**Instructor:** James R. McCusker PhD / Gloria Ma PhD  
**Office Location:** Dobbs 209 / Kingman 212  
**Office Hours:** TBA  
**Email:** mccuskerj@wit.edu / mag@wit.edu  
**Telephone:** (617) 989-4799 / 617-989-4607

**Meeting Times and Credits:**

This is a four-credit course. There will be one hour of lecture per week and 6 hours of laboratory sessions per week.

**Attendance:**

Attendance is required at team, faculty advisor(s) - group consultation, and every class meetings. Each student is expected to strive for 100% attendance.

**Catalog Description:**

This course is only for electromechanical students with senior status and the required prerequisite courses. Students will work in the electrical and mechanical fields alone and in small groups to study, analyze, design, and sometimes build and test concepts in a field of their choosing. The study will be performed under the direction of one or more faculty advisors. Projects from industry will be encouraged to increase the interaction and cooperation with local engineering firms. Course requirements include oral and written progress reports throughout the semester. The final technical report will detail the plans and schedule for the following Senior Design II.

**Prerequisites:**

MECH620 - Engineering Thermal Design  
ELEC820 - Feedback and Control  
MECH600 - Advanced Mechanics of Materials
Textbook:

No formal text is required

Recommended References:

• Strunk and White, The Elements of Style. McMillian Publishing Co.

• M. Horenstein, Engineering Design, A Day in the Life of Four Engineers. Prentice Hall, 1998


• H. Suh, Principals of Design, MIT Press.

• Instructor's notes

• Internet and Library resources. Device data sheets, manufacturers' application notes, and trade journal articles (depending on the project.)

Meeting Times:

<table>
<thead>
<tr>
<th>LECTURE:</th>
<th>Tuesday</th>
<th>2-2:50/3:00-3:50</th>
<th>RBSTN 105/ANXCN 306</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAB:</td>
<td>Monday</td>
<td>1-2:50</td>
<td>ANXCN103/ANXCN 201</td>
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<tr>
<td></td>
<td>Wednesday</td>
<td>1-2:50</td>
<td>ANXCN103/ANXCN 201</td>
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<tr>
<td></td>
<td>Friday</td>
<td>1-2:50</td>
<td>ANXCN103/ANXCN 201</td>
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Course Goals:

1. To develop and hone the skills necessary to move from the problem statement, to the design solution on paper, to the prototype, and finally to the actual product.

2. To gain familiarity in design methodologies (design and production process).

3. To gain familiarity with the business environment of engineering (competition, project planning, scheduling and cost analysis).

4. To develop project planning skills (task, time-lines, identification of resources, and decision making).

5. To provide training of the mind in innovation problem-solving techniques.
6. To develop professional communication skills (writing, effective oral "thinking-on-your feet" and business presentations.)

7. To develop competence in research, simulation, prototyping, time and financial budgeting, and component purchasing.

8. To develop lifelong design decision-making skills.

9. To develop lifelong learning strategies.

10. To develop team-working skills.

11. To have the student experience a complete design program, utilizing the steps learned in previous courses.

12. To expand the student's knowledge in technical literature and in particular, to encourage the student to employ resources other than undergraduate textbooks.

13. To develop a stronger sense of ethical issues in engineering design.

### Learning Outcomes:

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.</td>
<td>Evaluation based on student's ability to apply the design process. Rubric attached to syllabus.</td>
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<tr>
<td>a knowledge of contemporary issues</td>
<td>Evaluation based on written</td>
</tr>
<tr>
<td>Ability to communicate effectively</td>
<td>Evaluation based on final oral presentation and final written reports. Rubric attached to syllabus</td>
</tr>
</tbody>
</table>

### General Course Requirements, Instructional Methodologies, and Work Schedule:

Students work in teams of two or three students per project. Teams of more than three students are allowed by the instructor only for large projects. Each project is expected to be a high quality and creative engineering solution to a societal problem. Each project is selected to have an appropriate balance of an electrical component as well as a substantial mechanical component. The activities undertaken in each project include the following steps: (1) comprehend and analyze the need for an engineered solution, (2) define the problem from an engineering standpoint, (3) gather information, (4) plan the project, (5) conceptualize alternative approaches, (6) evaluate the design alternatives, (7) rationally select the best alternative, (8) implement the preferred design, (9) evaluate the design, and (10)
communicate the design and associated work using standard that are acceptable in industry, academia, and government. The engineering solution shall be a direct response to the need, and shall reflect serious attention to cost, safety, ethics, environmental and professional responsibility.

Project Idea:

It is hoped that each student coming into this course has at least one project in mind and that the prospective project has been thoroughly researched during the summer co-op semester. In the event that a few students do not have a project in mind already, the suggested project generator is recommended for finding a societal problem whose solution may be undertaken for this course.

Pre-proposal

The pre-proposal is due by the middle of the second week of classes (9/13). The pre-proposal form must be submitted on or before this date to allow time for consultation and changes if necessary.

Below is a suggested pre-proposal format:

a. What is the title of the proposed project?
b. Who are the team members?
c. What is the problem to be solved?
d. What are the objectives of the proposed project?
e. What labs, other facilities or processes (welding, machining, electronic fabrication, etc.) will be necessary?
f. What is the rough estimate of the overall cost?
g. At the end of the semester, what are the deliverables? and how would the project be evaluated?

Preliminary Topic Approval

Preliminary approval or rejection of the topic will be based on the written pre-proposal. The students are required to confer with the instructor(s) and discuss the pre-proposal.

Formal Proposal

By the fourth week of the semester, the team submits a written proposal on a selected topic to the instructor for approval (9/29). The proposal should contain a clear outline of what will be accomplished in the project, important design parameter and consideration, specifications, a schedule of anticipated progress during the semester, and an estimated budget. An oral presentation of the proposal is required at this time.

The following format is suggested for the Formal Proposal:

a. Summary / Abstract
b. Introduction
c. The Need
d. The Objectives
e. The Methods
f. Qualifications
g. The Evaluation
h. Deliverables and their Timetable/Gantt Chart
i. The Estimated Budget
j. Bibliography
k. Appendices

A lecture on proposal writing takes place during the third week of the semester.

**Class Presentations (week of 10/2-10/6)**

Each design team presents its proposed project to the class (formal attire is not required for this presentation). Each team is expected to show adequate predevelopment research of the project's topic as well as sound planning. Presentations will be limited to 20 minutes each.

**Weekly Consultations, Progress Memos and Time Sheets**

Each team is to have an extensive weekly consultation with the instructor(s) during the laboratory session of the course. During each weekly consultation, the team is required to submit a progress memo to the instructor. The memos are used to report on progress, problem areas that have developed, schedule status, and plans for the next reporting period as well as progress on the project. As a component of this memo, students will attach a time sheet indicating the tasks that each member performed and the amount of time allotted to each.

**Midsemester Progress Presentation**

In this presentation, the team discusses the progress to date, challenges encountered and the way they went about tackling them, and work plans between the present and next report. Here, classmates may ask questions pertaining to the project or can offer specific suggestions based upon their own experiences. Class participation is an important part of the oral presentations. The progress presentations are planned for the week of October 30th.

**End-of-Semester Report and Final Presentation (Due on 12/5)**

The final report, at the end of the semester, is a well-written comprehensive technical report on the project (with supporting theoretical material where applicable). All final diagrams, relevant computations, evaluation data, and artwork for printed circuit boards and mechanical systems should be included in the final report. Presentations of report material is to be done according to accepted and common engineering standards.

A comprehensive final oral presentation is also required at the end of the semester.
**Engineering Notebook**

Each student is to have an engineering notebook. The day-to-day activities, ideas, design calculations, evaluation data, mechanical sketches, flow charts, block diagrams, circuit sketches, and information pertinent to the project are to be recorded using conventional industrial procedures. All pages of the notebook must be pre-numbered, and all records must be dated. No page should be left blank and no page should be torn out. The use of pencil and eraser is not recommended. Photographs and critical printouts or data sheets should be taped or pasted to the notebook as needed. The notebook will be examined weekly, witnessed and signed by the instructor.

<table>
<thead>
<tr>
<th>Evaluation and Grading</th>
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<tbody>
<tr>
<td>Final oral presentation (in formal attire)</td>
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<tr>
<td>Final report (quality of writing as well as technical content)</td>
</tr>
<tr>
<td>Formal proposal (paper and presentation)</td>
</tr>
<tr>
<td>Quality of Engineering, Innovation and inventiveness, breadth and depth of analysis and quality of hardware if applicable</td>
</tr>
<tr>
<td>Weekly Progress Memos and Time Sheets</td>
</tr>
<tr>
<td>Mid-semester Progress Presentation</td>
</tr>
<tr>
<td>Engineering Notebook</td>
</tr>
<tr>
<td>Attendance</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

- All assignments must be completed in order to receive a passing grade in the course
- All group assignments are subject to correction through peer assessment. A student that does not contribute or is ineffective in working in a group may receive an up to 20% deduction in their grade for those particular assignments.
- If a member of a group does not contribute to a particular assignments, it is at the group’s discretion to omit their name from it. If this occurs, that member has the option to submit their contribution to that report within three days of the original due date. This submission will be graded on its own merit.
Grading Factors:

Attendance is required at team, faculty design advisor(s) and class meetings (with active participation)

• Work submitted late will not be accepted.

• Grade Differential within a Group.
  The Faculty Design Advisor(s) will determine a component of the grade differentials within a given group. This grade differential component will be determined by the relative contributions of the individual group members along with a peer assessment.

• Constructive Course Participation:
  The success of engineering design activities depends on the constructive participation of all team members. Constructive course participation includes
  1. Coming to class and team meetings promptly,
  2. Participating constructively to the team activities,
  3. Being part of the SOLUTIONS with a can-do attitude,
  4. Returning items that are due – on time

BONUS: Bonus credit can be achieved through submitting any aspect of your design project for publication to a conference or a journal, or submission of a patent application to the USPTO. A Paper describing the project that gets accepted for publication in a trade journal or a national conference will substitute for a final report, and will also earn the team extra credit on their final grade

Note: All written reports and memos must be type written. All written reports and memos must meet the standards of English I. Poorly written papers will be returned to the students, without grade, for revision. Students are encouraged to utilize the Center for Teaching and Learning Facility for help in polishing their papers. In addition, the Center for Teaching and Learning, located in Beatty 402, offers FREE tutoring in a number of subjects from all departments, and is open Monday-Friday (Monday-Thursday in the evenings). You are encouraged to visit the CTL web site http://www.academics/resource to make an appointment if you need extra help with your courses.

Consultation attendance policy: All consultations are mandatory for all group members. If any student fails to attend a scheduled consultation the final grade for the weekly progress memo as well as the engineering notebook will be reduced by 15% for each occurrence. This policy will also apply for a student's notebook grade, in the event that it does not represent sufficient progress over a given week.
Pre - proposal Form

1. What is the title of the proposed project?

2. What are the objectives of the proposed project?

   If the project is the continuation of a previous project in Thermal Design or Junior Design, you must mention that clearly and provide a copy of the previous report to the instructor.

3. Give a brief description of the proposed project and your plan of action.

4. What courses taken at Wentworth will be reflected (i.e.; theory from these courses) in your project?

5. Who will be the additional staff (peer person/persons) in the group?
6. What labs, other facilities or processes (welding, machining etc..) will be necessary?

7. What is your estimate of the overall cost of completing the project? Wentworth will not contribute unless the project is one involving laboratory equipment improvement or fabrication of new laboratory equipment for Wentworth. Can you find an external sponsor for this project? Wentworth will not contribute unless the project is one involving laboratory equipment improvement or fabrication of new laboratory equipment for Wentworth.

8. Once completed, how will the project be evaluated (graded); i.e. how will we (classmates and faculty) know how successful the project has been (how will we evaluate your project)? How are we going to know it is complete?

This question must be answered in detail in order to define the grading of your project.
<table>
<thead>
<tr>
<th>Week</th>
<th>Tentative Lecture Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Week 1: Course Introduction / Semester Plan / Pre-Proposal</td>
</tr>
</tbody>
</table>
| 2    | Week 2: Project Idea Generation/ Research / Engineering Notebook  
**Due:** Pre-proposal (Due) informal consultation |
| 3    | Week 3: Project Planning / Proposal Writing  
**Due:** Project pitch / class feedback |
| 4    | Week 4: Presentation Techniques / Project Funding  
**Due:** Formal Consultations memo/timesheet/notebook |
| 5    | Week 5: Solving open-ended problems  
**Due:** Proposal Report and Proposal Presentations |
| 6    | Week 6: Creativity in the Design Process  
**Due:** memo/timesheet/notebook |
| 7    | Week 7: Ethical and environmental concerns  
**Due:** memo/timesheet/notebook |
| 8    | Week 8: Information gathering design methodology, Technical analysis and Implementation skills  
**Due:** memo/timesheet/notebook |
| 9    | Week 9: Progress Presentations  
**Due:** Presentations |
| 10   | Week 10: Intellectual property concerns  
**Due:** memo/timesheet/notebook |
| 11   | Week 11: TBD  
**Due:** memo/timesheet/notebook |
| 12   | Week 12: TBD  
**Due:** memo/timesheet/notebook |
| 13   | Week 13: Final Presentation and Paper Preparation / Course Evaluations  
Weekly consultations optional |
| 14   | Week 14:  
**Due:** Final paper, Presentation, Peer review  
**Due:** Final Presentation |
|      | Finals Week: Pre-break consultation  
**Due:** Final Presentation |
**Wentworth Grading System:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Definition</th>
<th>Weight</th>
<th>Numerical</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Student learning and accomplishment</td>
<td>4.00</td>
<td>96-100</td>
</tr>
<tr>
<td>A-</td>
<td>far exceeds published objectives for the course/test/assignment and student work is distinguished consistently by its high level of competency and/or innovation.</td>
<td>3.67</td>
<td>92-95</td>
</tr>
<tr>
<td>B+</td>
<td>Student learning and accomplishment</td>
<td>3.33</td>
<td>88-91</td>
</tr>
<tr>
<td>B</td>
<td>goes beyond what is expected in the published objectives for the course/test/assignment and student work is frequently characterized by its special depth of understanding, development, and/or innovative experimentation.</td>
<td>3.00</td>
<td>84-87</td>
</tr>
<tr>
<td>B-</td>
<td>Student learning and accomplishment</td>
<td>2.67</td>
<td>80-83</td>
</tr>
<tr>
<td>C+</td>
<td>meets all published objectives for the course/test/assignment and student work demonstrates the expected level of understanding, and application of concepts introduced.</td>
<td>2.33</td>
<td>76-79</td>
</tr>
<tr>
<td>C</td>
<td>meets all published objectives for the course/test/assignment and student work demonstrates the expected level of understanding, and application of concepts introduced.</td>
<td>2.00</td>
<td>72-75</td>
</tr>
<tr>
<td>C-</td>
<td>Student learning and accomplishment</td>
<td>1.67</td>
<td>68-71</td>
</tr>
<tr>
<td>D+</td>
<td>based on the published objectives for the course/test/assignment and student work demonstrates the expected level of understanding, and application of concepts introduced.</td>
<td>1.33</td>
<td>64-67</td>
</tr>
<tr>
<td>D</td>
<td>based on the published objectives for the course/test/assignment and student work demonstrates the expected level of understanding, and application of concepts introduced.</td>
<td>1.00</td>
<td>60-63</td>
</tr>
<tr>
<td>F</td>
<td>Student learning and accomplishment</td>
<td>0.00</td>
<td>Less</td>
</tr>
<tr>
<td></td>
<td>based on the published objectives for the course/test/assignment and student work demonstrates the expected level of understanding, and application of concepts introduced.</td>
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</table>

**ADD/DROP:**

Students should check the academic calendar to confirm the add/drop deadline. Dropping and/or adding courses is done online. Courses dropped in this period are removed from the student’s record.

Non-attendance does not constitute dropping a course. If a student has registered for a course and subsequently withdraws or receives a failing grade in its prerequisite, then the student must drop that course. In some cases, the student will be dropped from that course by the Registrar.

However, it is the student’s responsibility to make sure that he or she meets the course prerequisites and to drop a course if the student has not successfully completed the prerequisite. The student must see his or her academic advisor or academic department chair for schedule revision and to discuss the impact of the failed or withdrawn course on the student’s degree status.
MAKE-UP POLICY:
All assignments must be submitted on the assigned due date. No late submissions will be accepted unless previously arranged with the course instructor(s).

ACADEMIC SUPPORT:
The Center for Academic Excellence facilitates Wentworth students’ academic success and helps them to achieve their full learning potential. Students may choose to receive individual assistance through one-on-one tutoring in many subjects, including math, science, writing, and major classes. In addition, the Center for Academic Excellence offers Facilitated Study Groups (FSGs), tutor-led study tables, academic workshops, and learning-strategy consultations. The peer-tutoring program is certified by the College Reading and Learning Association’s International Tutor Training Certification program. To make an appointment or to review our drop-in offerings, please visit www.wit.edu/cae. For additional assistance or support on subjects not listed, please reach out via email at cae@wit.edu.

ACADEMIC HONESTY STATEMENT:
Students at Wentworth are expected to be honest and forthright in their academic endeavors. Academic dishonesty includes cheating, prohibited collaboration, coercion, inventing false information or citations, plagiarism, tampering with computers, destroying other people’s coursework or lab or studio property, theft of course materials, or other academic misconduct. If you have any questions, contact your professor prior to submitting an assignment for evaluation. See your academic catalogue for a full list of definitions and the WIT Academic Honesty website for the procedures: wit.edu/academic-honesty.

STUDENT ACCOUNTABILITY STATEMENT:
Any cheating, plagiarism or copying of previous work to submit in the course will result in a zero for the assignments. Multiple occurrences will result in a final grade of F for the course.

WELLNESS AND DISABILITY SERVICES:
College can be challenging and it is common to feel overwhelmed or stressed at times. If these feelings are related to course work or academic performance, please talk to me. For more significant mental health concerns, the Center for Wellness and Disability Services (003 Watson Hall, 617-989-4390) provides free and confidential mental health counseling. If you or someone you know needs support around thoughts of suicide, the following resources are available:
• Center for Wellness and Disability Services, Watson 003, 617-989-4390, M-F 8:15-4:45
• Campus Police, First level of 610 Huntington Avenue, 617-989-4444, 24/7
• Samaritans, call or text 1-877-870-4673
• Crisis Text Line, text “start” to 741-741
• National Suicide Prevention Lifeline, call 1-800-273-8255
• GLBT Youth Hotline, call 1-866-488-7386
• Beth Israel Deaconess Emergency Room, 190 Pilgrim Rd Boston, MA

Students requiring academic accommodations must provide an official accommodation memo from the Center for Wellness and Disability Services and contact me privately to discuss logistics.
COLLEGE OF THE FENWAY STUDENTS:
If you are enrolled in this course through COF Cross Registration, notify your course instructor. Please provide her/him with your email address to be sure that you receive course information in a timely way. You should also discuss how to access online applications that might be used in the course.