BU Division of Systems Engineering

Graduate Student Handbook for Masters Students

Fall 2016
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College of Engineering GPA Requirement for Awarding Master of Science, Master of Engineering and PhD degrees

Master’s students must earn a grade point average of at least 3.00 in the set of courses used to satisfy the program requirements for the degree.

Doctoral students must complete all degree program requirements and earn a cumulative grade point average of at least 3.00 to be awarded a degree. The cumulative grade point average includes all coursework taken after matriculation and all courses completed prior to matriculation submitted in fulfillment of degree requirements.

College of Engineering Graduate Student Academic Standards Policy

Academic Standards
The academic progress of every graduate student is reviewed at the end of each semester. Failure to make satisfactory progress and remain in Good Standing can result in Academic Probation, Suspension for a stated time or until stated conditions are met, or Dismissal, as detailed below.

Grades of C– or lower are not acceptable for master’s degrees; Grades of C+ or lower for PhD students are interpreted as failures.

Good Standing
Students maintain good academic standing when they: (1) earn a semester GPA of at least 3.00 (students enrolled only in Pass/Fail courses are exempt from the semester GPA standard); and (2) maintain a cumulative GPA of at least 3.00.

Academic Probation
A student is put on Academic Probation when s/he earns a semester or cumulative GPA below 3.00. Students on Academic Probation may have their financial aid discontinued. In the event that the semester or cumulative GPA is below a 2.00, a student may be dismissed from the program.

Students are reviewed after one semester on Academic Probation. Those who earn a semester and cumulative GPA of 3.00 or above will return to Good Standing. Those students who do not achieve Good Standing (as defined above) after the probationary semester will be subject to Academic Suspension, Dismissal, or an additional semester of Academic Probation as determined by the College on a case-by-case basis.

Academic Suspension
A student on Academic Probation faces Academic Suspension or Dismissal when s/he has not achieved Good Standing (as defined above) after the most recent semester of Academic Probation. Specifics regarding Dismissal or the duration and terms of the Academic Suspension will be determined by the College on a case-by-case basis. Dismissal results in permanent separation from the University. Appeals of Dismissal or Suspension are directed to the Associate Dean for Academic Programs.

Reinstatement after Academic Suspension
Students who have fulfilled their period of Academic Suspension must meet with their academic advisor and must also reestablish their standing in the College by contacting the College of Engineering Graduate Programs Office.
College of Engineering Master of Science and Master of Engineering degrees “with Engineering Practice”

The College of Engineering offers an Engineering Practice degree option to students in all of its Masters programs. Engineering Practice is a valuable opportunity for a student at the masters level to complete an approved internship integral to their program of study, thereby allowing them to develop additional technical and professional skills. Students interested in the Engineering Practice degree option must apply and meet the requirements outlined below. Students successfully completing the Engineering Practice degree option of their program will earn the accompanying degree designation (e.g., Master of Science in Electrical Engineering with Engineering Practice).

Internships used to complete the degree requirements must be relevant to the student’s program of study and must go through a program level approval process. Satisfactory completion of the requirement is determined by the program and then formally recorded by the Graduate Programs Office.

Requirements and Grading

- An internship site and project must be approved by the student’s faculty advisor.
- A mid-point review between the student and the internship supervisor must be conducted and submitted.
- Before the end of the semester in which the internship takes place, a final report must be submitted and reviewed by the Academic Advisor.
- Students receive a grade of Pass or Fail. The final grade is based on satisfactory completion of all requirements and is determined by the academic advisor in consultation with the internship supervisor.

For International Students

- International students must have completed two semesters in full-time status to be eligible to begin an internship in the United States, and they must complete additional paperwork with the BU International Students and Scholars Office (ISSO) after registration.
- International Students with an off campus internship must complete the Curricular Practical Training (CPT) form, and bring the approved Engineering Practice Approval form and the CPT form to the ISSO for review and approval for off-campus curricular practical training.

Summary of Course Requirements for SE Masters Students

MEng Degree Requirements

MEng students must take 32 credits, all of which must be at the 500 level or higher and 16 credits of which must be structured courses. Courses used to satisfy the Core requirements cannot also be used to satisfy the Concentration requirements.

Master of Engineering students must maintain a cumulative GPA of 3.0 to remain in good academic standing and to graduate. All graduate courses are counted in the GPA. Only grades of C or better fulfill MEng curricular requirements.
Curriculum

The 32 credits must be selected as follows:

- **Core** (two courses)
- **Concentration** (two courses)
- **Advanced technical course requirement** (at least two courses 500-level or higher from the systems engineering concentration areas, or courses approved in advance by the Systems Engineering Graduate Committee).
- **Practicum Requirement** through satisfactory completion of project-based graduate courses approved by the Division.
- **Elective(s)** The remaining required MEng credit hours remain unstructured and can be chosen, with advisor approval, to meet an individual student’s academic needs.

MS Degree Requirements

Master of Science (MS) must take 32 credits. Courses must be at the 500-level or higher. Courses used to satisfy the Core requirements cannot also be used to satisfy the Concentration requirement.

Master of Science students must maintain a cumulative GPA of 3.0 to remain in good academic standing and to graduate. All graduate courses are counted in the GPA. Only grades of C or better fulfill MS curricular requirements.

- **Core** (three courses)
- **Concentration** (two courses)
- **Electives** (4-8 credits)
- **Practicum** (4-8 credits)
- **Advanced technical course requirement** (at least two 700-level or higher Core or Concentration courses or courses approved in advance by the Systems Engineering Graduate Committee)
- Elective and Practicum courses are flexible and can be chosen, with advisor approval, to meet an individual student’s academic needs.
- MS Non-Thesis track students may include no more than one Engineering Management course.

MS with Thesis Degree Requirements

Master of Science (MS) must take 32 credits. Courses must be at the 500-level or higher. Courses used to satisfy the Core requirements cannot also be used to satisfy the Concentration requirement.

Master of Science students must maintain a cumulative GPA of 3.0 to remain in good academic standing and to graduate. All graduate courses are counted in the GPA. Only grades of C or better fulfill MS curricular requirements.

- **Core** (three courses)
• **Concentration** (two courses)
• **Electives** (4-8 credits)
• **Thesis** (4-8 credits, MS 954 MS Thesis or MS 900 PhD Research; students will complete the Practicum requirement through their Thesis requirement)
• **Advanced technical course requirement** (at least two 700-level or higher Core or Concentration courses or courses approved in advance by the Systems Engineering Graduate Committee)
• Elective and Practicum courses are flexible and can be chosen, with advisor approval, to meet an individual student’s academic needs.
• MS Non-Thesis track students may include no more than one Engineering Management course.

**MS with Thesis Logistics**

MS candidates choosing the thesis option must enroll in MS 954 MS Thesis or MS 900 PhD Research for at least 4, but no more than 8, credits toward their MS. Thesis work is likely to entail several semesters of research; as a result, completion of the master’s degree usually requires more than one year. Students are therefore encouraged to discuss their research interests with faculty at the beginning of their master’s program.

Before a student enrolls in ENG SE MS 954 MS Thesis or MS 900 PhD Research, a Thesis Committee must be formed and the student should submit to the SE Graduate Programs Manager a thesis plan signed by the members of the student’s committee. The Thesis Committee consists of a thesis advisor and at least one additional reader (at least one member of the SE faculty). The student must submit a written thesis proposal (approved by the readers) at least one semester before the thesis presentation, and no later than the first semester of enrollment in ENG MS 954 MS Thesis or MS 900 PhD Research. The MS Thesis Proposal and Committee Approval Form and the MS Final Thesis Presentation Form are online.

The thesis is publicly presented with the members of the student’s Thesis Committee present, and the final version must be approved by all readers. The deadline for submission of the thesis is one month prior to graduation.

**Thesis Requirements** – An MS thesis must be written and defended successfully to satisfy the requirements of the MS with Thesis degree. The thesis committee should have at least two members, one of which must be an SE appointed faculty member.

**Finding a Research Home**

**Research Opportunities in the Division** – Most students choose to do their research with a faculty member from the SE Department or affiliated research centers. To find out more about specific research programs, please visit the individual faculty member webpages via the SE, Center for Information and Systems Engineering (CISE) or faculty website.

**Research Project** – A major requirement for the MS with Thesis degree is a research-based thesis. Each student is responsible for finding a research project, conducting scientific studies under the guidance of an approved faculty member, presenting the proposal and results to the general scientific community in a public defense and finally turning in a thesis to be bound for the library and the SE Division.
**Academic vs. Research Advisors** – Each new student is assigned an academic advisor when entering the program. The Graduate Programs Manager will notify incoming students about their advisor assignment prior to registration. The student’s academic advisor can provide general information/guidance and help the student to complete his/her course registration for the first year.

**Research Rotations** – Masters students may seek out laboratory rotations during the first year. This provides the students an opportunity to gain exposure to more than one research area and to help in identifying a good match with a research advisor. After finding a lab, the research advisor will be in charge of the student’s research project and will help coordinate the student’s schedule towards fulfilling all of the graduation requirements. MS with Thesis students are expected to choose a research advisor no later than the end of the second semester of matriculation (April 30). When a student chooses his/her research advisor, that person automatically becomes the student’s academic advisor as well.

**Who Can Be A Research Advisor** – For MS with Thesis students, any full-time member of the SE faculty, or any affiliated or adjunct faculty member who has an appointment with the Division, is eligible to serve as a research advisor.

**Finding a Research Advisor and Project** – Occasionally students enter the program with a specific research advisor in mind and may even plan to work on a specific project. The majority of students, however, will utilize the first two semesters to determine what their specific interests are in the field of systems engineering and identify the opportunities for funding in a professor’s lab. MS with Thesis students typically connect with their research advisors through (1) doing rotations and deciding upon a research area; (2) through coursework, informal discussions with faculty and, most importantly, arranging lab rotations. An easy way to find out what is available is to check the list of current Faculty Research Interests and SE Laboratory and Research Center Descriptions, available on the SE website.

Another valuable way of learning more about specific research opportunities is to speak with other graduate students who are currently working in the various SE faculty labs. The best measure for learning about working in a specific lab is to make an appointment to speak with the faculty member in charge of a lab you are interested in. Some useful questions to ask him/her are:

1. What projects are currently going on and what projects are planned for the near future?
2. What background is required to work in the lab?
3. How is the lab funded and is there the possibility of funds for a new graduate student?
4. What expectations does the faculty member have of graduate students?
5. If the potential advisor has been at BU for at least a few years, does he/she have a strong history of training students in a timely manner? Have his/her students generally been successful?

Once a student finds a research opportunity and has the consent of a faculty member to be his/her advisor, the process of developing a research project begins.

**Patent Policy Agreement** – Students who receive support from sponsored research programs or who make significant use of BU funds and facilities are required to sign the BU Patent Policy Agreement. Seek counsel with your faculty advisor about this policy pertaining to intellectual property. A signed form is required before a student can be paid. The Patent Policy Agreement form is on the Division website.
**Thesis Topic** – A research problem is selected after initial discussions between the research advisor and the student. The development of a thesis topic is typically a cooperative effort between the student and research advisor. Commonly, the advisor initially suggests a problem to be addressed, but the student is expected to contribute ideas and thought as to how to approach the problem.

**Thesis Committee** – By the end of the second semester following matriculation, MS with Thesis candidates are required to form a Thesis Committee with a minimum of two members. The student’s research advisor will be the chairman of the thesis committee.

If a researcher from outside the University serves on a student’s committee, a Special Service Appointment Form (available online) must be completed and submitted to the Division Graduate Programs Manager for division approval. The completed form and a copy of the person’s curriculum vitae, with the Associate Chair for Graduate Studies’ signature, will then be submitted to the Graduate Programs Office. The Thesis Committee is charged with assessing the appropriateness of the research problem and the student’s preparation, based on the written proposal and the oral presentation. The Thesis Committee must approve that the Thesis is at a stage appropriate for scheduling the final presentation via their signature on the Final Thesis Presentation form.

**Written Thesis** – Candidates shall demonstrate their abilities for independent research and scholarship by completing a thesis in their field of study. The thesis will be primarily guided by the first reader (advisor), with the advice of the other member(s) of the Thesis Committee. The thesis should represent original scientific/engineering contributions that are appropriate for publication in a recognized peer-reviewed journal. The thesis is defended at a presentation open to the entire BU community.

Guidelines for preparing the thesis and its abstract, according to the requirements of the University Microfilms International, are distributed by Mugar Library to all doctoral candidates and are available on the SE website.

Although students will have an opportunity to make final revisions to the thesis and abstract after their Final Thesis Presentation, they should not regard their Final Presentation version as a “rough draft”.

**Final Thesis Presentation** – The MS Final Thesis Presentation form is located on the SE website under “Online Forms and Documents”. The Thesis Presentation is a public presentation of the candidate’s thesis. The presentation should clearly define the problem, describe the method(s) used to solve the problem, report results and establish significance of the results. The purpose of the Final Thesis Presentation is to ensure that the thesis constitutes a worthy contribution to knowledge in the candidate’s field and that the candidate has attained an expertise in his/her field of research specialization.

**Scheduling the Final Thesis Presentation** – It is the student’s responsibility for scheduling a date, location and time with all the Thesis Committee members for the examination. Conference room reservations can be requested via the SE website.

At least two weeks prior to the Thesis Presentation date, the candidate must submit the MS Final Thesis Presentation form to the Division Graduate Programs Manager, including an electronic version of the abstract. Before submitting this form, the candidate must have provided a copy of the thesis document to all members of the Final Thesis Presentation committee and obtained their ORIGINAL
signatures on this form indicating 1) that they have been provided a copy of the thesis and 2) agree that it is ready to be defended. This form must also contain the date, time, location and abstract.

**Conduct and Length of the Final Thesis Presentation** – The faculty research advisor or chair should introduce the candidate and include a brief academic background description. The candidate should restrict the length of the examination to approximately one-hour. During this period, either the Thesis Committee members or audience may ask questions of clarification. The chair should guard against digression and inappropriate questioning during the presentation. After the presentation, a reasonable period of questioning will follow, and then the audience will be dismissed. The Thesis Committee may wish at this time to ask additional questions of the candidate. Following this additional questioning, the candidate should be excused and the committee should complete its assessment of the examination.

**Assessment** – The Thesis Committee is charged with assessing completeness of the research, contribution to knowledge, and the candidate’s mastery of his/her research area, based on the written thesis and the oral presentation. Vote may be ballot or voice. A unanimous vote is required for a candidate to pass.

It is the chair’s responsibility to call the candidate back after the Thesis Committee has reached a decision. The chair will advise the student of the committee’s decision. At this time the candidate will be advised of any changes that must be made to the final title, abstract or thesis document, with a deadline provided by the Thesis Committee.

**Reporting** – The College’s MS Final Thesis Presentation Form must be completed at the examination, with specific indication of whether the title, abstract and thesis are acceptable as they stand. If ALL requirements are acceptable, the committee members should sign the signature pages of the thesis. If there is some rework to be done, this is to be noted on the Final Oral Exam form. Thesis Defense Committee members should sign off on the form but will refrain from signing the signatures page of the thesis until all conditions have been met UNLESS faculty will be traveling at the time of library submission in which case all but one (usually the advisor) Committee member may sign the signature pages. The last signature will be added when all revisions are completed.

**Thesis Approval and Library Submission** – The signatures of the Thesis Defense Committee members on the thesis signatures page, if not given at the Final Oral Examination itself, will indicate final approval of the title, abstract and thesis. Once signatures have been obtained, the student must submit the following (minimum) unbound thesis copies to the Division Graduate Programs Manager for binding: one copy for the SE Department and one personal copy for the advisor. Copies for the Thesis Committee are optional and to be submitted for binding at the candidate’s discretion. All copies must have original signatures pages.

The Associate Chair for Graduate Studies gives final approval on the Final Oral Examination form. The student will then follow the electronic submission guidelines provided by Mugar Library. The Division Graduate Programs Manager will provide departmental electronic approval for the student upon seeing the 1) original signatures page and 2) title page.

The Division Graduate Programs Manager will handle the binding of the additional thesis copies. The cost for hardbound copies is $10.00 per copy (subsidized by the SE Division). Thesis to be hardbound are sent to an external bindery once a year (early fall). Students who submit a personal copy for binding should be sure to leave a correct forwarding address after graduation so that their hardbound copy of
the thesis can be mailed.

Financial Information

Students receiving any form of financial support for graduate studies are not permitted additional employment without prior written approval from both the student’s advisor and the SE Graduate Committee. These forms of financial support include BU Fellowships (Dean’s, SE, Photonics, etc.), Training Grant Fellowships, Research Assistantships and other external Fellowships (NSF, NIH, foreign government fellowships or other foundations).

Stipend Paychecks – All students are expected to have a bank account in the U.S. Direct Deposit of payments to your bank account is the norm for most students. If you elect not to use direct deposit, paychecks can be picked up at the BU Payroll Office at 25 Buick Street on the last Friday of the month. Students with one-academic-year BU fellowships (Dean’s, SE, Photonics, etc.) should secure a funded Research Assistantship no later than the end of their first academic year (April 30).

Research Assistantships – Research Assistantships are offered by individual faculty members with sponsored research grants. A Research Assistant is a member of a research group in a laboratory or center. The position offers close association with members of the faculty and is a very effective arrangement for graduate study. Work on the thesis project is normally part of an assistant’s assignments. RA’s are expected to work full-time, with time allowed for courses during the academic year.

College of Engineering policy on stipend levels:
• All Masters students on a Research Assistantship or Fellowship will receive the same monthly stipend at the base rate.

Student Payroll-Related Deadlines
• Summer Payroll
  All students must register for Fall by April 1. (PhD students graduating in September must register for 2 credits of research in SUM1.)
  First Year Students must have a research advisor and funding secured by April 1.
• Fall Payroll
  Students typically have no deadline to consider.
• Spring Payroll
  Students must register by December 1.

Payroll Set Up – The Division Graduate Programs Manager will coordinate with other department managers and Payroll Coordinators to make sure that student funding is set up each semester prior to the account settlement date. In order to be set up on Payroll, students must register according to the Student Payroll-Related Deadlines listed above. First Year PhD students must notify the Graduate Programs Manager when a research advisor and summer funding is confirmed.

• Students must register according to the Student Payroll-Related Deadlines listed above
• Setting-up the student on payroll; Coordinated by the Graduate Programs Manager in conjunction with the Department Grant Administrator overseeing the grant that funds the student’s stipend
• Settling the student’s tuition account by Isabel Tereso in the Graduate Programs Office
• Settling the student’s health insurance payment by Isabel Tereso in the Graduate Programs Office

**Tuition** – RA’s supported full-time by a faculty’s sponsored research grant typically receive tuition coverage. Eligible RA’s receive 8 credits of tuition, applicable to their degree, each semester they serve as an RA during the academic year.

**In order to be paid during the Summer** – Students must register for EK 920S for the Summer I term (0 credits) prior to the start of the summer session. International students must also pre-register for the Fall semester, prior to the start of the Summer term.

The exception to registering for EK 920S are: If you plan to complete your thesis or thesis during the summer and graduate in September, then you are required to register for two credits of SE MS 954 MS Thesis or MS 900 PhD Research

**Summer Stipends and Tax Withholding** – Students funded on fellowships other than NIH will have FICA taxes withheld from their paychecks during the summer (May, June, July and August).

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**Logistical Information**

**Previous Masters theses** are available for review in the Division. Please see the Division Graduate Programs Manager for access.

**Printing Facility** - The SE copy room has a color printer, black and white printer, scanner, and copy machine available. Students must request card access to EMB 120.

**Email** – SE uses electronic mail as a medium for official communication. Please be sure to check your BU email account on a daily basis for important information, and make sure that your account is not filled up.

**Mailing address** – Division of Systems Engineering, Boston University, 15 Saint Mary’s Street, Room 118, Brookline, MA 02446.

**Graduate Student Concerns** – Any matters concerning leave of absences, medical leave of absences or maternity leaves should be discussed with the Division Graduate Programs Manager and/or the Associate Division Head for Graduate Studies.

**SE Kitchenette** – Masters students may request access to the EMB 120 kitchenette (including a refrigerator, microwave, coffee maker, toaster oven) that are available for faculty, graduate students and staff in EMB and EMA.

**Room Access** – Students who need access to Division space should request card access via Zaius (http://www.bu.edu/dbin/eng/zaius/).

• **Division Graduate Student Code** – Division Grad Students Only (15 Saint Mary’s Street entrance, Rooms 118 and 120, 730 Commonwealth Avenue entrances)
• EMB (15 St. Mary’s) 121A Kitchen

Staff Directory

SE Graduate Programs Staff
• Professor Hua Wang, Associate Division Head for Graduate Programs, wangh@bu.edu
• Elizabeth Flagg, Division Graduate Programs Manager, eflagg@bu.edu, 617-358-0351

SE Division Staff
• Christos Cassandras, Division Head, cgc@bu.edu
• Ruth Mason, Director, rmason@bu.edu
• Cheryl Stewart, Communications Manager, cstewart@bu.edu

Center for Information and Systems Engineering (CISE) Staff
• Christina Polyzos, Associate Director, cpolyzos@bu.edu
• Denise Joseph, Administrator, dejoseph@bu.edu

College of Engineering Staff
• Kenneth Lutchen, Dean, klutch@bu.edu
• Solomon Eisenberg, Senior Associate Dean for ENG Academic Programs, sre@bu.edu
• Catherine Klapperich, Associate Dean for ENG Research and Technology Development, catherin@bu.edu
• Domenic Lomanno, Director of Graduate Programs, dlonanno@bu.edu
• Isabel Tereso, Assistant Director of Graduate Programs, mit@bu.edu
• Linda Hession, Graduate Records, hession@bu.edu
Master of Engineering (MEng) students must take 32 credits all of which must be at the 500 level or higher. The coursework requirements for the MEng degree are as follows: Core (2 courses), Concentration (2 courses from one concentration area), and Electives (4 courses, including 2 Advanced Technical Electives). The Advanced Technical Elective Requirement is satisfied by taking at least two 500-level or higher courses from the SE-designated courses in the Concentration or Elective course lists, or other courses approved by the Systems Engineering Graduate Committee in advance. The Elective courses may be chosen to meet an individual student’s academic needs. The Electives may include no more than two Engineering Management courses listed on the reverse. The choice of courses must form a coherent and balanced program in Systems Engineering. Among the 32 credits, the Practicum Requirement can be satisfied by up to two courses from the approved list. MEng students should make their course selection in consultation with their faculty advisor. MEng students must maintain a cumulative GPA of 3.00 to remain in good academic standing and to graduate. Grades of “C–” or lower are not acceptable for the MEng degree.

NOTE: Courses are color coded to indicate when they are usually offered, in Fall, Spring, either semester (subject to change). Courses may be offered every other year.

### Course Requirements

**Core** Select one course from each of two Core areas – 8 credits
- A. SE/EC/ME 501 Dynamic Systems Theory, or SE/EC/ME 710 Dynamic Programming and Stochastic Control Semester/Grade ________________
- B. SE/EC 524 Optimization Theory and Methods Semester/Grade ________________
- C. SE/ME 714 Adv Stoch Modeling/Simulation, or EC 505 Stochastic Processes, or EK 500 Probability with Stat App Semester/Grade ________________

**Concentration** Select two courses from one Concentration area listed on reverse – 8 credits
Circle the Concentration Area:
- A. Computational and Systems Biology
- B. Control Systems
- C. Energy and Environmental Systems
- D. Network Systems
- E. Operations Research
- F. Production and Service Systems

**ELECTIVES** Select 4 courses (16 credits). Must include at least two 500-level SE-designated courses from the Concentrations listed on the reverse, if not used to satisfy the Concentration requirement; other Suggested Electives listed on the reverse; may include up to 8 credits from the approved Engineering Management courses listed on the reverse. Indicate course number, semester, and grade.

Course/Semester/Grade ________________
Course/Semester/Grade ________________
Course/Semester/Grade ________________
Course/Semester/Grade ________________

**PRACTICUM** Indicate up to two courses (8 cr), from the approved list on the reverse, used to satisfy Core, Concentration or Elective Requirements.

Course/Sem Grade ________________
Course/Sem Grade ________________
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Division of Systems Engineering
MEng Program Planning Sheet, Page 2

Concentration Areas

A. Computational and Systems Biology
- ENG BE 555 Molecular Bioengineering
- ENG BE 561 DNA and Protein Structure Analysis
- ENG BE 562 Computational Biology: Genomes, Networks, Evolution
- ENG BE 567 Nonlinear Dynamics in Biological Systems
- ENG BE 747 Adv. Signals and Systems Analysis for Biomedical Eng
- ENG BE 760 Structural Bioinformatics
- ENG BE 777 Computational Genomics

B. Control Systems
- ENG SE/EC/ME 503 Dynamic Systems Theory
- ENG ME/MS 507 Process Modeling and Control
- ENG ME/MS 560 Precision Machine Design and Instrumentation
- ENG ME 570 Robot Motion Planning
- ENG SE/EC/ME 701 Optimal and Robust Control
- ENG EC 702 Recursive Estimation and Optimal Filtering
- ENG SE/ME 704 Adaptive Control
- ENG SE/EC/ME 710 Dynamic Programming and Stochastic Control
- ENG SE/EC/ME 733 Discrete Event and Hybrid Systems*
- ENG SE/EC/ME 734 Hybrid Systems
- ENG SE/ME 740 Vision Robotics and Planning
- ENG SE/ME 762 Nonlinear Systems and Control

C. Energy and Environmental Systems
- CAS EC 513 Game Theory (both semesters)
- ENG SE/EC/ME 543 Sustainable Power Systems
- ENG ME/MS 545 Electromechanics of Fuel Cells and Batteries
- CAS EC 571 Energy and Environmental Economics
- CAS EC 572 Public Control of Business
- ENG EC/MS 573 Solar Energy Systems
- GRS GE 712 Regional Energy Modeling

Approved Practicum Courses:

1. EK 691 Lean and Agile New Product Development
2. Two of the following, OR
   - ENG ME/EC 507 Process Modeling and Control
   - ENG ME/EC 534 Simulation
   - ENG SE/EC/ME 543 Sustainable Power Systems
   - ENG SE/EC/ME 544 Networking, the Physical World
   - ENG ME 570 Robot Motion Planning
   - ENG SE/EC/ME 701 Optimal and Robust Control
   - ENG EC 702 Recursive Estimation and Optimal Filtering
   - ENG SE/ME 704 Adaptive Control
   - ENG SE/EC/ME 710 Dynamic Programming and Stochastic Control
   - ENG SE/EC/ME 724 Advanced Optimization Theory and Methods
   - ENG SE/ME 740 Vision Robotics and Planning
   - ENG SE/EC/ME 755 Communication Networks Control
   - ENG SE/ME 762 Nonlinear Systems and Control
   - ENG SE/ME 764 Mobile Ad Hoc Networking and Computing
   - ENG SE/ME 766 Advanced Scheduling Models and Methods

ELECTIVE COURSES

Other Suggested Electives:
- CAS CS 510 Object-Oriented Software Principles
- ENG SE 700 Advanced Special Topics
- GSM OM 855 Project Management
- ENG SE 951 Independent Study

Engineering Management Courses
- ENG EK 731 Biomedical Innovation
- ENG ME 502 Innovation: Technology Creation, Protection, & Commercialization
- ENG ME 517 Product Development

Fall 2016
MS (Non-Thesis) Program Planning Sheet

Boston University College of Engineering
Division of Systems Engineering
MS (Non-Thesis) Program Planning Sheet

Student Name: ____________________________________________
Advisor Signature: _______________________________________

BU ID ________________

MS (Non-Thesis) students must take 32 credits, all of which must be at the 500 level or higher. The coursework requirements for the MS (Non-Thesis) are as follows: Core (3 courses), Concentration (2 courses), and Elective (3 courses). Among the 32 credits, the Practicum Requirement is satisfied by up to two courses from the approved list. Electives are chosen, with advisor approval, to meet an individual student’s academic needs. MS students must also satisfy the advanced technical course requirement by taking at least two 700-level or higher courses from the Systems courses below, on the reverse, or courses approved by the Systems Engineering Graduate Committee in advance. MS students must maintain a cumulative GPA of 3.00 to remain in good academic standing and to graduate. Grades of “C-” or lower are not acceptable for the MS degree.

NOTE: Courses are color coded to indicate when they are usually offered, in Fall, Spring, or either semester (subject to change). Courses may be offered every other year.

CORE: Select one course from each of the following three Core areas (12 credits).

A. Computational and Systems Biology
   - ENG EE 557 Molecular Bioengineering
   - ENG EE 561 DNA and Protein Sequence Analysis
   - ENG EE 562 Computational Biology: Genomics, Networks, Evolution
   - ENG EE 563 Nonlinear Dynamics in Biological Systems
   - ENG EE 574 Adv. Signals and Systems Analysis for Biomedical Eng
   - ENG BS 760 Structural Bioinformatics
   - ENG BS 767 Protein and Genomic Systems Engineering
   - ENG BS 777 Computational Genomics

B. Control Systems
   - ENG SE/EC/ME 543 Dynamic Systems Theory
   - ENG SE/EC/ME 544 Dynamic Programming and Stochastic Control
   - ENG SE/EC/ME 570 Robotic Motion Planning
   - ENG SE/EC/ME 701 Optimal and Robust Control
   - ENG SE/EC/ME 702 Recursive Estimation and Optimal Filtering
   - ENG SE/EC/ME 704 Adaptive Control
   - ENG SE/EC/ME 710 Dynamic Programming and Stochastic Control
   - ENG SE/EC/ME 713 Discrete Event and Hybrid Systems
   - ENG SE/EC/ME 734 Hybrid Systems
   - ENG SE/EC/ME 740 Vision Robotics and Planning
   - ENG SE/EC/ME 762 Nonlinear Systems and Control

C. Energy and Environmental Systems
   - CAS EC 510 Game Theory (both semesters)
   - ENG EE/ME 543 Sustainable Power Systems
   - ENG EE/ME 545 Electrosynthesis of Fuel Cells and Batteries
   - CAS EC 571 Energy and Environmental Economics
   - CAS EC 572 Public Control of Business
   - ENG EE/ME 573 Solar Energy Systems
   - GRS GE 712 Regional Energy Modeling
   - GRSE 716 Game Theory
   - GSM OM 845 Clean Technology Business Models

ELECTIVE: Select 3 courses from the Concentrations listed above, if not used to satisfy the Concentration Requirement, from the other Suggested Electives listed on the reverse, or no more than one Engineering Management Course from the approved list (12 credits).

Course/Semester/Grade ____________________________
Course/Semester/Grade ____________________________
Course/Semester/Grade ____________________________

PRACTICUM: Indicate up to two courses (8cr), from the approved list on the next page, used to satisfy Core, Concentration, or Elective requirements.

Course/Semester/Grade ____________________________
Course/Semester/Grade ____________________________

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ELECTIVE COURSES

Other Suggested Electives:
CAS EC 513 Game Theory
ENG MS 700 Advanced Special Topics
GRS EC 716 Game Theory
CAS CS 511 Object-Oriented Software Principles
GSM OM 855 Project Management
ENG SE 951 Independent Study
ENG SE 954 MS Thesis

Engineering Management Courses (no more than one permitted)
ENG ME 502 Invention: Technology Creation, Protection, & Commercialization
ENG ME 517 Product Development
ENG ME 525 Technology Ventures
ENG ME 550 Product Supply Chain Design
ENG ME 583 Product Management
ENG ME 584 Manufacturing Strategy
ENG EK 691 Lean and Agile New Product Development
GSM OB 848 E1 The Leadership Challenge
GSM SI 839 Design & Innovation Strategy
GSM SI 852 Starting New Ventures
GSM PL 870 Gov’t, Society, & the New Entrepreneur
ENG EK 731/GSM HM 801 Bench to Bedside

Approved Practicum Courses:

1. SE 925 Graduate Project, OR

2. Two of the following, OR
   • ENG ME/MS 507 Process Modeling and Control
   • ENG ME/EC 514 Simulation
   • ENG SE/EC/ME 543 Sustainable Power Systems
   • ENG SE/EC/ME 544 Networking the Physical World
   • ENG ME 570 Robot Motion Planning
   • ENG SE/EC/ME 701 Optimal and Robust Control
   • ENG EC 702 Recursive Estimation and Optimal Filtering
   • ENG SE/ME 704 Adaptive Control
   • ENG SE/EC/ME 710 Dynamic Programming and Stochastic Control
   • ENG EC 715 Wireless Communications
   • ENG SE/EC/ME 724 Advanced Optimization Theory and Methods
   • ENG SE/EC/ME 725 Queuing Systems
   • ENG SE/EC/ME 732 Combinatorial Optimization and Graph Algorithms
   • ENG SE/EC/ME 733 Discrete Event and Hybrid Systems
   • ENG SE/ME/EC/EC 734 Hybrid Systems
   • ENG SE/ME 740 Vision Robotics and Planning
   • ENG SE/EC 741 Randomized Network Algorithms
   • ENG EC 744 Mobile Networking and Computing
   • ENG SE/ME 755 Communication Networks Control
   • ENG SE/ME 762 Nonlinear Systems and Control
   • ENG SE/ME 765 Production System Design
   • ENG SE/ME 766 Advanced Scheduling Models and Methods

3. A Practicum Course from other College of Engineering departments:
   • ENG ME 526 – Simulation of Physical Processes
   • ENG ME 560 Precision Machine Design and Instrumentation
   • ENG EK 691 Lean and Agile New Product Development
   • ENG BE 700 Advanced Topics in Biomedical Engineering
   • ENG EC 952 Directed Group Project

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**Student Name:**  
**Advisor Signature:**  
**BU ID**

MS (Thesis) students must take 32 credits all of which must be at the 500 level or higher. The coursework requirements for the MS (Thesis) are as follows:

**Core** (3 courses), **Concentration** (2 courses), **Elective** (4-8 credits), and **Thesis** (4-8 credits). The Practicum Requirement is satisfied by 4 credits of SE 954 Thesis or SE 950 Research (PhD Only). Courses used to satisfy the Core requirement may not also be used to satisfy the Concentration or Elective requirements. Elective courses may be chosen, with advisor approval, to meet an individual student’s academic needs. MS students must also satisfy the advanced technical course requirement by taking at least two 700-level or higher courses from the Concentration areas, or courses approved by the Systems Engineering Graduate Committee in advance. MS students must maintain a cumulative GPA of 3.00 to remain in good academic standing and to graduate. Grades of “C-” or lower are not acceptable for the MS degree. **NOTE:** Courses are color coded to indicate when they are usually offered, in Fall, Spring, either semester (subject to change). Courses may be offered every other year.

**CORE** (Select one course from each Core area. 12 credits.)

A. ENG BE/ME 501 Dynamic Systems Theory, or ENG EC/ME 710 Dynamic Programming and Stochastic Control  
Semester/Grade ______________________________

B. SE/EC 524 Optimization Theory and Methods  
Semester/Grade ______________________________

C. SE/ME 714 Adv Stoch Modeling and Sim, or IC 505 Stoch Processes, or EE 500 Probability with Statistical Applications  
Semester/Grade ______________________________

**CONCENTRATION** (Select two courses from one Concentration area.)

A. Computational and Systems Biology  
ENG BE 505 Molecular Bioengineering  
ENG BE 561 DNA and Protein Sequencing Analysis  
ENG BE 562 Computational Biology: Genomes, Networks, Evolution  
ENG BE 567 Nonlinear Dynamics in Biological Systems  
ENG BE 747 Adv. Signals and Systems Analysis for Biomedical Eng  
ENG BE 760 Structural Biomechanics  
ENG BE 767 Protein and Genetic Systems Engineering  
ENG BE 777 Computational Genomics I  

B. Control Systems  
ENG SE/EC/ME 511 Dynamic Systems Theory  
ENG ME/MS 507 Process Modeling and Control  
ENG ME 560 Precision Machine Design and Instrumentation  
ENG ME 570 Robot Motion Planning  
ENG SE/EC/ME 701 Optimal and Robust Control  
ENG EC 702 Recursive Estimation and Optimal Filtering  
ENG SE/ME 704 Adaptive Control  
ENG SE/ME/EC 710 Dynamic Programming and Stochastic Control  
ENG SE/EC/ME 738 Discrete Event and Hybrid Systems  
ENG SE/ME/EC 734 Hybrid Systems  
ENG SE/ME 740 Vision Robotics and Planning  
ENG SE/ME 762 Nonlinear Systems and Control  

C. Energy and Environmental Systems  
CAS EC 511 Game Theory (both semesters)  
ENG SE/EC/ME 543 Sustainable Power Systems  
ENG ME/MS 545 Electrochemistry of Fuel Cells and Batteries  
CAS EC 571 Energy and Environmental Economics  
CAS EC 572 Public Control of Business  
ENG ME/MS 573 Solar Energy Systems  
GRS GE 712 Regional Energy Modeling  
GRS EC 716 Game Theory  
GSM OM 845 Clean Technology Business Models  

D. Network Systems  
ENG EC 541 Computer Communication Networks  
ENG SE/EC/ME 544 Networking the Physical World  
ENG EC 715 Wireless Communications  
ENG SE/EC/ME 725 Queueing Systems  
ENG SE/EC/741 Randomized Network Algorithms  
ENG EC 744 Mobile Ad Hoc Networking and Computing  
ENG SE/ME 755 Communication Networks Control  

E. Operations Research  
ENG ME/EC 514 Simulation  
ENG SE/EC/ME 710 Dynamic Programming and Stochastic Control  
ENG SE/ME 714 Advanced Stochastic Modeling and Simulation  
ENG SE/EC/ME 724 Advanced Optimization Theory and Methods  
ENG SE/EC/ME 725 Queueing Systems  
ENG SE/EC/ME 732 Combinatorial Optimization and Graph Algorithms  
ENG SE/EC/ME 733 Discrete Event and Hybrid Systems  
ENG SE/ME 766 Advanced Programming Models and Methods  

F. Production and Service Systems  
ENG ME 510 Production Systems Analysis  
ENG SE/EC/ME 543 Sustainable Power Systems  
ENG SE/ME 733 Discrete Event and Hybrid Systems  
ENG SE/ME 765 Production System Design  
ENG SE/ME 766 Advanced Programming Models and Methods  
GSM OM 726 Creating Value Through Operations and Technology  
GSM OM 854 Supply Chain Management  

**Elective** (4-8 credits. Courses from the Concentrations listed above or suggested below. No more than one Engineering Management Course may be selected from the approved list.)

1. Course/Semester/Grade ______________________________  
2. Course/Semester/Grade ______________________________  

Suggested Electives: CAS EC 511 Object-Oriented Software Principles, CAS EC 513 Game Theory, ENG SE 700 Advanced Special Topics, GRS EC 516 Game Theory, GSM OM 855 Project Mgt, ENG SE 900 Research (PhD Only), SE 925 Graduate Project, or SE 950 Independent Study.

**Thesis:** (4-8 credits of SE 900 Research (PhD Only) or SE 954 Thesis.)

Course/Semester/Grade/Credits ______________________________  
Course/Semester/Grade/Credits ______________________________

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