

**Welcome to the
Department of Materials Science and Engineering**

2017 -2018

McMaster University, Hamilton, Ontario

Updated: January 2018

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Welcome to Materials Science and Engineering!

Enclosed in this package is information which you may find useful in your first few days here at McMaster University and should answer some of your questions.

If you have any problems or questions please don't hesitate to contact the **Graduate Assistant** (Mary-Anne Bechamp, bechamma@mcmaster.ca) in the Materials Science and Engineering main office, JHE 357.

Chair,

Dr. Hatem Zurob, ext. 23515, zurobh@mcmaster.ca

Grad Associate Chair

Dr. Joey Kish ext.21492, kishjr@mcmaster.ca

DEPARTMENTAL STAFF

Graduate Administrative Assistant

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TECHNICAL STAFF

Research Technician

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Research Technician

Xiaogang Li, ext 21881, JHE 248, lixiaog@mcmaster.ca

GENERAL INFORMATION

Arrival

When you arrive at McMaster, please come to the main office (JHE 357) and bring the following documents with you;

- Original Transcripts
- Study Permits
- Social Insurance Number

Graduate Calendar

Please read and review the graduate calendar that corresponds with the year you entered the program. This calendar outlines all rules and regulations that apply to your program. It is your responsibility to read and understand these requirements.

The calendar can be found online: <http://academiccalendars.romcmaster.ca/index.php?catoid=25>

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 as soon as possible.

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

Desk Assignments

Every full-time graduate student in the Department of Materials Science and Engineering is assigned a desk. Your desk assignment will be included in your welcome package. As you approach finishing your programme, you may be asked to vacate your desk to accommodate the arrival of new students.

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 to get around the Department. The Materials office has forms for keys (*Key Authorization Card*). Find out what keys are required from your supervisor. After the form is signed by the Graduate Administrative Assistant, take it 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

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 periodically.

The correct address for your 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 Materials Office.

Verification Letter Requests

If you require a letter for any purpose, please print and complete the request form from our website: <https://faculty.eng.mcmaster.ca/materials/resources#graduate-students>

Return the form and send it to Danielle (dmather@mcmaster.ca) who will prepare the requested letter. Please allow up to 2 business days to have request complete.

Photocopying

The photocopier is located in JHE-355. If photocopying is required for your research project, speak to your supervisor and forward request approval to Danielle via email.

Photocopying Paper

Paper is stored in the Materials Office (under the 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

Refer to the bulletin board located outside the main office for events, scholarships, courses, and job announcements for graduate students. It is essential that you check 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). The Social Insurance Number (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 at:**

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

or

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

International students need a Canadian Social Insurance Number to work in Canada. If you hold a TA you will need to take the following documents with you when you apply:

- Your employment contract.
- Your passport and study permit.
- A Social Insurance Number Application Form.

Once the new number is received, bring it to MSE office and Grad Studies.

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 Assistant 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 monthly payment.

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 3 months in advance. The ultimate responsibility for maintaining up-to-date documents lies with the student. Remember also that it is your responsibility to ensure that your passport remains current. Citizen and Immigration Canada website: <http://www.cic.gc.ca/english/study/study.asp>.

GRADUATE STUDIES

Visit the School of Graduate Studies website for all graduate related questions and documents:

<http://graduate.mcmaster.ca>

If you have questions about your graduate study that cannot be answered by the department, 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 & Ph.D. defenses	gthesis@mcmaster.ca
Scholarship competitions	graduatescholarships@mcmaster.ca

Mosaic

The Mosaic Student Center

Mosaic's Student Center provides access to academic, personal and financial information. It will include the following features:

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 AND 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 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 uts@mcmaster.ca or at ext. 24357.

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

“8.02(c) The Employer will...provide access 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. This Collective Agreement will be provided to the employee in an agreed upon electronic format, unless a printed copy is requested by the employee.”

“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 CA can be found online at <http://www.workingatmcmaster.ca/med/document/CUPE-Unit-1-TA-CA-2011-2016-1-42.pdf>

CUPE 3906 DENTAL PLAN

The following information is intended to cover only the highlights of the CUPE Dental Plan. For more information, talk to a knowledgeable person in the CUPE office in Wentworth House, room B108, visit the CUPE website at www.cupe3906.org or consult a copy of the CUPE 3906 Unit 1 Collective Agreement (available online).

1. **Who is covered** - Employees in Classification A are eligible for coverage for any academic year, September 1 to August 31, in which they are contracted to work at least 130 hours. Employees who begin in January and are **not** scheduled to work 130 hours before August 31 are **not** eligible for coverage, as per the Collective Agreement.

2. **Premiums** – Premiums are normally deducted from monthly pay cheques. If you are **not** receiving a pay cheque (or if premiums do not show as a deduction), please contact CUPE 3906. From September 1, 2014 to August 31, 2015 the premium cost per month is: Individual - \$8.43 and Family - \$66.64

3. **Opt-out Provisions** - You may opt-out of the Dental Plan by completing the ‘CUPE DENTAL PLAN OPT-OUT AUTHORIZATION’ and by providing the required **proof of coverage** (normally a letter or Insurance ID card from the employer or insurance provider, which **clearly** indicates that dental coverage is in effect for **you**). Once approved, the opt-out will remain in effect until August 31, 2014. If this coverage is cancelled, you should contact CUPE to discuss your options. You must submit the ‘OPT-OUT’ form and ‘proof of coverage’ to the CUPE 3906 Office (Wentworth House B108) by Friday, September 5, 2014. Opt-outs must be completed **EACH YEAR** to keep your opt-out status valid.

4. **Family Coverage** - Family coverage is available for both spouse (married, common-law, or same sex) and children. To activate coverage, complete the ‘CUPE DENTAL PLAN FAMILY COVERAGE ENROLLMENT AUTHORIZATION’ and the attached dependent information form. Once approved, family coverage will remain in effect until August 31, 2015. You must submit the form to the CUPE 3906 Office (Wentworth House, B108) by Friday, September 5, 2014, and forms must be completed **EACH YEAR** in order to keep your family coverage valid. Any change(s) to those enrolled must be made through CUPE 3906.

5. **Deadlines - Changes/renewal of coverage status must be made every year and are permitted *only* in September.** Please ensure the completed forms and any required documents are submitted to the CUPE 3906 Office.

CUPE Dental Plan forms, including opt-out, family coverage and claim forms, are available at the CUPE 3906 Office (Wentworth House B108), or in PDF format at www.cupe3906.org.

NOT APPLICABLE IN JANUARY OR MAY

Graduate Student Welcome 2017-18!

The McMaster School of Graduate Studies would like to welcome all new McMaster Graduate Students.

The Graduate Student Welcome will be held from September 5 – 14. Join us for events that will introduce you to McMaster graduate studies, help you meet new people and discover your new school and city.

Tuesday, September 5

New Graduate Student Welcome Breakfast

Time: 9:00 to 10:30am

Location: The Phoenix

A welcome event for new McMaster Graduate Students. Students will have the option to sit inside or on the patio. In case of rain, students that opted to sit on the patio will have a rain date: Monday, September 11.

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Wednesday, September 6

Teaching and Learning Forum

Time: 9:00am to 12:00pm

Location: CIBC Hall

Organized by the MacPherson Institute for Leadership and Excellence in Teaching and Learning

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Thursday, September 7

New Graduate Student Welcome Breakfast

Time: 9:00 to 10:30am

Location: The Phoenix

A welcome event for new McMaster Graduate Students. Students will have the option to sit inside or on the patio. In case of rain, students that opted to sit on the patio will have a rain date: Monday, September 11.

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GSA Welcome Barbecue

Time: TBD

Location: The Phoenix

Annual barbecue presented by the Graduate Student Association.

Friday, September 8

Graduate Student Resource Fair

Time: 9:30 to 11:30am

Location: CIBC Hall

On-campus resources, student clubs, and off-campus resources will be available. Representatives will speak with students and introduce them to services offered.

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Monday, September 11

Life After the PhD – with Trina Foster

Time: 2:30 to 4:00pm

Location: CIBC Hall

Trina Foster, Executive Director at Ontario Centre for Workforce Innovation, will deliver a presentation about career choices after graduate studies and how to prepare for the non-academic job market.

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Wednesday, September 14

International Graduate Student Fair

Time: 4:30 to 6:00pm

Location: CIBC Hall

Student volunteers will be on hand to talk to new international graduate students about different aspects of being in Canada (cell phones, banking, housing, food, etc.). New and returning international students will be able to meet new people and participate in a few activities.

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Thursday, September 14

Roller Skating @ The Waterfront

Time: 6:00 to 9:00pm

Location: Waterfront Rink (47 Discovery Drive)

Graduate students can join us for a night of roller skating on the waterfront.

Materials Science and Engineering
2017-2018 Graduate Course Offerings

All courses scheduled to be offered can be found on Mosaic and all courses offered listed in the graduate calendar

** Note ** Graduate calendar section:

2.6.2 Course Levels and Types

"Graduate students are normally required to complete their course degree requirements by taking courses from within their program. As a minimum, at least 50% of courses taken must be listed or cross-listed by the program in order to be counted towards the degree. Courses taken outside of the faculty and not listed as part of the degree requirements, require the permission of the Associate Dean of the faculty or their delegate to be counted towards the degree."

MSE GRADUATE DEPARTMENT SEMINARS

MATLS 701/702 - Attendance is mandatory for all students

The Department holds a weekly meeting, which incorporates the Graduate Seminar, featuring oral presentations by registered graduate students (MATLS 701,702) 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 grade will be assessed based on overall performance in the course.

Registration required to present seminar – Please see Danielle Mather (dmather@mcmaster.ca) to register and schedule your seminar date

Masters = 1 seminar required, year 2

PhD = 2 seminars required, years 2 and 4 – registration only required for 2nd 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 Masters or Doctoral 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 and subsequently produce (at most) a two-page report before the end of their first year. The report must be submitted to the corresponding graduate advisor (for computer science or software engineering) before the end of August in their first year. Students entering in May of a given year may choose to submit the report in the second academic year instead

MANDATORY COURSES - SAFETY

All Graduate Students at McMaster University are required to complete two courses in Avenue to Learn in their first academic term. Anyone who has not completed either of the following courses by December 1st will be automatically assigned an F grade:

SGS 101 – Academic Research Integrity and Ethics
SGS 201 – Accessibility for Ontarians with Disabilities Act – AODA Training

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, 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 Term 1.

Notes

- The passing grade for SGS 101 is 14/20 and students have 3 attempts.
- The 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 Department Office.

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 or 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 Danielle.

Reporting of a Safety Incident

Any incident, which could have resulted in injury, must be reported to the Department immediately. Please advise your Faculty supervisor as soon as possible and see Danielle or Jane 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

DEPARTMENTAL SAFETY REPORTS

The Department of Materials Science & Engineering 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 departmental office within 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 Chairman of the Department 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 "Departmental 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 not significant change in a research project the safety report must be revised and submitted on a yearly basis.

The Departmental Safety Committee and the Departmental Chairman will review each report.

Applicability

A safety report is to be prepared and submitted to the Chairman of the Departmental Safety Committee by 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**

MASc/MSc ORAL EXAMINATIONS IN MATERIALS SCIENCE & ENGINEERING

Supervisory Committee Meeting

Using the supervisory committee meeting report form that is used for doctoral students, a supervisor must give each of their Masters students a mid-program progress review.

For students who are accelerated, this review should really be given once they start in the Masters degree to help them get started but otherwise within 6 months of starting.

For normal 20 mo/24 mo Masters, the review should come by 12-months in the program.

Part time students must also receive a review after their first year.

A student starting in September must have the report done by September 1 the following year; starting in January it is due January 1; starting in May it is due May 1.

Thesis Defenses and Transfer Examinations

Master's Thesis Defence

This is an oral exam administered by the Department. 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 candidate is asked to defend the contents and background to the written thesis. This is a PUBLIC examination open to all interested persons.

Transfer Exam from Master's to Ph.D.

Complete regulations for this exam are in the Graduate Studies Calendar under admission to a Ph.D. 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 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.

Transfer reports must be submitted at least one month before the end of the sixth term of 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 department Chair, an oral examination will be scheduled. 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 Ph.D. It also serves the valuable function of providing a good appraisal of the problem chosen for research. So what is required of a potentially good Ph.D. 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 Ph.D. 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 Ph.D. program or else they will be required to complete their research and submit this work for a Master's degree.

Exam	Milestone	Time Frame/Due Date	Committee
	Career Planning	Before end of 1 st year	Submit report to Grad Assistant
Supervisory Committee Meetings (SCM)		Once each year (Based on Start Date)	Supervisory Committee
MASc/MSc Thesis Defense		2 years (24 months)	Supervisory Committee

Ph.D. ORAL EXAMINATIONS IN MATERIALS SCIENCE & ENGINEERING

The department makes extensive use of oral examinations for the defense 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 Department Chair, 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/program shall ensure there is a formal regular meeting of each Ph.D. supervisory committee at least once within the academic year (September-August), and possibly more often, to discuss the student's progress. Each Ph.D. supervisory committee must report annually on the student's progress and the department/program chair 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.

A. Comprehensive Examinations for Ph.D. 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.

1. The 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 *February* and *May*. 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.

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

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.

- 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

2. 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 Ph.D. 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 Ph.D. thesis.

Retroactive Admission to the Ph.D. 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 Ph.D. program. This should be done within 9 months of arriving at McMaster. Students should have passed the Part I Comprehensive exam by this time.

The student must prepare a short report which is submitted to the Chair. 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 Ph.D. status, or continue as a Masters' student. In the latter case, it may still be possible for students to transfer to the Ph.D. 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 Ph.D. 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 departmental members. The nature and intent of this exam is similar to that of the Ph.D. transfer exam described in more detail above. The student must satisfy the committee that they are capable of successfully completing Ph.D. caliber research in order to be allowed to continue in the program.

Ph.D. 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 candidate will be asked to defend the contents and background to the written thesis. This is a PUBLIC examination open to all interested persons.

Exam	Milestone	Time Frame	Committee
	Career Planning	Before end of 1 st year	Submit report to Grad Assistant
Comp I		Within first 12 months (usually around 8 th month)	TBD by Chair
Supervisory Committee Meetings (SCM)		Once each year (before August)	Supervisory Committee
Proposal		Within first 16 months	Supervisory Committee + 1 external member from department
Comp II		24-36 months (before the end of 3 rd year)	3 Faculty Members <ul style="list-style-type: none"> • Supervisor • 1 member of SCM • 1 external member from faculty
Thesis Defense		End of 4 th year	SGS to arrange