Graduate Student Handbook

Department of Chemical Engineering

2025-2026

Department of Chemical Engineering - Graduate Student Handbook

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1. Chemical Engineering Department Information and Resources

Welcome to the Department of Chemical Engineering as a new graduate student! The Chemical Engineering faculty and staff are proud to welcome you to our academic family. This handbook has been compiled to provide you with information on the program, assist you in your adjustment to graduate school, and detail the requirements for obtaining an advanced degree (MS or PhD) in Chemical Engineering at Michigan Tech. Beyond the resources provided in this handbook, we also recommend that you refer to the MTU Graduate School Website and the Department of Chemical Engineering Graduate Website for additional helpful information and resources.

1.1. Department Mission and Vision

The **mission** of the Department of Chemical Engineering is to provide a high-quality educational experience that will prepare graduates to assume leadership positions within chemical and other associated industries. We foster and encourage the pursuit of new knowledge and innovative scholarship in chemical sciences and engineering. We teach in modern classrooms and carry out research in state-of-the-art laboratory facilities. We provide leadership to the chemical engineering profession through scholarship, teaching, and service.

The **vision** of the department is to be a nationally recognized chemical engineering program with research strengths in advanced materials; bioprocessing; catalysis; energy and sustainability; mineral and particulate processing; polymers; process safety, design, and optimization; sensors and microdevices; separations and surface chemistry.

1.2. Chemical Engineering Department Structure

Title	Name	Email Address
Department Chair	Dr. Patrick Pinhero	pjpinher@mtu.edu
Graduate Program Chair	Dr. Tim Eisele	tceisele@mtu.edu
Graduate Student Government Representative	Richmond Buckman Blessing Ozah	rbuckman@mtu.edu bozah@mtu.edu

Table 1.1: Chemical Engineering Department Staff with Responsibilities Relevant to the Graduate Program

Title	Name	Description of Responsibilities Relevant to the Graduate Program
Department Coordinator	Kristi Pieti krpieti@mtu.edu	Department operations, finance, policies, procedures, and graduate program records and assessment

Administrative Aide	TBD	Assists with ordering keys and assigning/booking rooms
Office Assistant	Shelby Stubenrauch skstuben@mtu.edu	Assists with ordering keys and assigning/booking rooms
Laboratory Tech	Tyson Kauppinen tskauppi@mtu.edu	Assists with construction, installation, and repair of laboratory equipment; in charge of ordering gas cylinders for the department
Lab Manager	Steve Wisniewski sgwisnie@mtu.edu	Assists with construction, installation, and repair of laboratory equipment; manages equipment inventory; point of contact for safety training

Table 1.2: Chemical Engineering Graduate Faculty and Research Areas

Research Areas	Caneba, Gerard	Eisele, Tim	Gencoglu, Aytug	Gencoglu, Maria	Handler, Robert	Heldt, Caryn	Landis, Amy	Liu, Yixin	Minerick, Adrienne	Mullins, Michael	Ong, Rebecca	Pan, Lei	Pinhero, Patrick	Sandell, John
Bio-Based Products					■		■				■			
Biomaterials				■			■	■		■				
Bioprocess Engineering						■					■			
Bioseparations			■			■			■					
Chemical and Biosensors								■	■					
Env. Life Cycle Assessment					■		■							
Mat. Recovery and Recycling					■		■				■	■		
Metals Bioprocessing		■												
Microfluidics and Microdevices			■					■	■					
Minerals Processing		■										■		
Particulate Processes		■										■		
Polymers							■	■			■			
Process Modeling and Design	■				■		■							
Reactor Dynamics										■				
Separations Technology						■								
Surface Science						■		■				■	■	
Sustainability and Resilience					■		■							
Sustainable Energy					■		■		■	■	■		■	
Tissue Engineering				■										
Virus Removal and Purification						■								

**The following are associate members of the graduate faculty (expertise in parenthesis). They can co-advise graduate students and serve on committees but cannot serve as the sole research advisor:*
Jeana Collins (microdevices), Kyle Griffin (bioprocessing), Kaiwu Huang (mineral processing), Daniel Kulas (energy & sustainability).

1.3. Building, Office, and Laboratory Access

Office Space*:* Offices are assigned to graduate students depending on availability, with priority given to funded GTAs and GRAs.

After Hours Building Access: After-hours access to the Chemical Sciences & Engineering building is available using your HuskyCard. Entrance is through the west entrance (on the MEEM side) of the building, or through the HSTEM entrances on the east or north sides of the building.

Keys: Office and teaching laboratory keys are assigned by the department coordinator. Laboratory keys for students on research projects are requested by research supervisors. Keys must not be loaned or given to others or duplicated *under any circumstances*. Lending or duplicating keys is grounds for dismissal. Lost keys need to be reported to supervisors *as soon as they are noticed to be missing*. Public safety charges a $100 fee for lost keys or those that are not returned when no longer needed. Payment is required from the student who was assigned the key.

Building Safety and Security: Do not leave office and laboratory doors unlocked when no one is present. For safety, laboratory and fire doors (double doors at entrances) must not be propped open. Do not store items in hallways or stairwells.

1.4. Email, Computers, & Security

Email: Email is the department's primary communication tool with graduate students regarding issues such as financial support, graduate program obligations and responsibilities, semester timelines and deadlines, etc. **You are expected to be responsive to departmental emails at all times.** If you are going to have difficulty responding to email for a period of time due to travel, illness, or for other reasons, please set up an out of office reply to immediately respond to any emails sent to you.

Computer Access: A limited number of computers are available for graduate students and are preferentially assigned to GTAs and GRAs. Research advisors are expected to provide computers for research use. Common use computers are also available in the university library. Information Technology staff will assign you a username and password during orientation. You need to change your password when you first log in. This username and password provide access to University Computers, Banweb, Gmail/Google Drive, Library Articles and Canvas. Do not give out your password to anyone under any circumstances.

Software Installation & Problems: Questions or problems with university computers and requests for software should be directed to IT. They can be contacted at the first-floor library help desk or it-help@mtu.edu. Software requests for research computers need to go through your research advisor. The university also has free software available for students to download to personal computers.

Privacy: Students should pay particular attention to Michigan Tech computer use policies regarding copyrights, privacy, passwords, and hacking. These can be found at https://www.mtu.edu/it/security/policies-procedures-guidelines/university-policies/standards-acceptable-use-information-technology-resources/ .

Be aware of possible phishing attacks. These are emails or phone calls that inspire a sense of urgency and may seem to come from someone you know but seem strange or are supposedly from official sources such as the police, IRS, immigration services, or a potential employer. Double-check the email address. If the address is suspicious, mark it as spam in Gmail, and report it to IT. Always get a second opinion if you are unsure. **Never** give out your personal information (e.g., your social security number or bank account numbers) by email. **Never** respond to a suspicious email request or send anyone money or credit card/bank account information in response to a phone or email request.

Research Security: The university has a comprehensive policy regarding protection of research in compliance with federal regulations. If you are conducting research at MTU, you are required to abide by these policies.

Travel: Traveling with university-issued laptop computers needs to follow university policy. Taking a university computer to certain countries may require special permission. Please discuss with your advisor before traveling outside the U.S. to ensure that you follow appropriate security procedures with your research and devices.

1.5. Access to Photocopiers, Printers, & Supplies

Photocopiers, laser printers, and office supplies are available in ChemSci 203 for Chemical Engineering graduate students to use *for research and teaching purposes only*. Departmental resources are limited, so making efficient use of resources, such as using double-sided printing and copying are appreciated. Please print only work-related material.

Note that there are important national laws regarding photocopying copyrighted materials. If you have a question about copyright law, please inquire in the library or see http://www.admin.mtu.edu/admin/procman/ch13/ch13p10.htm.

1.6. Safety

Safety is a high priority for the Department of Chemical Engineering. All graduate students are required to take a course on laboratory safety (CM 5310) and to go through annual university and department safety training.

Everyone in the department is expected to contribute to our safety culture. If you observe unsafe practices, please suggest changes to the person conducting those practices, whether they are a supervisor, peer, or subordinate. Report any observed unsafe conditions or practices immediately to the responsible party (laboratory instructor, research advisor, department coordinator, etc.), or using the Prevent Accidents with Safety (PAWS) – Chemical Engineering

Research Form. If someone suggests that something you are doing is unsafe, please listen to their concerns and then respond immediately by adjusting your work practices. Discuss with your advisor and/or the department safety chair if you are unsure of the proper response.

General departmental laboratory policies include:

- Unsupervised laboratory work will not normally be permitted for safety reasons.
- **Laboratory maintenance is the responsibility of the person using the work area.** This includes washing glassware, wiping bench tops, cleaning spills, labeling samples, and returning tools to their proper place when not in use.
- **NEVER** enter another laboratory or "borrow" tools, equipment, or supplies from another laboratory without the prior approval of your research advisor and the faculty (or staff) member in charge of the laboratory and item in question. Please return borrowed items promptly when no longer needed.
- Unattended laboratory experiments that could result in a hazard if something goes wrong (ventilation fails, power goes out, water lines become disconnected) need to have a notice posted on the laboratory door informing what to do in an emergency. Speak with your research advisor to see whether they have a copy of this form, and if they do not, contact Steve Wisniewski to obtain a form and assistance in filling it out.
- A job safety assessment should be completed before beginning any new laboratory experiment. This document identifies potential hazards associated with the process. It is important to help you guard against laboratory accidents and to be prepared to respond in the event an incident does occur.
- **Be aware that ChemSci fume hoods are typically not operational outside of normal work hours or on weekends.** To request ventilation outside of normal hours, contact the ChemSci Facilities Building Mechanic – Chris Cornish.
- **In the event of an incident:** *When in doubt, call 911, and as soon as possible notify your research supervisor.* If you cannot reach them, contact department office staff (phone numbers for responsible personnel are listed outside of all laboratory doors). Stay on the phone with 911 until released by dispatch. Even if the incident requires evacuation, you are required to remain in the vicinity of the building as a point of contact for emergency personnel. All incidents and injuries requiring medical treatment must be reported to MTU EHS. If you need to undergo medical treatment due to injuries resulting from work, the attending physician will need to fill out a Return to Work form. Be sure to bring this with you if possible. Note that Portage Health Express Care is generally not helpful for filling out this form, and, depending on the urgency, it is better to go to an actual doctor or the emergency room for treatment.

- Failure to observe laboratory policies may result in restricted access to the Chemical Engineering laboratories or complete loss of laboratory privileges.

Please refer to the Chemical Engineering Safety Website and MTU Environmental Health & Safety (EHS) Website for more resources. The EHS website contains links to University documentation, such as the University Chemical Hygiene plan, hazardous waste pickup requests, the SDS database, and access to your University safety training modules and records.

1.7. Departmental Seminars

The department offers periodic seminars during the Fall and Spring semesters. These are typically on Fridays at 10:00 am. **You are expected to attend** if you do not have other required responsibilities (classes or teaching) at that time. Please pay attention to email announcements from the department regarding seminar offerings.

1.8. Write-D Program

Write-D is a program sponsored by the Graduate School that provides a dedicated time and space for graduate students to work on writing projects such as manuscripts, research proposals, etc. Guest speakers from the Department, University and Industry visit to present briefly on research, writing, and publishing tips. Write-D sessions are optional, but highly encouraged. Students who have participated in the past have found them highly valuable.

The department Write-D facilitator is nominated from the advanced PhD students, interviewed, and selected by the current Write-D coordinator, and receives a small stipend. The facilitator is responsible for polling the student body for desired topics, arranging for guest speakers, and coordinating the weekly meetings. The time commitment is expected to be ~2-3 hr per week total. If you're a PhD student and interested in being nominated to serve as the Write-D facilitator, please contact the graduate chair.

1.9. Work-Related Travel

During your time at Michigan Tech, you may have the opportunity to travel for conferences, training, research, etc. If your travel is covered by the University, you will likely need to submit forms related to travel authorization and expenses. Information regarding work-related travel is included below.

Vehicle Rental: Vehicles can be rented from Husky Motors by students for all official University-related travel and must be billed to a department account. To reserve a vehicle, you are required to be 18 years of age, have a valid driver's license, and a Fleet Commander account. Rental of a Husky Motors passenger or cargo van requires van certification training. Personal vehicles can be used for transportation and reimbursed at a university determined mileage rate.

International Travel: All work-related international travel requires written approval. Note that transportation of MTU laptops may be restricted to certain countries. If travel is being charged to a federally sponsored project, it is required that a U.S. airline be used.

Cash Advances and Travel Reimbursements: Some travel expenses can be placed on a university purchasing card (airline tickets, hotel rooms), while some cannot (gasoline for personal vehicles, food/meals, sales tax). Your research advisor should have a purchasing card (P-card) that can cover expenses. For items that cannot be purchased on a P-card, you can either request a cash advance or submit a travel reimbursement following the trip. Travel reimbursements must be ***submitted within two weeks of the work-related travel***. Expenses should be itemized by the day they were incurred. Copies of receipts must be included. Note that different forms are used for day trips and overnight stays. You must have a valid university account number when submitting reimbursements. Generally, this will be provided by the research advisor who is sponsoring the travel.
http://www.mtu.edu/fso/financial/travel/reporting/index.html

Travel and Career Enrichment Grants: The Graduate Student Government (GSG) administers a travel grant and career enrichment grant program for students to attend professional and scholarly conferences and cover professional development activities. Travel funds are intended to be supplemental and are not sufficient to cover the full cost of attendance. ***They are also not intended to support students who have funds available from other sources.*** Refer to the GSG website for more information.

1.10. Preparing for Graduation

Ultimately, you, not the department or your advisor, are responsible for ensuring that all your required forms and requirements are completed by the necessary deadlines. Please familiarize yourself with the deadlines, dissertation submission policies, and necessary graduation forms via the Graduate School's website. You have a personalized Degree Progress Checklist but you should also refer to the graduate school degree timelines that lists key milestones. Please refer to this frequently during your program.

Coursework MS Elective Evaluation: As part of our graduate assessment program, the Chemical Engineering department requires an elective communication evaluation form from all coursework MS students the semester that they graduate. Coursework MS students are responsible to contact an instructor who taught one of their elective courses (preferably a recent course that contained a significant oral and/or written communication component) and request that the instructor fill out the form. Students will not be approved for graduation until this form is submitted.

When you leave the department, you are responsible to go through closeout procedures, completing the following tasks, as applicable:

- Remove personal files from department computers.

- Clean computer, desk, and surrounding office space
- Discard supplies, papers and other unwanted personal items in assigned spaces.
- Turn in all assigned office, teaching, and laboratory keys to Public Safety
- *Research-active students:* Coordinate with research supervisor about appropriate disposal/storage/transfer of personal data, chemicals, samples, and equipment

2. Graduate Coursework

2.1. Overview of Chemical Engineering Graduate Degrees

The Department of Chemical Engineering offers two graduate degrees: MS in Chemical Engineering and PhD in Chemical Engineering. Students pursuing an MS must choose whether to complete a coursework, report, or thesis option (the coursework option is the default). A comparison of these options is listed in **Table 2.1**. More detailed specifics are included here, section 3, page 23; section 4, page 29).

Table 2.1: Comparison of Requirements for Graduate Degrees in Chemical Engineering

	MS - Coursework	**MS - Report**	**MS - Thesis**	**PhD**
Total Required Credits	30	30	30	60 (or 30 after MS degree)
Core Course Credits	15	15	15	15
Research or Special Topic Credits	Research credits do not count toward the degree	2-6 credits CM5990	6-10 credits CM5990	No max/min requirement CM6990
Elective Credits	15	No max/min requirement	No max/min requirement	No max/min requirement
Experiential Learning (Enterprise or Co-op)	Max of 6	Max of 6*	Max of 6*	Max of 6*
Advanced RCR Course	Online Certificate	CM5621 (2 credits)	CM5621 (2 credits)	CM5621 (2 credits)
Advisory Committee	None	Advisor + 2 members	Advisor + 2 members	Advisor + 3 members, 1 of whom must be external to ChE
Qualifying Exam?	No	No	No	Yes, plus CM5721 (1 credit)
Proposal Defense?	No	No	No	Yes
Final Written and Oral Examination by Committee?	No	Yes	Yes	Yes

*Research-active students should discuss with their research advisor and obtain their approval prior to enrollment in courses or applying to internships or co-ops

Students who have obtained their BS in Chemical Engineering from MTU are eligible to enroll in the Accelerated MS program.

2.2. Coursework

Six core courses (15 cr.) are required for all Chemical Engineering graduate degree programs. An additional 1-credit course (CM5721) is required for Ph.D. students. These can be completed in a single academic year (Note: full-time graduate status is 9 credits).

Fall

- CM5100 – Applied Mathematics for Chemical Engineers (3 credits)
- CM5200 – Advanced Thermodynamics (3 credits)
- CM5310 – Laboratory Safety (1 credit)
- CM5621 – Research Essentials (2 credits)

Spring

- CM5300 – Advanced Transport Phenomena (3 credits)
- CM5400 – Advanced Kinetics/Reactor Design (3 credits)
- CM5721 – Literature Reviews in Chemical Engineering (2 credits; only required for PhD)

This course schedule may look slightly different for students from non-Chemical Engineering backgrounds, for those who start their degree program in the Spring semester, and for those who are pursuing an Accelerated MS degree or a graduate certificate.

Elective Courses: The department does not currently have a requirement for the number of elective credits for each degree. All students can apply up to a maximum of 12 credits of 3000-4000 level courses toward their degree requirements. Undergrad courses at the 1000-2000 level cannot count toward a graduate degree. Elective coursework can include:

- Courses 3000-6000 level from the following departments*:
    - Biomedical Engineering (BE)
    - Biological Sciences (BS)
    - Civil and Environmental Engineering (CEE)
    - Chemistry (CH)
    - Chemical Engineering (CM)
    - Computer Science (CS)
    - Economics (EC)
    - Electrical Engineering (EE)
    - Electrical Engineering Technology (EET)
    - Engineering Fundamentals (ENG)
    - Forest Resources & Environmental Science (FW)
    - Geological & Mining Engineering & Sciences (GE)
    - Mathematical Sciences (MA)
    - Mechanical Engineering – Engineering Mechanics (MEEM)
    - Mechanical Engineering Technology (MET)
    - Management (MGT)
    - Materials Science (MSE)

- Operations and Supply Chain Management (OSM)
- Physics (PH)
- Systems Admin. Technology (SAT)
- Surveying (SU)
- University Wide (UN)

**Specific courses from departments that are not listed may be considered for approval on a student-by-student basis. Contact the graduate chair to discuss approval of a specific course.*

- Advanced special projects (CM5950): a semester-long project (1-3 credits) designed and carried out with a specific faculty member.
- Experiential learning - Enterprise or Co-op credit – a maximum of 6 credits total of experiential learning may be applied to a degree.

Research credits (CM5990 or CM6990) are required for report/thesis MS and PhD degrees. The number of required credits for each degree is specified in the previous section.

Advanced RCR: All students are required to take an Advanced Responsible Conduct of Research course. One of our required courses, **CM 5621 – Research Essentials**, is an approved Advanced RCR course.

The standard for performance in graduate courses is higher than in undergraduate courses (**Table 2.2**). Students must obtain a B grade or better in the six core department courses listed previously, and only 6 credits of BC/C grades are allowed to count toward a graduate degree. Refer to the later section for more details on academic standing.

Table 2.2: Graduate level interpretation of academic grades

Grade	**Level of Progress**
A	Excellent and good graduate work
AB	Acceptable graduate work
B	Marginally acceptable graduate work
BC	Unacceptable graduate work
C	Unacceptable graduate work (all requirements completed)
F	Unacceptable graduate work (all requirements not completed)

Research credits (CM5990/CM6990) are assigned one of three letter grades based on your progress as evaluated by your research advisor:

- **S - Satisfactory** - assigned when a student has satisfactorily completed the research objectives for the semester. This is a permanent grade that will assign credit to the student's audit.

- **I - Incomplete** - assigned when a student has not satisfactorily completed the research objectives due to extenuating circumstances. The grade is temporary and conditional. The instructor should change this grade to S or Q after the conditions have been met (or not met).
- **Q - Inadequate progress** - assigned when a student has **not** satisfactorily completed the research objectives for the semester. This is a temporary grade that will be changed when the research degree is completed. It assigns 0 credits to the student and places them on probation (or suspension if received in two consecutive semesters)

Q research grades have various negative effects on academic standing and students who receive a Q grade must fill out the Plan to Correct Inadequate Research Progress Form with their research advisor.

2.3. Responsible Conduct of Research

Responsible Conduct of Research (RCR) Training is an important aspect of being an effective scholar, and is mandatory whether a Masters or Doctoral degree candidate. Basic training is generally completed during the Graduate School's on-campus orientation program, and it must be completed within the first two semesters at MTU, or a registration hold will be placed on the student's account.

One of our required courses, CM 5621 – Research Essentials, fulfills the Advanced RCR requirement. This course is typically taken in the Fall of your first year.

Note: Advanced RCR training must be completed by the end of the third semester, or a hold will be placed on the student's account. Students may not graduate or enter candidacy if RCR training is incomplete. This will not be an issue as long as CM 5621 is taken during the first Fall semester on campus.

2.4. Experiential Learning – Enterprise Program

The Michigan Tech Enterprise Program (https://www.mtu.edu/enterprise/) was founded in 2000 and is administered through the Michigan Tech Pavlis Honors College. Although this program is primarily targeted toward undergraduates, graduate students can also elect to participate in a design experience within a topic-based, multidisciplinary Enterprise team for elective credit.

A typical Michigan Tech Enterprise is organized like a small business, with a faculty advisor, student leaders/officers, and funding from one or more clients (e.g., government agencies, large companies, local businesses, foundations). Throughout the school year students work together to accomplish well-defined design tasks subject to appropriate engineering standards, multiple realistic constraints, and economic considerations. Students in Enterprise learn to manage a budget and respond to clients' needs.

The number of Enterprises at Michigan Tech has grown from 8 in the year 2000 to 25 at present. The Chemical Engineering Department currently hosts three Enterprises: Consumer Product Manufacturing (CPM), Alternative Energy Enterprise (AEE), and Green Campus Enterprise (GCE). Currently there are no guidelines for allowed number of Enterprise credits for graduate students within the department, however we restrict the total number of experiential learning credits (enterprise and co-op) that can be applied to a degree to a maximum of 6.

2.5. Experiential Learning - Co-ops and Internships

Prior to completion of your degree, graduate students with good academic standing are eligible to go on a co-op (cooperative education experience) at a company to earn academic credit and obtain work experience. **Co-ops for credit are expected to be relevant to chemical engineering.**

- Up to 6 credits of chemical engineering-relevant enterprise and co-op credit can be applied to degree electives.
- Full-time status can be maintained with 1 co-op credit.
- While on co-op, graduate students can enroll in online courses offered through MTU for elective credit, provided they meet the previously specified course requirements.

International students can enroll for co-op through curricular practical training (CPT), provided they meet the following requirements:

- Must have F-1 status.
- Must have been enrolled full-time for at least one full academic year.
- Must be authorized by Career Services and International Programs and Services before beginning the co-op.

If you are considering going on co-op, we strongly recommend reviewing the information on the Career Services and IPS websites before you apply.

- https://www.mtu.edu/career/students/jobs-intern/coop-intern/co-ops/
- https://www.mtu.edu/career/students/advising/international/
- https://www.mtu.edu/international/students/resources/employment/cpt/index.html

PhD students and thesis/report MS students who wish to go on co-op or an internship **must clear this with their research advisor before applying for positions.** You will need to **submit a form** with your advisor's signature to the department, demonstrating you have discussed this with them.

Failure to do so could result in termination of financial support, as research funding is often tied to the accomplishment of deliverables by a certain date. Leaving the university mid-project may require your advisor to find another student for the project, and funding may not be available when you return from your co-op or internship. Leaving for 3-6 months may also make it impossible to complete your graduate program milestones in time for you to graduate while

maintaining your visa standing. We want you to have rich opportunities for personal and professional development, but we also want you to successfully complete your degree.

2.6. Graduate Certificates

Graduate certificates are micro-credentials (9-15 credits) that show up on your transcript and require targeted coursework in a specific topic area. Students can apply for a graduate certificate as a stand-alone credential, or enrolled graduate students (MS or PhD) can elect to obtain a graduate certificate at the same time they complete their graduate degree. A list of currently offered graduate certificates is available online.

The Department of Chemical Engineering is home to two graduate certificates:

Engineering Sustainability and Resilience
Format: Online or On-Campus
Website: https://www.mtu.edu/engineering/graduate/certificates/resilience/

Profit-Increasing Strategies in Chemical Processing
Format: Online or On-Campus
Website: https://www.mtu.edu/engineering/graduate/certificates/profit-chemical/

The timing to take courses for these certificates depends on whether you are an existing graduate student or a student currently pursuing a B.S. in Chemical Engineering at MTU.

Example Course Schedules: Current MTU Coursework MS Students

The following two example schedules would allow a student to finish a coursework MS degree by the end of Fall semester of their 2nd year. Other schedules are also feasible, but this is the most efficient.

Engineering Sustainability and Resilience

Fall – 1st Year	• CM5100 – Appl. Math. for Chem. Engineers (3 cr) • CM5310 – Laboratory Safety (2 cr) • CM5621 – Research Essentials (2 cr) • ENG5515 - Introduction to Sustainability and Resilience (3 cr)
Spring – 1st Year	• CM5300 – Advanced Transport Phenomena (3 cr) • CM5400 – Advanced Kinetics/Reactor Design (3 cr) • ENG5525 - Systems Analysis for Sustainability and Resilience (3 cr)
Spring or Summer – 1st Year or Fall – 2nd Year	• Sustainability & Resilience Elective OR General Elective (3 cr)
Fall – 2nd Year	• CM5200 – Advanced Thermodynamics (3 cr) • Elective (3 cr) • Sustainability & Resilience Elective OR General Elective (3 cr)

Profit-Increasing Strategies in Chemical Processing

Fall – 1st Year	• CM4855 – CM Process Analysis & Design I (3 cr) • CM5100 – Appl. Math. for Chem. Engineers (3 cr) • CM5310 – Laboratory Safety (2 cr) • CM5621 – Research Essentials (2 credits)
Spring – 1st Year	• CM5300 – Advanced Transport Phenomena (3 cr) • CM5400 – Advanced Kinetics/Reactor Design (3 cr) • CM 5860 - ChE Industrial Capital Projects (3 cr)
Fall – 2nd Year	• CM5200 – Advanced Thermodynamics (3 cr) • CM5315 - Chemical Process Dynamics, Automation, and Control (3 cr) • Elective (3 cr)

Adding a Certificate

- If you are **currently enrolled** in a master's or PhD program, you may submit the Add a Graduate Certificate form. You must add the certificate **before** you complete your degree. Certificates are **not automatically awarded** even if you have completed all the coursework.
- If you've **already graduated**, you'll need to apply for admission as a new student. **Current and recent MTU undergrads** can apply for an accelerated certificate – refer to the appropriate section (8.2 , page 63) for more information.

Sharing Credits Between Certificates

If pursuing more than one certificate, credits may be shared between them, if this is possible per the course requirements of the certificates.

- A maximum of one-third of the credits in a certificate may be shared with a second certificate.
    - Example 1: If one certificate requires 9 credits and a second certificate requires 12 credits, a maximum of three (3) credits may be shared between the two certificates.
    - Example 2: If both certificates are 12 credits, a maximum of four (4) credits may be shared between the two certificates.
- Once credits are shared between two certificates, they may not be shared with a third certificate.

Earning a Certificate

Once you have completed at least six credits, you'll be eligible to submit an Application to Graduate on your Student Profile. You should complete this application in the semester you

plan to complete the requirement, but you must complete it no later than your final semester of enrollment at Michigan Tech.

In rare instances, you may also be required to submit a Graduate Certificate Course Schedule form, which outlines the specific courses applied to your certificate. If this form is necessary for your certificate, your program or the Graduate School will notify you.

Example Course Schedules: MTU Undergraduate Students

MTU Undergraduate students can take advantage of Senior Rule and double-counting to finish 2/3 of a graduate certificate (6 out of 9 courses). The remaining 3 credits would need to be completed as an enrolled graduate student. The following course schedules are just examples and

Engineering Sustainability and Resilience

Junior-Level Standing or Higher	• ENG5515 - Introduction to Sustainability and Resilience (3 cr)	Double-Counted
Spring – Final BS Year	• ENG5525 - Systems Analysis for Sustainability and Resilience (3 cr)	Senior Rule
Fall – Graduate Year	• Sustainability & Resilience Elective (3 cr) *refer to certificate elective list*	--

Profit-Increasing Strategies in Chemical Processing

Fall – Final Year	• CM4855 – CM Process Analysis & Design I (3 cr)	Double-Counted
Spring – Final Year	• CM 5860 - ChE Industrial Capital Projects (3 cr)**	Senior Rule
Fall – Graduate Year	• CM5315 - Chemical Process Dynamics, Automation, and Control (3 cr)	--

**Students must also take CM4860 (CM Process Analysis & Design 2) & CM4861 (CM Design Laboratory 2) for their BS degree, or the equivalent enterprise courses.

A list of other graduate certificates is available on the graduate school website. Other certificates that may be of interest from other departments include:

- Data Science Foundations
- Fundamentals of Materials Engineering
- Quality Engineering
- Water, Sanitation, and Hygiene (WaSH) Engineering

2.7. Completion of Two Degrees Simultaneously

Some PhD students choose to complete a MS in chemical engineering on the way to their PhD in chemical engineering.

It is possible to attain two master's degrees simultaneously (e.g. an MS in chemical engineering and an MBA) or a PhD and MS in a related field (e.g. a PhD in chemical engineering and an MS in materials science). It can be possible to share courses between the two degrees.

Rules for sharing courses:

- Satisfy all requirements for your primary degree (PhD or master's).
- Apply to the graduate program from which you would like to earn the additional master's degree. (Admission is not automatic and is at the discretion of the program.)
- Ask your graduate program director to complete the Additional Master's Course form for each course that will count toward the two degrees.

Credit requirement:

The credits double-counted and applied to the additional master's degree must meet the following criteria:

- Earned at Michigan Tech.
- Up to one-third of the required **coursework credits** may be double-counted. Please note that credit allowances may vary based on the specific degree option (e.g., coursework, thesis, or report).
    - Example 1: A master's degree with the coursework option requires 30 credits. Up to 10 credits may be double-counted.
    - Example 2: A master's degree with the thesis option requires 20 coursework credits and 10 research credits. Up to six (6) credits may be double-counted.
- Approved by the graduate program. Graduate programs will not allow students to double-count credits if it could negatively impact their education. Program approval is indicated by completing the Additional Master's Course form for each course that will count toward the two degrees.
- Must be graded coursework credits (research and practicum credits are not eligible).

2.8. Transfer Credits

If you have eligible graduate credits from a degree at another institution, you may be able to transfer these credits to Michigan Tech for completion of a graduate degree or certificate. You must ask the Graduate Program Director to complete the transfer credits form to initiate the credit transfer. Approval prior to registration is recommended.

In order to be approved to transfer credits in for a degree in chemical engineering, you will typically need to have completed the course(s) at a U.S. academic institution and performed well in the course (B or better).

The following rules apply:

- Up to one-third of the required coursework credits may be transfer credits. The amount varies based on the degree (**Table 2.3**).
- The credits must not have been used for a previous degree at another institution.
- The Graduate Program Director must approve of the transfer credits.

Table 2.3: Maximum number of transfer credits allowed for each degree option.

	Required Non-Research Credits	Maximum Transfer Credits
MS - Coursework	30	10
MS - Report	24	8
MS - Thesis	20	6
PhD	--	10
Graduate Certificate	9	3

3. MS Degree Requirements

3.1. MS Graduate Learning Objectives

Following completion of an MS in Chemical Engineering, we expect that students will demonstrate the following learning outcomes. Most graduate student assessments are linked to these learning objectives. GLO4 and GLO5 only apply to the MS Thesis/Report degree options.

GLO1 – Demonstrate Subject Knowledge

Core chemical engineering topics	• Demonstrates the ability to learn and apply new content related to the core chemical engineering topics. • Able to accurately solve quantitative and conceptual problems with occasional mistakes
Research field/Elective topics	• Demonstrates a solid understanding of existing literature, scientific concepts, and experimental strategies. • Able to synthesize and summarize information from diverse sources

GLO2 – Demonstrate Professional Skills

Written communication	• Writing is mostly clear and well-organized, and level of writing is appropriate to the audience. • Mostly accurate use of grammar, mechanics, spelling, and punctuation
Oral communication	• Presentation is clear, professional, engaging, and at the level of their audience's understanding. • Able to concisely describe their project, why it is important, what their data shows, and what it means. • Speed, mannerisms, language, and eye contact are appropriate and not distracting. • Supporting materials (poster, slides, etc.) are well organized, legible, and contain few typos
Data presentation and graphics	• Figures and tables are legible, well-organized, relevant, and decipherable in terms of their meaning
Organization and planning	• Keeps their workspaces organized and respects the space/equipment/resource needs of others. • Able to design a schedule and research plan, and stay focused on a task to achieve a desired outcome

GLO3 – Demonstrate Responsible & Ethical Conduct

Professional behavior	• Collaborates well during team activities (listening, leadership, negotiation, training) • Able to balance the demands of different responsibilities and effectively manage their time. • Arrives to scheduled events on time and fully prepared to participate • Responds promptly to communications, submits required documents in a timely manner, and dresses appropriately in professional settings
Ethical behavior	• Properly cites and references prior work during written and oral presentations. • Properly records, maintains, and reports data, neither adding false data nor omitting inconvenient data

Safety mindset	• Able to discuss possible laboratory safety issues and/or societal EHS issues relevant to their course or research. • Prepares proper safety documentation before beginning a new experiment and follows safe work practices. • Responds quickly to rectify deficiencies in work practices and promotes safe work practices to others

GLO4 – Demonstrate Research Skills

Critical analysis of research	• Able to summarize key points from and identify strengths and weaknesses in their own and other's research (e.g. individual posters, papers, presentations, etc.)
Method application and experimental design	• Applies existing methods and designs experiments to answer research questions. • Understands when it is appropriate to use certain techniques
Data analysis and interpretation	• Recognizes which data is clearly relevant to their research, and reports and interprets the meaning accurately. • Correctly and creatively applies statistics, analytical and computational tools to analyze data, where appropriate

GLO5 – Make Original Contribution to the Discipline

Originality and independence	• Able to independently learn and apply new content. • Self-motivated and capable of thinking of next steps required for a project to proceed

3.2. MS Degree Coursework

MS students take at minimum 30 credits, or roughly two years of coursework. In addition to the 15 credits of core classes, students take an additional 15 credits of electives, research, or special topics, co-op, or enterprise. For the report and thesis options, elective courses are chosen jointly by the student, their advisor, and their research advisory committee.

- At most 12 credits at 3000-4000 level
- For the report option, between 2-6 credits of MS Research (CM5990) are required.
- For the thesis option, between 6-10 credits of MS Research (CM5990) are required.

3.3. MS Advisor and Advising Committee

All graduate students are required to have an advisor. By default, the academic advisor for all coursework MS students is the graduate committee chair. However, students may choose an alternate advisor from the Chemical Engineering research faculty. For report and thesis MS students, their advisor should be the individual who is advising on their research activities. In addition to the main research advisor, report and thesis MS students also need to form an advising committee, which consists of the primary research advisor and two other graduate faculty.

Refer to the section on Advising for more extensive information on this topic.

3.4. MS Report/Thesis Written and Oral Defense

For the report and thesis MS options, students must prepare a written document (report or thesis) and give an oral presentation of their completed work, both of which are evaluated by their advisory committee. The topic and scope of the report/thesis is decided jointly by the student and their primary research advisor.

The main difference between a report and thesis is in the scope of work required. Both the report and thesis should include an in-depth literature review on a topic. In addition, a thesis includes an in-depth research project (e.g. computational/experimental). A report may have a computational/experimental component, but this is not required, and if included would be less extensive and detailed compared to a thesis project.

The written report/thesis must be formatted in accordance with the Graduate School instructions. It is recommended that you try to follow the formatting rules as early as possible in the writing process to avoid significant time spent making changes later.

At least two weeks prior to the oral examination, students must:

- Schedule their defense through their Degree Progress Checklist.
- Submit a draft report/thesis to the Graduate School.
- Distribute the report/thesis to their research advisory committee.

The Degree Schedule form must be completed and approved before the oral defense is scheduled.

Students are responsible to coordinate with the Chemical Engineering Graduate Assistant to:

1. Schedule the room/ Zoom meeting for the defense.
2. Bring the **thesis defense assessment QR code** from the office to the defense.
3. Fill out and bring the Report of Final Oral Examination to their oral defense for their committee members sign, and return this form to the Graduate Assistant.

Following the defense, the MS candidate is responsible for incorporating all corrections and suggestions from the advisory committee into the final report/thesis. Students must report the results of the oral examination and submit a final thesis to the Graduate School by the grad school deadline for the semester they intend to graduate.

3.5. MS Timelines

On average, the Master of Science in Chemical Engineering can typically be completed in 2 years (**Figure 3.1**) and must be completed within 5 years.

You have a personalized Degree Progress Checklist that has a list of all tasks you will need to complete prior to being awarded your degree. It is recommended that you check this list every few months to ensure that you are not missing any important deadlines. The Graduate School has also compiled timelines for MS that link to required forms that need to be completed at specific times. We recommend you consult these periodically throughout your program. Ultimately it is **you**, not your research advisor or the department, that is driving completion of your degree.

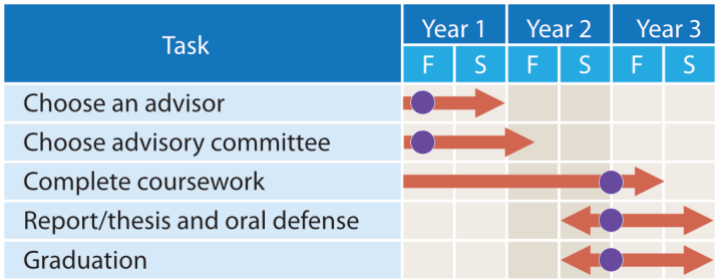

Figure 3.1: Typical timelines for completion of an MS in Chemical Engineering. Purple circles indicate the average time expected to fully complete requirements. The advisory committee and report/thesis and oral defense only apply to report and thesis options.

The tables below show the coursework schedule (**Table 3.1**) and department/graduate school deadlines (**Table 3.2**) for coursework MS. A typical coursework MS takes 4 semesters to complete.

Table 3.1: Example Coursework MS schedule*.

Fall Y1 (9 credits)	Spring Y1 (9 credits)	Summer Y1 (3 credits)	Fall Y2 (9 credits)
CM5100 (3)	CM5300 (3)	Elective (3)	Elective (3)
CM5200 (3)	CM5400 (3)		Elective (3)
CM5310 (1)	Elective (3)		Elective (3)
CM5621 (2)			

*See an example schedule for Accelerated MS students here.

Table 3.2: Typical milestones in a **Coursework MS program** and typical timeframes in which they are completed.

Deadline	Form/Item	Submit to
Orientation Week	Attend Graduate and Department Orientation Events	N/A
	Fill out the Advisor Recommendation Form (The advising and mentoring plan is not required)	Graduate Director
First Fall Semester	Complete CM5721 – Research Essentials for Advanced Responsible	N/A

	Conduct of Research training requirement	
Before graduation	Submit the Add a Graduate Certificate form if you plan to complete a graduate certificate	Online
Semester before planned completion	Submit MS Degree Schedule	Graduate Director
Final semester	Find an elective instructor to fill out the ChemE Coursework MS Student – Elective Competency Form	Course Instructor (Email them the form link)
	Submit Commencement Application Form	Online
	Submit Graduation Application Form	Online
	Submit Verification of Final Degree Requirements	Advisor (Graduate Director)
Before you leave campus	Cleanout all workspaces	Online
	Complete Exit Survey	Online

A report/thesis MS typically takes 2 years to complete. Milestones, with a typical range of times to completion, and required forms are listed below (**Table 3.3**).

Table 3.3: Typical milestones in a **Report/Thesis MS program** and typical timeframes in which they are completed.

Expected Timeline	**What**	**Submit form to**
Orientation Week	Attend Graduate and Department Orientation Events	N/A
First or second semester	Choose a research advisor and submit the Advisor Recommendation Form	Graduate Director
	Choose a research committee and submit the Committee Recommendation Form	Graduate Director

Expected Timeline	What	Submit form to
First Fall Semester	Complete CM5721 – Research Essentials for Advanced Responsible Conduct of Research training requirement	N/A
Before graduation	Submit the Add a Graduate Certificate form if you plan to complete a graduate certificate	Online
Semester before planned completion	Submit MS Degree Schedule	Graduate Director
Final Semester (generally between 4th-6th)	Submit Commencement Application Form	Online
	Submit Graduation Application Form	Online
Two weeks before defense date	Schedule the defense in your Degree Progress Checklist Submit your thesis to the Graduate School and Advisory Committee	Online and Advisory Committee
Before the defense	Fill out the headers for the Report on Final Oral Examination Form (one total), and print off for the committee.	-
Day of the defense	Bring the internal assessment QR code (in department office) and printout of the Report on Final Oral Examination form to your defense	Advisory Committee
By Graduate School Semester Deadline *(often the Friday before Finals Week)*	Make all technical and formatting corrections to the thesis and submit to Digital Commons and ProQuest	Online
Before you leave campus	Clean out all workspaces	-
	Complete Exit Survey	-

4. PhD Degree Requirements

The Doctor of Philosophy in Chemical Engineering can typically be completed in 3-6 years, depending on whether the student already has a research MS and the area of study, and must be completed within 8 years.

4.1. PhD Graduate Learning Objectives

Following completion of an PhD in Chemical Engineering, we expect that students will demonstrate the following learning outcomes. Most graduate student assessments are linked to these learning objectives.

GLO1 – Demonstrate Advanced Knowledge

Core chemical engineering topics	• Demonstrates the ability to learn and apply new content related to the core chemical engineering topics • Able to accurately solve quantitative and conceptual problems with occasional mistakes • Able to propose and conduct projects relevant to the core chemical engineering disciplines
Research field topics	• Demonstrates a solid understanding of existing literature, scientific concepts, and experimental strategies • Able to synthesize and summarize information from diverse sources

GLO2 - Demonstrate Professional Skills

Written communication	• Writing is mostly clear and well-organized, and level of writing is appropriate to the audience • Mostly accurate use of grammar, mechanics, spelling, and punctuation
Oral communication	• Presentation is clear, professional, engaging, and at the level of their audience's understanding • Able to concisely describe their project, why it is important, what their data shows, and what it means • Speed, mannerisms, language, and eye contact are appropriate and not distracting • Supporting materials (poster, slides, etc.) are well-organized, legible, and contain few typos
Data presentation and graphics	• Figures and tables are legible, well-organized, relevant, and decipherable in terms of their meaning
Organization and planning	• Keeps their workspaces organized and respects the space/equipment/resource needs of others • Able to design a schedule and research plan, and stay focused on a task to achieve a desired outcome

GLO3 - Demonstrate Responsible & Ethical Conduct

Professional behavior	• Collaborates well during team activities (listening, leadership, negotiation, training) • Able to balance the demands of different responsibilities and effectively manages their time • Arrives to scheduled events on time and fully prepared to participate

	• Responds promptly to communications, submits required documents in a timely manner, and dresses appropriately in professional settings
Ethical behavior	• Properly cites and references prior work during written and oral presentations • Properly records, maintains, and reports data, neither adding false data nor omitting inconvenient data
Safety mindset	• Able to discuss possible laboratory safety issues and/or societal EHS issues relevant to their research • Prepares proper safety documentation before beginning a new experiment and follows safe work practices • Responds quickly to rectify deficiencies in work practices and promotes safe work practices to others

GLO4 - Demonstrate Advanced Research Skills

Critical analysis of research	• Able to summarize key points from and identify strengths and weaknesses in their own and other's research (e.g. individual posters, papers, presentations, etc.)
Method development and experimental design	• Effectively uses equipment/resources, and applies existing methods and to answer research questions • Develops creative approaches (experiments) and methods to answer questions or solve problems
Data analysis and interpretation	• Recognizes which data is clearly relevant to their research, and reports and interprets the meaning accurately • Correctly and creatively applies statistics, analytical and computational tools to analyze data, where appropriate

GLO5 – Make Original & Substantial Contribution to the Discipline

Identification of knowledge gaps and research opportunities	• Able to identify knowledge gaps in their research field and propose hypotheses and experimental plans to address those gaps
Originality and independence	• Able to independently learn and apply new content and takes initiative in proposing new ideas or methods • Self-motivated and capable of thinking of next steps required for a project to proceed
Understand broader context and impacts of their research	• Able to define how their individual research fits within the broader research community, and can identify and describe potential positive direct and indirect impacts on the scientific community and society

4.2. PhD Degree Coursework

Students who already have an MS in Chemical Engineering require a minimum of 30 credits to obtain a PhD degree. Students who obtained their MS at MTU do not need to retake the core courses when advancing to a PhD. Students who transfer in with an MS in Chemical Engineering will be evaluated on an individual basis by the Graduate Committee and Department Chair in terms of the feasibility of waiving core course requirements.

Students without an MS (proceeding directly from a BS in Chemical Engineering) require a minimum of 60 credits to obtain a PhD degree.

In addition to the 15 credits of core chemical engineering courses required for an MS, Ph.D. students must also take the 1-credit course, CM 5721 - Literature Reviews in Chemical Engineering. This course is necessary preparation for the Ph.D. Qualifier Exam, described further in section 4.4. All credits beyond the 16 credits of required chemical engineering courses can be any combination of elective courses and research credits (CM6990). These are chosen jointly by the student, their advisor, and their research advisory committee. Courses should be comparable to technical electives and have relevance to the student's degree.

4.3. PhD Advisor and Advising Committee

All graduate students are required to have a research advisor. For PhD students, their advisor should be the faculty member who is advising on their research activities. It is sometimes possible to have co-advisors.

In addition to the main research advisor, PhD students also need to form an advising committee. This committee consists of their primary research advisor, and three other graduate faculty, one of whom must be external to the chemical engineering department.

Refer to the section on Advising for more extensive information.

4.4. PhD Qualifying Examinations

The PhD Qualifying Examination is taken upon completion of all PhD core coursework, either at the end of Spring semester of the first year, for Summer and Fall admissions, or at the end of Spring semester of their second year, for Spring admissions. The purpose of the qualifying exam is to:

- Determine your capability to perform certain aspects of research.
- Determine your ability to describe what has previously been researched in your field and what is still unknown.
- Determine whether you can identify a significant research question/topic in your research field where the answer is not already known or is not fully explored, but if known/explored, could have a significant impact on the research field/industry/society/etc. – and where the process of answering that question could form the basis for a PhD dissertation.
- Determine whether you can use the literature to develop and support your claims in a logical and methodical manner that convinces your Committee that 1) the answer to the research question is *unknown*; 2) that it is *significant* (would have an impact on your research field); and 3) that it is *relevant* to chemical engineering.

The exam consists of two parts: 1) a written document that provides a discussion of relevant literature and identifies a significant research problem that could form the basis for a future PhD dissertation, while highlighting the relevance to the core chemical engineering disciplines, and 2) an oral presentation on the same topic. These will be presented to and evaluated by a

committee of Department of Chemical Engineering graduate faculty, who will determine collectively whether the student passes or fails.

Timing: You can start work on the exam while enrolled in CM 5621 –Research Essentials (2 credits) during Fall semester. This will be followed by enrollment in CM 5721 – Literature Reviews in Chemical Engineering (1 credit) in the Spring semester preceding the examination. You will be assigned an evaluation committee by the department during Spring semester, who will be selected at random from the graduate faculty in the department and are distinct from your dissertation advisory committee. The graduate assistant will work with you and the committee to schedule a time for the oral examination following the end of Spring semester.

Submission: The written exam must be submitted to the committee at least two weeks before the scheduled oral exam. The written document will also be submitted on Canvas (the link will be provided when your committee is assigned) and evaluated using originality software, such as Turnitin. The original report will be provided to the committee to use in their evaluation. Please make use of the Library, the Writing Center, and other resources to ensure that you are properly crediting and utilizing information.

Written Exam Specifications:

- **Length and Format:** maximum 20 pages, single spaced, 1" margins, and 11 pt font. All pages should have page numbers, except the cover page. The page limit does not include references or front matter (e.g. cover page, abstract, etc.)
- **References:** at least 60
- **Reference Format:** the format of the reference list and in-text citations are up to the student, but they need to be consistent and free from errors. We recommend using the reference format from a relevant journal in the student's research field.
- The document should include the following sections:
    - **Abstract:** The abstract should briefly (< 300 words) summarize the contents of the paper.
    - **Literature Review (Background):** This should be the bulk of the document, summarizing key background from primary sources on a given topic. The goal is to lead the reader to understand that the research question is *unknown* and that the topic is *significant*. The qualifying exam should **not** include detailed research methods or preliminary results. This differentiates it from the proposal defense, which should include both elements.
    - **Core Chemical Engineering:** The document must include a 2–3-page section where you relate your research to **one** of the core chemical engineering disciplines (e.g. mass and energy balances, thermodynamics, kinetics, transport phenomena, separations, unit operations, process control, and/or plant design) that is most relevant to your project. This section should cite relevant journal

articles and not just textbooks. It may include both theory and application. Make sure that you *fully* understand every equation that you include in this section. Here are some questions to consider regarding equations as you work on this section:

- Why is this equation relevant to your problem? Why not a different equation?
- Are there any assumptions associated with this equation? Are these assumptions applicable in your system? Do you need to change any assumptions? Can you adapt the equation to match your assumptions, or is this not feasible? If yes, how would you adapt the equation?
- Is the equation based on theory or is it empirically derived (based on experiments only), or some combination of the two? How would this impact its relevance to your research?
- When is the equation applicable? Are there any situations where it cannot be applied accurately?
- How can the equation be applied? How has it been applied before? Has it ever been used in a way that is similar to your research or is your approach novel?

Note that you don't have to directly answer all of these questions in your report - they are intended to help direct your thought process. And remember that this section still needs to be relevant to your research question.

- **Description of a Significant Research Question/Topic (Gap in the Field):** The document must include a section where you identify a specific question or topic that is not known or understood well in your field (a research gap). If the literature review section was written appropriately, the question should make sense to the reader, and the need for further research should become obvious based on your review. The research question should be narrow enough that it could form the basis for a PhD dissertation and does not need to encompass everything that is unknown in a research field. Everything in the literature review (first section) should be relevant to this research question/gap. If anything in the literature review is not relevant to this section, then your literature review is probably too broad, and you should consider removing those irrelevant elements.
    - What is a research gap?
    - "A **gap** is something that remains to be done or learned in an area of research; it's a gap in the knowledge of the scientists in the field of research of your study. Every research project must, in some way, address a gap–that is, an attempt to fill in some piece of information

missing in the scientific literature. Otherwise, it is not novel research and is therefore not contributing to the overall goals of science." [1]

    - How to identify the research gap
    - Ways to identify a research gap

- **Tables and Figures:** Tables and figures should be positioned as close to where they are referenced in the document as possible. As much as possible, draw your own figures, rather than copying them from another source. This is good practice because when you publish papers, you will almost never be able to directly copy figures from another document. ChemDraw, Google Drawings, Vectr, Inkscape, Matlab, and R are great tools to make professional-looking figures. These are either open source or available to download through the MTU Software Download Center. BioRender is another great program, but it is not free. (Check if your advisor has a BioRender account!) If you do use tables and figures from other sources, these should be cited. But avoid this, if possible, as you won't be able to use figures from other sources in documents you write in the future without proper copyright permission.

Oral Examination Specifications:

- The oral exam will consist of a presentation designed to last 30 minutes + 20 minutes for questions.
- Physical props that are relevant to the presentation are permitted.
- Students are allowed to receive feedback from others on their oral exam before it is presented to the committee.
- The presentation will be open to the public for the presentation and open Q&A. After the public questions have finished, the committee will close the session and have a second, closed Q&A.
- Students should bring the **qualifying exam assessment QR code** from the office.
- Students should fill out and bring the **PhD Qualifying Examination and Proposal Defense Form**.

Evaluation: Once the exam is finished, the committee will excuse the student, deliberate on their performance, and then decide jointly whether the student passes or fails. The current evaluation rubric being used for the qualifying exam will be made available to all students that are preparing for the exam, and can be requested any time from the Graduate Program Chair.

- **Pass:** Student successfully passes the exam. Students will be provided with a list of potential areas of concern where critical points were not adequately described or explained, and students are expected to provide these corrections to their examining committee within two weeks of receiving the list of potential concerns.

- **Fail:** The student had major issues with the content, organization, explanation, justification, and/or other aspects of their written report and/or oral presentation. The issues are unlikely to be easily fixed by the student within a few weeks. There may be some concerns by the committee about whether the student would succeed in a PhD program.

Committee Specifications: The qualifying exam committee will consist of three Department of Chemical Engineering graduate faculty who will be assigned by the graduate committee, with the goal of having at least one committee member in an adjacent research field. As much as possible, the workload will be evenly distributed across faculty members. The student's advisor does not serve on the evaluation committee.

Advisor Role: PhD advisor(s) *are expected* to read the written report and watch practice oral presentation(s) and give feedback to help mentor their student through this process. Advisors can provide comments; however, they should not physically edit the documents (e.g. they can use the comment function in Word or Google Docs, but should not alter the text). For example, the following would be acceptable comments:

- A specific section of the written document needs more references.
- The significance of the research gap is not convincing and needs to be reworded or supported with more references.
- The literature review is too broad or there are too many research gaps – brainstorm with the student how to condense and focus – then let them do it.
- Suggest how sections of the document might be reorganized to be clearer or tell a better story.
- The figures are pixelated and need to be added at higher quality, or the font size is too small, or the content is not well-organized, and walk them through how to make changes using an example or give them a "mock-up" example.

If the document requires major improvements to the language, the student can visit the Michigan Tech Writing Center for help editing.

The advisor is not part of the committee however they can join the oral exam. The advisor should remain silent during the questioning of the student by the committee. They are allowed to answer questions on behalf of the student during the deliberation period to clarify the content and to provide details on student performance and their perception on the likelihood of their success. However, the committee has the ultimate say in whether the student was successful in their exam.

Multiple Attempts: Students who fail the exam on their first attempt are allowed a second, final attempt. This will be scheduled for the following academic semester (not including summer) with the same committee, if possible. For example, if the first attempt was at the end of Spring 2022, the final attempt would be at the end of Fall 2022. Students who fail the exam twice will be dismissed from the PhD program, although they may be eligible to continue in the MS program if they have not already completed an MS in chemical engineering.

If a student passes their qualifying exam, but then later changes their research focus compared to what was presented in their qualifying exam (whether with the same advisor or a different advisor) they do not need to retake the exam.

Relationship to Proposal Defense: Students will not be allowed to conduct their proposal defense until they successfully pass their qualifying exam. And students must wait at least three months from the completion of their qualifying exam to complete their proposal defense. (e.g. If they pass their qualifying exam on May 4th, the soonest they would be allowed to schedule their proposal defense is August 4th.) The proposal defense can replicate or modify elements of the qualifying exam, but it does not need to replicate or include the entire qualifying exam. The proposal defense should primarily provide a detailed research plan to address a research gap identified by the student, with methods and preliminary data.

4.5. PhD Proposal Defense

The Research Proposal Examination is taken after the Qualifying Exam, usually by the end of the second year of the program. It is administered by the student's Advisory Committee for the purpose of reviewing and evaluating the student's proposed plan for research.

The goal of the exam is for you to define the key research projects (typically at least three) that will be a part of the dissertation, describe their context within the existing literature, provide preliminary data that helped lead to the planned research, describe the experimental plan for current and future projects, show data from experiments that have been completed, and provide a timeline for completion of projects, publications, and the dissertation. You should demonstrate that you have a plan in place to complete your dissertation, develop methods, design experiments, and collect, analyze, and interpret data.

For the research defense, you will write a report that includes a detailed literature review on the proposed research topic, describes in detail the proposed research, and typically includes preliminary data that has been generated during the years leading up to the research proposal defense. This document can build on the work completed for the qualifying exam or it can diverge completely if there is a significant change in research focus. This report should be distributed to the Advisory Committee two weeks prior to the scheduled oral exam.

The oral exam is typically scheduled for two hours. The student should prepare a 40-minute talk outlining both the problem and the proposed research methods. The remainder of the exam is devoted to questions and answers related to the proposed research.

Students are responsible to coordinate with the department office staff to:

1. Schedule the room/Zoom meeting for the defense.
2. Bring the **proposal defense assessment QR code** from the office to the defense.
3. Fill out and bring the PhD Qualifying Examination and Proposal Defense Form to the defense.

Students are evaluated by their PhD advising committee, who decide jointly whether the student passes or fails. If a student fails the proposal defense on their first attempt, they can have a second attempt, after which, if they fail again, they are dismissed from the PhD program.

4.6. Candidacy

Once students have completed the requirements for candidacy (see details below), they are able to register for research credits at a reduced rate. The intent is that all academic courses have been completed prior to entering candidacy. To enter candidacy, students must complete all of the following requirements and then submit the Petition to Enter Candidacy form and a Degree Schedule to the graduate school.

Master's candidates— These are typically MS students who are also pursuing a PhD.

- Complete the full 30 credits required for their MS degree.
- Submit and complete all academic courses on their Degree Schedule
- Complete Basic and Advanced RCR training
- Appoint their advisory committee.

Doctoral candidates

- Submit and complete all academic courses on their Degree Schedule
- Complete Basic and Advanced RCR training
- Appoint their advisory committee
- Pass their qualifying exam
- Pass their research proposal examination

In addition:

- **PhD students who have an MS degree from an institution other than Michigan Tech** will need to complete a minimum of 18 credits at the 3000 level or above prior to entering Candidacy (any combination of course work and research credits).

- **PhD students lacking a MS degree** (those pursuing a PhD direct from a BS degree) will need to complete a minimum of 20 credits (any combination of coursework and research credits) at the 3000 level or above before entering Candidacy.

4.7. Doctoral (PhD) Dissertation Defense

Students must prepare a written dissertation and oral presentation of their completed research for evaluation by their research advisory committee. At least two academic semesters must have passed from the completion of the proposal defense to the dissertation defense.

The written thesis must be formatted in accordance with the Graduate School instructions. It is recommended that you utilize the graduate school template and follow the formatting rules as early as possible in the writing process to avoid significant time spent making changes later.

At least two weeks prior to the oral examination, students must:

- Notify the Graduate School of your defense details on your Degree Progress Checklist.
- Submit a draft dissertation to the Graduate School.
- Distribute the dissertation to your research advisory committee.

Students must coordinate with the Chemical Engineering Graduate Assistant to:

1. Schedule the room/Zoom meeting for the defense.
2. Bring the **dissertation defense assessment QR code** from the office to the defense.
3. Fill out the header, print out, and bring the Report of Final Oral Examination form to the oral defense.

Following the defense, the PhD candidate is responsible to incorporate all corrections and suggestions from the advisory committee into the final dissertation. Students must report the results of the oral examination and submit the final dissertation to the Graduate School prior to completing their degrees.

4.8. PhD Timeline

A PhD can typically be completed in 3-6 years (**Figure 4.1**), depending on the area of study, and must be completed within 8 years. Three years is a reasonable estimate for the time to completion for students who already have a MS degree in Chemical Engineering and prior research experience. For students without an MS or research experience, 4-6 years to completion is typical. Doctoral degrees are unique to the individual and do not have a firm

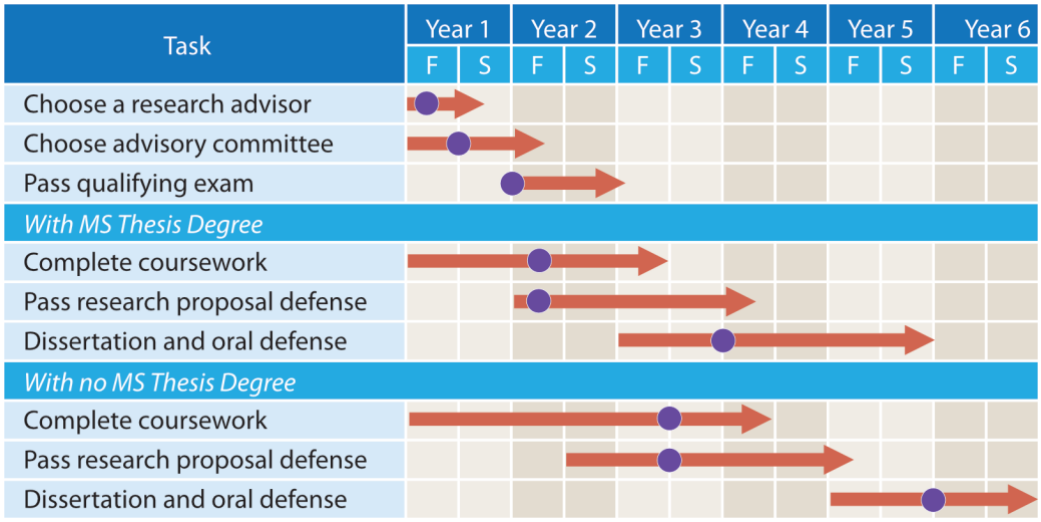

Figure 4.1: Typical timelines for completion of a PhD in Chemical Engineering.

timeline that must be followed. The minimum amount of time required will be the time needed to take all required courses and complete research activities.

You have a personalized Degree Progress Checklist that lists all tasks you will need to complete prior to being awarded your degree. It is recommended that you check this list every few months to ensure that you are not missing any important deadlines. The Graduate School has compiled timelines for a PhD that link to required forms that need to be completed at specific times. We recommend you consult these periodically throughout your program. Ultimately it is **you**, not your research advisor or department, that is driving completion of your degree.

The table below (**Table 4.1**) shows some typical milestones, times to completion and required forms.

Table 4.1: Typical milestones in a PhD program and typical timeframes in which they are completed.

Expected Timeline	**What**	**Submit form to**
Orientation Week	Attend Graduate and Department Orientation Events	-
First semester	Choose a research advisor and submit the Advisor Recommendation Form	Graduate Director
First or second semester	Choose a research committee and submit the Committee Recommendation Form	Graduate Director
First Fall semester	Complete CM5721 – Research Essentials for Advanced Responsible Conduct of Research training requirement	-
Second or third semester	Complete required coursework	-
	Defend your qualifying exam Bring the qualifying exam QR code from the office to the defense Fill out the header for the Qualifying Examination Form, and print off for the committee	Online & Qualifying Exam Committee
Between fourth and sixth semesters	Submit PhD degree schedule (when coursework is complete or semester before applying for candidacy)	Chemical Engineering Graduate Assistant
	Schedule research proposal defense date with your committee and write the document	-

Expected Timeline	What	Submit form to
	Submit written document to Advisory Committee (2 weeks before defense date)	Advisory Committee
	Fill out the header for the Research Proposal Examination Form (one total), and print off for the committee Bring the proposal defense QR code from the office to the defense	Advisory Committee
	Submit the Petition to Enter Candidacy	Online
Semester of planned degree completion	Schedule final oral defense date	-
	Submit Graduation Application Form	Graduate School
	Submit Degree Completion Form	Chemical Engineering Graduate Assistant
Two weeks before final defense date	Schedule the defense in your Degree Progress Checklist Submit your thesis to Graduate School and Advisory Committee	Graduate School Advisory Committee
Before the defense	Fill out the header for the Report on Final Oral Examination Form (one total), and print off for the committee	-
Day of the defense	Defend your thesis Bring the dissertation defense QR code from the office to the defense Bring the print out of the Report on Final Oral Examination form for the committee	Advisory Committee
By Graduate School Semester Deadline *(often the Friday before Finals Week)*	Make all technical and formatting corrections to the dissertation and submit your dissertation to Digital Commons and ProQuest.	Online
Before you leave campus	Clean out all workspaces	-
	Complete Survey of Earned Doctorates	-

Expected Timeline	What	Submit form to
	Complete Exit Survey	-

**Three years is a reasonable estimate for the time to completion for students who already have a MS degree in Chemical Engineering and prior research experience. For students without an MS and research experience, 4-6 years to completion is typical.

5. Advising

Every graduate student in the Chemical Engineering department is required to have an academic/research advisor. The purpose of an academic advisor is to oversee academic progress and help guide coursework selection. For those students pursuing research MS or PhD, the advisor serves as a research mentor and chair of the graduate committee for thesis or dissertation research.

It is recommended that new students come up with a list of courses they might be interested in and consult with their advisor by the 7th week of the first semester to create a degree plan that meets the student's needs.

5.1. Coursework MS Advisor

For students pursuing a coursework MS, the default advisor is the Graduate Director. This is typically set up during new student orientation by submitting the Advisor Recommendation Form. Students may choose another advisor, though this is not recommended as the Graduate Director is most familiar with the requirements of the coursework MS program and is best qualified to advise you.

5.2. Research Advisors – Selection Process

Students pursuing a report or thesis MS or a PhD are required to find a research advisor to oversee their academic and research activities. You should be paired with a research advisor as soon as possible during your first semester (ideally within the first two months).

In some cases, particularly if your thesis/dissertation research is highly interdisciplinary, you may wish to be co-advised by two faculty. This decision should be made by mutual agreement of all parties involved. The main research advisor must be a member of the Chemical Engineering Department and full member of the Graduate Faculty, but non-departmental faculty and Associate Graduate Faculty can serve as co-advisors. It should be decided and clearly laid out at the beginning of this relationship which advisor is the main advisor with the power of final decision, as this can prevent future conflict.

Scenario 1 – PhD Student Entering with a GRA: You may have arranged with a faculty member at the time of an offer of admission to join a project as a GRA. In this situation, simply fill out the Advisor Recommendation Form with the appropriate information when you arrive.

Scenario 2 – PhD Student Entering with a GTA: You may have been awarded a GTA during your first year as a graduate student. Within the first two weeks of your first semester on campus you will either be provided with a list of those faculty members and their projects or hear them present on their projects during a class or the department graduate orientation.

You should meet with several of these faculty members before selecting an advisor. When making an appointment with a faculty member, first do your homework – learn about the

faculty member's interests and projects, search for and read their recent publications, and come up with a list of questions. Allow enough time for a meaningful discussion. Indicate your research interests, background, and how the faculty member will benefit from supervising you. Establish mutual interest in working together. Explain your financial needs and explore avenues for meeting these needs. It is in your advisor's best interest to help you find the financial and academic support that you need.

We strongly recommend that you determine their general expectations for their research students (**please read section 7.3, page 56)** as these expectations vary from person to person and the faculty member may not volunteer them. It is best to lay these out at the beginning of the potential relationship to prevent future misunderstanding and conflict that arise from incompatible expectations.

Be open to considering new research fields. You might find a project you are interested in that you were not expecting before coming to Michigan Tech. If new faculty joined the department since you applied, their research would not have been listed online at the time of your application, and they typically start with research funding. It can be very rewarding to be the first PhD student in a new research lab.

The department will solicit your feedback and you will need to submit a form, ranking your preferred advisors. The graduate committee will consult with the faculty regarding the results and then pair students with faculty advisors. The student must then work with their advisor to complete the Advisor Recommendation Form that is submitted to the Graduate Director.

Scenario 3 – MS Project/Thesis Student: MS thesis students have significantly more leeway in choosing their academic advisor because they cannot be awarded GTAs based on university protocols. MS thesis students can occasionally be supported as GRAs, either stipend or hourly, but this is entirely dependent on whether the faculty advisor has any funding available. Follow the guidance listed above for Scenario 2 for guidance on how to locate a research supervisor. Once you have located an advisor, work with them to complete the Advisor Recommendation Form and submit this to the Graduate Director.

5.3. Individual Development Plans

Individual Development Plans (IDPs) are designed to help students reflect on what they want to get out of their graduate education, think of short-term and long-term goals, and explore their interests and career paths. It is important to discuss this information with your advisor so that they are best equipped to help direct you toward opportunities that align with your goals, and to prevent misunderstandings. The IDP is a living planning document and can be modified as needed over time.

While not required, we recommend all research-active graduate students fill out an IDP and go through this document with their advisors. Please take the initiative if your advisor does not

propose to conduct an IDP with you. The Graduate School has compiled several options for IDP templates.

It is also recommended that each research-active student undertake a self-reflection that can be conducted at the end of each semester. This can be considered part of an individual development plan. Example student self-evaluation forms used by Chemical Engineering faculty or your advisor may have their own preferred format.

5.4. Research Advisory Committee

Students who are pursuing a report or thesis MS or a PhD are required to form a research advisory committee. The purpose of the committee is to ensure the quality and technical accuracy of the report/thesis/dissertation. In general, the primary research advisor will act as chair of the Advisory Committee. PhD Advisory Committees are *required* to have at least one member who is external to the chemical engineering department, though some students may choose to have more than one.

For the report/thesis MS program the advisory committee consists of, at minimum, 3 members:

- Primary research advisor (Chemical Engineering department)
- Chemical Engineering graduate faculty
- Any graduate faculty

For the PhD program the advisory committee consists of, at minimum, 4 members:

- Primary research advisor (Chemical Engineering department)
- Chemical Engineering graduate faculty
- External (non- Chemical Engineering) faculty member, occasionally external to the University
- Any graduate faculty

Contact several faculty members who you might be interested in having on your committee and meet with them. Come prepared with a short description of your research project and be ready to answer questions. Once you have met with everyone, sit down, and discuss your options with your advisor. They may give you recommendations, but ultimately it is up to you to determine who you most want to advise and mentor you on your research during your graduate program.

Once the committee is formed, the Advisor and Committee Recommendation Form must be filed with the Graduate School.

5.5. Changing Advisors or Committee Members

Before initiating the process to change your graduate advisor, please consider all the options listed on the Graduate School's website for how to address difficulties in the student-advisor relationship.

Once you have decided to change your graduate advisor, you must follow the steps listed below.

1. Meet with the Chemical Engineering Graduate Chair to initiate the process to change advisors. If meeting with the graduate program director is not feasible or appropriate, meet with the Chemical Engineering Department Chair or Dean of the College of Engineering.
2. Discuss the following with the graduate program director (or Chair/Dean) and, if appropriate, your current advisor:
    - Whether additional resources within or outside the department (such as the Ombuds office) could help resolve the situation.
    - The impact of the change of advisor on your time to complete the degree. Coursework, qualifying exam(s), and the research proposal examination are all factors that could be impacted with a change in advisor.
    - Your current and future funding.
    - Research already conducted. Whether this will be incorporated into the dissertation, thesis, or report, and if so, how.
    - Impact on immigration status (if any). Consult International Programs and Services (IPS), if necessary.
    - Record the agreement from the discussions in writing, including indications of agreement from all affected faculty advisors, and provide copies to the student, the graduate program director, and all affected faculty advisors.
3. Work with your new advisor on a new Advisor Recommendation Form and submit to the Graduate Director.
4. If the student and the graduate program director are unable to reach agreement on the advisor change, contact the Assistant Dean of the Graduate School to determine additional steps to resolve the situation.

Withdrawal of Committee Members: In some cases, committee members may choose to withdraw from your advising committee. This can happen for many reasons and does not necessarily indicate any fault on your part. If this happens, you will need to find a replacement if the number of committee members drop below the required number. Once the new conformation of the committee is determined, fill out an updated Committee Recommendation form and submit to the Graduate Director.

6. Department and University Policies

6.1. Student Responsibility

It is the responsibility of each chemical engineering graduate student to:

- Be aware of the recommended timeline for completion of their degree and ensure completion of necessary tasks within that timeline (MS or PhD).
- Initiate and respond to communication with the Chemical Engineering department and their academic advisor about all aspects of their graduate program.
- Be familiar with and follow Chemical Engineering department policies as outlined in this handbook, and Graduate School policies as detailed on their website.
- Ensure that all forms that are required for continuation and completion of their degree program are completed and authorized in a timely fashion, and filed with Chemical Engineering administrative staff, graduate school, etc.
- Maintain their office and laboratory space and manage their assigned keys.

6.2. Continuous Enrollment, Residency, and Full-Time Status

Students who wish to remain active in the graduate program must be enrolled *every academic fall and spring semester* in 1) academic courses, 2) research credits, OR 3) in one of two courses offered by the graduate school to address special circumstances (**UN5951** or **UN5953***). **Nine (9) credits are required for full-time status in fall and spring semesters.**

> **Contact the Graduate School regarding these courses. Please note that tuition for these courses may not be waived and these courses may not be paid from departmental or sponsored accounts.*

Students who do not maintain active status enrollment (through one or more of the three course options above) will have to apply for re-admission to regain active status. Students may request a waiver of continuous enrollment. However, waivers of continuous enrollment will be strictly limited to one term except in the most serious situations. For more information, contact the Graduate School.

Graduate students (both domestic and international) are not required to register for classes during the summer session. However, if full-time status is needed for employment or a fellowship, any of the following options count as **full-time status during summer**:

- 1 academic course
- 1 research credit, if student is not in candidacy.
- 3 research credits, if the student is in candidacy.

Graduate students supported (with full or partial support) by teaching, research, administrative assistantships, or fellowships, must be registered as full-time students during each semester (including summer) for which they receive support. Students enrolling in fewer than the full-time number of credits may be at risk of losing their financial assistance or visa. Any international student who is considering enrolling for less than nine credits should consult International Programs and Services (IPS) to ensure that their visa status will not be jeopardized.

A graduate student taking fewer than nine credits during an academic-year semester is considered full-time at Michigan Tech in the following instances:

- The student is enrolled in a course that carries full-time status regardless of the number of credits, e.g., co-op (UN5000).
    - A list of these courses can be found online.
- The student is dual-enrolled at Michigan Tech and an affiliated university and the student's total credit load equals or exceeds nine credits.
    - An affiliated university is one with whom Michigan Tech has a formal written agreement for exchange and/or dual enrollment of students. Enrollment at the affiliated university must be documented to the Graduate School by the student's home department at Michigan Tech.
- Students who have successfully defended in a given semester are considered full-time at less than 9 credits for up to 2 semesters **after** the defense semester.
    - The two semesters after the successful defense includes summer, **even if** the student chooses **not to enroll in summer**.
    - For example, if a student successfully defended in spring, they would be considered full-time at less than 9 credits for the following summer and fall semesters.
    - The minimum enrollment for these students for full-time status is one credit for all students or three research credits for candidates.

Refer to the graduate school website for more detailed information on university policies and special cases.

6.3. Academic Standing, Probation, Withdrawal and Dismissal

According to the Graduate School, graduate students must maintain *at least a 3.0 cumulative grade-point average in the courses required for a graduate degree*. The Graduate School allows up to six credits total of BC/C to count toward a degree. An interpretation of how grades correspond to expectations for graduate work is listed in **Table 6.1**.

Table 6.1: Graduate level interpretation of academic grades

Grade	Level of Progress
A	Excellent and good graduate work
AB	Acceptable graduate work
B	Marginally acceptable graduate work
BC	Unacceptable graduate work
C	Unacceptable graduate work (all requirements completed)
F	Unacceptable graduate work (all requirements not completed)

In addition to the graduate school requirements, the Department of Chemical Engineering requires an average grade point of 3.0 for CM courses. A grade of "B" or better is *required* in the following six core CM courses:

- CM5100 – Applied Mathematics for Chemical Engineers
- CM5200 – Advanced Thermodynamics
- CM5300 – Advanced Transport Phenomena
- CM5310 – Laboratory Safety
- CM5400 – Advanced Kinetics/Reactor Design
- CM5621 – Research Essentials
- CM5721 – Literature Reviews in Chemical Engineering

Students who do not obtain a "B" in these courses will be required to repeat them and obtain the required grade before they can be awarded their degree. It is highly recommended that if you feel you are not doing well in a course, that you speak as soon as possible with the course instructor and your academic/research advisor to try to develop a plan to improve your performance. If you fail a course, a general good practice is to plan to take the undergraduate version of the course (either for credit or audited) before retaking the graduate version of the class. Be sure to discuss this with your advisor. If you wish to audit, you must obtain approval of the course instructor and follow their guidelines for expectations for homework/project/exam participation.

Research credits are required for an report/thesis MS or PhD in Chemical Engineering. **Good academic standing requires grades of "S" for research credits.** Failure to make adequate performance, as determined by your advisor, will result in a "Q" grade.

Probation: Students who fail to maintain a 3.0 GPA or who receive a "Q" grade in research credits will be placed on academic probation. If you are given a "Q" research grade, your research advisor is required to meet with you that semester to give you feedback and help develop a plan and timelines for improvement using the Plan to Correct Inadequate Research Progress Form (see Forms here). This form will be filled out each semester a "Q" grade is assigned.

Students who successfully raise their GPA above a 3.0 and receive "P" grades in their research credits the semester following probation will be returned to good academic standing, and removed from probation.

Suspension: Students who are on probation for two sequential semesters will be placed on academic suspension and will not be allowed to enroll in courses the following semester. Students suspended for poor research performance will need to review their probationary plan, identify deficiencies in the plan and their progress, and revise and develop a new research plan for the returning semester with benchmarks and deadlines for satisfactory progress. This plan must be approved by the research advisor.

Students who bring their grade point above a 3.0 and achieve research grades of "P" will be moved from suspension back to probation the following semester. Progression from probation to good academic standing will proceed as indicated in the previous section.

Dismissal: Students will be dismissed from the program who:

- Fail to improve following two semesters on suspension.
- Fail their qualifying exam twice (PhD only)
- Fail to pass a proposal defense twice (PhD only)
- Fail to pass the final thesis (MS research) or dissertation (PhD) defense.

Response to Suspension and Dismissal: Students may either appeal as described in the Graduate Appeals of Suspension or Dismissal policy, or leave campus. Those who leave campus must follow closeout procedures.

6.4. Absence Policy

Students taking courses or receiving financial support through the university in a given semester are expected to be in attendance at the start of the semester (see the academic calendar for semester start dates). The department allows for a maximum of a one-week delay in start date for most reasonable causes (or a two-week delay in start date if due to visa delays). This must be for a very good reason, and communicated with the department, course instructors, and research advisors prior to the start of term. Longer delays than this are not permitted due to the increased difficulty in catching up on course and work responsibilities.

Students receiving financial support through the University (teaching assistantship, research assistantship, and/or fellowship) are entitled to staff holidays and, unless otherwise specified by their advisor, are allowed two weeks of vacation per year. *Please note that the Thanksgiving and Spring breaks, the breaks between academic terms, and the summer semester are not automatically considered holidays or time off.*

In the case of GRAs, excused absences must be arranged with the faculty advisor. GTAs require the approval of the course instructor and/or their advisor and may not take personal time off during an academic term or finals week when they have teaching responsibilities. Travel to

attend conferences or other work-related activities is allowed but must be approved by the course instructor.

6.5. AI UsageParental Accommodation

Michigan Tech understands the importance of accommodating the needs of a graduate student who becomes the primary caregiver of a new child or children that join(s) the student's family through childbirth or adoption. The Graduate Student Parental Accommodation Policy provides assistance to students during a pregnancy, during a postpartum period, during an adoption process, or following a foster care placement.

Students are eligible for parental accommodation who:

- Have new childcare or related responsibilities due to a recent or upcoming birth or placement of a child under eighteen years of age in the home for the purposes of adoption or foster care.
- Are enrolled at Michigan Tech.
- Any parent in a given household is eligible to apply for parental leave.

Accommodation can be made with an excused absence from course, research, and teaching assignments; and a one-semester extension on degree timelines and deadlines. The primary caregiver is eligible for up to 6 weeks, or 8 weeks for birth by C-section. The secondary caregiver is eligible for up to two weeks.

In the event of multiple births or placements, students can receive up to one year extension on the deadline for completion of their research proposal examination, in addition to a one-year extension on the time to complete their graduate degree.

Students must submit a formal application for parental accommodation with all required signatures to the Graduate School **at least one month before the planned accommodation**. Note that *the department is not notified* when you submit this form, so please let the graduate chair and/or department chair, your research advisor (GRA) and your course instructor (GTA) know as soon as possible. Providing this information prior to the start of the semester would be greatly appreciated if you are able to do so. This will give everyone advance warning to arrange for your accommodation and ensure your work responsibilities are covered if you request an excused absence.

International graduate students who are attending Michigan Tech full-time with a student visa or exchange visitor visa are encouraged to consult with International Programs and Services about their plans during the parental accommodation period to ensure compliance with immigration regulations.

6.6. Academic Integrity & Plagiarism

The University and the Department of Chemical Engineering expect all students to maintain the highest level of academic and scientific integrity in all aspects of their studies, from classwork to exams to research. If you are unsure of or have specific questions about assignments, projects, examinations, etc., please ASK your instructor or research advisor.

Detailed information is available on Michigan Tech's academic integrity policy and procedures. This includes definitions of plagiarism, cheating, fabrication, and facilitating academic dishonesty. Plagiarism includes not only replication of exact wording, but also paraphrasing, using images, or representing another's ideas as your own, without proper citation. All graduate students should carefully read this policy.

6.7. Grievance Procedures

Defining Grievance Cause: Faculty or students with concerns or complaints about the behavior of other faculty or students in professional situations or interpersonal relationships should follow the grievance procedures described below. Note that questions of plagiarism should be taken to the Dean of Students, and sexual discrimination and sexual harassment issues should be taken to the University Title IX Coordinator

These procedures are designed to protect the rights and privacy of both faculty and students and to equitably adjudicate conflicts between faculty and students.

General Guidelines for Grievances: Students should avoid discussing their complaints with colleagues. Students who believe they have been subjected to discrimination based on sex or sexual harassment, suspect that an unfounded discrimination complaint may be filed against them, or have been threatened with the filing of such a complaint should notify the Affirmative Action Officer as soon as possible.

If you have a concern of any nature, you may report this through the appropriate form on the Dean of Students website.

Student-Initiated Grievances: Students have the right to fair and equal treatment by administrators and to expect professional behavior from faculty and other students. Professional behavior includes such matters as a respect for expertise, individual beliefs, and personal privacy.

Students should be aware that the campus provides an ombudsperson. One of the functions of the ombudsperson is to process student complaints. Students who have complaints about administrators, faculty, or other students should first discuss their complaints with the person concerned, if possible. If the complaint cannot be resolved in this way, they should discuss the complaint with the Graduate Committee Chair. The Graduate Committee Chair will attempt to resolve the problem through discussions with relevant parties. If resolution is not possible, the complaint will be referred to the Chemical Engineering Department Chair. If the complaint concerns the Graduate Committee Chair, it should be referred directly to the Chemical Engineering Department Chair. If the complaint concerns the Chemical Engineering Department

Chair and resolution is not possible within the department, the complaint should be referred to the Dean of the Graduate School.

Title IX: Title IX of the Education Amendments of 1972 is a Federal civil rights law that prohibits discrimination on the basis of sex in educational programs and activities that receive Federal funds. It states:

> *"No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."*

Under Title IX, discrimination on the basis of sex can include gender discrimination, pregnant and parenting discrimination, sexual harassment or sexual violence, such as rape, dating violence, domestic violence, stalking, sexual assault, sexual battery, and sexual coercion.

To officially report an incident of gender discrimination, sexual harassment, or sexual assault/violence, you may contact the Title IX Coordinator at titleix@mtu.edu, 906-487-3310, 306 Administration Building or Public Safety and Police Services at 906-487-2216. If you are a student, you may also choose to report to the Office of Academic and Community Conduct.

6.8. International Students

Upon arrival on campus all international students must register with the Office of International Programs and Services, located in room 200 of the Administration Building. All matters concerning employment and visa renewals are handled through this office. Changes in I-20 forms are handled in the Graduate School.

In order to be visa compliant, international students must register as full-time students during Fall and Spring semesters. Full-time enrollment is not required during summer unless required by employment or a fellowship. Questions regarding I-20 forms, visa status, and full-time student status may be directed to the Graduate School.

All international students who are provided GTA positions and whose native language is not English must take an English Language Assessment. The assessment takes place in the Michigan Tech Testing Center, Center for Teaching and Learning, Van Pelt and Opie Library 226. Visit the Testing Center to schedule a time to take the assessment or contact them at 906-487-1001, techtesting-l@mtu.edu.

6.9. Accommodations for Students with Disabilities

Michigan Tech complies with all federal and state laws and regulations regarding discrimination, including the Americans with Disability Act of 1990 (ADA) (https://www.mtu.edu/success/disability/students/policy/). If you have a disability and need a reasonable accommodation for equal access to education or services at Michigan Tech, please contact Student Disability Services. If you have any concerns please contact your advisor,

Graduate Advisor, or the Department Chair, or you can report a variety of concerns through the Dean of Students website.

7. Financial Support and Assistantships

7.1. Types of Support

Teaching Assistantships: Teaching assistantships are offered to qualified applicants, and are ***reserved for PhD students***. Per university policy, GTAs are not awarded to MS students. Occasionally the department will hire MS students hourly to serve as graders, but this is uncommon and only in times of great need. Graduate teaching assistants (GTAs) work with the faculty and conduct laboratory sections and student assessments. First-year PhD students are generally supported as GTAs, if positions are available. A typical GTA package includes tuition, fees, and a stipend. Stipends are adjusted periodically to ensure that they are competitive. PhD stipends increase at the start of the semester after passing the qualifying exam and again at the start of the semester after passing the proposal defense.

Research Assistantships: Research assistantships are offered to qualified applicants based on the availability of external funding. These are made at the prerogative of the faculty member who received the funding. Students are encouraged to contact graduate faculty in research areas they are interested in to discuss possible research projects and the availability of funding. Research funding may be available for PhD or MS students. Graduate research assistants (GRAs) are not assigned to teaching duties. The stipend and benefits are the same as those for GTAs.

Doctoral Finishing Fellowships: The Graduate School offers a limited number of highly competitive Finishing Fellowships for one or two semesters to PhD students in residence who are close to finishing their dissertations. It is important to communicate a clear and realistic plan for finishing that semester, and to have a strong publication record, which will require advanced planning. For more information, please review the Graduate School website.

Other PhD Funding Opportunities:

- DeVlieg Foundation Fellowships: The DeVlieg Foundation Fellowship program provides graduate support for PhD students in engineering, wildlife, and biology at MTU. Applicants must be a U.S. citizen or permanent resident.
- Portage Health Foundation Graduate Assistantships: PhD students who are participating in health-related research, and in research mode at the time of application, can apply for a PHF graduate assistantship. Preference is given to students who will complete their degree during the funding period.

Other MS/PhD Funding Opportunities:

- King/Chavez/Parks Fellowship: The Michigan King/Chavez/Parks Fellowship program provides grants to support graduate education (MS or PhD) for students from under-represented groups who commit to going into a career in post-secondary education. Applicants must be a U.S. citizen and Michigan resident.

- GEM Graduate Fellowships: Competitive graduate fellowships are available for MS and PhD underrepresented students in engineering. Applicants must be a U.S. citizen or permanent resident. More details are available at their website:
- Other Fellowships: The graduate school also provides links to several other competitively awarded fellowships. Securing prestigious awards provides time for concentration on one's research and writing.
- Summer Youth Programs: Students may find employment as counselors or instructors in various summer youth/outreach programs offered by the university. The Chemical Engineering department hosts summer youth programs every year – contact the department if you are interested in coordinating those activities.

Many government agencies have competitive funding opportunities, and you may be eligible for Fulbright fellowships for graduate students. You would need to do some digging to find these opportunities and talk to your research advisor about whether these are suitable for your research area. These fellowships often require a detailed research application and are highly competitive, but also highly prestigious if you are able to obtain one.

7.2. Procedure and Schedule for Awarding Support

The Chemical Engineering department endeavors to support all students needing financial assistance using a combination of external and internal funding. However, this may not be possible for every student, particularly those engaged in the coursework/report MS programs. The Graduate Research Committee makes support recommendations simultaneously with decisions on admission. Department (internal) funding is reserved for PhD students, however individual faculty members may have external support available for MS students to conduct research.

Decisions on financial support and contract offers for the coming academic year are made every spring semester, usually in March. However, some funding opportunities may become available at other times during the year. New students who start as GTAs, are preferentially assigned to faculty advisors who have open research funding.

Reappointments to graduate teaching assistant (GTA) positions are subject to review by the Department Chair in consultation with the graduate committee and faculty mentors. GTA evaluations submitted by faculty on GTA performance will play a major role in decisions made regarding reassignment of GTA positions.

Graduate research assistantships (GRAs) are selected based on the decision of the faculty advisor providing the financial support and can be withdrawn at the discretion of the advisor based on student performance.

7.3. Work Expectations

Graduate students are encouraged to be in the building during normal working hours (i.e. from 8:00 AM- 5:00 PM., Monday-Friday). Working during these normal hours enables you to better interact with your research advisor, other faculty, and fellow students. In the event of an emergency, it also makes it more likely that other people will be in the building to provide aid.

University expectations for graduate student workloads:

1. **Course Workloads**: Students who are enrolled in courses (academic or research) are expected to work according to the General Requirements of Credit Expectations. In summary, these guidelines state: "One credit should average 3½ hours of a student's time per week for one semester. One hour in class and 2½ hours in individual study is a typical division." The 3.5 hours commitment per credit holds as well for students enrolled in research credits.

   Thus an ***average*** graduate student enrolled in 9 credits of research should spend ***on average*** 9*3.5=31.5 hours per week on their research.

2. **Supported Workloads**: Students who are supported by a GRA, GTA, GTI, GADI, etc. are expected to perform work for the University at the rate of 20 hours per week (for a full appointment). This 20 hours per week is **IN ADDITION** to the amount of time a student spends working on their coursework or research for the credits in which they are enrolled. These graduate appointments are considered part-time jobs that provide some financial assistance to students so that they can pursue their degrees on a full-time basis.

Note that the sum of #1 and #2 above is more than 40 hours per week, but less than 60 hours per week. The most successful students are those who focus their attention on achieving the intended outcomes for their courses and research.

For students supported on an hourly basis, all hours worked must be reported and paid per labor laws. International students are limited to 20 hours per week while classes are in session during fall and spring semesters.

Expectations for Continuation of Support:

Continued funding of a graduate student through assistantships depends upon:

- Performing well in courses
- Adequately completing GTA/GRA duties
- Fulfilling all thesis/dissertation requirements
- Maintaining effective communication with the Graduate School, department, advisor, and course instructors

Failure to meet these expectations or prolonged absences (e.g., expected vacation, leaving town, etc.) for reasons other than hardship may result in the suspension or termination of financial support.

Clarification of Expectations with Research Advisor:

Before you start your position, you should clarify your advisor's expectations of you, as this will vary from person to person, and they may not volunteer this information. Here are some important questions to ask.

- **Work effort** - How many hours per week am I expected to work on research? If the funded research and dissertation research are not the same, how much time is expected to be devoted to both each week?
- **Work hours** – Should I be in the building 8 am-5 pm? Can I work flexible hours? Can I work remotely (when your tasks allow for this)?
- **Vacation time** – How many weeks can I take off each year? Does this include university holidays? Am I expected to work over Thanksgiving, Winter, and Spring breaks? Am I expected to work during the summer?
- **Summer funding** - Is there summer funding available, or will I need to find funding or find a summer job?
- **Experiential Learning** – Are you supportive of me engaging in experiential learning (Co-op, enterprise or internship)? Would I be permitted to apply for co-ops and internships, and if so, when? *(Note: If they are not supportive and this is something you want to do, find out the reasons why.)*
- **Publications –** How many first-author publications do you expect from me per year? How is authorship decided?
- **Timeline** - What are your expectation for my program timeline – when should I reach key milestones (MS thesis defense, PhD proposal defense, PhD dissertation defense)?
- **Advising committee** – How is the advising committee chosen? Does the advisor choose, does the student choose, or is it a joint decision between the two? Who has the deciding say?
- **Reading** – What is your expectation for the number of journal articles a PhD student should be reading per week?
- **Conferences** – Are you supportive of graduate students attending conferences? Which conferences do your students normally attend? When are they eligible to start attending conferences?
- **Additional responsibilities** – What other responsibilities do you regularly expect of your graduate students – examples might include participation in a journal club, mentoring and supervising undergraduate researchers, helping write grant proposals or patent applications, organizing and managing activities such as team meeting, lab cleaning, and outreach?

- **Other** – If there is an opportunity you are particularly interested in, or there is some idea you have, ask! And if your advisor doesn't think something is a good idea, try to find out why. They probably have a reason and may not think to share this.

Teaching Assistantships (GTAs): GTAs are assigned course-related duties, which are specified by the course instructor, but may include grading, teaching a laboratory, developing assignments, designing tutorials, holding review sessions, giving lectures while the instructor is traveling, supervising undergraduate graders, and proctoring exams. The standard level of effort expected is 20 hours per week, though this may vary from week to week. Sometimes GTAs are assigned part-time (10 hours per week each) to more than one course. This can be challenging as you need to manage the expectations of multiple faculty members.

If you feel that your workload is too heavy to allow you to complete your other responsibilities (coursework, research, etc.), please speak with your course instructor(s) as soon as possible. If you are unable to reach a satisfactory resolution following discussions, please contact the graduate chair as soon as possible, as they may be able to help.

New GTAs are required by the University to go through the GTA orientation before they begin their TA position. Additionally, international students must take an English Language Assessment (see section 6.8, pg. 52). Also be aware that there are almost no GTA lines available during the summer semester.

Research Assistantships (GRAs): GRAs have no course-related duties but are provided financial support to conduct research. Sometimes your dissertation project and the funded project will align. However, often this is not the case, and you will need to divide your time between the funded research and the dissertation research (this is similar to managing dissertation research and a GTA). Most advisors expect at least 20 hours per week on the funded project in addition to other graduate student time commitments (coursework, teaching responsibilities, dissertation preparation, etc.). In the event GRA funding runs out, students will be notified in writing two months in advance.

7.4. Timely Written Feedback: Teaching and Research Evaluations

Graduate Teaching Assistants (GTAs): GTAs are evaluated at the end of the semester by their instructor using the department evaluation form. The instructor is to review this evaluation form in person with the GTA. This process is designed to assist the GTA in improving their teaching ability. However, *if performance is exceptionally poor, this is likely to influence future funding decisions.* It is highly recommended you review the form with your instructor at the beginning of the semester to ensure that you both understand how you will be evaluated. Following completion of the evaluation, copies of the form are filed with the department and provided to the student, instructor, graduate program director, and Department Chair.

Graduate Students Engaged in Research: All graduate programs at the university provide constructive written feedback to students who are completing a report, thesis, or dissertation,

at least annually. This formal process ensures that both students and advisors are aware of the student's academic progress and future. The goal of this process is to facilitate continuous improvement and completion of the student's degree program.

The Chemical Engineering Department requires completion of our Graduate Research Assistant Evaluation Form for both MS and PhD students at the end of each semester, which can assist students to more rapidly self-correct and assist with research grade assignment. This form must be completed for any Chemical Engineering MS or PhD student involved in research, regardless of the source (or lack) of funding. To save time, the research evaluation can be conducted at the same time as the student self-reflection (see section 2.6, pg. 18). Following completion, the evaluation form is filed with the department and provided to the student, advisor, graduate program director, and Department Chair.

If a "Q" grade is assigned due to deficiencies identified in a student's performance, written feedback will be provided twice yearly using the Plan to Correct Inadequate Research Progress Form. This plan will specifically address the area(s) of deficiency, include a timeline and milestones for making up the deficiency, and list consequences for continued unsatisfactory performance. These actions will generally be warranted if a student's performance puts research funding or continuance of a research program in jeopardy.

7.5. Resigning a GTA/GRA Position

Students who find they must resign their GTA/GRA position during the year should make every effort to ***inform the Graduate Chair and the appropriate supervisor as soon as possible***, but at least two weeks prior to the start of the semester. Students who are scheduled to teach during the summer sessions should inform the Graduate Chair and the appropriate teaching supervisor at least five weeks prior to summer semester if they need to relinquish their assignment.

8. Information for Graduate Students with an MTU Bachelor's Degree

8.1. Accelerated MS

Current MTU undergraduate students who intend to obtain both their BS and MS from Michigan Tech can apply for the Accelerated MS program after attaining junior-standing. This program allows you to complete either a MS (coursework, report, or thesis) in one additional year beyond the bachelor's degree.

- You may apply any time after attaining junior-standing and before earning your BS degree. (Enrolled graduate students may *not* retroactively apply.)
- You must have a GPA of 3.0 or higher.
- **Accelerated credits:** Up to 9 undergraduate credits at the 3000 level or higher can be double counted toward both the BS and MS degrees.
- **Senior rule credits**: Up to 6 credits can be taken during the senior year under senior rule for the accelerated MS. Senior ruled courses only apply to a graduate degree but are covered under undergraduate tuition. Refer to the section on senior rule (8.3, pg. 64) for additional information.
- Accelerated MS students must take all 15 credits of core CM courses required for chemical engineering MS degrees.
- An additional 15 credits of technical courses or research credits are required for the Accelerated MS. The same rules for credits apply for the Accelerated MS as for the standard MS degree (see 2.2, pg. 14).
- Students may pursue coursework, report, or thesis Accelerated MS. For the research option, graduate research credits (CM 5990) cannot be taken prior to completion of the undergraduate degree. This means that graduate research credits cannot be used as accelerated credits or senior ruled.

More details on the Accelerated MS program can be found at the Department Website.

Accelerated MS Example Course Schedules

Students generally decide to pursue an Accelerated MS during their second-to-last or last year in their BS program. Because of this, example course schedules for the Coursework (**Table 8.1**) and Research (**Table 8.2**) Accelerated MS programs only include the last year of the BS and the first year of the MS. However, double-counted courses are often technical electives that were taken in the second-to-last year in the BS program (after achieving junior-level standing). An example degree schedule is available online.

Course schedules are planned in consultation with the undergraduate advisor and graduate chair to ensure efficient completion of both degrees.

Table 8.1: An example Coursework Accelerated MS course schedule.

Fall (Final year of BS)

Category	Course	Title	Credits
BS	CM 4110	Unit Operations Lab	3
BS	CM 4310	Process Safety/Environment	3
BS	CM 4855	ChE Proc Analysis and Design I	3
Double-Counted	--	Free or Technical Elective (3000-6000 level)	3
Senior Rule	CM 5100 or --	Applied Math for Chem Eng OR MS Elective (3000-6000 level)	3
BS	--	Undergrad required course (if needed)	3
		Total	15-18

Spring (Final year of BS)

Category	Course	Title	Credits
BS	CM 4120	Chemical Plant Operations Lab	3
BS	CM 4860	ChE Proc Analysis and Design Lab II	2
BS	CM 4861	ChE Design Lab II	1
Double - Counted	--	Free or Technical Elective (3000-6000 level)	3
Senior Rule	CM 5300 or CM 5400 or --	Advanced Transport Phenomena OR Advanced Reactive Systems Analysis OR MS Elective (3000-6000 level)	3
BS	--	Undergrad required course (if needed)	3
BS	--	Undergrad required course (if needed)	3
		Total	12-18

Fall (First Year of MS)

Category	Course	Title	Credits
MS	CM 5200	Advanced Thermodynamics	3
MS	CM 5310	Laboratory Safety	1
MS	CM 5621	Research Essentials	2
MS	--	Elective (3000-6000 level)	3
		Total	9

Spring (First Year of MS)

Category	Course	Title	Credits
MS	CM 5300 or CM 5400	Advanced Transport Phenomena OR Advanced Reactive Systems Analysis	3

MS	CM 5400 or --	Advanced Reactive Systems Analysis OR Elective (3000-6000 level)	3
MS	--	Elective (3000-6000 level)	3
		Total	9

Table 8.2: An example Research Accelerated MS course schedule.

Fall (Final year of BS)

Category	Course	Title	Credits
BS	CM 4110	Unit Operations Lab	3
BS	CM 4310	Process Safety/Environment	3
BS	CM 4855	ChE Proc Analysis and Design I	3
Double-Counted	TBD	Free or Technical Elective (3000-6000 level)	3
Senior Rule	CM 5100	Applied Math for Chem Eng	3
BS	-	Undergrad required course (if needed)	3
		Total	15-18

Spring (Final year of BS)

Category	Course	Title	Credits
BS	CM 4120	Chemical Plant Operations Lab	3
BS	CM 4860	ChE Proc Analysis and Design Lab II	2
BS	CM 4861	ChE Design Lab II	1
Double-Counted	TBD	Free or Technical Elective (3000-6000 level)	3
Senior Rule	CM 5300 or CM 5400	Advanced Transport Phenomena OR Advanced Reactive Systems Analysis	3
BS	-	Undergrad required course (if needed)	3
BS	-	Undergrad required course (if needed)	3
		Total	12-18

Fall (First year of MS)

Category	Course	Title	Credits
MS	CM 5200	Advanced Thermodynamics	3
MS	CM 5310	Laboratory Safety	1
MS	CM 5621	Research Essentials	2
MS	CM 5990	MS Research	3
		Total	9

Spring (First year of MS)

Category	Course	Title	Credits
MS	CM 5300 or CM 5400	Advanced Transport Phenomena OR Advanced Reactive Systems Analysis	3

MS	CM 5990	MS Research	3-5
MS	-	Elective (3000 – 6000 level)	1-3
		Total	9

8.2. Accelerated Graduate Certificates

Current MTU undergraduates or MTU bachelor's alumni who have graduated within the past two years are eligible to complete an accelerated graduate certificate as a standalone credential or part of a graduate degree. Up to 3 credit hours can be double-counted toward both the B.S. degree and a graduate certificate.

Eligibility requirements:

- Be a **current Michigan Tech undergraduate student** in good standing and have achieved at least junior-level standing or be a **recent bachelor's graduate of Michigan Tech** (less than two years since graduation).
- Have a cumulative grade point average of **2.75 or above**.
- **Intend to complete both** your bachelor's and graduate certificate at Michigan Tech.
- **Apply** through the Graduate School application process OR if currently enrolled in an MTU graduate program, using the Add a Graduate Certificate form.

Because the certificate can only be applied for by at least the junior-level, only courses completed while at junior-level standing or higher can be counted toward the certificate.

Double-Counting Credits Toward a Certificate and a BS Degree:

- Three (3) credits can be **double-counted** toward one certificate.
- A different (3) credits can be **double-counted** toward a second graduate certificate.
- All credits must be approved by the graduate program director.
- Double-counted credits must be **earned while at junior-level standing or higher.**
- The certificate can count toward an MTU graduate degree.
- Certificates are eligible for **senior rule** - up to 1/3 of the courses required for the certificate (e.g. 3 credits of a 9-credit certificate) can be taken under senior rule during the final year of the bachelor's degree.

These rules mean that 6 of the 9 credits for a certificate can be completed at the undergraduate level, and 3 credits must be completed as an enrolled graduate student.

For additional information, please refer to the following sections of the handbook and graduate school websites:

- **Graduate Certificates:** (section 2.6, page 18)
- **Senior Rule:** (section 8.3, page 64)

8.3. Senior Rule

The senior rule allows students who are finishing their undergraduate degree at MTU within the next 12 months to take courses during that time that could apply to a graduate degree at MTU.

- For the MS in Chemical Engineering, the senior rule can be applied to 6 credits.
- These courses are not double-counted – they only apply to the MS degree.
- Students must **submit the Senior Rule Form** to the Registrar's office by Wednesday of Week 2 **the semester they are completing the course**. These forms cannot be submitted retroactively.
- The decision is final once the senior rule form has been approved. Those courses can no longer be applied to the BS degree.
- Undergraduate students enrolled in 6 credits or more of 5000 or 6000 level courses in a semester may carry no more than 16 credits of course work per semester.
- Senior rule credits may not exceed 1/3 of the required non-research course credits for the MS degree.
- Senior rule courses are not eligible for undergraduate financial aid – i.e. they don't count toward full-time or part-time status in financial aid considerations.
- You do not need to apply to an MTU graduate program before submitting the senior rule form.
- Senior rule classes are covered by undergraduate tuition - you do not need to pay graduate student tuition rates for these courses.

9. Professional Development Opportunities and Support Services

9.1. Graduate Student Government

The Graduate Student Government (GSG) of Michigan Tech represents the professional, intellectual, and academic concerns of graduate students to the various governing bodies of the university and acts as advocate for graduate students. GSG Representatives work with the Chemical Engineering Department Chair to provide programming for Chemical Engineering graduate students, faculty, and staff. You are encouraged to consider volunteering to serve as a Chemical Engineering representative to the GSG.

9.2. Graduate Student Advisory Board (GSAB)

The Graduate Student Advisory Board (GSAB) is a chemical engineering graduate student organization that exists as a vehicle for department graduate students to network, learn from each other, and build community with other grad students, as well as faculty and staff. The GSAB can also serve as a formal conduit for relaying input to the faculty and staff in the department. Information about regular GSAB meetings will be announced every fall semester. If you are interested in learning more about the GSAB and how you can get involved, please contact ChemESAB@mtu.edu.

9.3. The J.R. Van Pelt and Opie Library

Along with a growing collection of textual and electronic resources, the J. R. Van Pelt and Opie Library is connected to MELCAT & ILLIAD, so that students may retrieve sources from other institutions. The library also provides research and instructional support for all students. This modern and well-lit library has several group study rooms, computers, printing and photocopying areas, a café, University Archives and Historic records, and other amenities.

9.4. The Center for Teaching and Learning

The William G. Jackson Center for Teaching and Learning holds events and workshops to support Michigan Tech in the continuous improvement of teaching and learning at all instructional levels. The CTL also holds the required orientation sessions for new GTAs. It is highly recommended that you attend their events if you are a GTA or plan to teach in the future. You can also contact them if you have specific questions about Canvas, teaching technology, or pedagogy.

9.5. The Michigan Tech Writing Center

The Michigan Tech Writing Center has coaches who can help with communicating across a wide array of cultures, disciplines, and methods of expression, including written, visual, and spoken forms. Communication is an important component of your graduate

education, regardless of your degree program. If you need help with improving your oral, written, or visual communication skills, or just need some feedback on a particular project or assignment, we recommend that you consider making an appointment with a coach.

9.6. Career Services

Career Services offers various events and activities that can help you secure a future job. Pay particular attention for events targeted at graduate students, which are offered periodically during the year. Note that if you are a **thesis/report MS or PhD student** that you should **consult with your research advisor** and receive their approval **before applying for internships or co-ops.**