INDUSTRIAL AND MANAGEMENT SYSTEMS ENGINEERING (IMSE) GRADUATE PROGRAM MANUAL

Social Justice
Responsive – Compatible – Sustainable.

Designing products and managing systems to improve individual wellbeing, respect community culture and protect the environment, both locally and globally.

Effective August 2020

(revised December 2020)

TABLE OF CONTENTS

Graduate students at Montana State are doing amazing work to help solve our world's most critical challenges in food, the environment, health and security.

I celebrate all the differences that you bring to your work as a graduate student at MSU. The different ethnicities, cultures, gender, political viewpoints, and sexual orientation you bring as an individual mean that each of you has different ways of solving problems and different life experiences. This helps you make analogies and launch new ideas that build creative and robust solutions to our most complex problems.

The challenge for each of us is, given this combination of our differences and common humanity, how to create an inclusive, valuing graduate workspace? My thinking at this stage is that each of us needs to fully commit to truly get to know each other, listen deeply to each other's viewpoints, and read widely so we learn about barriers to teamwork such as microaggressions, privilege, and marginalization.

I am excited about being part of this vibrant community, thank you for the honor of being your graduate dean.

Craig Ogilvie | he/him/his

Graduate Dean & Associate Vice President of Research

Montana State University
(406)994-5555

> *Engineering problems are complex and have many constraints that go beyond technical constraints ones, such as fulfilling corporate interests, meeting community priorities, and protecting the environment. Often, these problems are difficult to solve in ways that are satisfying to all involved parties and are intertwined with complex societal elements such as activist debates, nationalism, and poverty. Thus, engineering problems are complex, and often lead to challenging ethical situations for engineers.*[1]

By pursuing a graduate degree in Industrial and Management Systems Engineering (IMSE), you will acquire advanced knowledge and skills to design, manage, and analyze complex human-centered systems.   You will pursue advanced technical topics to design, analyze and manage systems that improve the effectiveness and efficiency of businesses, non-profit organizations, and governments. Since all these systems involve humans and impact the social and physical environment, these systems are most successful when they combine technical solutions with social responsibility, defined as:

> *"the responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior that (a) contributes to sustainable development, including health and the welfare of society; (b) takes into account the expectations of stakeholders; (c) is in compliance with applicable law and consistent with international norms of behavior; and (d) is integrated throughout the organization and practiced in its relationships."[2]*

Thus, the vision of the program is to integrate technical depth with social awareness from a multidisciplinary (i.e., systems) point of view. But what is our goal? Just like the goal of medicine is to promote health and the goal of law is to promote justice, [1] engineering must also identify with a social goal in order to be relevant to society.

As engineers, we believe the goal for engineering is social justice, [3] defined as the "full and equal participation of all groups in a society that is mutually shaped to meet their needs".[4] Social justice can only be assured with socially responsible practices that (1) support individual needs (responsive), (2) respect community culture (compatible), and (3) protect the physical environment (sustainable).

Accordingly, our IMSE Graduate Program is organized around three focus areas related to Social Justice that provide graduates with the knowledge, skills and desire to be socially responsible in the design, management, and analysis of systems to ensure Social Justice:

- **Inclusive Design** involves principles and processes to ensure that systems are *intentionally designed* to meet requirements while supporting individual needs, respecting community culture and protecting the environment.
- **Management Systems** ensure that systems are *intentionally operated* to meet requirements while supporting individual needs, respecting community culture, and protecting the environment.
- **Data Analytics** provide the modeling and analyses to provide rationale and inform design decisions, guide system management, and optimize multiple objectives.

Our graduate problem integrates project-based learning and internships with communities and organizations that address complex social and environmental issues using best practices in public transparency and legal accountability. This problem-solving approach to graduate training instills students with a sense of Social Justice in their education, work and future profession as engineers. To allow students to focus on areas of Social Justice that interest them most, we offer flexibility in choose elective courses from a range of disciplines.

---

[1] Footnotes should be added as "Source" with the associated link: https://www.asee.org/public/conferences/106/papers/23613/view
[2] http://iso26000.info/wp-content/uploads/2017/02/ISO-26000_and_OECD_Guidelines_MNE_PPO_v1.pdf
[3] https://www.pachamama.org/social-justice/social-responsibility-and-ethics
[4] https://www.naspa.org/constituent-groups/posts/the-social-justice-and-inclusion-competency

INCLUSIVE DESIGN

Topic Leader: Professor Nicholas J. Ward
Assistant Professor Bernadette McCrory

DEFINITION

It is socially responsible to design products, services and systems that are responsive to the needs of most people. Such design should also be compatible with the culture of user communities and sustain their local environments. In this context, **Inclusive Design[5]** is an intentional process to involve all relevant user communities in the design process to create solutions that provide usable and meaningful access to products, services and systems for most people .[6] Successful Inclusive Design can improve quality of life amongst diverse user communities in a way that respects their local culture and protects the shared environment.

Inclusive Design can produce a single solution by integrating features to address the needs of diverse user communities. For example, this staircase integrates steps with ramps for access by users requiring wheelchair. Inclusive Design can also produce a single solution with special features to include a target user community but is also more usable by other users. For example, Good Grip[7] is a utensil design with oversized handles for arthritic users to comfortably operate them, which is also comfortable for other users.[8]

Oxo

PRINCIPLES

The following principles create innovative solutions for Inclusive Design:

- **Seek out, recognize and accommodate contributions from excluded user communities (and contexts that limit usability)** to generate new solutions that increase benefits for all users.

- **Use an inclusive design process and accessible design tools** so diverse user communities can participate in the design process, thereby overcoming our own biases as designers.

- **Recognize diversity of user communities (and use contexts)** by providing choice and control over interaction methods, thereby creating equally meaningful experiences for all users.

- **Favor products and services that demand less of the user** by prioritizing information, simplifying interfaces (only include value), and applying design features consistently.

- **Explore opportunities to apply innovative design solutions** that can extend the benefits of a product or service designed for a specific user community to other communities.

- **Assess the impact of the design solutions beyond the target user community** to include the broader sociotechnical, cultural and environmental consequences.

---

[5] "Inclusive Design" originated in Europe and primarily focuses on the design of technology and considers all forms of exclusion. The related term "Universal Design" originated in the USA and primarily focuses on the design of the physical environment with attention to exclusion due to physical disabilities.

[6] http://www.inclusivedesign.no/practical-tools/definitions-article56-127.html

[7] https://www.oxo.com/categories/cooking-and-baking/tools-and-gadgets/can-and-jar-openers/smooth-edge-can-opener-437.html

[8] http://universaldesign.ie/What-is-Universal-Design/Case-Studies-and-Examples/Examples/OXO-Good-Grips/

CORE COMPETENCIES (AND COURSES)

Competencies *(learning objectives)*	Courses
Systems Thinking *(Students will be able to analyze design needs and develop solutions with awareness of anticipated and unanticipated interactions amongst multiple agents and processes).*	EIND410, EIND411, EIND513
Social Justice and Design Ethics (Students will be able to develop design solutions that authentically represent the values inclusive design and make full consideration of possible consequences – both intended and unintended).	EIND410, EIND513
Diversity Awareness (Students will be able to recognize and appreciate the needs of diverse user communities in the design process and possible design solution).	EIND410, PSYX562, EIND513
Human and Social Attributes (Students will be able to develop design solutions that support human needs and aspirations while being consistent with the social and cultural factors of user communities).	EIND410, EIND413, EIND513
Context and Environment Attributes (Students will be able to develop design solutions that consistent with relevant use contexts and sustainable in the local environment).	EIND410, EIND413, EIND510, EIND513
Design Process (Students will be able to identify, devise, and use a rationale, systematic, and iterative process to create design solutions).	EIND410, EIND411, EIND510
Usability Engineering (Students will be able to evaluate solutions and integrate user feedback throughout the design process to ensure solutions align with user needs, use context, and community culture).	EIND410, EIND510
Transformational and Community-based Research (Students will be able to translate science into practical actions and effective solutions for community-based needs).	CHTH503, NSRG615

SOURCES

SOURCES
"What do we mean by Inclusive Design?" by the Inclusive Design Research Center.
"6 Principles for Inclusive" Design by L. Xiao.
"Inclusive Design Principles" by H. Swan, I. Pouncey, H. Pickering, and L. Watson.

Topic Leader: Associate Professor William J. Schell
Professor Durward K. Sobek II

DEFINITION

Organizations are ubiquitous in society and have been for millennia. Each of us is associated with multiple organizations as part of daily life, whether it be for employment, social outlets, community service or other reasons. Organizations are universal because they are needed to accomplish goals larger than any one person can do alone. At the same time, every person is impacted daily by the decisions and actions of organizations, for good or for ill.

To function effectively, organizations need structures and systems to complete their work that are tailored to the organization's environment and goals. Those systems and structures should not only accomplish goals efficiently and effectively, they should be consistent with the diverse needs, abilities and backgrounds of the people involved with and impacted by the organization. The **Management Systems** focus is about achieving efficiency and effectiveness of an organization's technical systems in a manner that people want to participate because they see how they add value, feel connected and have opportunities to grow.

PRINCIPLES

The following principles are foundational to Management Systems design:

1. **There is no one best way to organize** – The most effective way to structure an organization depends on the unique environment in which it operates, considering uncertainty, complexity and technology.

2. **Optimize at a system level** – A management system is comprised of numerous interconnected parts that interact to produce outcomes. A system view recognizes the inherent risks of attempting to optimize at the component level, which can have unintended consequences. In other words, how the pieces of a system work together is often more critical than getting a single piece to function perfectly.

3. **Simultaneous consideration of the social and technical sides of any problem** – The entire work of an organization is important. Too often only one aspect of that work becomes the sole focus – e.g. driving shareholder value. A socially responsible approach to management systems considers the social dynamics and interactions as key outcomes and attempts to jointly optimize both aspects.

4. **Lead ethically** – Leadership is more than planning or telling others what to do. It's about helping an organization do the right thing and inspiring people to feel part of something bigger than themselves. Ethical leadership extends into consideration of the organization's impact on its local and global community.
5. **Work collaboratively** – The best systems emerge when all stakeholders' concerns are sought out, deeply understood and factored into designs and decision-making.

COMPETENCIES AND COURSES

Competencies	Courses
Organization theory (Formal structures and coordinating mechanisms, informal structures that include communication networks and culture, knowledge work and problem solving versus production work and doing, power and control)	EIND 574, PSCI 530, PSCI 554, PSCI 558
Leadership (Leadership approaches in context, motivation theory, systems level considerations and strategic planning, planning, workforce dynamics, change management and organizational resistance, ethical frameworks)	EIND 434, EIND 500 BMGT 420, BMGT 466, NRSM 421, PSCI 520
Systems Interactions and Management (Scheduling and flow control, inventory management, quality assurance, lean principles, continuous improvement, systems simulation, interdisciplinary collaboration)	EIND 458, EIND 477 EIND 506, EIND 525 BMGT 464, PSCI 525

SOURCES
"10 principles of Organization Design" by Gary L. Neilson, Jaime Estupiñán, and Bhushan Sethi.
"Three Pillars of Sustainability" by Thwink.org.
"Ethical Leadership Guide" by Martin.
"Transformational Leadership" by Kendra Cherry.

Topic Leader: Associate Professor David Claudio
Professor Durward K. Sobek II
Associate Professor William J. Schell
Assistant Professor Andreas Thorsen (Jake Jabs College of Business and Entrepreneurship)

DEFINITION

The Information Age has brought rapid technological advancements with an irreversible impact in our daily lives and social organizations. Advancements in computational speed and storage capacity has led our society to collect all sorts of data. This often leads to problems such as not having enough data or having too much data (big data). The end goal of data collection is to identify patterns or convert it into useful information which is then used for decision-making purposes that could have a direct or indirect impact on individuals, organizations and society.

As social organizations have transitioned towards business analytics and data-driven decisions, now, more than ever, it is crucial to ensure we select the *right* data to be analyzed with the *right* tools and techniques to obtain the *right* information, in the *right* format, to the *right* entities at the *right* time (our *Six rights of data analytics' social justice*). Within the **Data Analytics** focus area, students learn about selecting and analyzing the appropriate information to process, interpret, organize, structure and display meaningfully to optimize a process or assist in making better informed decisions.

PRINCIPLES

The following principles are foundational to Data Analytics:

1. **Asking an interesting/important question**- Know the question being asked and the goal of the analysis. Additionally, basic things to know about the potential data include what data sources are available, how is that data structured, what tools or methods will be used for the analysis.

2. **Obtaining the data**- Understand how the data was generated or captured. Develop some familiarity with it to gain a basic understanding of what the data provides and does not provides. Ensure data reliability, credibility and validity.

3. **Exploring the data**- Understand how the data is organized or grouped. Identify which data is structured vs. unstructured, quantitative vs. qualitative. Recognize which data is nominal, ordinal, intervals or ratios. Clean and check the data for duplication, errors and completeness.

4. **Modeling the data** - Data analytics is broken into four basic types of analyses: Descriptive, Diagnostic, Predictive, and Prescriptive Analysis. Check for correctness and validity of the results.

5. **Stating assumptions** - It's unlikely that the data is perfect, and it probably doesn't capture everything needed to complete a thorough and exhaustive analysis. It is crucial to state the assumptions made throughout the work. These need to be explicitly stated when sharing results.

6. **Communicating and visualizing the results**- Identifying effective and ineffective visualizations.   Recognize when charts are attempting to "trick" the audience. Differentiate between causation ad correlation. Construct appealing visuals that offer valuable insight.

7. **Maintaining the ethics of data collection**- Cultural sensitivities should always be respected. This means considering differences in culture, local behavior and norms, religious beliefs and practices, sexual orientation, gender roles,

disability, age, ethnicity and other social differences when planning data collection activities or communicating findings. Confidentiality, anonymity and avoidance of harm need to be respected as well.

COMPETENCIES AND COURSES

Competencies	Courses
Data Collection (Understanding data sources and what tools or methods will be used to understand the process and collect data. Time studies, work sampling, flow analysis, process mapping)	EIND 422 EIND 509 BMIS 415 STAT 446 BMKT 420
Data Exploration (Basic statistics, data classification, data mining, missing/incomplete data)	EIND 455/554 EIND 457/557 EIND 422 EIND 509 STAT 431 STAT 439
Data Modeling/Analytics (Descriptive, diagnostic, predictive and prescriptive analysis)	EIND 422 EIND 455/554 EIND 457/557 EIND 464 EIND 468/558 EIND 509 BMGT 405 STAT 448 STAT 578 STAT 509 ECNS 461
Results Visualization (Statistical significance/implications, presentation/visualization)	STAT 408 BMIS 405 EIND 422 EIND 509

SOURCES

Principles of good data analysis by Greg Reda.
Exploratory Data Analysis: the Best way to Start a Data Science Project by InData Labs.
5 Steps to Data-Driven Business Decisions by Elena Roth.
What is predictive analytics? Transforming data into future insights by John Edwards.
Using big data to predict the future by Tim Sandle.

GRADUATE SCHOOL

The rules and policies of the IMSE graduate program must comply with those of the Graduate School. In this manual, we include specific rules and policies defined by the Graduate School in blue text. Additional IMSE graduate program requirements are provided black text. All student must be familiar and comply with Graduate School rules and policies:

> *If you have any questions during your academic career please contact the Office of Degree Programs & Certificates at degreesandcertificates@montana.edu 994-4145 or stop by Montana Hall Room 108.*

MS DEGREE

The Master of Science (MS) degree in Industrial and Management Systems Engineering may be attained under one of two plans:

- MS Plan A (Thesis) is 31 credits and requires thesis research (minimum of 10 credits) that advances theoretical issues by testing hypotheses.

- MS Plan B (Non-Thesis) is 33 credits and requires a major community-based project (6 credits maximum) to solve a real-world problem or internship with a social justice organization (6 credits maximum).

GRADUATE COMMITTEE

This committee advises the student on academic matters and is the examining committee for the master's comprehensive and/or thesis defense examinations.

COMMITTEE CHAIR — A tenured or tenure-track faculty member serves as the chair of the student's graduate committee and acts as a channel of communication within the degree-granting department. In the event that the student does not select a chair of their graduate committee within the first (1st) term of attendance as a master's student, the department head will appoint a temporary advisor. This advisor will advise the student until a tenured or tenure-track faculty member is selected as the graduate committee chair.

CO-CHAIR — A co-chair is not required. If a student elects to have a co-chair serve on their committee, they may choose one of the following committee compositions:

1. Chair, co-chair, and members
2. Co-chair, co-chair, and members. If there are two co-chairs, at least one must be tenured/tenure-track faculty. For information regarding non-tenure track committee members, see section below.
3. More than two co-chairs and members. If there are more than two co-chairs, the majority must be tenure/tenure-track faculty.

COMMITTEE COMPOSITION — A master's committee is composed of a minimum of three (3) members. The majority of the committee should be made up of faculty from the degree-granting department, but due to the interdisciplinary nature of many degrees, is not limited to the degree-granting department. The graduate committee chair and the department head recommend the committee composition to The Graduate School. Final approval of committee composition rests with The Graduate School. See Graduate Program of Study & Committee or Committee Revision forms.

NON-TENURE-TRACK COMMITTEE MEMBERS — Committee members not holding tenured or tenure-track faculty status at MSU must submit a letter of recommendation from the student's department head to The Graduate School. In some cases, these committee members may act as co-chairs of a student's committee.

CHANGES TO THE COMMITTEE — The student may make changes to their committee composition, using the Graduate Committee Revision form. Committee makeup should not be changed simply to accommodate short term scheduling issues.

COMMITTEE APPOINTMENT DEADLINE — The committee composition must be submitted to The Graduate School by the end of the student's second (2nd) term of graduate attendance.

- See Graduate Program of Study & Committee form.
- See Fees & Holds.

PLAN OF STUDY

The program of study acts as a contract between the student, the department, the college, The Graduate School, and the University. The program of study, jointly developed by the graduate committee and the student, defines the minimum requirements for the degree. Other requirements as determined by the student's graduate committee may also be listed. Once a course is graded, it cannot be removed from a program of study. Courses applied toward one degree may not be used for another. Students may take classes beyond those listed on their program of study.

PROGRAM APPROVAL —The program of study must be recommended by the student's graduate committee chair and department head. Final approval rests with The Graduate School.

Note: Approval comes with a fee. See Fees & Holds.

FILING DEADLINES — The program of study must be submitted on an official Graduate Program of Study & Committee form to The Graduate School by the end of the student's second (2nd) term of graduate attendance. A one-time fee is associated with the filing and approval of this form. See Fees & Holds. See Degree Requirements/General/Other Credits.

A student must have an approved, not just submitted, Program of Study and Committee form on file with The Graduate School prior to sitting for any portion of the comprehensive exam or defense.

CHANGES TO THE PROGRAM OF STUDY — The program of study may be amended through the course of the student's graduate study. Changes to a student's program of study must be made through the Program of Study Revision form and recommended by the graduate committee chair and the department head. Final approval rests with The Graduate School. No fee is associated with this form.

HOLDS — See Fees & Holds.

MS COMPREHENSIVE EXAM

All students are required to complete an oral comprehensive exam prior to graduation. The purpose of this examination is to determine if the student has attained sufficient mastery of the core courses in the MS degree program. The oral exam should be scheduled for 90 minutes. It is the student's responsibility to ensure that all committee members are available when scheduling an exam.

EXAM CONTENT — The content of the oral comprehensive exam covers the stated learning objectives from the core courses across all three focus areas: inclusive design, management systems, data analytics. Students are responsible for acquiring the necessary knowledge to answer these questions from the graduate core courses. This may also require sufficient understanding of the foundational undergraduate material that is the basis of these core courses.

For example, here are the learning objectives for the Inclusive Design focus area with examples of possible comprehensive exam questions:

Courses	Learning Objective	Example Question
EIND410, EIND411, EIND513	**Systems Thinking** Students will be able to analyze design needs and develop solutions with awareness of anticipated and unanticipated interactions amongst multiple agents and processes.	Describe a set of conditions that might result in the stock of a system oscillating?
EIND410, EIND513	**Social Justice and Design Ethics** Students will be able to develop design solutions that authentically represent the values inclusive design and make full consideration of possible consequences – both intended and unintended.	What are the benefits of an inclusive design process?
EIND410, PSYX562, EIND513	**Diversity Awareness** Students will be able to recognize and appreciate the needs of diverse user communities in the design process and possible design solution.	Describe a process to identify latent user needs in designing a bicycle for people with arthritis i their shoulders, elbows and hands.
EIND410, EIND413, EIND513	**Human and Social Attributes** Students will be able to develop design solutions that support human needs and aspirations while being consistent with the social and cultural factors of user communities.	Describe some limiting factors on human behavior and cognition as described by the Informati Processing Model.
EIND410, EIND413, EIND510, EIND513	**Context and Environment Attributes** Students will be able to develop design solutions that consistent with relevant use contexts and sustainable in the local environment.	How can we learn from nature about design solutions that are inherently sustainable?
EIND410, EIND411, EIND510	**Design Process** Students will be able to identify, devise, and use a rationale, systematic, and iterative process to create design solutions.	What is the difference between formative and summative usability testing in design processes?
EIND410, EIND510	**Usability Engineering** Students will be able to evaluate solutions and integrate user feedback throughout the design process to ensure solutions align with user needs, use context, and community culture.	What are some advantages and disadvantages of usability questionnaires?
CHTH503, NSRG615	**Transformational and Community-based Research** Students will be able to translate science into practical actions and effective solutions for community-based needs.	Based on Multiple Resource Theory of Attention, what recommendations would you give to an automotive designer to design a new collision avoidance warning that would not distract the driver.

Note: Video Conferencing Policy.

MINIMUM REGISTRATION — The student must be registered for a minimum of three (3) credits at MSU during the term in which the examination is taken. If the student wishes to sit for the comprehensive examination during the time between terms, then the student must be registered for a minimum of three (3) credits in the term prior to or immediately following the time between terms.

DEADLINE — The last day to sit for the comprehensive examination is on or before the fourteenth (14th) business day prior to the end of the term the student intends to graduate.

GRADING — Faculty associated with a focus area will assess student responses to the set of exam questions in that area. Students will be asked two questions from their selected core area, one question from each of the other core areas, and one questions that relates two or more core areas (5 questions total). Students are assigned a pass or fail grade for each question. Students must pass at least 4 of the 5 questions to pass the exam.

REPORTING THE RESULTS — The committee and department head are responsible for submitting written notice of the results of the comprehensive examination to the student and to The Graduate School no later than five (5) business days after the examination is held or after each section is administered.

FAILED EXAMINATION — The student is allowed a total of two (2) attempts to pass the comprehensive examination. At least two (2) months must elapse before the second attempt at the examination. Failure to pass the second (2nd) attempt results in termination of graduate study and dismissal from the academic program. Students who are dismissed from the program due to a second (2nd) failed attempt are ineligible to reapply to the same degree program.

MS PLAN A - THESIS

Students chose a focus area (and a thesis topic consistent with that focus area). Then, students complete a minimum 31 credits: 22 credits from core course list, including 10 credits of thesis + 9 credits from the elective course list in the chosen focus area. Alternative elective courses can be substituted with written permission of the student's committee and course instructor.

Focus area	Core Courses	Elective courses
Inclusive Design	EIND 510, 511 One of (EIND 500, 574) One of (EIND 554, 557) EIND 590 (10 credits)	EIND 410/411, 413, 513, 525, 592 PSYX 461, 477, 562 CHTH 503 NSRG 615
Management Systems	EIND 500, 574 One of (EIND 510, 511) One of (EIND 554, 557) EIND 590 (10 credits)	EIND 434, 458, 468, 477, 506, 509, 525, 558, 592 BMGT 420, 464, 466 NRSM 421 PSCI 520, 525, 530, 554, 558
Data Analytics	One of (EIND 455, 457, 468) One of (EIND 554, 557, 558) One of (EIND 510, 511) One of (EIND 500, 574) EIND 590 (10 credits)	EIND 422, 464, 509, 592 BMGT 405 CSCI 440 M 430, 441, 507, 508 STAT 408, 421, 431, 439

NOTE: EIND 490, EIND 492, EIND 499, EIND 575, and EIND 598 cannot be used towards Plan A course requirements. The final graduate plan of study must comply with Graduate School Policy including the requirement that the number of 5xx-level course credits must be equal to two-thirds (2/3) of the total graded coursework, including Thesis Research credits (590).[9] In addition, MS degree candidates must also satisfy all Graduate School degree and examination requirement.

---

[9] This means no more than 9 credits from 4xxx level courses (or below).

THESIS

A thesis is based on original research using an experiment design to test one or more hypotheses derived from credible theory. The goal of a thesis is to expand knowledge and theory development as a result of testing these hypotheses. Any practical outcomes of a thesis are secondary. All MS theses must be based on an explicit set of hypotheses.

There are two forms of acceptable thesis format:

- Standard thesis format: see http://www.montana.edu/etd/format_standard.html
- Journal manuscript format: http://www.montana.edu/etd/format_manuscript.html

All theses are to be submitted to the ETD system (http://www.montana.edu/etd/).

THESIS PROPOSAL

Students must prepare a proposal of their planned thesis. The purpose of this proposal is for the committee to decide if the planned thesis is valid, feasible and corresponds to the degree requirements. It is recommended that students include pilot data in their proposal to demonstrate the feasibility of their proposed methods (e.g., power calculations) and viability of proposed hypotheses. Once approved, the proposal serves as the plan for the thesis. It also represents an agreement between the committee and student that – if completed correctly – the final thesis should be suitable for awarding the MS degree. Proposal format and process for approval is determined by the student's advisor.

DEADLINE — The last day for scheduling the proposal defense (if requested by student advisor) is on or before the fourteenth (14th) business day prior to the end of the first term in the students second year.

DEADLINE — The student must provide a copy of the thesis proposal to all committee members (in their preferred form: paper copy or electronic copy) 14 days prior to the defense date.

THESIS DEFENSE

In Plan A, the thesis defense examination is required. The student's approved graduate committee carries out this examination. The student should have prepared and distributed a draft of the thesis to the committee at least fourteen (14) business days prior to date of defense.

Note: Video Conferencing Policy.

MINIMUM REGISTRATION — A student must be registered for a minimum of three (3) credits at MSU during the term in which the defense is held. If the student wishes to sit for the thesis defense during the time between terms, then the student must be registered for a minimum of three (3) credits in the term prior to or immediately following the time between terms.

DEADLINE — The last day to defend a thesis is on or before the fourteenth (14th) business day prior to the end of the term the student intends to graduate.

COMMITTEE REPRESENTATION — See Committee

DEADLINE — The student must provide a copy of the thesis to all committee members (in their preferred form: paper copy or electronic copy) 14 days prior to the defense date.

INVALID DEFENSE — A thesis defense held in the absence of the chair of the student's graduate committee will be considered invalid and the defense will have to be rescheduled.

GRADING — The thesis defense is graded with either a passing or failing grade determined by a majority vote of the student's approved graduate committee.

CRITERIA —The following criteria can be used by the committee to evaluate the MS thesis and defense:

1. Independence of research – extent to which student independently planned and completed research.
2. Originality of research – extent to which research addresses and relatively unexplored topic or use of novel methods to re-examine existing topics.
3. Competency in topic area – extent to which student is aware and able to explain primary research relevant to this topic area; for example, answering questions during the defense about the topic domain and justification for the research topic, method and analysis.
4. Overall effectiveness – extent to which student effectively applied the chosen research methods and analytic methods.
5. Overall validity – extent to which the "story" of the thesis makes sense; namely, does the introduction set up the identified hypotheses, are the results appropriately related back to these hypotheses, and does the discussion and conclusion logically follow from these results?

   NOTE: These criteria can be paraphrased by determining if the theses could be parsed into at least one peer reviewed conference presentation. Indeed, using the manuscript format of the thesis, any portions that are already peer reviewed and presented at a relevant conference before the defense date will be deemed to de facto satisfy these criteria.

   NOTE: The criteria exclude consideration of the thesis purpose, methods, and analysis presented in an approved thesis proposal. Approval of that proposal is taken as a prior indication that the purpose, methods, and analysis plan are acceptable for the degree if they are completed correctly as evident from the final thesis and defense.

REPORTING THE RESULTS — The graduate committee and department head are responsible for providing written notice of the results of the defense to the student and to The Graduate School no later than five (5) business days after the defense is held. The Report on Comprehensive Exam/Thesis Defense is to be submitted to The Graduate School by the department, not the student.

FAILED DEFENSE — The student is allowed two (2) total attempts to pass the defense. At least two (2) months must elapse before the second (2nd) attempt takes place. Failure to successfully pass the second attempt results in termination of graduate study and dismissal from the academic program. Students who are dismissed from the program due to failure to pass the defense are ineligible to reapply to the same degree program.

- See Degree Requirements/General/Age of Courses
- See Special Courses
- See Commencement & Degree/Certificate Completion

MS PLAN B – PROJECT/INTERNSHIP

Students chose a focus area. Then, complete a minimum 33 credits: 18 credits from core course list including 6 credits of project or internship + 15 credits from the elective course list in the chosen focus area. Students must complete a total of 6 credits of either a project or internship, but not both. Alternative elective courses can be substituted with written permission of the student's committee and course instructor.

Focus area	Core courses	Elective courses
Inclusive Design	EIND 510, 511 One of (EIND 500, 574) One of (EIND 554, 557) *One of (EIND 575 or 598)	EIND 410/411, 413, 513, 525, 592 PSYX 461, 477, 562 CHTH 503 NSRG 615
Management Systems	EIND 500, 574 One of (EIND 510, 511) One of (EIND 554, 557) *One of (EIND 575 or 598)	EIND 434, 458, 468, 477, 506, 509, 525, 558, 592 BMGT 420, 464, 466 NRSM 421 PSCI 520, 525, 530, 554, 558
Data Analytics	One of (EIND 455, 457, 468) One of (EIND 554, 557, 558) One of (EIND 510, 511) One of (EIND 500, 574) *One of (EIND 575 or 598)	EIND 422, 464, 509, 592 BMGT 405 CSCI 440 M 430, 441, 507, 508 STAT 408, 421, 431, 439

NOTE: Students must take either EIND 575 (6 credit project) or EIND 598 (6 credit internship). For the Inclusive Design focus area, CHTH 503 or NSRG 615 must be completed before project or internship. See also MSU Internship Policy. A maximum of 3 credits of EIND 592 can be taken as an elective course. The final plan of study must comply with Graduate School Policy including the requirement that the number of 5xx-level course credits must be equal to two-thirds (2/3) of the total graded coursework, including Professional Paper/Project credits (575). In addition, MS degree candidates must also satisfy all Graduate School degree and examination requirement.

COMMUNITY-BASED PROJECT

A project applies focus area knowledge and skills to solve a real-world problem in a community. The methodology may be based on credible theory, but there is no expectation to state or test specific hypotheses. The goal of the project is to give students experience applying engineering to help communities create more just social environments. These projects are a form of "service learning" because the student learn from serving the needs of a community.

PROJECT PROPOSAL

Students must submit a project proposal for approval from their committee. The proposal is a maximum of five pages and includes the following headings (sections):

- Title (Name of project, which should convey its purpose).
- Community (Name lead community for the project).
- Community Partner(s) (Name the other partners involved in the project).
- Overview (Describe community issue addressed by the project).
- Project (Describe project and its goal in relation to the state community issue).
- Scope (Describe your role in the project)

- Competencies (Describe what knowledge and skills are required. Which do you have now, and which do you need to learn?).
- Timeline and Deliverables (Provide a Gantt chart of your involvement in the project and the deadlines for your assignment deliverables).

Upon approval of the project proposal, the student enrolls in EIND 575.

COMMUNITY REPORT

Student are required to produce a report about the project. This is a non-academic report intended for the community audience. The format and content of the report will be decided by the lead community and advisor.

COMMUNITY PRESENTATION

Based on the community report, the student is required to make a public presentation to the community partnership and student committee. The student should also invite other relevant stakeholders.

INTERNSHIP

An internship gives students the opportunity to develop knowledge and skills by working within an organization or business that engage in work to improve social justice. Internships also help students develop a professional network of colleagues and collaborators. The goal of the internship is for students to be able to more quickly find employment opportunities and integrate within a workplace. This requires registration in EIND 598 – Internship for the permitted number of credits each semester.

INTERNSHIP PROPOSAL

A proposal for the internship must be written by the student and approved by their committee. The proposal must include a "role letter" provided by the hosting organization to specify the student role during the internship (e.g., duties, responsibilities) and identify any necessary travel or other expenses not covered by the organization. An internship is not approved without financial support for accommodation and subsistence, including related travel requirements (e.g., visa, insurance, etc.). The internship must also comply with university guidelines.

INTERNSHIP DELIVERABLES

Students undertaking an internship will be graded on one or more deliverables. Standard deliverables include bi-weekly progress reports and a final report. A variety of additional deliverables are also possible, but the chairperson and committee must agree on the deliverables to be graded. The choice of deliverable should be feasible for the type of internship and relevant to the student's graduate program goals. Here, we list two examples of deliverables: Reflective Blog and Social Network Map.

REFLECTIVE BLOG

Students will maintain a "Reflective Blog" during their internship as a way of journaling and sharing their experiences.[10] The student decides on the form and style of blog, but the reflections should relate to their growth during the internship. To support this reflection, the first entry will be a "Letter to Self" stating the student's expectations, hopes, and concerns prior to starting the internship. The final entry will reflect on the growth of the student from that first letter. Throughout the internships, blog entries should be made at least weekly. Students are encouraged to be creative in developing their blogs.

SOCIAL NETWORK MAP

Students will prepare and submit to their committee a social network map of the people they worked with during the internship. The content and format of the map will be decided by the student and committee chair. It may be advisable to use existing software designed to create node maps including Ludic and NodeXL.

PHD (IMSE OPTION)

MS EN ROUTE TO PHD

We recommend students obtain an MS before completing the Ph.D. In fact, your faculty advisor may insist that an MS in completed en route to the PHD. To obtain the MS en route to the PHD, the student must complete the following requirements:

- Complete the requirements of a Plan B MS option in IMSE.
- Submit a peer reviewed article of conference paper based on the 6-credits of community-based project (EIND575).

In the semester all the agreed upon courses are complete, the student taking the MS en route to a PhD will need to fill out a Graduate Program of Study and Committee Form *for the Master's degree*. This is a separate program of study from the Program of Study PhD students file for their PhD degree. The student will simultaneously complete a Graduation Application for the Master's degree.

PHD REQUIREMENTS

All students earning a doctoral degree from MSU must complete a minimum of sixty (60) credit hours post-baccalaureate, of which eighteen (18) to twenty-eight (28) must be dissertation credits. The satisfactory completion of certain courses is stipulated by the department. In this case, Ph.D. students must complete the core courses in all three focus areas specified for the MS Plan A (except EIND 590) as well as ENGR 610 and ENGR 694. For the remainder of their program of study, students are encouraged to choose from the elective courses listed in the MS Plan A. Students should work with their supervisor and committee to create and approve their final program of study.

Only those courses listed on an approved Graduate Program of Study are applicable toward graduate degree credit requirements.

A maximum of thirty (30) credits from a previously earned master's degree (from MSU or another accredited University) may be applied toward the sixty (60) credit minimum required for the doctoral degree, excluding thesis and internship credits.

---

[10] https://etec642summer.wordpress.com/assignments/reflective-blog/

Doctoral students who have previously earned a master's degree must take at least twelve (12) coursework credits and eighteen (18) to twenty-eight (28) dissertation (690) credits. For students who apply master's credits, an **additional** twelve (12) coursework credits must be taken beyond the master's degree credits.

A minimum of thirty (30) credits applicable to the degree must be taken from MSU. :

Also see Minimum Enrollment

GRADUATE COMMITTEE

The graduate committee advises the student on academic matters and is the examining committee for the oral and/or written doctoral comprehensive examination and dissertation defense.

Note: If a doctoral student is not registered for three (3) consecutive terms, not counting summer, they will be considered inactive and the graduate representative on their committee will be released. Once a student has been reactivated (via an Intent to Register form) they will need to confirm their committee is valid. See Re-enrollment/Registration.

COMMITTEE CHAIR — A tenured or tenure-track faculty member serves as the chair of the student's graduate committee and acts as a channel of communication within the degree-granting department. In the event that the student does not select a chair of their graduate committee within the third (3rd) term of attendance as a doctoral student, the department head will appoint a temporary advisor. This advisor will advise the student until a tenured or tenure-track faculty member is selected as chair of the graduate committee.

CO-CHAIR — A co-chair is not required. If a student elects to have a co-chair serve on their committee, they may choose one of the following committee compositions:

1. Chair, co-chair, and members.
2. Co-chair, co-chair, and members. If there are two co-chairs, at least one must be tenured/tenure-track faculty. For information regarding non-tenure track committee members, see section below.
3. More than two co-chairs and members. If there are more than two co-chairs, the majority must be tenure/tenure-track faculty.

COMMITTEE COMPOSITION — A doctoral committee is composed of a minimum of four members. The majority of the committee should be made up of faculty from the degree-granting department, but due to the interdisciplinary nature of many degrees, is not limited to the degree-granting department. The graduate committee chair and the department head recommend the committee composition to The Graduate School. Final approval of committee composition rests with The Graduate School. See Graduate Program of Study & Committee or Committee Revision forms.

A student and committee can elect to add a graduate representative to the student's graduate committee. See Optional Graduate Representative.

NON-TENURE TRACK COMMITTEE MEMBERS — Committee members not holding tenure or tenure-track faculty status at MSU must submit a letter of recommendation from the student's department head to The Graduate School. In some cases, these committee members may act as co-chair of a student's committee.

CHANGES TO THE COMMITTEE — The student may make changes to their committee, using the Graduate Committee Revision form. Committee makeup should not be changed simply to accommodate short term scheduling issues.

COMMITTEE APPOINTMENT DEADLINE — The committee composition must be submitted to The Graduate School by the end of the student's third (3rd) semester of graduate attendance. See Graduate Program of Study & Committee form. See Fees & Holds.

The Graduate Representative is an optional member of the doctoral committee. The first time that this option can be exercised is at the time that the Program of Study & Committee form is submitted for approval.

GRADUATE REPRESENTATIVE'S RESPONSIBILITY — The primary responsibility of the Graduate Representative is to ensure that examinations and defenses are conducted in a fair and satisfactory manner. The Graduate Representative is to attend all examinations and defenses with the exception of the written examination. The Graduate Representative, however, must be a participant in any reviews of the results of the written exam. At examinations and defenses the Graduate Representative has the same privileges to ask questions and offer comments that are accorded to any other committee member.

PROGRAM OF STUDY

The program of study acts as a contract between the student, the department, the college, The Graduate School, and the University. The program of study defines the minimum requirements for the degree. Approval of a program of study is a two-step process. The first step is the submission to The Graduate School and the second step is a review by the ODPC.

The graduate committee and the student together develop the Graduate Program of Study. Once a listed course is taken and graded, it cannot be removed from a program of study. Courses applied toward one degree may not be used for another. Exception: the graduate committee may recommend that up to thirty (30) credits obtained from a master's degree can be applied to a doctoral degree.

Students may take classes beyond those listed on their program of study. Other requirements as determined by the student's graduate committee may also be listed.

PROGRAM APPROVAL— The program of study must be recommended by the graduate committee chair and department head. Final approval rests with The Graduate School.

Note: Approval comes with a fee. See Fees & Holds.

FILING DEADLINES — The program of study must be submitted on an official Program of Study & Committee form to The Graduate School by the end of the student's third (3rd) semester of graduate attendance. A one-time fee is associated with the filing of this form. See Fees & Holds. See Requirements/General/Other Credits.

A student must have an approved Program of Study and Committee form on file with The Graduate School prior to sitting for any portion of the comprehensive examination or dissertation defense.

CHANGES TO THE PROGRAM OF STUDY — The program of study may be amended through the course of the student's graduate study. Changes to a student's program of study must be made through the Graduate Program Change form and recommended by the graduate committee chair and department head. Final approval rests with The Graduate School. No fee is associated with this form.

HOLDS — See Fees & Holds.

PH.D. QUALIFYING EXAM

The Ph.D. Qualifying exam will be administered on the second Tuesday in February of the Spring semester. Students will be examined on the following three Industrial Engineering topics: engineering probability & statistics (e.g. EIND 354), work design & analysis (e.g. EIND 313), and engineering economy (e.g. EGEN 325). Additionally, students will choose from one of the following Industrial Engineering topics: principles of operations research (e.g. EIND 364), ergonomics and human factors engineering (e.g. EIND 413), or engineering management & ethics (EIND 300).

The exam will be 5 hours duration in an open book, open notes format. Each problem set will be graded by the faculty member who most recently taught the course. The results will be analyzed by the Industrial Engineering Ph.D. Option Coordinator, and each candidate will receive a grade of Pass (all four examples passed), Fail (two or more questions failed) or Remediate (one question failed). For remediation, the student advisor decides on what form of remediation –

if any – is required for the failed topic. For failure, the student must retake the entire exam prior to the next fall semester. Students may not retake the exam more than twice.

PH.D. COMPREHENSIVE EXAM (DISSERTATION PROPOSAL)

The purpose of the Ph.D. comprehensive examination is to determine whether the student is ready for independent research in their chosen area of study. The comprehensive examination is administered by the student's graduate committee, and must be completed within two years after passing the qualifying examination. It is also recommended that the student has taken 2/3 of their graded coursework. In addition, students must complete ENGR 694 prior to taking the exam; the course is designed to assist the student in preparing their proposal.

The Ph.D. comprehensive examination is comprised of:

- A written proposal for the student's Ph.D. dissertation, and
- An oral presentation of the proposal and oral examination.

The candidate will prepare a written proposal associated with the research topic for the Ph.D. dissertation, in a format designated by the Ph.D. Option. The successful proposal will include a significant literature review, preliminary research to date, and the research proposed to complete the Ph.D. The written proposal will be presented to the student's graduate committee in advance of the oral presentation, by a date agreed to by the student and graduate committee.

The student will then present the dissertation proposal as a public research seminar that has been advertised to the College of Engineering, 30-40 minutes in length followed by Q&A from the audience. This will be followed by a closed-session oral examination by the student's graduate committee on:

- the candidate's current and proposed research;
- the candidate's graduate level understanding of option-specific engineering principles; and
- additional topics relevant to the proposed research, including fundamentals of other disciplines drawn upon in the research.

The student's graduate committee will inform the student of the results of the comprehensive examination immediately following the oral examination and committee deliberation, and will document the results on the appropriate form filed with The Graduate School. A student not passing the comprehensive will have one opportunity to retake the comprehensive after a span of six months has passed. Failure to pass the examination on the second attempt is grounds for dismissal from the Ph.D. program.

MINIMUM REGISTRATION — The student must be registered for a minimum of three (3) credits at MSU during the term in which the examination is taken. If the student wishes to sit for the comprehensive examination during the time between terms, then the student must be registered for a minimum of three (3) credits in the term prior to or immediately following the time between terms.

DEADLINE — Students must provide all committee members with a copy of the dissertation proposal at least 14 business before the scheduled comprehensive exam date.

Note: Video Conferencing Policy.

DISSERTATION

A dissertation is based on original research using a valid experimental design to test one or more hypotheses derived from relevant and credible theory. The goal of a dissertation is to expand knowledge and theory development as a result of testing these hypotheses. Any practical outcomes of a thesis are secondary. All dissertations must be based on an

explicit set of hypotheses grounded in valid theory. **All written dissertations are expected to include a discussion section that relates the results of the research to a social justice issue relevant to the research topic.**

There are two forms of acceptable dissertation format:

- Standard dissertation format: see http://www.montana.edu/etd/format_standard.html
- Journal manuscript format: http://www.montana.edu/etd/format_manuscript.html

All theses are to be submitted to the ETD system (http://www.montana.edu/etd/).

DISSERTATION DEFENSE

All doctoral candidates must defend their dissertation, with the exception of Ed.S. candidates. The defense usually consists of a public presentation and an oral examination of the candidate's research. The candidate must have an approved Graduate Program of Study & Committee form on file with The Graduate School prior to the defense of dissertation. The public is invited to the oral presentation of the defense. Following the public portion of the defense, the committee chair will excuse the public from the defense. The graduate committee then will examine the candidate's knowledge of the research in-depth.

Note: See Video Conferencing Policy.

DEADLINE — The last day to defend a dissertation is on or before the fourteenth (14th) business day prior to the end of the term the candidate intends to graduate.

COMMITTEE REPRESENTATION — See Committee

MINIMUM REGISTRATION — The candidate must be registered for a minimum of three (3) credits at MSU during the term in which the defense is held. If the candidate wishes to sit for the dissertation defense during the time between terms, then the student must be registered for a minimum of three (3) credits in the term prior to or immediately following the time between terms.

NOTIFICATION OF THE DEFENSE DATE — Each member of the graduate committee must be given a minimum of fourteen (14) business days prior to the defense date to read the dissertation. The graduate committee chair should discourage a candidate from defending if the candidate is not adequately prepared.

ADVERTISING THE DEFENSE — The candidate and the major department are responsible for submitting an announcement to the MSU calendar at least seven (7) business days prior to the defense with the following information:

- candidate's name,
- dissertation title,
- defense time and place, and
- dissertation location.

Note: Announcements must be tagged with the correct presentation code so they appear on the Graduate School website. Complete instructions, with screen shots, can be found in this "How To" document.

INVALID DEFENSE — A dissertation defense held in the absence of the candidate's graduate committee chair will be considered invalid and the defense will have to be rescheduled. See Optional Graduate Representative.

CRITERIA —The following criteria can be used by the committee to evaluate the MSC thesis (Plan A) and defense:

1. Independence of research – extent to which student independently planned and completed research.
2. Originality of research – extent to which research addresses and relatively unexplored topic or use of novel methods to re-examine existing topics.

3. Significance of research – extent to which research provide a substantive impact and contribution to the topic area, related body of knowledge, and associated theory development
4. Expertise in topic area – extent to which student is able to demonstrate expertise in the topic area; for example, being able to integrate and critique primary research in the area, identify key gaps and methodological limitations to current topic area knowledge, and propose new directions of research to advance the topic area.
5. Overall effectiveness – extent to which student effectively applied the chosen research methods and analytic methods.
6. Overall validity – extent to which the "story" of the thesis makes sense; namely, does the introduction set up the identified hypotheses, are the results appropriately related back to these hypotheses, and does the discussion and conclusion logically follow from these results?

NOTE: These criteria can be paraphrased by determining if the theses could be parsed into two or more manuscripts that is deemed likely to be published in a relevant peer-reviewed journal. Indeed, using the manuscript format of the thesis, any portions that are already published before the defense date will be deemed to defacto satisfy these criteria.

NOTE: The criteria exclude consideration of the thesis purpose, methods, and analysis presented in an approved thesis proposal. Approval of that proposal is taken as a prior indication that the purpose, methods, and analysis plan are acceptable for the degree if they are completed correctly as evident from the final thesis and defense.

GRADING — The dissertation defense is graded with either a passing or failing grade determined by a majority vote of the candidate's approved graduate committee.

REPORTING THE RESULTS — The graduate committee and department head are responsible for providing written notice of the results of the defense to the candidate and to The Graduate School no later than five (5) business days after the defense is held. The Report on Comprehensive Exam/Dissertation Defense is to be submitted to The Graduate School by the department, not the candidate.

FAILED DEFENSE — The candidate is allowed two (2) total attempts to pass the defense. At least two (2) months must elapse before the second (2nd) attempt takes place. Failure to pass the second (2nd) attempt successfully results in termination of graduate study and dismissal from the academic program. Candidates who are dismissed from the program due to failure to pass the defense are ineligible to reapply to the same degree program.

AGE OF DEFENSE — The dissertation defense must be conducted no later than five (5) years from the term of successful completion of the comprehensive examination.

OTHER INFORMATION

ACADEMIC HONESTY

Graduate students are expected to hold the highest standards of academic honesty. Adhering to a few simple guidelines should sufficiently meet this expectation:

- Do your own work. Any work submitted with your name on it should be of your sole, original authorship.

- Do not collaborate with others unless authorized to do so. When you do collaborate, note with whom and to what extent.

- Reference all external sources of information (books, journal articles, websites, etc.). Learn how to do this properly if you do not know how.

- Gain proper authorization before using any departmental equipment or facilities.

All graduate students will conform to the MSU Student Conduct Code, and if violated, will be subject to the sanctions outlined therein. All students should be familiar with the MSU Student Conduct Guidelines, which can be found at: http://www.montana.edu/policy/student_conduct/.

LABORATORY USAGE

The MIE department has the following labs available to graduate students. The lab supervisors are listed and their contact information can be obtained from the MIE office (Rob220). Students should contact the lab supervisors to obtain lab usage policies and determine access and availability.

Lab Name	Lab Location and description	Supervisor
Computer Aided Design & Drafting (CADD) Lab	BARNH 134	Bob Charlton
Computer Integrated Manufacturing (CIM) Lab	NAH 188	Durward Sobek
Decision Support Systems (DSS) Lab	ROBH 419	David Claudio
Work Design (Ergonomics & Human Factors) Lab	ROBH 401	Bernadette McCrory
Measurements & Instrumentation Lab	NAH 230	Robb Larson
Mechanical Design Lab	BARNH 129	Bob Charlton
Ceramics Lab	BARNH 248	Stephen Sofie
HVAC Lab	BARNH 008E	Kevin Amende
Cellular Mechanotransduction	CBB 129	Ron June
and Osteoarthritis Lab		
Composites Manufacturing and Testing Labs	BARNH 130/BARNH 008C	Doug Cairns/David Miller
Fluid Dynamics	BARNH 009	Mark Owkes/Erick Johnson
Magnetic Resonance and Rheology Lab	COB 324	Sarah Codd
Machining Lab	Innovation Alley, first floor NAH	Glenn Foster
Ragsdale Production Systems & Facilities Design Lab	ROBH 415	Durward Sobek

STUDENT OFFICES

The Department has a number of graduate student offices. Normally, only students employed by the department (i.e., as a GTA, GRA, or grader) will be granted office space, but other students may acquire office space if any is left over. The staff in the MIE office ROB220 assign office space on a semester-by-semester basis. If you have office space needs, please contact the MIE office staff. If a student has desk space available elsewhere but needs desk space for offering office hours or for a few hours in between classes, then there is desk space that can be booked on an hourly basis each week, please see the MIE office staff

GRADUATE TEACHING ASSISTANTSHIP (GTA)

The Department has a number of Graduate Teaching Assistantships available each year. A student's advisor normally requests GTA support for continuing students. A fulltime GTA will involve 19 hours of assigned work each week. The assigned work should allow adequate course study and preparation time so that GTAs have the ability to get up to speed on the course material before they have to grade assignments or tutor students. GTAs should expect to be assigned to no more than two separate courses. The GTA is offered with the understanding that the student will be working full-time towards the completion of a graduate degree (please see the external work policy for the department below). Continued appointment as a GTA depends on student performance and available funding.

EXTERNAL FUNDING

Under certain conditions a student's career development or research program may benefit from part-time involvement in outside professional activities closely related to their thesis work, or in other exceptional situations students may need to seek approval for compatible employment opportunities. In these cases, approval may be considered only if the following conditions are satisfied:

- The student's advisor and department head are satisfied that the student will remain on track to completion of the graduate program in a timely manner
- the student will still be able to fulfill a full-time commitment to their teaching duties, study and thesis work (ie: at least 40 hours per week)
- the student will be available at the appropriate times in the week to perform the activities necessary for their teaching duties, study and research activities.
- The department head, advisor and student agree that compelling reasons exist for consideration of approval

In accordance with standard conflict of commitment policies, under no circumstance will approval be given for outside employment (either voluntary or paid) that exceeds either 20% of the student's time, 1 day per week or 8 hours per week.

GRADUATE RESEARCH ASSISTANTSHIP (GRA)

The Department may also offer Graduate Research Assistantships, which are funded and managed by individual faculty. The roles and responsibility for these positions – along with the amount of the stipend – will be determined by the individual faculty. Normally, the faculty member offering the GRA is also the chairperson of the student's Graduate Committee. Continued appointment as a GRA depends on student performance and available funding.