discussions.

NCC 5530: Marketing Management

Fall, Spring. 3 credits. Course intended for non-Johnson School students only.

The course addresses controllable and uncontrollable marketing variables that managers in multi-product firms face in today's business environment. Topics include customer behavior, product planning, distribution, advertising and promotion, pricing, and competitive strategy.

NCC 5540: Management and Leading in Organizations

Fall, Spring. 3 credits.

This course takes a resource-based approach to management by arguing that organizations should link their strategy to their internal resources and capabilities. This theme is developed by addressing: 1) the strategic value of internal resources and capabilities; 2) the role of human resources and organizational behavior in formulating and implementing strategy; and 3) the importance of structure and the design of organizations in formulating and implementing strategy. Included among the topics are how firms create sustainable competitive advantage through internal resources and capabilities; what the best practices are for managing people; what effects best practices have on attitudes and behaviors; why putting the customer first is not necessarily best practice from a resource-based perspective; why organizational culture is central to organizational effectiveness; why the formal organizational chart and structure of an organization are important; how organizations innovate; how organizations change through re-architecture and re-engineering; what firms gain and lose through pursuing core competencies; and what firms gain through strategic alliances and networks. The course makes extensive use of case materials.

APPENDIX G

OVERALL LISTING OF CEE COURSE INFORMATION:

For an up to date listing of all CEE courses, please visit:

<https://classes.cornell.edu/browse/roster/FA15/subject/CEE>

(please note that the CEE spring 2016 course roster will be available by mid-September.

All other course listings/rosters for the Fall 2015 term can be found at

<https://classes.cornell.edu/browse/roster/FA15> with the spring courses being available by mid-September.