IE/ME 497 & IE/ME 498
MIME CAPSTONE DESIGN
Fall 2011 & Winter 2012

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<tr>
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<th>ME 497/98 General</th>
<th>ME 497/98 SAE</th>
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<td>WGN 115/ GILB 124</td>
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<tr>
<td>Instructor:</td>
<td>John Parmigiani</td>
<td>Bob Paasch</td>
<td>Ken Funk</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:parmigjo@engr.orst.edu">parmigjo@engr.orst.edu</a></td>
<td><a href="mailto:paasch@engr.orst.edu">paasch@engr.orst.edu</a></td>
<td><a href="mailto:funk@engr.orst.edu">funk@engr.orst.edu</a></td>
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<tr>
<td>Phone:</td>
<td>541-737-7023</td>
<td>541-737-7019</td>
<td>541-737-2357</td>
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<tr>
<td>Office:</td>
<td>Dearborn 303F</td>
<td>Rogers 414</td>
<td>Rogers 212</td>
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<td>Office hours:</td>
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<tr>
<td>TA</td>
<td>Brian Grimm</td>
<td>TBA</td>
<td>Wei-Tau (Mike) Lee</td>
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</table>

Credits: Fall: 4
Winter: 4

Day/Time: Fall: TR 4:00–5:50 pm
Winter: MW 4:00–5:50 pm

Grading: Fall: 1000 pts
Winter: 1000 pts

Communication Liaison for all sections:
Tracy Ann Robinson  
tracy.ann.robinson@oregonstate.edu

COURSE OVERVIEW

IE/ME 497 and IE/ME 498, the School of Mechanical, Industrial, & Manufacturing Engineering’s capstone design sequence, gives MIME seniors the opportunity to integrate the engineering knowledge and experience they’ve gained throughout their undergraduate program and apply their skills to work on real-world engineering projects. To complete these projects, teams of students (1) work with sponsors, perform analyses, and conduct research to develop requirements for a mechanical or industrial system or solution to a mechanical or industrial engineering problem; (2) design the system or solution methods; (3) implement a prototype, model, or method according to the system or solution design; (4) operate the prototype, model, or method; (5) evaluate the prototype, model, or method with respect to the project requirements; (6) document the process, products, and results; and (7) manage the projects.

Each student team works on a distinct project. In addition to being supervised and evaluated by one of the course instructors, each team works with a representative of the project’s sponsor or customer (“sponsor mentor”) and a MIME advisor who provides technical guidance and consulting. In addition to their technical roles, the sponsor mentor and MIME advisor evaluate student performance and provide input to the course instructors for grading purposes. For some projects, the sponsor mentor and MIME advisor may be the same person. In rare cases, one of the course instructors may fill all three roles.

IE/ME 497 & IE/ME 498 is also the School of MIME’s designated writing-intensive course sequence that satisfies the university’s WIC requirement. Course participants complete a variety of written and oral assignments that support the engineering design process, further their engineering communication skills,
and otherwise prepare them for success in their chosen profession. In completing these assignments, students are expected to review and respond to one another’s writing in a professional and collegial manner; revise individually and collaboratively produced drafts; and use informal writing techniques to explore and solve engineering analysis, design, and evaluation problems.

**COURSE-SPECIFIC LEARNING OUTCOMES**

At the completion of MIME Capstone Design, students will be able to perform the following tasks:

1. Starting from a sponsor’s statements of need, work with the sponsor, perform appropriate research and analyses, and apply relevant engineering standards to develop formal requirements for a mechanical system, an industrial system, or the solution to a mechanical or industrial problem.
2. Considering multiple alternative approaches, design and implement a prototype, model, or method to meet those requirements by correctly applying appropriate engineering principles.
3. Operate or implement the prototype, model, or method and evaluate the results against the requirements using objective performance measures.
4. Plan and manage the project so as to use team resources efficiently and meet project requirements on time and on or under budget.
5. Recognize and constructively address ethical dilemmas that may arise and potential adverse environmental, safety, health, and social impacts.
6. Collaboratively produce written and oral reports that effectively communicate project information to target audiences—i.e., that are at the appropriate technical level for these audiences and follow disciplinary conventions of usage, vocabulary, format, and citation.
7. Function effectively on a team, contributing to all major aspects of the design, implementation, and testing of an engineering project.

**ABET PROGRAM OUTCOMES**

In developing your skills in product design and development, the MIME capstone design course sequence directly supports ABET Program Outcome c, “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.”

In focusing on the communication and teamwork skills needed for producing formal engineering reports and preparing and delivering professional-quality oral presentations, thinking critically about local and global design issues, and working collaboratively on engineering projects, this course sequence also supports ABET Program Outcome d, “Ability to focus on multidisciplinary teams,” and g, “Ability to communicate effectively.”

Finally, the content of this capstone design course sequence also supports ABET Program Outcome f, “Understanding of professional and ethical responsibility” and i “Recognition of the need for, and ability to engage in, lifelong learning.”

**WIC PROGRAM OUTCOMES**

Students will

1. Develop and articulate content knowledge and critical thinking in the discipline through frequent practice of informal and formal writing.
2. Demonstrate knowledge/understanding of audience expectations, genres, and conventions
appropriate to communicating in the discipline.

3. Demonstrate the ability to compose a document of at least 2000 words through multiple aspects of writing, including brainstorming, drafting, using sources appropriately, and revising comprehensively after receiving feedback on a draft.

**POLICY REGARDING STUDENTS WITH DISABILITIES**
Accommodations for students with disabilities will be made according to University policy. Accommodations are collaborative efforts between students, faculty, and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

**POLICY REGARDING STUDENT ACADEMIC DISHONESTY AND CONDUCT**
Instances of student academic dishonesty and improper conduct will be dealt with according to University policy. Students are referred to [http://oregonstate.edu/admin/stucon/achon.htm](http://oregonstate.edu/admin/stucon/achon.htm) for a definition and examples of academic dishonesty and improper conduct.

**MACHINING LAB CERTIFICATION**
For students completing senior projects with significant mechanical design requirements, certification to work in the MIME machining lab is strongly encouraged. If you are not certified, contact Brian Jensen immediately to schedule your certification. Lack of machining lab certification is not a valid excuse for your project being over budget or behind schedule or otherwise failing to meet course requirements.

**CATIA**
Students on teams assigned to projects involving the Baja SAE and Formula SAE vehicles will be using CATIA V5. If you do not have working knowledge of CATIA V5 for part and assembly modeling, you should enroll in ME 249: Project (CATIA). Inexperience with CATIA is not a valid excuse for your project being over budget or behind schedule or otherwise failing to meet course expectations and requirements.

**ME 206**
All students involved in ME 497/98 SAE projects are strongly encouraged to attend the ME 206 lectures. ME 206 provides background theory on race car design and advice on practical applications.

**GRAF HALL WORKSPACE**
Project workspace is available in Graf on a first-come, first-served basis. See Prof. Parmigiani’s GTA for availability. Use of this space is subject to the following guideline and rules:

1. Project workspaces must be kept neat, clean, organized, and safe at all times. The instructors reserve the right to deduct up to 100 course points for failure to comply with this requirement.
2. Unless approved by a course instructor, the workspace must be completely emptied by the end of winter term. Failure to comply with this requirement will result in a course grade of Incomplete.
3. At least one other student must be present at all times when machinery, steam, compressed air, or electrical devices are used.
4. Students may not use the space after hours.
5. Unauthorized students are not allowed access to the space.
6. Other teams’ equipment/supplies in the space must not be disturbed.
ATTENDANCE POLICY
Attendance is required at all instructor-scheduled class and team meetings (i.e., everything listed on the class schedule). Your signature on the attendance sheet indicates that you have attended the entire class session. You are permitted two absences without penalty; for every absence beyond the second, your course grade will be reduced by 1/3 of a letter grade (e.g. A to A- to B+ to B). Attendance will be taken with sign-in sheets.

1. It is your responsibility to sign-in during class and to check the course web site to verify that your attendance has been recorded correctly.
2. Do not sign-in for someone else. This is academic dishonesty and will be dealt with accordingly.
3. Sign in ONLY if you attend the entire class or meeting

HOUSE OF QUALITY
Any changes to the House of Quality (customer requirements, engineering requirements, testing plans, etc.) must be done using the procedure presented in class. Unauthorized changes are not valid and will result in a grade penalty.

A fully approved House of Quality is required to pass IE/ME 497. If a team does not have an approved House of Quality at the end of IE/ME 497, all team members will receive an I/F grade for IE/ME 497 and will not be permitted to take IE/ME 498.

PROJECT REPORT ASSIGNMENT STRUCTURE
The final project written report, which will be completed by the end of IE/ME 498, documents the entire design project. This substantial document will be produced sequentially, starting with the Background Report, continuing with the Preliminary and Final Proposals, and culminating in the Final Report. Each subsequent project document will incorporate and expand on the contents of the previous document, revised as necessary to meet the current assignment requirements, address reviewer comments on the previous report iteration, and contain document-appropriate language. (For example, final proposal narrative written in the future tense will need to be converted to past tense in the final report, the latter being a project retrospective.)

The project report template will be provided on the course web site and you are required to adhere to this template. Scoring rubrics for each of the report iterations will also be provided; be sure to consult these when completing the assignments. Note to students: There are many opportunities to express your creativity in capstone design; however, modifying the format of the templates provided for written reports, oral presentations, etc., is not one of them. Follow the supplied templates.

Much of the writing in IE/ME 497 & IE/ME 498 is produced collaboratively, meaning it is generated as a team. In order to produce coherent collaboratively written documents, each section of each of these documents will be under the editorial control of designated “lead editor” (see the assignment descriptions later in this syllabus). Every team member has lead editor responsibilities at least once per term.

PROJECT MANAGER
In order to simplify communication, one team member must be designated as the project manager. If possible, this person needs to be available fall, winter, and spring term (to coordinate and set up the team’s Engineering Expo display). If not available spring term, the project manager must arrange for the Expo display to be set-up in their absence.

CITING SOURCES
In completing the background research for your design project, you are expected to consult multiple sources, and these sources must be cited correctly in your project report. Unless your MIME advisor specifically requests a different citation format, use whichever of the following applies to you,
• Students enrolled in ME 497/98 SAE should use SAE citation format (see http://volunteers.sae.org/authors/references.htm).

• Students enrolled in ME 497/98 General and IE 497/498 should use IEEE citation format (see http://www.ieee.org/portal/cms_docs_iportals/iportals/publications/subservices/confpub/ieeecitationref.pdf)

IE/ME 497 ASSIGNMENTS
1000 total course points

There are two types of assignments for the course: graded and ungraded. Both types of assignments are required, and failure to complete any of them on time and per specifications will affect your course grade. Ungraded assignments that are not completed satisfactorily or on time will incur a point penalty. These points will be deducted from the student’s total earned points at the end of the term, and the course grade will be based on the adjusted total. Graded assignments have specific earned point-values, the details of which are provided with the specific assignment.

UNGRADED ASSIGNMENTS

Capstone Communication Inventory (P/N, Individual)
• Online assignment, available on course web site.
• Graded by course instructor.
• Is a self assessment and goal-setting tool that prepares you to take advantage of this course for fine-tuning your engineering communication skills.
• This assignment will receive a penalty of 35 points if not completed by the due date.

Team Charter (P/N, Individual)
• Consists of a written agreement describing the roles of each team member (template will be provided).
• Graded by course instructor.
• This assignment will receive a penalty of 35 points if not completed by the due date.
• May be updated during the term to reflect changes in team member duties.

Project Status Meetings (P/N, Individual)
• Consists of a brief discussion with course instructors, MIME advisor, and sponsor mentor.
• Attendance of all group members required (per Attendance Policy above)
• A project status report (template will be provided on course web site) must be completed and copies for all attendees provided at the start of the meeting.
• If a team fails to conduct a satisfactory status meeting, all team members will incur a penalty of 35 points.
• A satisfactory status meeting consists of a thoughtful and appropriate discussion of the assigned deliverables and significant progress on assigned deliverables (see course schedule)

Graded Assignments

Progress Reports (Oral and Email, 100 pts, Individual)
• Email electronic copies to MIME advisor and sponsor mentor.
- Slides serve as a progress report for MIME advisor and sponsor mentor. As such, that must contain sufficient text to have adequate stand-alone value. Note this may be more text than you are accustomed to placing on oral report slides.

- Each team member is required to give an oral progress report at least once during IE/ME 497. Detailed requirements for each of the oral progress reports will be provided on the course website. In the rare cases of two-person teams, one team member will give two oral progress reports. In these cases, the team selects who will give two reports and the student doing so will receive, as their course grade, the higher of the two presentation scores.

**HOUSE OF QUALITY**

**PART 1: PROJECT DESCRIPTION, CUSTOMER REQUIREMENTS AND WEIGHTINGS**

(Written, 40 points, Team)

- A hard copy of the original project description given to the students and a HoQ with Customer Requirements that has been signed by all team members, the project sponsor, and the MIME advisor must be submitted to the course instructor associated with your project. The course instructor reserves the right to reject the submission and require resubmission if (i) the scope of the project, as defined by the customer requirements, is not appropriate for the course, or (ii) proper formatting, as discussed in class, has not been used, (iii) weightings have not been properly assigned, or (iv) any aspect of the submission is not suitable for the course.

- Scoring will be based on the number of resubmissions required to create an acceptable document (i.e. If the initial submission is acceptable, 40 points are awarded. Each subsequent revised submission reduces the points awarded). Resubmissions must be made in a timely manner to receive consideration.

- The instructor will sign the final, acceptable, version

- A fully approved HoQ is required to enroll in IE/ME 498

**PART 2: ENGINEERING REQUIREMENTS WITH TARGETS AND TOLERANCES**

(Written, 30 points, Team)

- A hard copy of the HoQ, including all Part 1 requirements and Engineering Requirements, Targets, and Tolerances, signed by all team members, the project sponsor, and the MIME advisor must be submitted to the course instructor associated with your project.

- Scoring will be based on the number of resubmissions required to create an acceptable document (i.e. If the initial submission is acceptable, 40 points are awarded. Each subsequent revised submission reduces the points awarded). Resubmissions must be made in a timely manner to receive consideration.

- The instructor will sign the final, acceptable, version

- A fully approved HoQ is required to enroll in IE/ME 498

**PART 3: TESTING PLAN AND DESIGN LINKS**

(Written, 30 points, Team)

- A hard copy of the HoQ, including all Part 1 and Part 2 requirements and the Testing Plan and Design Links, signed by all team members, the project sponsor, and the MIME advisor must be submitted to the course instructor associated with your project.

- Scoring will be based on the number of resubmissions required to create an acceptable document (i.e. If the initial submission is acceptable, 40 points are awarded. Each subsequent revised submission reduces the points awarded). Resubmissions must be made in a timely manner to receive consideration.
• The instructor will sign the final, acceptable, version
• A fully approved HoQ is required to enroll in IE/ME 498

**ENGINEERING NOTEBOOK OR MEMOS (INFORMAL PROJECT WRITING, 100 PTS, INDIVIDUAL)**
- Hard copy to course instructor due at the end of the term.
- Graded by course instructor.
- Students must pick one of two options to document their project work through informal writing. Each student must either keep an engineering notebook for the entire quarter or must write and send (to project sponsor, MIME advisor, vendors, customers, and/or team members) ten e-mail memos of at least 600 words each across the course of the term.
- This notebook or set of memos is used to record project ideas, identify project issues and challenges, work out design solutions, list meeting minutes, etc. The notebook or memos will serve as a “diary” of a student’s capstone design experience.
  - Notebooks must be bound with permanently-numbered pages (a loose-leaf binder is not appropriate). Suitable notebooks are available in the OSU bookstore. Notebooks will be graded using the following criteria:
    - plus 10 points per quality page (up to 100 points)
    - minus 10 points if not permanently bound;
    - minus 10 points if not permanently page numbered (writing page numbers on originally unnumbered pages, even if in ink, is not acceptable).
  - For students using memos, a printed copy of each memo must be submitted at the end of the term. The printed copy should include the e-mail heading information (who the e-mail was sent to, who the e-mail was from, date that e-mail was sent, and title of the memo). The memo’s can be printed using double-sided mode and should be arranged chronologically. A single staple or clip should be used to fasten all memos together. A single cover sheet with the student name, project name, and instructor name should be included. Memos will be graded using the following criteria
    - plus 10 points per quality memo (up to 100 points)
    - minus 10 points if not arranged chronologically;
    - minus 10 points if header information is not included on each memo.
- The instructor reserves the right to deduct additional points if the intent of the notebook or memos is not followed (e.g. all or most entries or memos occur at the very beginning or end of the term, content not suitable).

**BACKGROUND REPORT (200 PTS, INDIVIDUAL)**
- Template on course web site
- Hard copies to course instructor, MIME advisor, and sponsor mentor.
- Graded by MIME advisor.
- This is an individually written report (one per student) having two primary purposes. The first is to translate the project’s requirements, as provided by the sponsor, into customer requirements (as defined during the Engineering Methods lectures in class). The second is to describe existing designs, devices, and/or methodologies that have met similar statements of need or to complete a current state analysis and benchmarking study. Detailed requirements are provided on the course web site in the report template.
**Preliminary Proposal (200 pts, Team)**

- Template on course web site
- Hard copies to course instructor, MIME advisor, and sponsor mentor.
- Graded by the MIME advisor.
- This is a collaborative three-part report:
  - The first part is a synthesis of team members’ individual background reports, combining the best from each individual report and implementing comments from the grader.
  - The second part is a description of the project’s engineering requirements (as defined in the Engineering Methods lectures in class). Lead editor #1 coordinates the writing of parts one and two.
  - The third part (coordinated by lead editor #2) consists of a technical description (including feasibility) of several (at least three) possible designs that meet the project’s customer requirements. From these designs, one is selected (with justification given) as the one the team will pursue. Detailed requirements are provided in the report template.
- After the two lead editors have drafted their respective sections of the proposal, all team members will review both sections and return their comments to the lead editors, who will incorporate these into the final draft.

**Final Proposal (200 pts, Team)**

- Template on course web site
- Hard copies to course instructor, MIME advisor, and sponsor mentor.
- Graded by the MIME advisor.
- This is a collaboratively prepared three-part report:
  - The first part (coordinated by lead editor #1) of this report consists of the Preliminary Proposal, revised to address the comments made by the grader.
  - The second part (coordinated by lead editor #2) consists of describing the test procedures corresponding to each engineering requirement, resulting in a complete House of Quality.
  - The third part (coordinated by lead editor #3) describes the specific design selected, explains why that design was chosen, and documents the process the team will use to create the prototype, model, or method. **The final design and sourcing must be fully specified so that creation of the prototype, model, or method can begin at the start of IE/ME 498 in winter term.** Detailed requirements for this assignment will be provided on the course web site.
- After the lead editors have drafted their respective sections of the Final Proposal, all team members will review all sections and return their comments to the lead editors, who will incorporate these into the final draft.

**Individual Contribution (100 pts, Individual)**

- Instructor assigns points with student, sponsor, advisor, and other stake holder input
- Student team input is via a template provided on course web site (Peer Performance Evaluation)
ME / IE 498 ASSIGNMENTS
1000 total course points

There are two types of assignments for the course: graded and ungraded. Both types of assignments are required, and failure to complete any of them on time and per specifications will affect your course grade. Ungraded assignments that are not completed satisfactorily or on time will incur a point penalty. These points will be deducted from the student’s total earned points at the end of the term, and the course grade will be based on the adjusted total. Graded assignments have specific “earned” point values, the details of which are provided with the specific assignment.

UNGRADED ASSIGNMENTS

MID-COURSE WRITING GOALS REVIEW
- At the beginning of winter term, students will review the writing goals they prepared the previous fall, assess their progress on those goals, and decide whether to continue with those goals or to set new goals for the second half of the course.
- This assignment will receive a penalty of 35 points if not completed by the due date.

TEAM CHARTER (P/N, INDIVIDUAL)
See ME/IE 497 description

STATUS MEETINGS (P/N, INDIVIDUAL)
See ME/IE 497 description

CAPSTONE EXPERIENCE MEMO (P/N, INDIVIDUAL)
- Assignment will be made available on the course web site.
- An individually written memo in which students reflect on their capstone course experience.
- This assignment will incur a penalty of 35 points if not completed by the due date.

ETHICS CASE STUDY ANALYSIS (P/N: P REQUIRED TO PASS COURSE, REVISE AS NECESSARY)
- Assignment will be made available on the course web site.
- Graded by course instructor
- A memo, written individually, that reflects on students’ analysis of an assigned ethics case study.

ENGINEERING EXPO DISPLAY (P/N: P REQUIRED TO PASS COURSE, REVISE AS NECESSARY)
- Template provided on course web site
- Graded by course instructor.
- All teams are required to participate in the COE Expo held spring term. Students create posters; display (as appropriate) their prototype, model, or method; and prepare other supporting material to present and explain their project.
Graded Assignments

Engineering Notebook or Memos (Informal Project Writing (100 pts, Individual)

- See ME/IE 497 description.

Final Presentation (Oral, 100 pts, Team)

- Formal presentation of entire project experience.
- Details given in class or via email

Evaluation One (250 pts, Team)

- Team meeting with course instructor.
- Prototype, model, or method is evaluated. Points are awarded based on the extent to which the prototype, model, or method can be used to test the design against the project requirements.

Evaluation Two (250 pts, Team)

- Team meeting with course instructor.
- The final design is evaluated based on how well the design and prototype, model, or method has met the project requirements.

Final Report (200 pts, Team)

- Template on course web site.
- Hard copies to course instructor, MIME advisor, and sponsor point of contact.
- Graded by MIME advisor.
- This collaboratively prepared report fully describes the project and background, the various design solutions you considered and how you planned to execute your selected design specified in the Final Proposal. Lead editor #1 will coordinate writing these sections (using grader comments from the Final Proposal). Additionally, there are three new sections:
  - A discussion of how the creation of the prototype, model, or method actually occurred (coordinated by lead editor #3);
  - A discussion of the testing procedures and results (coordinated by lead editor #2);
  - A project summary that describes and reflects on the team’s experience with the project (coordinated by lead editor #1);
- After the lead editors have drafted their respective sections of the report, all team members will review all sections and return their comments to the lead editors, who will incorporate these into the final draft.

Individual Contribution (100 pts, Individual)

- See ME/IE 497 description.
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<th>Week</th>
<th>Day</th>
<th>Attendance</th>
<th>Topic</th>
<th>Assignment Given</th>
<th>Assignment Due</th>
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<td>9/27</td>
<td>All</td>
<td>Course Overview, Petition Process, Communication Inventory, Project &amp; Team Assignment Process, IP &amp; NDAs, Project Descriptions</td>
<td>IP Form, Team &amp; Project Preference Form, Engineering Notebook/Memos, Communication Inventory</td>
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<td>Assign projects &amp; Teams, Team Charter (Project Manager), HoQ Overview, HoQ CRs &amp; Weightings, Background Report, Design Research, Functional Decomposition</td>
<td>Team Charter, Draft of HoQ Part 1, Outline of Background Research</td>
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<td>Monday (12/5)</td>
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<td>Week</td>
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<td>Attendance</td>
<td>Topic</td>
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<td>Traylor Brothers speaker, Course schedule, Petitions, Team Charter (revisited), Mid-course writing goals Review, Status Meetings</td>
<td>Revised Team Charter, Mid-course writing goals review, Engineering Notebook/Memos</td>
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<td>9</td>
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<td>Status Meeting 6 Readiness for evaluation two</td>
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<td>W(3/14)</td>
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<td>(All due by 5 pm, Wed. of Finals week)</td>
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