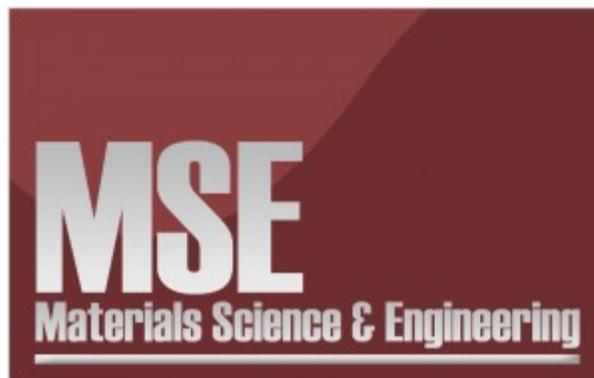




Materials Science
& Engineering



Graduate Student Handbook

Department of Materials Science and Engineering

2018-2019

McMaster University, Hamilton, Ontario

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Welcome to Materials Science and Engineering!

The Graduate Student Handbook outlines the policies and procedure followed by the Department of Materials Science and Engineering.

All students are advised to familiarize themselves with the regulations in the School of Graduate Studies Calendar (2018-19), available online:

<http://academiccalendars.romcmaster.ca/index.php>

If you have any questions or concerns please do not hesitate to contact your Graduate Administrative Assistant in the Materials Science and Engineering main office, JHE-357

Contacts

DEPARTMENT LEADERSHIP

Chair

Dr. Hatem Zurob | Extension 23515 | zurobh@mcmaster.ca

Associate Chair – Graduate

Dr. Gianluigi Botton | Extension 24767 | gbotton@mcmaster.ca

DEPARTMENTAL STAFF

Department Administrator

Samantha Kandilas | Extension 24293 | samkandilas@mcmaster.ca

Graduate Administrative Assistant

Mary-Anne Bechamp | Extension 26626 | bechamma@mcmaster.ca

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Chelsea Gregory | Extension 24295 | gregoc2@mcmaster.ca

TECHNICAL STAFF

Laboratory Manager

Ed McCaffery | Extension 24985 | JHE-248 | mccafer@mcmaster.ca

Research Technician

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Research Technician

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GENERAL INFORMATION

Arrival

When you arrive at McMaster, please come to the Department's main office, which is located in the John Hodgins Engineering (JHE) Building in Room 357 (JHE-357) and bring the following documents with you:

- Original Transcripts
- Study Permits
- Social Insurance Number

Welcome Package

Every new graduate student will have a welcome package which will include important paperwork that must be completed and submitted to the Graduate Administrative Assistant (Mary-Anne Bechamp) as soon as possible. To prevent delays in pay, please complete the following forms as soon as possible:

- Direct Deposit Forms
- Tax Forms
- Desk Assignment and Key Card

Desk Assignments

Every full-time graduate student in the Department is assigned a desk. Your desk assignment will be included in your welcome package.

The custodial staff regularly washes the floors and empties the trash containers. Large items for disposal that do not fit in the containers should be clearly marked for disposal. The custodians do not clean desks or equipment of any kind. **Graduate students are responsible for the general tidiness of the offices, of the appliances in them, and of their personal areas.**

Keys

A number of keys are commonly used by graduate students. When you meet with your supervisor, you will find out what keys are required. Once the card access key form has been completed and signed by appropriate supervisor and administrative staff, take the form to the HUB (JHE-216A). There is a \$20 key deposit required for each key and you will need to show your student ID. The deposit will be refunded when the key is returned when you graduate. Do not to lend your keys, or allow anyone else into any Department facility after hours. This is for reasons of safety and security.

Graduate Mailboxes

Physical mailboxes are located in JHE-355. Mail is filed under the first letter of your last name. It is a good idea to check your mailbox frequently. The correct address for your personal mailbox is your name plus:

Name, Graduate Student
Materials Science and Engineering (JHE-357)
McMaster University
1280 Main Street West
Hamilton, ON L8S 4L7

Outgoing mail can be left in the outgoing mail tray in the Department office (JHE-357).

Verification Letter Requests

If you require a letter to verify your status and financial details for work authorization, visas, travel etc. please print and complete the request form from the Department website:

<https://www.eng.mcmaster.ca/materials/resources#graduate-students>

Letters will be produced on letterhead, and can be picked up from the Graduate Administrative Assistant (Mary-Anne Bechamp). Please allow up to two (2) business days to have the request completed. A maximum of three (3) letters will be done per year.

Photocopying

The photocopier is located in JHE-355. If photocopying is required for your research project, you will require an account number from your supervisor.

Paper is stored in the Department office (JHE-357), underneath the set of faculty mailboxes. When taking paper, please fill in the form stating your name, supervisor and how many packages you are taking. Your supervisor will be billed at the end of the month.

Bulletin Boards/E-mail Messaging

Check you McMaster email regularly for important information such as events, scholarships, courses, and job announcements for graduate students that will be sent out by the Graduate Administrative Assistant (Mary-Anne Bechamp). You can also refer to the bulletin board located outside the Department office for similar postings. It is essential that you check your email and/or the notice board regularly to see if anything might apply to you.

SOCIAL INSURANCE NUMBER (SIN)

It is essential that the School of Graduate Studies has your Social Insurance Number (SIN) on your record (for income tax receipt purposes). Your SIN is a nine-digit number that you need to work in Canada or to have access to government programs and benefits. **If you do not have a SIN number, please apply for one immediately either at:**

Human Resources and Skills Development Canada (HRSDC)
Hamilton Mountain Human Resource Centre of Canada
1550 Upper James Street, Hamilton, ON (corner of Rymal Road)
905-572-2211

Hamilton East Satellite Office
2255 Barton Street East, Hamilton, ON (corner of Nash Road)
905-572-2211

International students need a Canadian SIN to work in Canada. If you hold a Teaching Assistantship (TA), then you will need to take the following documents with you when you apply:

- Your employment contract
- Your passport and study permit
- Completed SIN application form

Once the new number is received, bring it to the Department office (JHE-357) and the School of Graduate Studies (GH-212).

Your new SIN card will have the same expiry date as your study permit. Remember to renew both documents at the same time.

STUDENT AUTHORIZATIONS (for Visa students only)

Visa students are required to provide photocopies of their student authorizations to the School of Graduate Studies and to the Graduate Administrative Assistant (Mary-Anne Bechamp) when they begin their programs (i.e. at the time of their first registration in September, January or May) and each time such authorizations are renewed. Failure to do so will result in the withholding of your payments.

Student permit extensions take some time to process, so plan ahead. Remember that SIN and Study Permits have expiry dates and must be renewed at least three (3) months in advance. The ultimate responsibility for maintaining up-to-date documentation lies with you – the graduate student. Remember also that it is your responsibility to ensure that your passport remains current. Information regarding Study Permits can be accessed from the Citizen and Immigration Canada website:

<http://www.cic.gc.ca/english/study/study.asp>.

SCHOOL OF GRADUATE STUDIES

Visit the School of Graduate Studies website for more detailed information:

<https://gs.mcmaster.ca/>

If you have questions about your graduate study that cannot be answered by the Department (either the Graduate Administrative Assistant (Mary-Anne Bechamp) or the Associate Chair – Graduate (Dr. Gianluigi Botton)), you may contact members of the Graduate Studies office by email.

General Questions:	askgrad@mcmaster.ca
Student Records:	sgsrec@mcmaster.ca
Payroll & Graduate Support:	gradpay@mcmaster.ca
Student Accounts (Tuition/Fees):	student.accounts@mcmaster.ca
Thesis preparation & PhD defenses:	gthesis@mcmaster.ca
Scholarship Competitions:	graduatescholarships@mcmaster.ca

NEW GRADUATE STUDENT'S PAYROLL INFORMATION

TA Assignments

If you are to receive a TA assignment, as indicated in your offer, you will be paid bi-weekly by direct deposit, based on when you are scheduled to work. TA payments are normally in the Fall Term (Term 1) from September to December, 2018 and/or the Winter Term (Term 2) from January to April, 2019. For more information about when you are scheduled to work, please refer to your employment contract.

Research Scholarships

Research scholarships paid by supervisors from a research grant will be paid via lump sum installments via direct deposit at the beginning of each term, unless otherwise specified by your supervisor. All other scholarships will be disbursed to the student in lump sum installments via direct deposit at the beginning of each term. Further information about student accounts, timing of payments and payment schedule for the 2018-2019 academic year will be sent prior to the start of the fall Term (Term 1).

It is important for you to recognize that the Department scholarship support does not extend beyond the twenty four (24) months of a Master's program. Only under very special circumstances are exceptions made to this policy. For the PhD program, the Department scholarship support period is forty eight (48) months.

SCHOLARSHIPS AND AWARDS

McMaster University has adopted a policy of ensuring that all full-time PhD students receive at least a combined total of \$17,500 per year of research scholarships, awards, external scholarships, bursaries (where applicable), teaching assistantships, and other sources. The Faculty of Engineering has a policy ensuring that the gross pay minus tuition of any newly-hired full-time, non-overtime PhD student is a minimum of \$16,000.

There are three types of funds offered to graduate students: (1) those that require an application form (major awards), normally announced in the spring and funded in the following academic year; (2) those that are by nomination from the Department (internal scholarships and bursaries) and (3) a limited number of travel awards that are funded in the current academic year. The timing of most scholarship and award administrative processes takes place in the Fall Term (Term 1).

Information regarding the funding model can be found here: <https://gs.mcmaster.ca/awards-funding/awards-funding>. Should you have questions concerning your monthly payment, please contact the Graduate Administrator Assistant (Mary-Anne Bechamp).

The Department strongly encourages graduate students (Master's and PhD) to apply for an Ontario Graduate Scholarship (OGS), Ontario Graduate Fellowship (OGF) and/or a Canadian Graduate Scholarships administered by the National Science and Engineering Council (NSERC). Information regarding these awards can be found here: <https://gs.mcmaster.ca/awards-funding/awards-funding>. Should you have questions concerning your funding payments, please contact the Graduate Administrator Assistant (Mary-Anne Bechamp).

Successful awardees will see their funding packages increase by the following amounts:

Award	Value	Duration	Net Increase to Student Funding Package
OFS	\$15,000	1 Year	\$5,000
OGS	\$12,000	1 Year	\$5,000
NSERC CGS-Master's	\$17,500	1 Year	\$7,500
NSERC CGS-Doctoral	\$35,000	2 or 3 Years	\$17,450
NSERC PGS-Doctoral	\$21,000	2 or 3 Years	\$10,000

LEAVES OF ABSENCE

Please refer to the School of Graduate Studies Calendar:

https://academiccalendars.romcmaster.ca/content.php?catoid=37&navoid=7553#2-5-7_leaves_of_absence

MOSAIC STUDENT CENTRE

McMaster's on-line MOASIC Student Center provides access to the following academic, personal and financial information:

Academics:

- Class Search
- Academic Planner
- Enrollment (formerly called registration)
- Class Schedule - List & Weekly views
- Course History
- Enrollment/Financial Letters
- Grades
- Program/Plan/Sub-plan Selection
- Transcripts - instant access to unofficial transcripts and ability to order official transcripts
- Academic Advising (formerly called degree audit)

Finances:

- Account Inquiry
- Make a Payment
- Charges Due
- Enrollment/Financial Letters
- View/Print T2202A/T4A
- Travel Expense Reimbursement

Personal Information:

- Change mailing address
- Add emergency contacts

Scholarships/Financial Aid:

- Unified application for many scholarships and bursaries
- Application to determine eligibility for work/study positions

For a complete description of all of these services, and managing your MAC ID visit the MAC ID homepage at:

<http://www.mcmaster.ca/uts/macid>

To access these services, you need to activate your MAC ID account and enable your MAC ID services.

Enabling Your MAC ID Services

MAC ID is your McMaster username that is unique to a student and is used to access various McMaster resources such as:

- UTS Student Labs
- Wireless Access on Campus
- McMaster Email Account
- Avenue to Learn
- Online Voting System

Applicants are preassigned a MAC ID upon applying to McMaster University. An applicant must enable their MAC ID by going to MOSAIC and selecting “Enable you MacID services”

Password

Choose a strong password: it has to be at least eight (8) characters long, and has to include at least one character from two of the four groups below:

- Uppercase letters: A, B, C, ...Z
- Lowercase letters: a,b,c, ..z
- Numerals: 0,1,2,3,4,5,6,7,8,9
- Symbols on the keyboard that aren't letters or numerals: ~ ! @ # \$ % ^ & * () _ + - = { } | [] \ : " ; ' < > ? , . /
- Set your challenge questions (used if you forget your password, and need to reset it).

**For assistance, please contact the Technology Service Desk at:
Extension 24357 | uts@mcmaster.ca**

HEALTH INSURANCE INFORMATION

All registered students are required to have approved hospital and medical insurance. Medical costs in Canada are very expensive; therefore, having health insurance covered is essential.

Permanent Residents

Permanent residents who require health coverage under the Ontario Health Insurance Plan (OHIP) may obtain application kits from the Ministry of Health Office at 119 King Street West (the 10th floor of the Convention Centre) in Hamilton. The telephone number is 905-521-7100. You will be required to produce three pieces of identification (e.g. birth certificate, driver's license).

Visa Students

The University Health Insurance Plan (UHIP) was created in 1994 to provide affordable insurance to pay the cost of the hospital and medical services that students or employees at participating universities and colleges in Ontario and their families might need to maintain their health while in Canada. The plan provides coverage comparable to that of OHIP for Ontario residents. UHIP is mandatory for all McMaster University students, employees, and dependents of students and employees who do not have OHIP coverage.

The cost of medical treatment is very expensive in Ontario. It is extremely important that all international students, including exchange students, have adequate coverage while in Canada. UHIP is a comprehensive plan that is mandatory for international students. The plan provides doctors' services, hospital ward accommodation, and all maternity claims even if pregnancy began before arriving in Ontario, and coverage for medical care outside Ontario or Canada.

UHIP for all international students is administered by International Student Services (ISS).

UHIP cards are ready for pickup at the beginning of each academic term. Students are able to pick up their UHIP card from ISS between 2:00 pm and 4:30 pm Monday through Friday (excluding holidays). Student cards are required for UHIP card pickup and must be picked up by the student themselves. Students who are unable to pick up their UHIP cards within the scheduled time period must schedule an appointment by emailing iss@mcmaster.ca with their name, student number and a tentative pickup time.

If you have dependents living in Ontario with you please contact ISS at iss@mcmaster.ca or ext. 24748 for further information on how to register your dependents for UHIP. **Dependents must enroll in UHIP within 30 days of arrival in Canada.**

For more information visit:

http://oisa.mcmaster.ca/handbook%5Chealth_care.cfm#_UHIP_Card_1

CUPE 3906 Collective Agreement

The position of Teaching Assistant is a unionized one included in CUPE Local 3906 bargaining unit 1, and subject to the terms of the Unit 1 Collective Agreement (the "CA"). The Employer will:

- (i) Make copies of the revised Collective Agreement available within one month of the printing of this Agreement in all Human Resources Services Offices and academic units; and
- (ii) Provide direct access, via an email link, one month after the start of each semester, to a copy of this Collective Agreement to each newly hired employee, at no cost to the employee upon commencement of his/her initial assignment, unless a printed copy is requested by the employee.

The Collective Agreement can be found online at.

[http://www.workingatmcmaster.ca/med/document/CUPE-Unit-1-\(TA\)-CBA---FINAL-24FEB2017-1-42.pdf](http://www.workingatmcmaster.ca/med/document/CUPE-Unit-1-(TA)-CBA---FINAL-24FEB2017-1-42.pdf)

Dental Plan

All full-time graduate students who are receiving a TA and/or a RA in lieu of a TA of 130 hours or greater will have Dental Plan premiums deducted each month for the full year (September to August). Provisions for opting-out of the Dental Plan or for obtaining family coverage are covered in a separate document which describes the CUPE Dental Plan. Dental claim forms and opt out forms are available in PDF-format at <http://www.cupe3906.org/wordpress/benefits-forms/unit-1-benefits/dental>

CAMPUS SERVICES/RESOURCES

For a listing of the central services/resources that are available to you as a graduate student, please visit the following website for a listing of services/resources and the specific link to the individual websites: <https://gs.mcmaster.ca/resources>

GRADUATE STUDENT WELCOME 2018-2019

The School of Graduate Studies would like to welcome all new McMaster Graduate Students. The official Graduate Student Welcome period is scheduled from August 27 to September 8, 2018. Join in on events that will introduce you to life as a graduate student at McMaster University, help you meet new people and discover your new school and city. More information about Welcome Week Events will be communicated as they become available.

The Department of Materials Science and Engineering will also offer Welcome Week specific activities introducing you to MSE faculty, staff and students. More information will be communicated as they become available.

School of Graduate Studies Welcome Week

Date	Time	Event	Location
Tue. Aug 28	TBA	International TAs Session	TBA
Wed. Aug 29	9:00-10:30am	New Student Welcome Breakfast #1	Phoenix
Tues. Sept 4	9:00-10:30am	New Student Welcome Breakfast #2	Phoenix
	10:30-12:30	Nature Hikes	Depart from Phoenix
	2:00 – 4:00	Grad Resources Fair	CIBC Hall
Wed, Sept 5	9:00 – 12:10pm	Teaching and Learning Forum*registration required	CIBC Hall
	7:00 pm	Trivia Night	Phoenix
Thurs. Sept 6	9:00 – 10:30am	New Student Welcome Breakfast #3	Phoenix
	10:30-12:30	Nature Hikes	Depart from Phoenix
	TBA	Scavenger Hunt	TBA
	5:00 – 8:00pm	Board Game Night – International Students	CIBC Hall
Fri. Sept 7	2:30-5:30pm	GSA BBQ	Phoenix

GRADUATE COURSES REQUIREMENTS

The requirements listed below only apply to in-coming students with a September 2018, January 2019 or May 2019 start. For in-course students, you need to refer to the graduate course requirements stated in the School of Graduate Studies Calendar issued for the year of your start. For example, if you started in September 2016, January 2017 or May 2017, then the School of Graduate Studies Calendar, 2017-2018 needs to be consulted.

Master's Degree

Master's students are required to successfully complete at least 12 units of course work, which must include the mandatory seminar half course (3 units) MATLS 701. Courses at the 700 level are offered as either a half course (3 units) or a quarter course (1.5 units), whereas courses offered at the 600-level are offered as half courses (3 units). Only one 600-level course is allowed for graduate credit. Only one non-technical half course (3 units) is permitted with written approval from the supervisor. The passing grades for a graduate level course are A+, A, A-, B+, B, and B-.

PhD Degree

Students entering the PhD program in the Department directly with a Bachelor's degree are required to successfully complete at least 12 units (4 half-courses) of course work, which includes the mandatory seminar course MATLS 702 (3 units) and 6 units of technical courses at the 700 level. Courses at the 700 level are offered as either a half course (3 units) or a quarter course (1.5 units), whereas courses offered at the 600-level are offered as half courses (3 units). Only one 600-level course is permitted for graduate credit. Only one non-technical half course (3 units) is permitted for graduate credit with written approval from the supervisor.

Students entering the PhD program in the Department with a Master's degree are required to successfully complete at least 12 units (4 half-courses) of course work, which includes the mandatory seminar course MATLS 702 (3 units) and 6 units of technical courses at the 700 level. Courses at the 700 level are offered as either a half course (3 units) or a quarter course (1.5 units), whereas courses offered at the 600-level are offered as half courses (3 units). Only one 600-level course is permitted for graduate credit. Only one non-technical half course (3 units) is permitted for graduate credit with written approval from the supervisor.

Students transferred to the PhD program from the Master's program in the Department are required to successfully complete at least 12 units (4 half-courses) of course work, which includes the mandatory seminar course MATLS 702 (3 units) and 6 units of technical courses at the 700 level. Courses at the 700 level are offered as either a half course (3 units) or a quarter course (1.5 units), whereas courses offered at the 600-level are offered as half courses (3 units). Only one 600-level course is permitted for graduate credit. Only one non-technical half course (3 units) is permitted for graduate credit with written approval from the supervisor.

The passing grades for graduate level course are A+, A, A-, B+, B, and B-.

Courses Outside Department

Students are encouraged to consult with their Supervisor to select some of their courses from areas beyond the focus of their research, including courses offered by other Departments. For courses to be taken for credit outside of the Department, but within the Faculties of Engineering, Science and Health Science, written approval from the Supervisor is required. Any other courses for credit require approval from the Associate Dean Graduate Studies (Engineering). The passing grades for such graduate level courses are A+, A, A-, B+, B, and B-.

Graduate students are normally required to complete their course degree requirements by taking courses from within their program (Department of Materials Science and Engineering in this case). As a minimum, at least 50% of courses taken must be listed or cross-listed by the Department's (Materials Science and Engineering) program in order to be counted towards your degree. Courses taken outside of the Faculty of Engineering and not listed as part of the degree requirements require the permission of the Associate Dean – Graduate of the Faculty of Engineering or their delegate to be counted towards the degree.

Department Course Offerings 2018-2019

****All courses scheduled to be offered can be found on our website and MOSAIC****

Fall Term (Term 1)			Winter Term (Term 2)		
MATLS 6D03	3 Units	Corrosion	MATLS 6C03	3 Units	Iron/Steelmaking
MATLS 6G03	3 Units	Characterization of Nanomaterials	MATLS 6FF3	3 Units	Nanomaterials
MATLS 6I03	3 Units	Sustainable Manufacturing	MATLS 701/702	3 Units	Graduate Seminar
MATLS 701/702	3 Units	Graduate Seminar	MATLS 725	3 Units	TEM
MATLS 724	3 Units	Materials Characterization	MATLS 727	3 Units	Heterogeneous Kinetics
MATLS 726	3 Units	Electrochemistry	MATLS 730	1.5 Units	XRD2/XRD#
MATLS 753/755	3 Units	Mechanical Behaviour	MATLS 780	1.5 Units	Metallic Coatings
MATLS 792	3 Units	Research Methodology			

Note that the course enrollment process will automatically assign a course towards the primary academic program that a student is enrolled in for a particular term. This process does not determine whether the course will exceed the requirements outlined in the curriculum. Where a student wishes to designate a particular course towards a program other than their primary academic program a special request is required during the normal add period outlined in the sessional dates. The requirement designation form is available on the School of Graduate Studies website.

Extra Courses (Extra Course)

This category identifies courses that the student is taking with the approval of the supervisor, but that are not necessary to the student's current degree program. In order to designate a course as extra, a student will have to submit a course designation request during the normal add period of enrollment in a particular term. The form is submitted to the program office and once approved will have the designation added to the enrollment record for that course only. If a failing grade (i.e. less than B-) is received in a course taken as Extra, the courses (and grade) will not appear on the student's transcript unless because of academic dishonesty. Students may petition to change the designation of an Extra Course to a Master's or PhD course prior to the deadline to drop a course provided that this change is supported by the supervisor and program. Changes of designation after the drop date will not be approved. Courses designated as Extra Course may subsequently be counted towards graduate degree requirements and the course designation changed to Master's or PhD, if approved by the Faculty Admissions and Study Committee or the Associate Dean acting on its behalf. The passing grades for an Extra Course are A+, A, A-, B+, B, and B-.

Courses that are required by the supervisory committee or the Department Chair as additional requirements in excess of the stated minimum for the program must be designated as Master's or PhD.

MSE GRADUATE DEPARTMENT SEMINARS

MATLS 701/702 - Attendance is mandatory for all students

The Department holds a regular meeting, which incorporates the Graduate Seminar, featuring oral presentations by registered graduate students (MATLS 701 or MATLS 702) and by visitors and fulltime researchers.

Each student is required to prepare and present a major seminar, based upon extensive research work and literature surveys, on any topic of current research interest in Materials Science and Engineering. A pass/fail grade will be assessed based on overall performance in the course.

****Registration required to present seminar – P to register and schedule your seminar date****

Master's Students (MATLS 701): One (1) seminar required, usually in Year 2 of program

PhD Students (MATLS 702): Two (2) seminars required, usually in Year 2 and Year 4 of program. Please register for the course when planning to give the second seminar

The seminar schedule will be posted on our website.

SGS 700 Research/Writing (Full-Time)

MOSAIC requires students to be enrolled in a course, in every term that they are an active student. If there is a term in which the student is not taking a course, the student needs to enroll in SGS 700. This applies to course based and thesis based students. If the student is not enrolled in this course, during a term in which they are not taking anything else, Mosaic will class that student no longer being active and this will prevent them from moving onto the next academic year. It will also make a transcript read incorrectly, should students need transcripts for scholarships or applications to other degree programs. This does not apply to students who are on a leave of absence.

Once a student has this course in their term, they cannot add another course to the that term. If they originally planned not to take a course in that term or planned to work on their thesis for that term and put SGS 700 on their record, should they change their minds and want to take a course, they must first drop the SGS 700 course before the system will allow them to add anything else.

Students fees are either assessed on a per term or per course based structure, depending on their degree. Students with per course based fees will not see a financial impact from adding this course.

Career Planning

Entering graduate students in Master's or PhD programs within the Faculty of Engineering are required to complete a career planning exercise within their first academic year (September to August). Students will book through the Department, a planning session with a career specialist within the Faculty of Engineering and subsequently produce and (at most) a two-page report before the end of their first year (Year 1). This report is to be submitted to the Graduate Administrator Assistant (Mary-Anne Bechamp).

SGS MANDATORY COURSES

All graduate students at McMaster are required to complete the following two (2) on-line courses available within McMaster's Avenue to Learn software within their first academic term:

SGS 101 – Academic Research Integrity and Ethics

SGS 201 – Accessibility for Ontarians with Disabilities Act – AODA Training

Anyone who has not completed either of the following courses by December 1, 2018 (excluding the January 2019 starts) will be automatically assigned an F grade. Each course takes approximately one hour to complete and consists of watching an online presentation followed by a test.

Check your MOSAIC Student Centre to ensure that you are registered in these courses. If they do not appear in your course schedule or in Avenue to Learn, please contact the School of Graduate Studies (SGS) at sgsrec@mcmaster.ca

SGS will block all access to future registration if this requirement is not met by the end of the Fall Term (Term 1).

Notes

- Passing grade for SGS 101 is 14/20 and students have three (3) attempts.
- Passing grade for SGS 201 is 6/6 and currently there is no limit to the number of attempts.
- Students who have taken SGS 101 and 201 for a previous graduate degree do not need to take the course again.
- Any student who has taken an AODA equivalent course, either previously at McMaster (e.g. undergraduate welcome week rep) or at another institution, should contact aoda@mcmaster.ca. They will confirm that this is either complete or equivalent. Please then forward this confirmation to sgsrec@mcmaster.ca. Students in this situation do not need to retake SGS 201.

Below is a list of the mandatory safety courses every graduate student must take:

1. WHMIS Core
2. Office WHMIS
3. Asbestos Awareness
4. Fire Safety
5. Ergonomics
6. Slips, Trips and Falls
7. Chemical Handling and Spills

Machine Guarding, Gas Cylinder and Hydrogen Fluoride are required if hazard is present. (Please ask your supervisor for these and any others.).

Health and Safety training can be completed online or registered for through MOSAIC under "Important Links":

<https://epprd.mcmaster.ca/psp/preprd/?cmd=login&languageCd=ENG>

****Please complete these courses as soon as possible****

WHMIS CORE TRAINING SESSIONS

****This course is mandatory for all incoming graduate students****

The WHMIS legislation makes it mandatory that all employees attend a short course (approximately three hours in duration), which will provide basic information. WHMIS Core is for individuals handling chemicals working in a lab environment. It is intended to provide necessary and required training to all who use department laboratories. The Workplace Hazardous Materials Information System (WHMIS) is a comprehensive national system for safe management of hazardous chemicals which is legislated by both the federal and provincial jurisdictions.

WHMIS is mandatory training for anyone working with or in the proximity of hazardous materials. The WHMIS legislation provides that workers must be informed about the hazards in the workplace and receive appropriate training to enable them to work safely. To accomplish this, WHMIS requires all suppliers (manufacturers, importers, packagers and processors) to label and prepare Material Safety Data Sheets (MSDSs) for products they make, import, package, or process that meet the hazard criteria set out in the Controlled Product Regulations under the federal Hazardous Products Act. The buyers of these controlled products must make sure that these products are correctly labeled and that MSDSs are available.

Employers must set up worker education programs that instruct workers about the contents and significance of labels and MSDSs and how to work safely with hazardous materials. In summary, WHMIS delivers the necessary information by means of:

- Cautionary labels on containers of controlled products
- The provision of an MSDS for each controlled product
- A worker education program

The ultimate goal is to create a safer workplace by providing workers with the knowledge and tools to enable them to work safely. Please visit the web site listed below for all courses and to register:

<http://www.workingatmcmaster.ca/eohss/training/index.php>

****You must complete WHMIS training before you can work in the lab****

JOB HAZARD ANALYSIS FORM

A component of the Workwell audit criteria requires McMaster to provide a documented job hazard analysis of main activities associated with each worker. A job hazard analysis is essential in clarifying the work to be done in conjunction with the hazards and controls that are associated with the activity. While reviewing a list of the main activities involved with each job, common hazards are identified. If a hazard cannot be eliminated it needs to be minimized before the job is performed. Hazards can be minimized by implementing controls such as personal protective equipment, written procedures or training.

The form can be completed on the web at the following link:

<http://www.mcmaster.ca/workwell/>

Both you and your supervisor should review and sign the summary page and then submit it to the Graduate Administrator Assistant (Mary-Anne Bechamp).

DEPARTMENT SAFETY AND PROCEDURES

The Lab Safety Handbook

The Lab Safety Handbook has been recently updated. This is mandatory reading for all employees, graduate students and volunteers working in laboratories. This handbook applies to all campus labs. The weblink can be found on McMaster University's main page:

www.workingatmcmaster.ca/eohss

Alternatively, by connecting directly to the link below:

www.workingatmcmaster.ca/link.php?link=eohss:Lab-Safety-Handbook.

New Employee or Student Safety Orientation Checklist (RMM 300 FORM)

Make an appointment with your supervisor to discuss the New Employee Student Safety Orientation Checklist. Once completed submit the form to the Graduate Administrator Assistant (Mary-Anne Bechamp).

Reporting of a Safety Incident

Any incident, which could have resulted in injury, must be reported to the Department immediately. Please advise your supervisor as soon as possible and see the Graduate Administrator Assistant (Mary-Anne Bechamp) or the Department Administrator (Samantha Kandilas) for a McMaster University Injury/Incident Report form. These must be completed as soon as possible.

Fire Safety Procedure

In the case of fire, or the sounding of an alarm, "Get Out And Stay Out". You should be at least 50 feet away from the building and not return until the "All Clear" is given. Department Fire Wardens have been designated and can be identified by orange vests.

Security

Please be security conscious. Do not leave personal valuables in your office or desk. Keep all books, notes, etc. locked in your locker. Do not share your keys or invite others to the graduate student offices or other department facilities. So that no rooms are left unattended, the last person leaving an office should lock the door. Do not give your copier code to anyone. Do not reveal your computer password to anyone. If you suspect that it is compromised, change it immediately.

Emergency

The McMaster Security office is located in E. T. Clarke 201 and can be contacted at ext. 24281. This office is responsible for overall security on campus. In addition they operate a Lost and Found service (ext. 23366). Any lost items will be held by them for 60 days.

****IN CASE OF EMERGENCY DIAL 88****

MSE DEPARTMENT SAFETY REPORTS

The Department requires that all research personnel prepare a Departmental Safety Report. The guidelines for such a report are attached. Please follow them carefully. The reports are intended to aid you in addressing issues of lab safety before problems occur. This is intended to be a living document. Your initial safety report must be completed, signed by your supervisor, and turned in to the Department within two (2) months of the start of your studies or employment here. The document should then be updated whenever a major change in your experimental program occurs.

Procedure

A concise safety report is to be prepared and submitted in typed form to the MSE Department Chair prior to the start of a research project and whenever there is a significant change in the nature of a research project (that is when the potential hazards change). The standard "Department Safety Report" face sheet should be attached to the front of the safety report. Before submission the researcher's supervisor must approve the report. If there is significant change in a research project the safety report must be revised and submitted on a yearly basis. The Department Safety Committee and the Department Chair will review each report.

Applicability

A safety report is to be prepared and submitted each supervised researcher in the Department. The term "Supervised Research" includes: graduate students; undergraduate students; postdoctoral fellows; visiting scientist; research associates; research assistants; technicians.

Areas to be Addressed

1. **Potential Hazards Under Routine Operation.** These are the day-to-day hazards not associated with an emergency.
2. **Laboratory Protective Devices in Use.** For example: Fumehood; fire extinguisher (stating type and capacity rating); flammable gas detector; toxic gas monitor.
3. **Personal Protective Devices in Use.** For example: safety glasses; air pack; respirator; gloves (specifying material type); lab coat; safety shoes; safety helmet; radiation monitoring badges.
4. **Other Protective Procedures in Use.** An example is: medical monitoring (specifying type and frequency).
5. **Possible Emergencies.** What types of accidents are likely to occur and what are their consequences. What are the types and quantities (if applicable) of the hazard? In other words, list a credible "worst-case" scenario.
6. **Procedures for Emergencies.** For example: clean-up methods; neutralization procedures, evacuation plan.

Types of Hazard to be Addressed

The main likely types of potential hazard encountered in the laboratory include but are not limited to:

- **Fire/Explosion.** List the flash point and the auto ignition temperature.

- **Toxic.** This category usually comprises chemicals. For chemical hazards a Manufacturer's Safety Data Sheet (MSDS) must be attached to the report.
- **Radioactivity.** List the acceptable exposure values.
- **Electrical**
- **High Pressure**
- **Mechanical**
- **Falling Objects**

MASTER'S DEGREE REQUIREMENTS

Supervisory Committee Meeting

Each Master's student will meet with their supervisor and one additional faculty member (Supervisory Committee) to assess the progress of their studies and set goals. For students who are accelerated, this review should really be given once they start the Master's degree to help them get started, but otherwise within eight (8) months of starting. **For a normal 24 month Master's degree, it is MANDATORY that such a meeting take place prior to completion of 12 months in the program.** Part-time students must also receive a review after their first year in the program. A student starting in September must have the report done by September 1 the following year; if starting in January, then the report is due January 1 the following year; if starting in May, then the report is due May 1 the following year.

Master's Thesis Defence

This is an oral exam administered by the Department. This is a PUBLIC examination open to all interested persons. It is conducted by a minimum of three faculty members (including the supervisor). The exam covers material presented in the written thesis and the background material to this thesis. It is normally taken by students who intend to leave the program upon completion of their Master's degree. After a short oral presentation, the student is asked to defend the contents and background to the written thesis. After a discussion of the examination, the Chair will ask for a vote on the success or failure of the defence. If the examiners approve the defense, the Chair will ask the examiners to complete the Examination Report by initialing appropriately. The student will be invited back to the examination room for congratulations by the committee. In the event that minor revisions are required to the thesis, the Chair of the examination committee is responsible for ensuring that (1) the student is advised of the revisions, (2) the student receives and understands the 'Final Thesis Submission form' to be used by the supervisor to confirm that the revisions have been made, and (3) the supervisor is also aware of the form. The Chair will complete and sign the Examination Report and return it to the Graduate Administrative Assistant (Mary-Anne Bechamp), whom will return it to the School of Graduate Studies.

However, if there are two or more negative votes, the student will be deemed to have failed the defence, and a reconvened oral defence must be held at a later date. The student should be told as clearly as possible by the Chair and the examining committee what he/she must do to improve the defence. The reconvened defence is the student's final opportunity to complete the degree. Membership on the reconvened examining committee should be the same as that for the original defence. If the defence fails a second time, that decision is final, and is not open to appeal.

After a successful defense, the student must correct any errors detected by the readers to the satisfaction of the Supervisor and then submit an electronic copy to the School of Graduate Studies via MacSphere (see Section 2.8.3 - Publication of Electronic Theses at McMaster University). Students are normally expected to submit their final thesis within four weeks of a successful defence.

Tuition fees continue to be assessed until all degree requirements are met, including the successful submission of the final approved thesis to MacSphere.

Transfer Exam from Master's to PhD

Complete regulations for this exam are in the Graduate Studies Calendar under admission to a PhD program. The student submits five typed copies of a research report, which should take the form of a literature review plus some preliminary results and analysis followed by a detailed research proposal. The literature review should not simply catalogue the papers in the field. Rather it should offer some insight into the state of the field (i.e. what are the main advances achieved, what are the main problems which occur, what is good or bad about the approaches taken by previous workers). This should lead into a discussion of what approach you intend to take in your own research. What will you want to do different from previous research, and what advances in the state of the art do you hope to achieve? Some discussion of the techniques you expect to use will be important. You will be expected to demonstrate that you have thought about how best to approach your problem, and what its limitations may be. The report need not, and indeed should not, be a lengthy document. It should however indicate that you have a good grasp of the background to the project being undertaken, have demonstrated a potential to perform research, and have thought carefully about the research being proposed.

Transfer reports must be submitted at least one month before the end of the sixth term (24 months) registration in a Master's program. Failure to meet this deadline means that the student will be overtime before the transfer exam is taken, resulting in loss of income and status as a full-time student. Following the submission of the transfer report to the Associate Chair – Graduate (Dr. Gianluigi Botton), an oral examination will be scheduled by the Department. The committee for a transfer examination normally comprises five faculty members. The purpose of this exam is to determine whether the student has a good chance of successfully completing a PhD. It also serves the valuable function of providing a good appraisal of the problem chosen for research. After a discussion of the examination, the Chair will ask for a vote on the success or failure of the transfer. If the examiners approve the transfer, the Chair will ask the examiners to complete the Transfer Exam Report by initialing appropriately. The student will be invited back to the examination room for congratulations by the committee.

However, if there are three or more negative votes, the student will be deemed to have failed the transfer exam and a reconvened oral exam must be held at a later date. The student should be told as clearly as possible by the Chair and the examining committee what he/she must do to improve the defence of the transfer. The reconvened defence is the student's final opportunity to complete the transfer. Membership on the reconvened examining committee should be the same as that for the original exam. If the exam fails a second time, that decision is final, and is not open to appeal. The student is then expected to complete the Master's degree by written a thesis and defending it in an oral defense exam.

So what is required of a potentially good PhD student? Obviously knowledge as such has some importance but it is not of prime importance. In asking students to write a summary of their research proposal, we essentially are asking them to ask themselves questions such as:

- *Why am I doing this research, i.e. what is the essence of the problem? How does my proposal relate to previous work?*
- *What form of measurement will I use or what theoretical basis will I assume?*

- *Do I really understand this form of measurement, i.e. the basic science behind it, the accuracy and sensitivity required, etc?*
- *What alternative measurements or techniques could I use and why have I rejected them in favour of the one proposed?*
- *Can the problem be modeled, and on what basis?*

In short, does the student have the interest and capability of a scientist or engineer who can analyze a problem with complete understanding, or is the student prepared only to look at it superficially, with uncritical adoption of other people's opinions? Of course, the answers to everything cannot be known or there would be no point in doing the research, but the questioning by the student of what is important, should have been done. A PhD degree demands maturity on the part of the student and the student should be able to take over the problem from his supervisor. It is, after all, an indication of the ability to do independent research.

Following completion of the transfer exam students will either be granted direct transfer into a PhD program or else they will be required to complete their research and submit this work for a Master's degree.

PHD DEGREE REQUIREMENTS

The Department makes extensive use of oral examinations for the defence of theses and for testing the comprehensive background of students. Regulations related to these exams are contained in the Graduate Studies Calendar. This section provides further details including the form and content of these exams. Failure in any oral examination is grounds for requesting that the student withdraw from the program. However, at the discretion of the Department, students may be granted a second attempt at an examination. If you have questions about what is expected of you in any of these exams you should approach your supervisor and/or the Associate Chair – Graduate (Dr. Gianluigi Botton), well in advance of the exam.

Supervisory Committee Meeting

The supervisor and student have a mutual obligation to meet on a regular basis, the Department shall ensure there is a formal regular meeting of each PhD supervisory committee at least once within the academic year (September-August), and possibly more often, to discuss the student's progress. Each PhD supervisory committee must report annually on the student's progress and the Associate Chair – Graduate must forward such reports to the School of Graduate Studies. The report formally documents the supervisory committee's assessment of the progress of the student's program.

Comprehensive Examinations for PhD Students

Comprehensive exams are meant to test the student's background understanding in various areas of Materials Science and Engineering. It is important to realize what is expected of you in this type of examination. First of all, they are not designed simply to see how much you have remembered from your undergraduate program, although knowledge of key terminology and basic facts is important. These exams will test your ability to think and to question, and to elaborate fundamental concepts. The questions will probe your ability to work with and develop concepts. Therefore, it is the process, which is important, as much as the result. Always keep this in mind during the examination. Do not be concerned if you do not immediately know the final answer to a question you are asked. Start with some basic concept or a simple first order equation and work towards the solution. This will

demonstrate to the committee your ability to think and to develop concepts. Make extensive use of the blackboard to draw simple diagrams or to write down equations. As you prepare for these exams, try to develop a good fundamental understanding of basic concepts, and you should do well.

Part I Comprehensive Examination

The comprehensive examination is designed to ensure that all students who receive a Ph.D. degree in Materials Science or Engineering have a broad understanding of the foundations of the discipline. The key to this approach is an emphasis on fundamental concepts. Students will not be expected to demonstrate a very detailed knowledge of materials processes, or of the properties of any given material. However they will be expected to understand the broad classes of materials - how their underlying structure controls properties and affects the approaches used to process them, *etc.*

It is considered essential that all students demonstrate an appreciation for the interrelationships between structure/properties/processing of materials. The content that students must be able master is best illustrated by referring to sections in classical textbooks. Students are of course free to study use other books with which they are more comfortable. However, the book chapters given below offer guidance as to both the nature and the depth of the content required.

The Part I comprehensive exam topics are divided into core areas that all students are responsible for and elective areas in which students may choose their area of specialization.

Overview of thematic areas

Core areas:

- **Structure of Materials** (including atomic structure and bonding and defect structures) - Callister¹ Chs. 2 and 4
- **Thermodynamics** (with emphasis on solution thermodynamics and phase equilibria) - Ragone² Chs. 1-5 and 7-9, Callister Ch 9 [Gaskell Ch. 2, 3, 7, 9, 11-13]
- **Kinetics** (including mass transfer and phase transformations) - Callister Chs. 5, 10

Elective Areas:

- **Structure of Materials.** Choose one of:
 - ! Crystalline solids - Callister Ch. 3
 - ! Polymeric solids - Callister Ch. 14
- **Properties of Materials.** Choose one of:
 - ! Mechanical properties - Callister Ch. 6, 7, 8
 - ! Electrical and thermal properties - Callister Ch. 18, 19
 - ! Chemical properties - Ragone Ch. 6

This exam is normally offered in January (September starts), May (January starts) and September (May starts). However, students may arrange to take the comprehensive examination at any time, following discussion with the Chair. Students must successfully complete this examination within 12 months of initial registration. Students may be granted a second attempt, but the second attempt must be in this 12 month period. Thus, students should take this examination at the earliest opportunity. Special consideration may be given for part-time students.

¹ William D. Callister, Jr., *Materials Science and Engineering An Introduction*, 6th Ed., 2003, Wiley.

² David V. Ragone, *Thermodynamics of Materials Vol. 1*, 1995, Wiley. has been selected as the primary source for this material because it is fundamental and concise. However, many students may be more familiar with David R. Gaskell, *Introduction to the Thermodynamics of Materials*, 3rd Ed., 1996, Taylor and Francis, so cross-references are made in square brackets.

Detailed synopsis – key concepts

While the following is not meant to be an exhaustive list of topics that might be raised, it lists key concepts with which you should be familiar.

1. Structure of Materials

- a. Atomic structure and bonding – Callister Ch. 2
 - i. Atomic bonding forces and energies
 - ii. Bonding types
 - iii. X-ray analysis for chemical composition determination
- b. Crystalline solids – Callister Ch. 3
 - i. Concept of a crystal, unit cell
 - ii. Common structures including fcc, bcc, hcp, tetragonality
 - iii. Miller indices for directions and planes
 - iv. Physical basis of x-ray diffraction and Bragg's law
 - v. Meaning of crystalline anisotropy
- c. Defect structures – Callister Ch. 4
 - i. Vacancies
 1. Thermodynamic properties
 2. Vacancy concentration
 - ii. Dislocations (edge, screw, mixed)
 - iii. Interface defects (free surfaces, low and high angle grain boundaries, twin boundaries)
- d. Polymeric solids – Callister Ch. 14
 - i. Structure of common monomers (e.g. alcohols, ethers, acids, aromatic hydrocarbons)
 - ii. Basic concepts in polymers (homo- and co-polymers, functionality)
 - iii. Molecular weight
 - iv. Polymer types (linear, branched, crosslinked, network)
 - v. Thermosets vs. thermopolymers, effect of basic properties
 - vi. Crystallinity in polymers
 - vii. Characterization of polymer structure

2. Thermodynamics

- a. First Law of Thermodynamics – Ragone Ch. 1 [Gaskell Ch. 2]
 - i. Energy as a State Function
 - ii. Work
 - iii. Intensive and Extensive Properties
 - iv. Enthalpy
 - v. Heat Capacity
 - vi. Ideal Gases
 - vii. Enthalpies of Formation and Chemical Reaction
- b. Second Law of Thermodynamics – Ragone Ch. 2 [Gaskell Ch. 3]
 - i. Entropy as a State Function
 - ii. Adiabatic, Reversible and Steady State Systems
 - iii. Entropy Changes in Chemical Reactions and the Third Law
- c. Equilibrium – Ragone Ch. 4 [Gaskell Ch. 7]
 - i. Phase Equilibria
 - ii. First and Second Order Transitions
- d. Chemical Equilibrium – Ragone Ch. 5 [Gaskell Ch. 11 & 12]
 - i. Thermodynamic Activity

- ii. Gaseous and Solid-Vapour Equilibria
- iii. Ellingham Diagrams
- e. Solutions – Ragone Ch. 7 [Gaskell Ch. 9]
 - i. Partial Molar Quantities
 - ii. Ideal and Non-ideal Solutions
 - iii. Raoult's and Henry's Laws
 - iv. Regular Solutions
- f. Gibbs' Phase Rule – Ragone Ch. 8 [Gaskell Ch. 13.4]
- g. Phase Diagrams – Ragone Ch. 9 [Gaskell Ch. 12]
 - i. The Lever Rule
 - ii. Miscibility and Immiscibility
 - iii. Binary phase diagrams – Callister Ch. 9
 - 1. Types (isomorphous, eutectic/eutectoid, peritectic/ peritectoid)
 - 2. Congruent transformations
 - 3. Phases and compositions

3. Kinetics

- a. Mass transfer – Callister, Ch. 5
 - i. Mechanisms of atomic diffusion (vacancy, substitutional, interstitial)
 - ii. Steady-state diffusion, Fick's 1st Law
 - iii. Transient diffusion, Fick's 2nd Law
 - iv. Characteristic diffusion length
 - v. Applications to carburization
 - vi. Impurity diffusion – vacancy, substitutional and interstitial
- b. Microstructure development – Callister, Ch. 9
 - i. Effect of cooling rate on microstructure
 - ii. Fe-C phase diagram
 - 1. phases
 - 2. microstructure
- c. Phase transformations – Callister Ch. 10
 - i. Concept of chemical equilibrium, application to phase formation
 - ii. Thermodynamics of phase nucleation
 - iii. homogeneous vs. heterogeneous nucleation
 - iv. Transformation kinetics, Avrami equation
 - v. Fe-C system
 - 1. Kinetics of pearlite formation
 - 2. TTT diagrams
 - 3. Metastable phases – bainite, martensite
 - 4. Effect of alloying – hardness vs. hardenability
 - 5. Tempering
 - vi. Precipitation processes
 - 1. Precipitate growth by diffusion
 - 2. Age hardening

4. Properties of Materials

- a. Mechanical properties – Callister Chs. 6-8
 - i. Definition of stress and strain
 - ii. Elastic response (Hooke's law, elastic moduli)
 - iii. Tensile stress-strain curve and related parameters for strength and ductility
 - iv. Basic dislocation concepts (Burger's vector, slip systems, deformation due to slip)
 - v. Strengthening mechanisms (grain size, solute, work hardening, etc.)

- vi. Recovery and recrystallization
- vii. Ductile vs. brittle fracture
- viii. Fracture toughness, Griffith relationship
- ix. Ductile – brittle transition in steels
- x. Basic concepts in creep and fatigue
- b. Electrical properties – Callister Ch. 18
 - i. Ohm's law
 - ii. Band structure of metals, insulators and semi-conductors
 - iii. Conduction in terms of band structure and bonding models
 - iv. Electron mobility
 - v. Electrical resistivity of metals
 - vi. Semiconductivity
 - 1. Intrinsic
 - 2. Extrinsic: n-type and p-type
 - 3. Temperature dependence of conduction in semiconductors
 - vii. Capacitance
 - 1. polarization
 - 2. dielectric materials
- c. Thermal properties – Callister Ch. 19
 - i. Heat capacity
 - 1. Specific heat at constant volume & pressure
 - 2. Atomic and electronic mechanisms of heat capacity
 - ii. The basis of thermal expansion
 - iii. Thermal conductivity
 - 1. Fourier's law
 - 2. applications to steady-state heat transfer
 - iv. General ranking of different materials in terms of specific heat, thermal expansion and thermal conductivity
- d. Chemical properties – Ragone Ch. 6 [Gaskell Ch. 14]
 - i. Electrochemical Cells
 - ii. Half Cell Reactions
 - iii. Nernst Equation
 - iv. Pourbaix Diagrams
 - v. Concentration Cells

Part II Comprehensive Examination

The Part II comprehensive exam is centered about the research area of the student. The breadth of the exam will include the fields that are required by the student in order to understand all the features of the student's research and its possible applications. The topics on which the examination is to be based are set by the supervisory committee and approved by the Chair. The student will be informed of these topics at least one month prior to sitting this exam. The examination is an in-depth oral examination lasting two to three hours. The examining committee, to be appointed by the Chair, consists of three members of faculty – typically the supervisor, one other member of the supervisory committee and one other faculty member from outside the supervisory committee. For full-time students, it will normally take place between 24 and 36 months after the student has registered in the PhD program. Students may be granted a second attempt, but the second attempt must be in this same period. Part-time students should take the exam once their research direction is well established, but in any case it should be taken at least one year before the students expects to submit the PhD thesis.

Retroactive Admission to the PhD Program

Students who hold a Master's degree from abroad, but who were nevertheless admitted at the Master's level may apply for retroactive admission to the PhD program. This should be done within nine 9 months of arriving at McMaster. The student must prepare a short report which is submitted to the Associate Chair – Graduate. The aim of the report is to demonstrate that the student has a clear understanding of the background of the research project, and of the underlying basis for the work proposed. Thus, the report should include a survey of current literature relevant to the project, and a project outline. If the student has obtained preliminary results, these may be included. However, this is not a necessary component of the report. An oral examination will then be scheduled at which time the student will be expected to answer questions related to the content of the report, and to relevant background material. Following the exam, the committee will recommend either that the student be transferred directly to PhD status, or continue as a Masters' student. In the latter case, it may still be possible for students to transfer to the PhD program at a later date, as outlined above. The report should not be lengthy (30 typed pages at most).

Research Proposal Exam for Students Enrolling Directly in a Ph.D. Program

Students who enroll directly into the PhD program must submit a written proposal for their research program after one year. The student submits five typed copies of a research report, which should take the form of a literature review plus some preliminary results and analysis followed by a detailed research proposal. The report need not, and indeed should not, be a lengthy document. It should indicate that the student has a good grasp of the background to the project being undertaken, has demonstrated a potential to perform research, and has thought carefully about the research being proposed. The report is examined by a committee consisting of the supervisory committee, augmented by two other MSE faculty members. The student must satisfy the committee that they are capable of successfully completing PhD caliber research in order to be allowed to continue in the program.

After a short oral presentation, the student is asked to defend the Research Proposal. After a discussion of the examination, the Chair will ask for a vote on the success or failure of the exam. If the examiners approve the proposal, the Chair will ask the examiners to complete the Examination Report by initialing appropriately. The student will be invited back to the examination room for congratulations by the committee. The Chair will complete and sign the Examination Report and return it to the Graduate Administrative Assistant (Mary-Anne Bechamp).

However, if there are three or more negative votes, the student will be deemed to have failed the transfer exam and a reconvened oral exam must be held at a later date. The student should be told as clearly as possible by the Chair and the examining committee what he/she must do to improve the defence of the transfer. The reconvened defence is the student's final opportunity to complete the transfer. Membership on the reconvened examining committee should be the same as that for the original exam. If the exam fails a second time, that decision is final, and is not open to appeal.

So what is required of a potentially good PhD student? Obviously knowledge as such has some importance but it is not of prime importance. In asking students to write a research proposal, we essentially are asking them to ask themselves questions such as:

- *Why am I doing this research, i.e. what is the essence of the problem? How does my proposal relate to previous work?*
- *What form of measurement will I use or what theoretical basis will I assume?*

- *Do I really understand this form of measurement, i.e. the basic science behind it, the accuracy and sensitivity required, etc?*
- *What alternative measurements or techniques could I use and why have I rejected them in favour of the one proposed?*
- *Can the problem be modeled, and on what basis?*

In short, does the student have the interest and capability of a scientist or engineer who can analyze a problem with complete understanding, or is the student prepared only to look at it superficially, with uncritical adoption of other people's opinions? Of course, the answers to everything cannot be known or there would be no point in doing the research, but the questioning by the student of what is important, should have been done. A PhD degree demands maturity on the part of the student and the student should be able to take over the problem from his supervisor. It is, after all, an indication of the ability to do independent research.

PhD Defence

This is also an oral exam administered by the School of Graduate Studies. The examining committee includes members of the supervisory committee, members of the University from outside the department, and an external examiner from outside the University. After a short oral presentation, the student will be asked to defend the contents and background to the written thesis. This is a PUBLIC examination open to all interested persons.

COURSE WORK REQUIREMENTS SUMMARY

Master's Degree

- **12 units** of course work: **9 units** of course work in addition to the mandatory MATLS 701 course (**3 units**)
- 700 level courses are either a half course (3 units) or quarter course (1.5 units)
- 600 level courses are offered as half courses (3 units) – only 1 permitted
- 50% of courses must listed or cross-listed in the Department (Materials Science and Engineering)
- Select course work after consultation and permission of your Supervisor

Accelerated Master's Degree Option

- 1 term (4 months) research project with Supervisor; in summer of 3rd or 4th year
- 1 600 level course (**3 units**) in final year of undergraduate degree (counts towards undergraduate **AND** graduate degree)
- Complete MATLS 4K06 **OR** a second 4 month summer work term
- 50% of courses must listed or cross-listed in the Department (Materials Science and Engineering)
- Enroll in MASc. program
- **6 units** of course work (700 level) in addition to the mandatory MATLS 701 course (**3 units**)

PhD Degree

- **12 units** of course work: **9 units** of course work in addition to mandatory MATLS 702 course (**3 units**)
- 700 level courses are either a half (3 units) or quarter course (1.5 units)

- 600 level courses are offered as half courses (3 units) – only 1 permitted
- 50% of courses must listed or cross-listed in the Department (Materials Science and Engineering)
- Select course work after consultation and permission of your Supervisor

PROGRAM REQUIREMENTS SUMMARY

Master's Degree

TA Training Sessions (in-coming students only) – September 2018 and January 2019

- Complete in September 2018 for May 2018 and September 2018 start
- Complete in January 2019 for January 2019 start
- Students are paid 5 hours of time to attend this session. **Attendance is Mandatory**

SGS 101 Academic Research Integrity & Ethics – 201 AODA Training – mandatory

- Complete by the end of the month that you started your program: September 2018, January 2019 or May 2019

Safety Report

- Submit to Supervisory and/or Lab Manager for approval prior to working in a lab

MATLS 701 Seminar Course

- Mandatory attendance and presentation is required
- Register and/or sign up to present

TA Hours of Work Form

- Submit prior to end of the first month (September or January) in the Term that your TA work will be performed - mandatory requirement

Career Planning Milestone Training & Report, CARP

- Attend training session in September 2018 for May 2018 and September 2018 starts. **Attendance is Mandatory**
- Submit report by end of Year 1 (3 Terms: 12 months)

Supervisory Committee Meeting and Report

- Complete by end of Year 1 (3 Terms: 12 months). **Meeting is Mandatory**

Transfer Exam Option

- Transferring to the PhD program prior to completing a Master's degree
- Transfer report submitted by end of Term 5 (20 months)

Defence

- Complete by end of Year 2 (6 Terms: 24 months)
- Exam administered by Department
- Exam Committee: Supervisory Committee plus 1 external member

PhD Degree

TA Training Sessions (in-coming students only) – September 2018 and January 2019

- Complete in September 2018 for May 2018 and September 2018 start
- Complete in January 2019 for January 2019 start
- Students are paid 5 hours of time to attend this session. **Attendance is Mandatory**

SGS 101 Academic Research Integrity & Ethics – 201 AODA Training – mandatory

- Complete by the end of the month that you started your program: September 2018, January 2019 or May 2019.

Safety Report

- Submit to Supervisory and/or Lab Manager for approval prior to working in a lab

MATLS 702 Seminar Course

- Mandatory attendance and two presentations are required
- Register and/or sign up to present

TA Hours of Work Form

- Submit prior to end of the first month (September or January) in the Term that your TA work will be performed - mandatory requirement

Career Planning Milestone Training & Report, CARP

- Attend training session in September 2018 for May 2018 and September 2018 starts. **Attendance is Mandatory**
- Submit report by end of Year 1 (3 Terms: 12 months)

Part I Comprehensive Exam

- Complete before end of 2 Terms (8 months): January for May 2018 starts, May 2019 for September 2018 starts and September 2019 for January 2019 starts.
- Exam administered by Department
- Exam Committee: 3 faculty members

Supervisory Committee Meeting and Report – Annual Requirement

- Complete initial one by end of Year 1 (3 Terms: 12 Months)
- Complete yearly for the next 3 years: by end of Year 2 and by end of Year 3

Research Proposal Exam

- Submit written research proposal by end of Year 1 (3 Terms: 12 Months)
- Exam administered by Department
- Exam Committee: Supervisory Committee plus 2 external members

Part II Comprehensive Exam

- Complete before the end of Year 3 (9 Terms: 36 Months)
- Exam administered by Department
- Exam Committee: Supervisor Committee plus 1 external member

Defence

- Completed by end of Year 4 (12 Terms: 48 months)
- Exam administered by School of Graduate Studies

2018-19 Graduate Handbook

Sign-off Sheet

*Please sign and return to Mary-Anne Bechamp, Graduate Administrative Assistant
in the Department of Materials Science & Engineering, JHE-357*

- I have read the 2018-19 Graduate Handbook in its entirety.

- I have met with my Supervisor prior to the start of term.

Name

Date