IE 594
RESEARCH METHODS IN ENGINEERING
Spring 2009

Instructor:    Brian K. Paul
Office:       125 Covell Hall
Phone:        737-7320
E-mail:       Brian.Paul@oregonstate.edu
Office Hours: MW 1:20-2:00pm  Other times by appointment; please call or e-mail.

Catalog Description: Introduction to research methodologies including surveys, interviews, quasi-experimentation, and case studies. Methods for research design, and collection and analysis of data. PREREQ: Graduate standing or instructor approval.

Texts:

Reference:

Student Learning Outcomes:
At the completion of the course, students will have …
• Articulated the metrics of success within a research career
• Developed a plan for managing IME degree requirements
• Identified technical gaps in the literature by conducting a literature review
• Critiqued quantitative and/or qualitative research methodologies relevant to their research work
• Demonstrated proposal writing skills by developing a research pre-proposal
• Demonstrated presentation skills by presenting a research pre-proposal in class

Class Attendance, Participation, and Expectations
Students are expected to attend all classes. Students must get instructor’s prior approval for any absence due to an illness or a valid reason. Any unauthorized absences will affect the student’s grade. The nature of the course requires that students actively participate in class. Class participation can take different forms, including contributing to a discussion, sharing an experience or idea relevant to the topic being discussed, or asking a question or making an insightful comment that would lead into a discussion that can benefit the entire class. Assigned readings are a critical part of this course. Students are expected to have read the material prior to class to make meaningful contributions to in-class discussions. The quality of contributions is as important as the frequency of contributions.
Class Assignments

The assignments in this class fall into five categories:

1. A project plan for your degree
2. One synthesis paper
3. One critique of a journal paper
4. One pre-proposal paper
5. One pre-proposal presentation

Project Plan

Students tend to assume that thesis or dissertation research and any related writing can be put off until after the coursework is completed. This is a false assumption to make and can lead to significant delays in completing the requirements of a graduate degree. The Graduate School requires that you have a plan of study filed by the third quarter of your enrollment at OSU if you are an M.S. student, and by the fifth quarter if you are a Ph.D. student. The purpose of this assignment is to help you focus on developing a project plan with key target dates for all major events of your program to ensure timely completion of your degree. You will develop the project plan yourself but are required to get your major professor’s input and approval. The project plan should include all major events of your program as suggested by your advisor with target (or actual) dates. At a minimum, major events should include program events outlined in the Industrial and Manufacturing Engineering Graduate Program guide; research events such as when you will have data collected and write ups for major portions of your thesis/dissertation; as well as dates for completing your coursework. A Gantt chart can be used to present your project plan or any other software that you think is most useful to effectively communicate the project plan to your advisor/committee. It is your responsibility to make the necessary arrangements with your major professor to assist you with the development of the project plan. At least two meetings with your major professor are recommended to go over the project plan prior to submitting it. The project plan must be signed by your major professor before submission.

Synthesis Paper

The purpose of the synthesis paper is to become familiar with the style, structure and research methods associated with papers in your area of research and to demonstrate your ability to synthesize information from disparate sources (papers). The goal of synthesis is to draw commonalities and differences out of those sources in an effort to establish technical gaps (research issues that have not been previously addressed). These gaps will provide insight for future proposal opportunities. The paper must synthesize at least 20 research articles in your area of research.

Use 12-point font, double-spacing, and one-inch margins in your write-up. Use also headings, sub-headings, tables, and figures as you see fit to communicate the ideas effectively to the reader. Reference the articles that you have selected using the authors’ last name and year in the body of the paper, and list them in the back under list of references. You may use a style that is typically used by a journal. An example is given below.

The paper will be graded based upon the following criteria:

1. The effectiveness of synthesizing information in the selected articles (50%)
2. Writing composition (spelling, grammar, style, clarity, references, and ease of reading) (30%)
3. Have technical gaps in the literature been identified and clearly articulated? (20%)

**Critique of a Journal Paper**

The purpose of the critique is to demonstrate your ability to comprehend the research reported in a journal paper within your area of research, objectively critique the structure and methodology [i.e., model(s), experiment(s) and/or solution technique(s)] presented in the paper, and suggest improvements to the paper (as a reviewer) or to extend the research presented in the paper (as a proposer). It is expected that this paper will be one of the papers reviewed for the synthesis paper and that the critique of it will sharpen your critique of the technical literature and motivate you toward proposing new research.

Your critique should have two parts. The first part should focus on the objective critique of the article, listing your concerns and the reasons for your concerns. This should focus on issues such as, but not limited to, the relevance and objectives of the research, assumptions made, modeling/experimental techniques used, solutions developed, statistical tests used, findings presented, and conclusions made. The second part should focus on how you propose to improve the paper or extend the results.

Use 12-point font, double-spacing, and one-inch margins in your write-up. Use also headings, sub-headings, tables, and figures as you see fit to communicate the ideas effectively to the reader. Reference the articles that you have selected using the authors’ last name and year in the body of the paper and list them in the back under a list of references.

The paper will be graded based upon the following criteria:

1. Relative depth and breadth of critical evaluation (50%)
2. Writing composition (grammar, spelling, logic and ease of reading) (30%)
3. How would you improve the methodological issues or extend the research noted in the paper? (20%)
Pre-Proposal Paper

Independent research begins by crafting excellent research proposals. The purpose of a research proposal is to persuade your audience (proposal reviewers) to give you the resources to conduct your research. It is therefore incumbent upon you to convince your proposal reviewers that you are investigating a relevant question (or problem) that has not yet been answered (or solved) and that your approach will likely meet the research objective leading to significant positive impact on your research community and the world.

In this class, you will be asked to write a pre-proposal paper in an effort to move your research forward toward a proposal. Like a research proposal, the pre-proposal should have two parts. The first part should synthesize the relevant technical literature showing where gaps exist in current knowledge and technology. Where necessary, you should provide background information to help explain these gaps to a general technical audience (reviewers) in making the case that a research question or problem exists. It is expected that this first section will largely build upon the synthesis and critique developed in your first two papers but will focus the reader on a specific objective (problem you propose to solve or question you propose to answer) that you intend to pursue. The second part should focus on your proposed approach to the research problem or question emphasizing how you will measure progress, why your methods are feasible and why you are uniquely qualified to conduct them. In addition to addressing technical merit, you will also be expected to address the cost and timeline aspects of your research.

Use 12-point font, double-spacing, and one-inch margins in your write-up. Use also headings, sub-headings, tables, and figures as you see fit to communicate the ideas effectively to the reader. Reference relevant articles using the authors’ last name and year in the body of the paper and list them in the back under a list of references.

The paper will be graded based upon the following criteria:

1. Is the author focused on a relevant problem/question? (30%)
2. Does the author propose a unique approach that is feasible for them to carry out? (40%)
3. Writing composition (grammar, spelling, logic and ease of reading) (30%)

Pre-Proposal Presentation

Throughout your career, you will be asked to make oral presentations representing the findings that you found individually or as a member of a team. As part of your graduate degree requirements, you will be asked to present information about your research at all major events/milestones including your program meeting, your preliminary exam, your proposal exam, and/or your final defense.

The purpose of this assignment is to help you improve your presentation skills by making an in-class individual presentation. You will present the content of your research proposal. The time limit for the presentation will be based on the number of students in class and the class time available. Students exceeding the time limit will be penalized. You will be responsible for
making the slides for the presentation, and making sure that the material you have compiled can be presented clearly within the allotted time.

**Grading Policy:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Plan</td>
<td>50</td>
</tr>
<tr>
<td>Synthesis Paper (min 20 papers)</td>
<td>100</td>
</tr>
<tr>
<td>Critique (journal article)</td>
<td>100</td>
</tr>
<tr>
<td>Pre-Proposal Paper</td>
<td>100</td>
</tr>
<tr>
<td>Pre-Proposal Presentation</td>
<td>50</td>
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</tbody>
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**TOTAL** = **400 points**

Students are responsible for any changes to this syllabus announced in class.

**DISHONESTY:**

Students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:

- **Cheating**- use or attempted use of unauthorized materials, information or study aids
- **Fabrication**- falsification or invention of any information
- **Assisting**- helping another commit an act of academic dishonesty
- **Tampering**- altering or interfering with evaluation instruments and documents
- **Plagiarism**- representing the words or ideas of another person as one's own

When evidence of academic dishonesty comes to the instructor's attention, the instructor will document the incident, permit the accused student to provide an explanation, advise the student of possible penalties, and take action. The instructor may impose any academic penalty up to and including an "F" grade in the course after consulting with his or her department chair and informing the student of the action taken.

**EXPECTATIONS:**

The goal of Oregon State University is to provide students with the knowledge, skill and wisdom they need to contribute to society. Our rules are formulated to guarantee each student's freedom to learn and to protect the fundamental rights of others. People must treat each other with dignity and respect in order for scholarship to thrive. Behaviors that are disruptive to teaching and learning will not be tolerated, and will be referred to the Student Conduct Program for disciplinary action. Behaviors that create a hostile, offensive or intimidating environment based on gender, race, ethnicity, color, religion, age, disability, marital status or sexual orientation will be referred to the Affirmative Action Office.