

MSE Graduate Student Handbook

Department of Materials Science and Engineering, Iowa State University

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Office of MSE Graduate Programs

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Scope and Contents

This handbook outlines the requirements and policies of graduate degree programs offered by the Department of Materials Science and Engineering (MSE) at Iowa State University (ISU). The information provided is specific to MSE graduate programs and should be considered as a supplemental to the ISU Graduate Handbook. Students should be familiar with both documents. The requirements outlined in this document are applicable to any student whose first date of enrollment in an MSE graduate program is later than the listed revision date. This includes start dates arising from program changes within Iowa State University or within the MSE Department. General scope and contents are shown below, by section. Items not covered here include admission requirements, application and pre-enrollment procedures, and postdoctoral appointments.

Sections	
1.	Graduate Degree Programs in Materials Science and Engineering
2.	Example programs of study
3.	Academic and administrative requirements
4.	Graduate enrollment options
5.	Graduate student research
6.	Administration and procedures
7.	Program responsibilities
8.	Closing Remarks

1. Graduate Degree Programs in Materials Science and Engineering

The Department offers three graduate degree programs representing a range of opportunities for advanced study. While they share several common features, the programs are designed to serve students with a variety of academic backgrounds, technical interests, and career aspirations. In all three programs, it is expected that our graduate students will acquire fundamental understanding of the structure, properties, processing, and performance of materials, underpinned by the foundational pillars of thermodynamics and kinetics and manifested by the immense landscape of engineered materials and the broad range of physical, chemical, and mechanical functionalities that may be realized in them. Our degree programs include diverse combinations of classroom instruction, seminars, laboratory training, guided teaching experiences, individually mentored independent study, and various forms of materials research experiences, all intended to serve students with a wide range of educational goals. Students are admitted with undergraduate or prior graduate qualifications in a variety of technical areas, and each program of study is tailored to meet the needs of the individual student. The accomplishments of our alumni demonstrate that our graduate training enables a wide range of career paths, but specific types of technical employment opportunities are targeted by the program components contained within each of our degree programs, as summarized below.

1.1 Master of Engineering in Materials Science and Engineering

Purpose and design of the program: The Master of Engineering (M. Eng.) program in Materials Science and Engineering is a coursework-only degree program intended to provide broad knowledge related to materials processing, structure, properties, and performance, coupled with an understanding of the various materials challenges associated with existing and emerging technologies and industry/business sectors. The program is delivered mainly through classroom-based instruction but may also include laboratory-based courses and/or online courses. The curriculum combines a core of fundamental coursework with a highly flexible set of electives, which may include MSE courses and courses from other fields of study. This flexible coursework-only degree option is intended to provide advanced knowledge of fundamental and contemporary issues in Materials Science and Engineering relevant to a broad range of career paths. This degree option may be well-suited for certain groups of students, for example:

- New or returning B.S. graduates in the field of materials or other technical disciplines, who are interested in an industry-based career and would like to strengthen their position for opportunities or potential advancement in areas of engineering, engineering management, or technical business administration.

- New or returning B.S. graduates in the field of materials or other technical disciplines who are interested in advanced degree options but are uncertain about committing to a longer-term advanced degree program. (Transfers from the M.Eng. to the M.S. or Ph.D. programs are allowed for students who change their plans and meet the respective admissions criteria.)
- New or returning B.S. graduates and graduate students from other technical disciplines who would like to broaden their knowledge and credentials in the area of materials.
- New or returning B.S. or B.A. graduates from non-technical disciplines (e.g. business, law, political science, arts), interested in advanced materials knowledge for application to various sectors of business or public policy.
- Working professionals in technical or related fields interested in part-time pursuit of an advanced degree in the area of materials, including online course options.
- New or working professionals (e.g. law, medicine, government, business, education) seeking complementary expertise and credentials related to materials science. This may involve full or part-time study, including online course options.

Curricular Requirements: The M. Eng. degree program requires a minimum of 30 credits of coursework, including a 6-credit core and a minimum of 12 credits of graduate level MSE elective courses. The remaining 12 credits may be MSE graduate courses or other approved non-MSE courses.

Graduation Requirements: A student will be awarded the M.Eng. degree after all curricular requirements have been satisfied and the student is eligible for graduation according to the policies of the Iowa State University Graduate College.

1.2 Master of Science in Materials Science and Engineering

Purpose and design of the program: The Master of Science (M.S.) program in Materials Science and Engineering is an intensive advanced degree program combining graduate coursework and project-based research. The program is intended to provide broad-based knowledge related to materials processing, structure, properties, and performance, coupled with an understanding of the various materials challenges associated with existing and emerging technologies and industry sectors. The program is delivered mainly through classroom-based instruction but may also include laboratory-based courses and/or online courses. The curriculum combines a core of fundamental coursework and a complement of MSE and non-MSE electives.

Two program options are available, and students enrolled in the MS degree program will select either the *Research Thesis* track or the *Research Portfolio* track. Both tracks include a substantial research component but with different focus.

The *Research Thesis* track provides an opportunity for the student to complete a full-scale research project from beginning to end, including literature review, project design, planning, laboratory and/or computational investigation, data analysis, decision-making, formulation of conclusions, and appropriate reporting of outcomes. The research, culminating in a thesis document, will be conducted under the supervision of a major professor. In this track, the research efforts are aimed at making an identifiable contribution toward solving a relevant problem in a selected area of science and/or engineering. Project success is judged on the scientific soundness of the contribution and the quality with which it is presented in the Thesis document and in a final oral presentation/examination.

The *Research Portfolio* track provides an opportunity for the student to complete several separate research projects involving multiple selected topics and methods of experimental and/or computational investigation in accord with their interests. In this track, research is conducted through a sequence of three 3-credit project-based courses, each supervised by a specific faculty member and focused on a different area of research and related methods and analysis techniques. Each project has specific scientific objectives, but the focus of the overall portfolio is for the student to develop expertise in a targeted set of laboratory and/or computational research skills. Assessment is based on practical examinations and documented research results associated with each project. The program also requires a comprehensive presentation and oral examination covering all of the student's project work. Each student's overall program is overseen by a major professor.

The Master of Science degree program may be best suited for the following groups of students.

- New or returning B.S. graduates from materials programs or other disciplines who are interested in an industry-based career and would like to strengthen their position for opportunities or potential professional advancement in areas of materials testing, applied research, laboratory supervision, or technical management.
- New or returning B.S. graduates who are interested in industry-based materials testing and related laboratory work, including process/product development, quality control, field testing, technical customer service, failure analysis, and applied research.
- New or returning B.S. graduates who are interested in gaining substantial project-oriented research experience while earning an advanced degree but are undecided regarding industry/academic career path and uncertain about committing to the Ph.D. degree program. This degree option serves both pathways. Continuation or transfer from the M.S. program to the Ph.D. programs is certainly possible.
- Engineers or researchers with B.S. or advanced degrees in other fields looking to build substantive expertise in state-of-the-art research methods of materials processing, characterization, analysis, testing, and design.

Curricular Requirements: The M.S. degree program requires a minimum of 33 credits of coursework, including a 9-credit MSE core, a 1-credit core supplement, 3 credits of general graduate electives, and 1 credit of Responsible Conduct of Research (GrSt 565). In addition, the *Research Thesis* track requires 6 credits of MSE electives and a minimum of 12 credits of Graduate Thesis Research (MSE 699). The *Research Portfolio* track requires an additional 9 credits of MSE electives and 9 credits of research based Creative Component (MSE 599). See Table 1 for a detailed breakdown of curricular requirements.

Graduation Requirements: A student is awarded the M.S. degree after all curricular requirements have been satisfied and the student is eligible for graduation according to the policies of the Iowa State University Graduate College.

1.3 Doctor of Philosophy in Materials Science and Engineering

Purpose and design of the program: The Ph.D. degree is the highest academic credential in the field. ISU's robust multi-faceted program is intended to develop state-of-the-art competencies in academic scholarship, enabling graduates to make high-level career-based contributions in fields related to Materials Science and Engineering. The Ph.D. program combines graduate coursework with intensive and specialized project-based research expected to result in significant reportable scientific contributions in one or more selected areas, as evidenced by publication in peer-reviewed journals, industry standards, patents, or other forms of recognizable technical contributions. This degree option is best suited for students holding degrees (B.S., M.Eng., or M.S.) in Materials Science and Engineering, other engineering disciplines, physical sciences, or mathematics and data analytics, who are interested in careers involving fundamental or applied research of academic caliber. These career paths may include, but are not limited to:

- Tenure-track university academic faculty positions
- Non-tenure-track university research faculty positions
- Research scientist positions at national laboratories or other federal research facilities
- Industry-based research scientist positions or research and development specialists
- Industry or government research leadership and/or laboratory administration
- Private entrepreneurial endeavors and innovative technical enterprises
- Technical consulting positions related to entrepreneurial or legal activities
- Positions in public policy or legislation and related areas of analysis or management.

The Ph.D. program is a research-intensive program in which the student, under the direction of a major professor, undertakes a full-scale project, performing independent original research to address one or more relevant questions or challenges in advanced materials. Through this project, the student contributes to the field in a meaningful way, demonstrated through broad dissemination of research results in avenues such as peer-reviewed technical publications, trade journal articles, conference presentations and proceedings, books and book chapters, technical reports, patents, electronic codes and/or databases, industry standards and specifications, and open access electronic reports. Doctoral research projects are necessarily specialized, but the Ph.D. program is a broad and multi-faceted traineeship. Centered around a primary research topic as directed by a faculty advisor, the

student engages in a study of the research literature in the subject area and related applications and develops a detailed research plan aimed at answering a set of specific and significant questions. The student proposes a research plan and, after gaining approval from their Program of Study Committee (or “POSC”), the student performs the planned research in close collaboration with their faculty advisor and engages in a broad-based academic/professional development program aimed at building knowledge and high-level skills related to:

- Principles of scholarship - including citation practices, documentation, ethics, etc.
- Research methods – including experimental computational, and/or theoretical research;
- Best practices in technical communication - including field-specific written and oral communication, non-field-specific technical communication;
- Best practices in colloquial science communication – including communication with the general public and representative offices through press releases, news media, social media, and other public channels.
- Principles of project management - including documentation, technical supervision, budgeting, accounting, reporting, etc.
- Principles of laboratory and shop safety - including best practices for hazard control in various laboratory and shop settings, laboratory management, emergence response, safety management program structure and program administration.

The Ph.D. program includes a robust curriculum, consisting of both a fundamental core and flexible elective program intended to provide the student, in consultation with the major professor, an opportunity to build an academic experience that best complements and reinforces the student’s research program and career interests. With evidence of independent contribution to the field, as described above, and after completion of the academic curriculum, the Ph.D. program culminates in the preparation and presentation of a detailed dissertation document, a public oral defense, and a final committee examination (closed to the public).

Curricular Requirements: The Ph.D. degree program requires a minimum of 72 credits of coursework, including a 12-credit MSE core, a 3-credit core supplement, a minimum of 6 credits of MSE electives, 1 credit of Responsible Conduct of Research (GrSt 565), and 36 credits of Thesis Research (MSE 699). See Table 1 for a detailed breakdown of curricular requirements.

Graduation Requirements: The Ph.D. degree is conferred after all curricular requirements have been satisfied and the student is eligible for graduation according to the policies of the Iowa State University Graduate College.

Table 1. MSE Requirements by degree program

	M.Eng.	M.S. (RP)	M.S. (RT)	Ph.D.
CURRICULUM				
MSE Core (min) ¹	6	9	9	12
MSE 501/502 Core supp. w/Yr1 assess (P/NP) ²	---	1	1	2
MSE 503 Pre-doctoral qualification (P/NP)	---	---	---	1
GrSt 565 Resp. Cond. of Research (P/NP)	---	1	1	1
MSE Elective (5xx or 6xx) (min)	12	9	6	6
Total – regular graded coursework (min) ³	30	24	18	21
RESEARCH				
MSE 599 Creative Component	---	9	---	---
MSE 699 Research (min)	---	---	12	36
Seminar (connect to 599/699)	---	Required	Required	Required
Research Plan (supplement to POSC)	---	Required	Required	---
Research Proposal Document	---	---	---	Required
Preliminary Oral Exam	---	---	---	Required
Final Oral Exam	---	Required	Required	Required
Thesis	---	---	Required	Required
TOTAL CREDITS	30	35	32	72

¹ The core courses include MSE 510, 520, 530, 540. Requirements by degree program: PhD- all; MS - 510, 520, plus 530 or 540; MEng- 510 plus any one of 520, 530, 540.

² The core supplement includes MSE 501, 502, 503. These are P/NP courses that do not count toward the graded coursework minimum credit requirement. Requirements by degree program: PhD- all; MS – 501; M.Eng. – none.

³ Non-MSE electives are permitted, as needed to fulfill the total coursework requirement. There is no minimum. The term “regular” here indicates that this does not include MSE 599 or any P/NP credits. However, graduate-level special topics courses (MSE 590) are permitted.

2. Examples of typical programs of study – by degree program

2.1 Program of Study Examples – Master of Engineering

Example 1: Emphasis in Structural materials and related materials analysis

Yr	Sem.	Course	MSE Core	MSE Elect.	Non-MSE Elect.
1	Fall	MSE 510 – Structure and chemistry of materials	3		
		MSE 519 – Magnetism and magnetic materials		3	
		MSE 552 – Scanning electron microscopy and Auger microanalysis		3	
	Spring	MSE 564 – Fatigue and fracture of materials	3	3	
		MSE 540 – Mechanical behavior of materials			
		AER 480 – Ultrasonic nondestructive evaluation			3
2	Fall	MSE 551 – Characterization methods in Materials Science		3	
		EE 510 – Topics in electromagnetics			3
		ME 520 – Materials and manufacturing considerations in design			3
		MSE 581 – Computational modeling of materials	3		
Totals			6	15	9

Example 2: Emphasis in Materials for electronic devices

Yr	Sem.	Course	MSE Core	MSE Elect.	Non-MSE Elect.	
1	Fall	MSE 510 – Structure and chemistry of materials	3			
		MSE 519 – Magnetism and magnetic materials		3		
		EE 535 – Physics of semiconductors			3	
	Spring	MSE 530 – Solid state materials science	3			
		MSE 551 – Characterization methods in Materials Science		3		
		MSE 651 – Powder diffraction methods		3		
2	Fall	MSE 652 – Transmission electron microscopy		3		
		EE 510 – Topics in electromagnetics			3	
		EE 437 – Electronic properties of materials			3	
		MSE 532 – Microelectronics fabrication techniques		3		
		Totals			6	15

Example 3: Emphasis in Soft and biological materials

Yr	Sem.	Course	MSE Core	MSE Elect.	Non-MSE Elect.
1	Fall	MSE 510 – Structure and chemistry of materials	3		
		MSE 552 – Scanning electron microscopy and Auger microanalysis		3	
		MSE 553 - Physical and Mechanical Properties of Polymers		3	
	Spring	BBMB 404 – Biochemistry 1			3
		BIOL 428 – Cell Biology			3
		MSE 520 – Thermodynamics and kinetics of materials	3		
2	Fall	MSE 554 – Polymer Composites and Processing		3	
		MSE 556 – Biomaterials		3	
		CHEM 537 – Physical Organic Chemistry 1			3
		CHEM 572 – Spectrometric identification of organic compounds			3
		Totals	6	12	12

2.2 Program of Study Examples – Master of Science

Example 1: M.S. course of study (Research Thesis option)

Yr	Sem.	Course	MSE Core	MSE Core Supp.	MSE Elect.	Non- MSE Elect.	Res.
1	Fall	MSE 501 – Elements of Materials Science 1 (core supplement)		1			
		MSE 510 – Structure and chemistry of materials	3				
		MSE 520 – Thermodynamics and kinetics of materials	3				
		MSE 699 - Research					1
	Spring	MSE 521 – Mech. behavior and manuf. of polymers and composites			3		
		MSE 540 – Mechanical behavior of materials	3				
		MSE 554 - Polymer Composites and Processing			3		
		MSE 699 - Research					2
Sum.	MSE 699 - Research					1	
2	Fall	GrSt 565 – Responsible conduct of research (P/NP)		1			
		MSE 699 - Research					4
	Spring	MSE 569 – Mechanics of composite and combined materials			3		
		MSE 699 - Research					4
Totals			9	2	9		12

Example 2: M.S. course of study (Research Portfolio option)

Yr	Sem.	Course	MSE Core	MSE Core Supp.	MSE Elect.	Non- MSE Elect.	Res.
1	Fall	MSE 501 – Elements of Materials Science 1 (core supplement)		1			
		MSE 510 – Structure and chemistry of materials	3				
		MSE 520 – Thermodynamics and kinetics of materials	3				
		GrSt 565 – Responsible conduct of research (P/NP)		1			
	Spring	MSE 540 – Mechanical behavior of materials	3				
		AER 480 – Ultrasonic nondestructive evaluation				3	
		MSE 551 – Characterization methods in Materials Science			3		
Sum.	MSE 599 – Creative Component					3	
2	Fall	MSE 552 – Scanning electron microscopy and Auger microanalysis			3		
		MSE 564 – Fatigue and fracture of materials			3		
		MSE 599 – Creative Component					3
	Spring	MSE 652 – Transmission electron microscopy			3		
		MSE 599 – Creative Component					3
Totals			9	2	12	3	9

2.2 Program of Study Examples – Doctor of Philosophy

Example: Ph.D. course of study

Yr	Sem.	Course	MSE Core	MSE Core Supp.	MSE Elect.	Non- MSE Elect.	Res.
1	Fall	MSE 501 – Elements of Materials Science 1 (core supplement)		1			
		MSE 510 – Structure and chemistry of materials	3				
		MSE 520 – Thermodynamics and kinetics of materials	3				
		MSE 699 - Research					2
	Spring	MSE 502 – Elements of Materials Science 1 (core supplement)		1			
		MSE 530 – Solid state science	3				
		MSE 540 – Mechanical behavior of materials	3				
		MSE 699 - Research					2
	Sum.	MSE 503 – Elements of Materials Science 1 (core supplement)		1			
2	Fall	GrSt 565 – Responsible conduct of research (P/NP)		1			
		MSE 699 - Research					3
	Spring	MSE 569 – Mechanics of composite and combined materials			3		
		MSE 699 - Research					3
	Sum	MSE 699 - Research					1
3	Fall	ME 528 – Micro/Nanomanufacturing				3	
		MSE 699 - Research					6
	Spring	ME 536 – Advanced Heat Transfer				3	
		MSE 699 - Research					6
	Sum	MSE 699 - Research					1
4	Fall	MSE 699 - Research					6
	Spring	MSE 699 - Research					6
Totals			12	4	3	6	36

3. Academic Performance Standards

Minimum curricular requirements for each degree are listed in Table 1. Graduate students are required to maintain a cumulative GPA of 3.0 or higher (out of 4.0) for all graduate coursework. Registration privileges will be suspended for any student who does not maintain a satisfactory GPA. Requests for probationary removal of the academic hold on registration must be submitted in writing (email) to the DOGE, with a copy to the Major Professor and the Graduate Program Coordinator. The request should describe the circumstances of the case contributing to the sub-standard performance with relevant details about specific courses and should outline any remedial steps to be taken that are intended to lead to improved outcomes. Upon review of the case and approval by the DOGE and the Graduate College, the academic hold may be temporarily lifted to allow for registration.

In addition to the general requirements described above, there are several other performance standards that apply to students in the Ph.D. program. These are summarized below and must be satisfied to qualify for the Ph.D. preliminary oral examination, typically taken during the second year of the program. At the time of application for the Ph.D. preliminary examination, the student must have earned:

- a score of 70% or higher on the Doctoral Qualifying Exam,⁴ taken as a part of the MSE 503 course.
- a grade of "B" or higher in each of the four MSE core courses,
- a cumulative GPA of 3.3 or higher for the four MSE core courses, and
- a minimum of 10 credits of MSE 699, with a cumulative GPA of 3.3.

⁴ If a student scores below the minimum requirement on the doctoral qualification exam (July), a remedial study plan will be developed by the Major Professor, and the student may retake the exam at a scheduled time in November. If a student scores below the minimum requirement on the Fall retake, then the student will have the option to complete the MS(T) program. After successful completion of the MS(T) program, the student may repeat the MSE 502 course and exam with the same retake options. After passing the examination, the student will be eligible for the Ph.D. program.

All requirements of the Graduate College are specified in the ISU Graduate Student Handbook. The MSE Graduate Program has several additional administrative requirements, as listed in Table 3. The program design and academic progress of each student is tracked using the online POSC form. Once established and approved, this form can be updated throughout the program. In addition, thesis-based program students (MS(T) and Ph.D.) are required to complete a progress report form at the end of each semester, summarizing academic progress, research accomplishments, and professional development. All graduate students (thesis and non-thesis) are required to participate in an annual review process, which includes a self-assessment and program feedback survey and a review meeting with the student's major professor or academic advisor.⁵

Table 3. Regular Administrative Requirements for MSE Graduate Programs

Administrative Item	M.Eng.	MS(N)	MS(T)	Ph.D.	Notes / due date
English Requirement			X	X	Pre-enrollment
Major Professor			X	X	Upon enrollment
POSC Approval	X	X	X	X	Year-1/2 (see Table 2)
Semester Progress Report			X	X	Dead Week (F/S)
Annual Rept. / Program Survey	X	X	X	X	July 1 (annually)
Research Proposal Document				X	Year 2
Request for Preliminary Oral Exam				X	Year 2
Report of Preliminary Oral Exam				X	Year 2
Request for Final Oral Exam			X	X	4 weeks prior to exam
Report of Final Oral Exam			X	X	On exam date
Application for Graduation	X	X	X	X	Semester of graduation
Approval Slip for Graduation	X	X	X	X	
Submission of Thesis Document			X	X	
Thesis Submission Form			X	X	
Program Exit Survey	X	X	X	X	

4. Graduate Enrollment Options

4.1 Regular enrollment (on-campus graduate enrollment)

Graduate students on an assistantship are considered full-time as long as they are registered for at least one credit. Graduate students not on assistantship must be registered for a minimum of nine credits to be considered full-time students or five credits to be considered half-time students. Maximum credit limits apply for each term.⁶ A student may request a waiver to exceed the credit limit by written request to the DOGE, explaining the reason for the request. Students are responsible for checking with the offices of Financial Aid and/or the ISSO regarding specific enrollment requirements for the summer term.

4.2 Concurrent enrollment

The MSE Department offers B.S./M.S. and B.S./M.Eng. concurrent enrollment programs. This program is aimed at helping students who wish to continue into graduate school after completion of their B.S. degree by permitting the student to enroll in graduate coursework while still completing their undergraduate program. This enables the student to more efficiently or strategically schedule courses, according to the overall objective of obtaining both B.S. and M.S. or M. Eng. degrees. In addition, students accepted into a concurrent degree program may apply up to 6 credits of major or non-major graduate credit, earned while in the concurrent program, to both the B.S. degree and the relevant graduate degree (M.S. or M. Eng.). Note, all ISU graduate students are permitted to apply up to 6 ISU undergraduate credits to a graduate program, whether or not they were applied to the undergraduate degree.

⁵ The Semester Progress Report and Annual Review forms are submitted through Canvas, using the templates provided.

⁶ See Graduate College Handbook, section 2.1.6 for maximum credit limits.

The concurrent program enables the student to apply an *additional* 6 credits to their graduate degree program, provided that these credits were taken while concurrently enrolled. All normal restrictions apply regarding the eligibility of various courses for graduate credit. See the Graduate College Handbook for more details concerning application procedures.

- *Eligibility* – ISU undergraduate students who will have earned 90 credits toward the BS Mat E degree by the time of concurrent enrollment are eligible to apply.
- *Admission Requirements* – All regular MSE Graduate Program admission criteria apply.
- *Application Process* – Applications for concurrent enrollment are not submitted through the Graduate College online application system. Rather complete (paper) application packages should be submitted directly to the MSE Graduate Program Coordinator. Applications are accepted anytime during the academic year.
- *Application Package* – The application package must include the following materials.
 1. The ISU Concurrent Enrollment application form (“Concurrent Enrollment for Undergraduate Student Wishing to Pursue a Graduate Certificate or Degree”). See Reference (1).
 2. MSE Concurrent Enrollment Request form. See Reference (2).
 3. Resume/CV
 4. Three letters of recommendation

4.3 On-line/distance enrollment

The MSE department makes no distinction between online and residential coursework, and online courses may be applied to any degree program without limitation. Accordingly, the M.Eng. degree may be earned completely online. MSE 699 credit, however, cannot be earned online and must involve residential thesis research. For this reason, the MS(RT) and Ph.D. degree programs cannot be completed in a fully online manner. The degree to which the MS(PT) can be completed online depends on the nature of the MSE 590 Creative Component work involved.

5. Graduate Student Research

Materials research is an integral component of the MSE Graduate Programs. As a part of their programs of study, students engage in various forms of experimental, computational, and theoretical research, utilizing various forms of university resources. While access to facilities, specific procedures, and usage/training requirements for any particular student is established by the Major Professor and/or research supervisor, some general information related to MSE policies are outlined below.

5.1 MSE Laboratory Safety Program

The MSE Department is heavily engaged in a wide variety of laboratory research, and the students, staff, and faculty collectively share the responsibility of maintaining the safest and most efficient environment in which to perform research of the highest quality. We take this responsibility very seriously, and every graduate student is required to participate fully the MSE Safety Program and to maintain appropriate safety training credentials. This involves various programs, courses, and seminars, along with formal university, department, and group-level training. Every student performing research will have a personalized safety training plan, supervised by the major professor. Students and major professors are required to maintain safety training documentation consistent with the personalized plan and to review the plan and training documentation together every semester.

5.2 Laboratory Access and Usage

The professional and scientific development of our students is a high priority and requires that students have hands-on access to state-of-the-art research facilities. However, to maintain safe working conditions and integrity of our research facilities and data, access to research equipment is generally limited to work that is directly related to thesis-based research or other contract research. Access to any laboratory space or use of any laboratory equipment must be expressly authorized by the student’s major professor and the specific lab or equipment supervisor. It is prohibited to give such access to unauthorized personnel or to leave doors unlocked or propped

open. In addition, any known or suspected unauthorized entry to laboratory spaces or use of equipment must be reported immediately to the MSE Graduate Program Coordinator, Safety Officer, or Director of Graduate Education.

5.3 Curricular Research (MSE 699)

Except for special circumstances approved by the DOGE (typically involving an off-campus assignment), students in thesis-based programs are required to enroll in at least one credit of MSE 699 during each semester, including summer. Curricular research assignments will be made at the start of each semester. Results will be evaluated and graded by the MP at the end of each semester. Generally, an effort of approximately 3 hours per week is expected during the semester for each semester-credit-hour awarded. This effort should be considered separate from other coursework and assistantship-related research.

5.4 Graduate Research Assistantships (GRAs)

Any MSE graduate student supported on a GRA will have a formal letter of intent (LOI) and position description (PD), both of which are signed by the student, the major professor, and the Department Chair or delegate. The LOI will describe the terms of the assistantship, including the start/end dates, the base-type of appointment (9-month or 12-month), the effort level (typically 1/4-time or 1/2-time), the monthly stipend, tuition support, the name of the major professor, the supporting project or scholarship accounts, leave policies, and other details or conditions of employment related to the specific research project and expected outcomes. The PD will describe the duties and responsibilities of the graduate student, including academics, safety, administration, and research activities related to the specific research group, project, and laboratories involved. The PD document will be used by the major professor to evaluate the performance of the student each semester. It is critical that the student reads and understands the LOI and PD documents prior to signing.

Graduate students are eligible for various types of internal and external scholarships and fellowships, and they are encouraged to apply for these, as appropriate, under the supervision of the major professor. In most cases, the funding provided by scholarship and fellowship awards will serve to offset MSE stipend and tuition costs and will not be awarded as an addition to the GRA stipend. There are a few exceptions, where awarded funds are intended to supplement the regular GRA stipend. Students are advised to read and understand the terms of scholarship and fellowship programs to avoid confusion.

Graduate research assistantships are generally supported by specific research grants, contracts, or scholarships, administered by the student's Major Professor, who must be a full member of the MSE Graduate Faculty. Most often, students are admitted into a degree program as a member of a specific research group, and agreements for GRA support are made at the time of admission. In some cases, graduate students are admitted prior to any such agreement, and it is expected that the admitted student will search for a GRA position within the department by arranging interviews with potential Major Professors. In many cases Major Professor GRA support can be arranged prior to the start of the first semester. In other cases, depending on position availability, these arrangements cannot be made by the start of the student's first semester. A student admitted on a GRA but for which Major Professor support is not arranged by the start of the first semester will be assigned various department responsibilities at the commitment level of 20 hours per week, in accordance with the terms of the 1/2-time GRA. Typically, GRA appointments are made for 1-year terms and are renewable annually, contingent upon available funding and appropriate academic progress.

6. Graduate Program Administration and Procedures

Because graduate enrollment may involve various terms and conditions related to academic status, employment status, and immigration/visa status, graduate students (and major professors) are responsible for understanding the specific terms of their individual appointments. Graduate College administrative procedures are implemented through various official forms, available at the Graduate College website at the following link: <https://www.grad-college.iastate.edu/student/forms/>. All paper forms must be submitted to the MSE Graduate Program Coordinator, who will place a copy in the student's MSE file and will submit the form to the Graduate College. Students should refer to the Graduate College Handbook for a complete description of college-level administrative policies and procedures. Some of the most common administrative procedures are outlined below, along with administrative procedures specific to MSE graduate programs.

Graduate Student Advising and Review Process - In addition to any advising activities established by the Major Professor within the specific research group, all graduate students are required to participate in the departmental Student Advising and Review Process. The overall process is summarized below.

- **Fall and Spring Progress Reports** - All graduate students are required to submit a Semester Progress Report at the end of the Fall and Spring semester (5pm on Friday of “dead week”). These reports are uploaded to Canvas (as a pdf file) and are due at the end of dead week in Fall and Spring.
- **Annual self-assessment and survey** - Graduate students are required to submit an annual self-assessment related to all aspects of their academic progress and professional development. With the assessment, students are required to submit an updated CV/resume and a complete anonymous survey form related to various elements of graduate program. These items are uploaded to Canvas (as a pdf file) and are due July 1, each year of enrollment.
- **Annual Review and Performance Appraisal** – Referring to the student progress reports, annual self-assessment, CV/resume, and all other knowledge of accomplishments through the year, the Major Professor (or DOGE for non-thesis programs) will complete a written review and performance appraisal. The appraisal will be made available to the student, and the Major Professor will meet with the student to discuss the review and to provide constructive feedback and advising guidance. The appraisal report and meeting certification are submitted by the Major Professor through Canvas, due August 15.

Change in Program of Study/Committee - The Program of Study (POS) and the POS Committee (POSC) are established using the POSC form, accessible through AccessPlus. This is the principal administrative document for all graduate degree programs. As such, it should be established early in the program (see Table 1) and updated as needed to reflect changes in curriculum planning and committee members. (See section 6.1 of the Graduate College Handbook for requirements regarding the makeup of the POS Committee.) The POSC form is completed and submitted online, after which it is routed electronically for all necessary approvals. Having an approved POSC form on file is required for most other graduate student administrative procedures. The following POSC approval timeline requirement is excerpted directly from the Graduate College Handbook (6.1). This is strictly enforced by the Graduate College.

The student's initial Program of Study and Committee appointment form (POSC) must be approved by the Graduate College no later than three calendar months prior to the preliminary oral examination for doctoral candidates; the three calendar-month timeframe for scheduling a preliminary oral examination begins the day that the Graduate College approves the POSC. For master's students, the POSC must be approved by the Graduate College by the last day of the semester prior to the term of the final oral examination. For students in approved master's programs with no final oral examination, the POSC form must be approved by the Graduate College no later than the last day of the semester prior to the graduation term. For the POSC to be approved in any given term, it must be received by the Graduate College by the published deadline for that term.

Change in Major Degree Program - Students may request a change in degree program (M.Eng., M.S., Ph.D.) within the MSE Department using the appropriate request form (Request to transfer from one major/degree/certificate to another) which can be found at (<https://www.grad-college.iastate.edu/documents/forms/>). This is a paper form and must be submitted to the MSE Graduate Program Coordinator. The request must include the completed form and an attached memo from the major professor describing the student's progress in the current program, the reason for the requested change, and (if applicable) all GRA stipend/tuition information necessary for the LOI revision. Changes in major degree program to or from departments/programs outside of MSE are requested using this same form. Approvals from both departments/programs are required in such cases.

Emergency Committee Substitution - In special cases involving unforeseen circumstances, it may be necessary to request permission for a substitute committee member to participate in a Graduate Examination. The following allowance is provided in the Graduate College Handbook (6.2.7).

In the case of any emergency occasioned by sudden illness, accident, or other serious and unforeseen ability of a faculty member to attend a meeting of the POS Committee, the program should submit the Request for Committee Substitution at the Preliminary or Final Oral Exam form as soon as possible either before or

directly following the exam. The person substituting for the absent member will submit the request to the Graduate College. The major professor will have to approve the substitution before the Graduate College can approve. In extreme circumstances, the Dean of the Graduate College will approve via telephone an emergency replacement. This emergency procedure can be activated by calling the Dean's office directly at 515-294-4531.

Temporary discontinuation of program - A student will be changed from *active* to *inactive* status after not being registered during four consecutive semesters, excluding summer. Students in *inactive* status must be reinstated prior to further enrollment. Reinstatement requests should be initiated through the MSE Graduate Program Coordinator.

GRA/GTA leave of absence - Graduate Assistants (GRA and GTA) do not accrue sick leave, maternity leave, vacation time, or other forms of personal leave, but reasonable allowances are made using common professional practices of communication and advance notice. Unexpected absences should be communicated with the major professor in accordance with policies of the research group. It is important for graduate students to understand these policies and for major professors to communicate expectations. Requests for any planned leave of absence should be made directly to the major professor in advance of the absence, giving reasonable time for necessary planning (typically no less than one week plus the duration of the absence). Any special issues or concerns regarding appropriate handling of absence requests should be communicated to the DOGE, who will work to resolve the issue. Graduate students are referred to the Graduate College Handbook for a more complete description of responsibilities and benefits.⁷ Some special registration options are available for doctoral candidates (Ph.D. students who have completed the preliminary oral examination and all required coursework) requiring medical or personal leave.⁸

Request for transfer credit - In some cases, credits from other institutions may be applied to ISU program of study. Applications for transfer credit are made and granted on a case-by-case basis through the online POSC form approval process. As a part of the process, students may be asked for supplemental information about courses being considered for transfer credit (e.g. syllabus, textbook citations, exams, etc.). Except for highly unusual circumstances, no more than 6 transfer credits will be considered for any degree program. Transfer of MSE 699 credits are not permitted.

Minor Program of Study - MSE graduate students in thesis-based programs are encouraged to enroll in an optional minor program of study. Requirements for minor programs are established by the home department for each program. The MSE Department offers a Minor in Materials Science and Engineering. The graduate minor in MSE requires 12 credits of MSE graduate coursework, including 6 credits selected from MSE 510, 520, 530, and 540. In addition, the minor program requires that the POS committee includes at least one member of the MSE Graduate Faculty. Request for a Minor Program of Study are made and approved using the POSC form.

7. Description of Program Responsibilities

Successful completion of any of our graduate degree programs requires an understanding of the roles and responsibilities of the student and various program officials. These are briefly described here, but students are encouraged to discuss these with their major professor, since expectations and standard practices may vary between research groups.

The Director of Graduate Education (DOGE) - is responsible for overseeing the execution of all graduate degree programs, ensuring that graduate examinations are properly conducted and that academic requirements are met upon conferring graduate degrees. The DOGE will monitor academic progress through the POSC forms and departmental progress reports, and will engage in intervention activities, as deemed appropriate.

The Graduate Program Coordinator (GPC) - will facilitate program administration and will coordinate with other university officers on matters related to academic programs, assistantships, fellowships, international status, etc.

⁷ See Graduate College Handbook, sections 3.2.5 and 6.4.3.

⁸ See Graduate College Handbook, section 2.1.4.

The GPC will also serve as the primary administrative contact for students. All forms requiring DOGE signature/approval are to be submitted to the GPC.

The Major Professor (MP) - will serve as the principal student advisor for all matters related to research, academics, assistantships, and overall programmatic progress. The major professor will also serve as the primary evaluator of student performance and will be assisted by the Program of Study Committee and the MSE Graduate Program Committee. Under normal circumstances, the major professor is expected to meet with each graduate student individually for at least one hour per week to discuss research progress, professional development, and other issues as might arise with the student's program. The MP is responsible for providing safe laboratory facilities and ensuring that the student has received proper training to perform work safely.

The Program of Study Committee (POSC) - is responsible for working with the MP to review proposal (Ph.D.) and thesis (M.S. and Ph.D.) documents and to conduct preliminary/final oral examinations. In addition, the POSC serves as a technical advisory board, available to provide advice, guidance, or recommendations regarding research activities, as appropriate. The POSC must be established using the online POSC form by the second semester of enrollment. Refer to the ISU Graduate Handbook for policies regarding the make-up of the POSC.

The MSE Safety Coordinator (SC) - will coordinate general safety orientation programs and oversee usage of centralized department facilities (i.e. those not controlled by a specific faculty member or research group). The SC will organize and manage a Graduate Student Safety committee with membership from each research group. The SC has the authority to stop work or access to any room or instrument without notice for any reason. Such stoppage will immediately be reported to the major professor and DOGE so that a timely resolution may be achieved.

The Graduate Research Assistant (GRA) - is expected to engage professionally in the research activities assigned by the major professor. For a 1/2-time assistantship, a minimum of 20 hours per week of non-credit research is expected. More time may reasonably be expected under certain circumstances for fulfillment of commitments, as outlined by the MP. The GRA is expected to observe professional standards with regard to attendance and notification of absences, as directed by the MP.

The Graduate Student (whether on assistantship or not) - is expected to engage professionally in academic coursework and curricular research assignments (MSE 699). Students are also expected to read, understand, and follow the administrative procedures outlined in this document and the Graduate College Handbook. Graduate students are responsible for completing all required safety training and providing/maintaining appropriate records of such training, as assigned by the cognizant MP or course instructor. Students are expected to maintain the highest standards of integrity during academic, research, and reporting activities. Plagiarism, falsification, or misrepresentation of research results will not be tolerated.

8. Closing Remarks

The faculty and staff of the Materials Science and Engineering Department take great pleasure in mentoring and guiding future scientists, engineers, innovators, entrepreneurs, and educators on their way to becoming leaders and influential practitioners in their chosen areas of expertise. We value the contributions of our students and the opportunity to engage with them on their journey. This handbook is intended to provide basic factual information related to the structure and requirements of our graduate degree programs. In addition, we hope that the program descriptions provide deeper insights into the broad academic and career-centric aims of our curricula. If questions remain, we invite the reader to contact our office at the address listed on the front page.