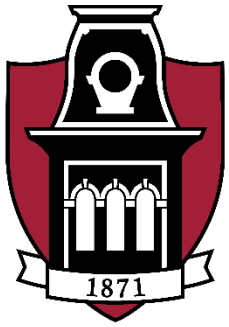
MATERIALS SCIENCE & ENGINEERING GRADUATE PROGRAM

GRADUATE STUDENT HANDBOOK

2024-2025
JANUARY 10, 2024



UNIVERSITY OF ARKANSAS

Graduate School
& International Education
Materials Science & Engineering

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INTRODUCTION

WELCOME

It is our sincere pleasure to welcome you to the Materials Science & Engineering (MSEN) Graduate Program at the University of Arkansas. It is our goal to provide you with both state of the art academic instruction, and the organizational skills to fully utilize that instruction, that will allow you to excel in your professional career. We are your partner and take a personal responsibility to make your experience at the University one that you will not soon forget.

MISSION

The Materials Science & Engineering program at the University of Arkansas, Fayetteville, is an interdisciplinary graduate program designed to expand a student's knowledge beyond the boundaries of traditional departmental based graduate programs. Students in the Materials Science & Engineering program participate in cross-departmental research, take applications-intensive classes from multiple engineering and science departments, and develop workplace productivity skills in a simulated industrial environment.

The outcome of their graduate education in this interdisciplinary environment will be a better understanding of materials and their properties; processes for producing materials and modifying their properties; creation of devices and systems with features enabled by this manipulation of material properties; and an understanding of the economics that affect successful introduction of these devices and systems into industry and society.

PHILOSOPHY

The Materials Science & Engineering program reports directly to Dean of the Graduate School of the University of Arkansas, but closely aligns its policies with the policies of both the Fulbright College of Arts and Sciences and the College of Engineering. The Arkansas Department of Higher Education (ADHE) approved the predecessor Microelectronics-Photonics M.S. degree in July 1999 for fall semester 1999 implementation, and the Ph.D. degree in July 2000 for implementation in the Fall 2000 semester. The ADHE approved the reconfiguration of the Microelectronics-Photonics graduate program to the Materials Science & Engineering program in January 2020 for implementation in the Fall 2020 semester.

Traditional students in the M.S. MSEN program are required to complete an interdisciplinary research-thesis based degree, an external technical organization-based research-project degree, or a non-research degree. The two research-based degrees provide the base to continue toward the Ph.D., and the non-research is intended primarily to support non-traditional students with professional experience or students on career paths that do not directly involve research. All three degree paths require a mixture of physics/chemistry, engineering, technical elective, and business management classes; resulting in a degree that is highly marketable to career opportunities in the development and manufacturing of high tech materials and devices.

The program's faculty and post-doc staff voluntarily associate themselves with MSEN to better coordinate research and educational efforts in this field. The MSEN faculty members' home appointments are in the departments of Biological and Agricultural Engineering, BioMed Engineering, Chemical Engineering, Chemistry, Civil Engineering, Computer Systems Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, and Physics. It is expected that students accepted into the MSEN program will begin working with the staff in their research laboratories shortly after their arrival at the University of Arkansas, Fayetteville.

UA GRADUATE SCHOOL CATALOG

This graduate handbook is designed to supplement the material found in the Catalog of the Graduate School of the University of Arkansas. The material found in this handbook is indicative of the current

philosophy of the program and may include changes that are being submitted into the UA approval cycle for publication in the next year's Graduate Catalog.

STUDENT RESPONSIBILITIES

Students wishing to enter the MSEN graduate program must first accept the responsibilities of becoming part of this student and faculty team. This mirrors the life one will face after graduation, when all privileges and benefits are firmly tied to different types of responsibilities that one must accept in order to gain the privileges.

In the case of the MSEN program, our students must first accept the types of responsibilities that are common to all graduate programs here at the University of Arkansas. These include such responsibilities as

- committing as much time to studies as are necessary to learn the academic materials presented to you,
- exceeding the minimum moral and ethical behaviors defined by the University,
- maintaining the minimum requirements on cumulative grade point average (CGPA),
- giving your employer (whether working as teaching assistant, graduate assistant, work study, or outside the University) a full measure of work for every hour you are paid, and
- treating all others you contact with the respect and professionalism that you desire from others toward yourself.

In addition, the MSEN program requires our students to accept additional responsibilities in return for the extra resources and training this program provides them. These MSEN specific responsibilities include

- enthusiastically participating in all non-academic training events scheduled by the MSEN graduate program,
- actively learning about your MSEN colleagues not only as classmates but also as people,
- embracing the concept that none of us are successful in our academic endeavors unless all of our colleagues also reach their full academic potential,
- providing tutoring and other support to your colleagues as needed,
- trusting your colleagues enough to ask for help if you are facing trouble in an academic arena,
- providing the MSEN management with constructive criticism toward improving the program, and
- adding your energy to define and implement needed program changes.

The MSEN program does not exist just to provide you with a series of courses to increase your knowledge. The MSEN program exists to help you mature into a highly skilled professional, one who will have not only an extensive knowledge set upon graduation but also the organizational skills needed to effectively utilize this knowledge set early in your career.

STUDENT OBLIGATIONS

Communications requirements:

1. Attend weekly MSEN operations seminar meetings (MSEN 5811/5911/6811/6911)
2. Attend MSEN student public presentations prior to their thesis/dissertation defense
3. Attend MSEN summer camp the week before start of classes in the fall
4. Attend MSEN supplemental training activities as scheduled
5. Check "name"@uark.edu email once per day for program communications
6. Empty mailbox in MSEN office once per week
7. Attend and present research summaries at small project group meetings (approximately six per semester)
8. Attend all MSEN monthly Research Communication Seminars (MSEN 5611/6611).

Proficiency to be demonstrated in following software packages:

1. Microsoft Project
2. Microsoft Word for Windows
3. Microsoft Excel
4. Microsoft PowerPoint (to be used for all student presentations unless another software product is required by a specific course instructor)

MSEN Documentation requirements:

1. Required for MSEN 5811, 5911, 6811, and 6911enrolled students, highly recommended for all students:
    a) One-page resume with attached list of all publications published, submitted and planned and all conferences attended (updated first full week of September and February). PhD students who have completed candidacy should submit a full CV.
    b) Research document between student, major professor, and MSEN Director (due to Director for review/approval by October 1 and March 1; fully approved, signed, and uploaded to Blackboard by November 1 and April 1). Not required during the first semester of a degree program.) See an outline at http://msen.uark.edu/.
    c) Research path defined in Microsoft Project (updated monthly as described in project document. Not required during the first full month of a degree program.)
2. Required for all MSEN students:
    a) Curriculum/degree plan (updated each semester as part of advising cycle and required before enrollment for the following semester).
    b) The degree plan must be reviewed with, and signed by, your major professor and returned to the MSEN office as well as any other required documents in order for your advising hold to be released.
    c) Research Quad Slide summarizing your MS or PhD research updated each spring semester beginning after your first semester in the program. The slide will be posted to the MSEN website and must be approved by your major professor. The format must strictly follow the template provided by the MSEN program. An example quad slide may be found at the end of this handbook.

Graduate School Documentation requirements:

The Graduate School requires additional forms as spelled out in the Graduate School Handbook.

MATERIALS SCIENCE & ENGINEERING GRIEVANCE PROCEDURES

The Graduate School handbook defines grievance procedures for students. An academic grievance means a dispute concerning some aspect of academic involvement arising from an administrative or faculty decision which the graduate student claims is unjust or is in violation of his or her rights.

In the event of a disagreement, MSEN students are requested to follow an orderly procedure with the goal of timely and efficient problem resolution. Disagreements or issues should first be openly discussed with the faculty member or administrative person whom the student believes has caused an unjust act. It is anticipated that most problems can be resolved by open communication guided by mutual respect.

In the event that a problem cannot be resolved between the student and the person or persons at the source of the disagreement, the student should discuss the matter with the Director of the MSEN graduate program. If the problem still cannot be resolved at this level, the student should request that the matter be reviewed and considered by the Graduate Studies Committee of the MSEN Graduate Program (GSCMSEN).

If the problem or disagreement is with the Director of the MSEN program, the student may choose to meet with the academic dean or the Graduate dean for a possible informal resolution of the matter.

A student has the right to file a formal grievance as defined in the Graduate School catalog at any time, and the program fully supports the use of this formal process by our students. However, MSEN students should recognize that the informal approach described above is aligned with the formal grievance procedure's initial steps.

In addition, MSEN Graduate Students may contact the University of Arkansas Office of Student Standards and Conduct for advice on any issue that is negatively affecting their academic success. The web site for this office is http://ethics.uark.edu, and the telephone number is (479) 575-5170.

ACADEMIC HONESTY AND PLAGIARISM

Honesty in all things is a core value of the MSEN Graduate Program. All MSEN students are not only expected to display the highest level of personal honesty in their own actions, but also to stop - by whatever means necessary - any dishonesty they observe in the University environment.

Any act of academic dishonesty of any kind by a MSEN student ***may result in immediate expulsion from the MSEN Graduate Program***. There is no tolerance on this issue, so do not put yourself in the position of trying to explain why you did something that you know is clearly wrong.

UA overview from the office of the Provost:
As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail.

Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which may be found at https://provost.uark.edu/academic_initiatives.php. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

The MSEN program fully supports this policy enforcement. You should read all the information in the link as these policies define what will happen in any case of academic dishonesty.

It is the responsibility of every MSEN Graduate Student to fully familiarize themselves with these documents. **Lack of knowledge of these policies will not be grounds for appeal of any sanction imposed as the result of violations of these policies.**

The MSEN Graduate Program does consider any kind of copyright infringement to be no different than theft, and as serious as cheating or plagiarism. This includes (but is not limited to) the use of pirated software to meet your academic assignments and the copying of textbooks (except in very rare and very limited special circumstances).

PLAGIARISM

It has been noted that incoming students may believe that portions of another person's work can be pasted into a document and sufficiently modified to make it non-plagiarized. This shows up most often in the first chapter of theses and dissertations when prior work and current state of the art are being discussed.

Please be clear on one point – each person writes in their own voice, which includes the choice of words and the manner in which words are placed. YOU CANNOT MODIFY PRIOR WRITTEN TEXT ENOUGH TO MAKE IT NON-PLAGIARIZED!

The advice of the MSEN Graduate Program is to always start from a blank page to write down the knowledge you have gained from reading other sources. These sources will be cited as your references attached to that section of your work.

If you feel that you must use someone else's exact words, either for clarity or because the original author's words may be used to emphasize a point, then use the following format:

> *"You will note that the quotation is separated into a stand-alone paragraph that is not only contained in quotation marks, but is also indented a quarter inch more on both sides and put into italics. The reference number after the quotes is bogus in this case, but if this handbook contained reference footnotes it would say Private Communication from Matt Leftwich."* [1]

ACADEMIC HONESTY AND PLAGIARISM (CONTINUED)

All MSEN students working on a candidacy exam, thesis, or dissertation will be given access to self-submit their document to the web site http://www.turnitin.com/ if they wish to confirm that their document does not contain inadvertent plagiarism. The final submitted document will also be submitted by the MSEN program to this or other plagiarism sites before being accepted for its intended academic purpose.

It should be noted that any and/or all documents submitted by MSEN students as part of their academic work may be submitted to plagiarism sites for review without prior notification beyond that of this handbook. Any work submitted will be edited to protect the identity of the student whose work is being submitted per UA policies and procedures.

Any document found to contain plagiarized material will be reported per the UA Academic Honesty Policy and the defined response under the Sanctions Rubric will be fully implemented.

ANNUAL ACADEMIC REVIEW POLICY

Materials Science & Engineering graduate students are required to participate in an annual review of academic progress. Such review will be conducted as a face-to-face interview between the student and the Major Professor. At a minimum, the review will cover progress in completing courses with an adequate grade point, in completing all required examinations, in completing the thesis/dissertation/project requirements, and towards completing any other requirements for the degree as listed in the handbook. Reviews will be completed in February of each year, reflecting performance over the prior calendar year, but no more than thirteen (13) months may lapse between successive reviews. Any student that fails to arrange for and complete an annual review will not be allowed to enroll in courses in the following semester. MSEN students who begin their graduate program in January will complete their first annual review the following February.

It is the student's responsibility to self-assess their performance using the third page of the MSEN annual review form prior to meeting with the Major Professor. Any significant differences between the student's self-assessment and the professor's assessment should be the focus of the discussion during the review.

Both the graduate student and the Major Professor will sign the documented outcome of the annual review. This document will then be submitted to the Materials Science & Engineering review coordinator for approval. If the student is judged to be making neither ordinary nor adequate progress toward the degree, then a written explanation will be included with the documentation, along with planned corrective actions. The MSEN Program Director is required to review and approve any identified corrective actions. In the event that planned corrective actions are not deemed to be adequate, then the student will be removed from the program.

FUNDING OPPORTUNITIES – GRADUATE ASSISTANTSHIPS

There are two types of Graduate Assistantships, Teaching and Research. If you are on a 50% appointment (requiring 20 hours per week of work) then you are considered an in-state student for purposes of tuition assessment, and the fund that pays your stipend will also pay that in-state. If you are on 25% appointment (10 hours per week of work), you are considered an in-state student for purposes of tuition assessment, which you will pay from your own funds.

Regardless of the type of Graduate Assistantship that you may receive, all students must pay all supplemental fees themselves.

Teaching Assistantships require that a student be competent in both written and spoken English. Students who graduate from an undergraduate institution where English was not the language of instruction must demonstrate competency in written and spoken English before they can be considered for positions requiring live instruction (such as being an undergraduate lab class instructor). See the Graduate Catalog for methods to prove this written and spoken English competency.

The MSEN Graduate Program is very entrepreneurial in working with our admitted students to help them identify and then compete successfully to win funding opportunities. Over 95% of our students have secured funding for their degrees within a year of their arrival on campus, but the MSEN program cannot guarantee funding for any student. That is because selections to new positions most strongly depend on the reputation you build as a student in our classes and on your research skills you display in working on your research project. Most of our students who are selected for Teaching Assistantships win those positions because they have taken the financial risk to come here for their education and proven themselves, and the positions most frequently open in the last three weeks before the start of the next semester. MSEN graduate students have worked as TAs for Physics, Chemistry, EE, ChE, and MSEN, depending on the background of the individual student. TAs are generally paid about $1545 - $2000 per month, depending on the department in which the TA is located.

Individual professors, through research grants that they win in the highly competitive marketplace, directly fund Research Assistantships. Students are selected directly by these professors to work on the specific research projects supported by these funded grants. A student hired by a professor in a RA position is expected to align his or her own research (in support of their thesis or dissertation) with the research of their hiring Professor. In a typical workweek, the student would do 20 hours of work directed by his or her major professor and then do additional research in the professor's laboratory in support of their thesis/dissertation. In this way, both the professor and the student make progress toward their common research goal in a shorter calendar period than would otherwise be possible.

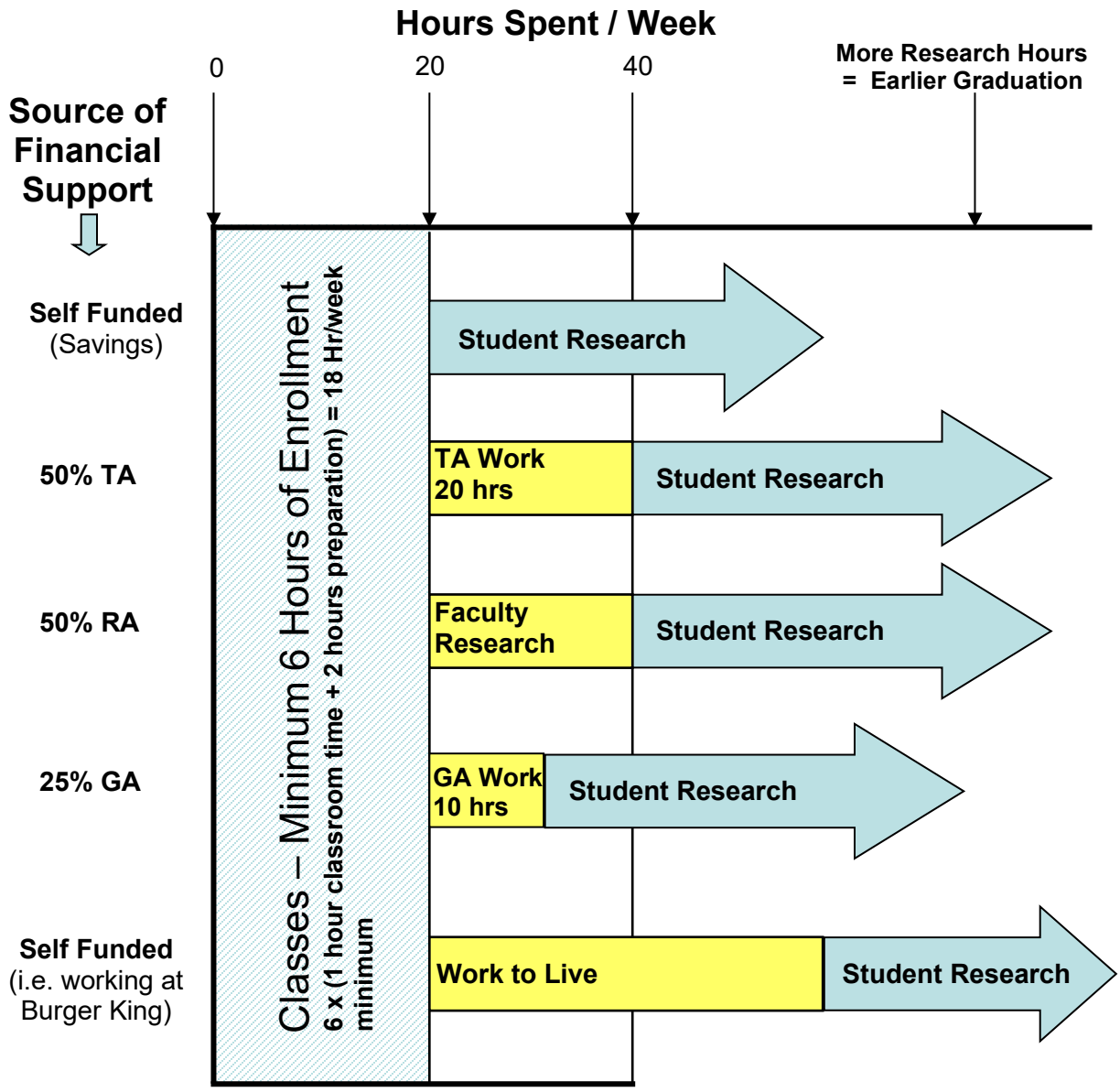
Research Assistantships generally pay about the same as a TA in that professor's department, although individual researchers may budget higher stipends in their proposals in an attempt to attract top graduate students.

The MSEN Graduate Program acts as an agent for MSEN students to match their talents and interests with RA and TA positions as they become available. TA positions most often are open for the fall semester, although some TA positions become open in the spring and summer semesters as students move into RA positions. RA positions may open at any time, both from current students graduating and from new research grants being approved for funding.

As an agent for both MSEN students and faculty, the MSEN director uses knowledge of both the open positions' requirements and MSEN students' skills to quickly arrange job interviews that seem likely to produce strong partnerships. It must be noted that these interviews are very similar to job interviews after graduation – they are only opportunities to compete, not guarantees of being given the new funded position. For a MSEN student to win an appointment, the student must convince the hiring supervisor that they can together form an effective partnership that will result in the goals of both parties being met.

FUNDING OPPORTUNITIES GRADUATE ASSISTANTSHIPS (CONTINUED)

Students can win funded TA or RA positions before arriving on campus on the basis of such things as their academic record, their GRE scores, their record of prior research, and strong recommendations from faculty. However, the chances of a new student competing successfully for new positions are much higher if the new student is already on our campus, taking UA graduate classes and volunteering in a research laboratory under a professor whose research matches their own interests. The fact that UA professors can directly observe the work ethic and academic capabilities of an on-campus student gives that student a distinct advantage over off-campus students who are represented only by paperwork.



Funding for your graduate work is a job, not a gift. The MSEN program expects its students to set the standard in providing value far in excess of the salary received.

FUNDING OPPORTUNITIES – FELLOWSHIPS

Fellowships are grants to a student to support their educational process. These types of grants typically are not tied to a particular professor, and may or may not have specific task requirements associated with them. As an example, one Fellowship may require specific work hours partnered with a teacher in a 6th grade classroom but a Distinguished Doctoral Fellowship has no specific tasks assigned outside of academic and research excellence.

Fellowship checks are issued at the start of an academic period, either monthly or by semester.

University of Arkansas Costs and Funding:
https://graduate-and-international.uark.edu/graduate/costs-and-funding/index.php

The MSEN web site contains links to many different sources of Fellowships and Assistantships. Students are encouraged to take and entrepreneurial approach to both competing for existing funded positions as well as to work with faculty to write new research proposals that contain new RA positions for their continued educational support.

FACULTY OF THE MSEN GRADUATE PROGRAM

Faculty of the MSEN graduate program are appointed to traditional departments but have chosen to self-associate with other faculty pursuing research and education in the field of materials science and engineering.

New faculty members can be added to the MSEN faculty list upon their request if they (1) agree to support a MSEN graduate student as a research professor, (2) support a MSEN graduate student as a member of an advisory or research committee, or (3) agree to actively participate in normal academic responsibilities associated with the management of a degree granting program at the University of Arkansas. Current faculty members of the MSEN Graduate Program are:

Biological and Agricultural Engineering	Jin-Woo Kim	Yanbin Li
Biomedical Engineering	Morten Jensen	Kartik Balachandran
Chemical Engineering	Keisha Walters Robert Beitle	Ranil Wickramasinghe
Chemistry and Biochemistry	Hassan Beyzavi Jingyi Chen Robert Coridan Martin Edwards Lei Guo Ingrid Fritsch Susanne Striegler Julia Kohanek, Adj. (MSEN AD)	Colin Heyes Mahmoud Moradi Julie Stenken Z. (Ryan) Tian Feng Wang Bin Dong
Civil Engineering	Paneer Selvam	Lei Guo
Computer Science	Jia Di	
Electrical Engineering	Zhong Chen Magda El-Shenawee Omar Manasreh Alan Mantooth Morgan Ware (MSEN AD)	Roy McCann Hameed Naseem Errol Porter Fisher Yu Jeff Dix
Industrial Engineering	Ed Pohl	
Mechanical Engineering	Han Hu David Huitink Xiangbo Meng Paul Millet Arun Nair	Steve Tung Uche Wejinya Wenchao Zhou Min Zou
Materials Science & Engineering	Russell DePriest, Adj. (MSEN AD)	
Nano Institute	Mourad Benamara	
Physics	Julio Gea-Banacloche Laurent Bellaiche Hugh Churchill Huaxiang Fu Jin Hu Pradeep Kumar Jiali Li Yong Wang Matt Leftwich (MSEN Director)	Salvador Barraza-Lopez Bothina Manasreh Hiro Nakamura Lin Oliver Greg Salamo Surendra Singh Ken Vickers (adj/ret) Rick Wise (adj/ret)

MATERIALS SCIENCE & ENGINEERING CURRICULUM OVERVIEW

OVERVIEW

The definition of a MSEN student's curriculum can vary dramatically within the MSEN field. Analogies of this are obvious in most traditional engineering and science departments, where students all receive a "department" degree despite significant differences in educational content of the graduate degree plan.

The Graduate Studies Committee of the Materials Science & Engineering program (GSCMSEN) believes that significant organizational and student career preparation benefits arise by requiring MS students to create a concentrated knowledge base in an application area of interest. The curriculum plan described below is designed to help the students achieve this goal.

CORE CURRICULUM CONTENT

The program is built on the proposition that MSEN students must have an academic exposure to a wide variety of subjects at both the M.S. and Ph.D. level, while building deep level knowledge in an area supportive of their career objectives. Each student is expected to build a curriculum that creates a deeper area of knowledge in a technology area, including courses in materials, fabrication, and management of technology.

The minimum number of courses needed to meet MSEN program requirements for diversity among areas of emphasis is summarized in the following list:

1. Fundamentals of Materials Science (MSEN 5313 required for all students)
2. Materials Characterization (MSEN 5322 required for all students)
3. One of the following "fab" classes: Fabrication at the Nanoscale (MSEN 5733L), Microelectronic Fabrication Techniques and Procedures (ELEG 5243L), Integrated Circuits Fabrication Laboratory (ELEG 5293L), or Additive Manufacturing (MEEG 5633).
4. Materials Engineering Design (MSEN 6323 required for all MS Materials Engineering students and all PhD students)
5. Computational Materials Science (MEEG 5343 required for all MS Materials Science students)
6. Management skills in technology-based careers (MSEN 5811/5911/6811/6911/5821 required for all students).
7. Intra/entrepreneurial skills in high technology environments (MSEN 5383 Commercialization of Research required for all students)
8. Research Communication Seminar, MSEN 5611 at the M.S. level or MSEN 6611 at the Ph.D. level. A Student will register for this seminar course during his or her third semester as a M.S. student, or during the fifth semester if a Ph.D. student. However, the seminar grading accumulates from the first semester of the M.S. or Ph.D. program enrollment.

All MSEN students must enroll in a MSEN one semester-hour course each semester as part of the program emphasis on organizational training during the first two years of their enrollment. The enrollment sequence is as follows:

1st Fall or Spring	MSEN 5811*	Op Mgmt: Infrastructure Mgmt	2nd Fall	MSEN 6811*	Op Mgmt: Mgmt and Leadership I
1st Fall or Spring	MSEN 5911*	Op Mgmt: Personnel Mgmt	2nd Spring	MSEN 6911*	Op Mgmt: Mgmt and Leadership II
1st Summer	MSEN 5821*	Ethics	2nd Spring or 3rd Fall	MSEN* 5611(MS) or 6611(PH)	Monthly RCS

**Core courses required of all MSEN students and all NSF NRT Trainee students (if not MSEN students)*

MSEN Ph.D. students must achieve in their M.S./Ph.D. total curriculum plan the same level of academic diversity and other skills required of MATS M.S. and MATE M.S. graduates. The curriculum for both M.S. degrees and the Ph.D. degree are fully described in following sections of this handbook.

A minimum cumulative GPA of 2.85 is required to remain enrolled in the Graduate School. However, if any MSEN student falls below a 3.25 GPA (MSEN curriculum coursework only, does not include UG deficiencies) during any given semester, they will be placed on probation and will be required to recover to a 3.25 GPA on the following semester in order to maintain good standing in the MSEN program. If multiple, back-to-back semesters result in less than a 3.25 GPA, the student may be removed from the MSEN program. GPA is a direct measure of work ethic. The MSEN program requires an elevated work ethic and therefore the minimum cGPA criteria for acceptance and to remain in good standing is 3.25/4.00.

FURTHER DETAIL ON RESEARCH COMMUNICATIONS SEMINAR (MSEN 5611/6611)

One of the foundations of the MSEN program is that students form a partnership with each other and with the MSEN faculty that benefits all parties. As part of this collaboration building process, the program has established a monthly (usually 8 meetings per academic year) seminar that allows students to present both the status of the research and demonstrate how the project planning built into the MSEN curriculum has helped to minimize downtime and maximize research productivity. The participation of all MSEN students in this seminar has the following benefits:

- Students are exposed to the research activities occurring around them.
- Student presenters are given an opportunity to utilize public speaking and presentation skills that will be vital in the workplace.
- MS students that complete the 5811/5911/6811/6911 seminar sequence will take MSEN 5611 during their fourth or fifth semester.
- PhD students that complete the 5811/5911/6811/6911 seminar sequence will take MSEN 6611 during their fourth or fifth semester.

The format of the monthly seminar is 3 min (one slide) "elevator pitch" presentations by one small group and 10-12 min conference style presentations by another small group.

Research Communications Seminar (MSEN 5611/6611) is a PASS/FAIL course that has the following requirement: 100% attendance of the monthly seminars will result in a course grade of "A", while anything less will be given a course grade of "F". In the event a student cannot attain a 100% attendance, the remediation opportunity available to the student is:

- For an absence for any reason, the student must attend **1** public presentation or defense for a MSEN student or other make-up as determined by the MSEN program. This absence must be made up during the same semester in which the student is enrolled in the course.

- If a student does not make-up an absence and receives a Failing grade, they will be put on probation and will have to re-take the 5611/6611 course, whichever was failed, during the following semester.

It is the hope of the program management team that these monthly presentations foster additional collaborations between research groups. In addition, public speaking in a "friendly" atmosphere can reduce the stress that a student may feel during a thesis/dissertation defense or an oral conference presentation.

FURTHER DETAIL ON RESEARCH SUMMARIES DURING SMALL PROJECT GROUP MEETINGS

At the beginning of each semester (Fall/Spring), the MSEN management team will divide the "early career" cohorts into small groups that will function as workgroups or project teams. These teams will be based on the students enrolled in each of the professional practice seminar courses. Each of the workgroups will be under the leadership of an experienced MSEN student. Typically, these leaders are M.S. or Ph.D. candidates nearing the completion of their research and degree requirements.

Early in each semester, the group leaders will join the professional practice seminar classes (last 15 minutes of the first class meeting of each month – Sept, Oct, Nov and Feb, Mar, Apr) to meet with their small teams (30 - 45 min meeting duration). Attendance at these scheduled meetings and being prepared to participate is mandatory and is part of the course requirements for MSEN 5811/5911/6811/6911 (further details are found in the syllabi for these courses). Weekly course instruction in 5811/5911/6811/6911 will be tailored to compliment the small team meetings that will begin 15 minutes prior to the end of the first class of each month. The MSEN Director(s) will be present during the small team meetings to ensure instruction and guidance our synergistic with the professional practice seminar course instruction.

The MSEN management team views the structure of these workgroups as analogous to a diverse team in industry comprised of technologists and project leaders reporting to a single technical section manager. The focus of these meetings is to provide peer review and feedback on each group member's research plan (as shown using Microsoft Project) and the execution of the research to that plan.

UNDERGRADUATE DEFICIENCIES

The MSEN graduate program is a professional development style graduate program. As such, it welcomes students into the program from any rigorous science or engineering B.S. or M.S. degree program.

Undergraduate course deficiencies in traditional graduate programs are designed to assure the public that a student achieving an advanced degree in that department has the equivalent of the core undergraduate courses needed to achieve the underlying BS degree in that department. A student entering traditional science or engineering graduate programs is therefore required to take approximately 30 hours of undergraduate deficiency courses before officially beginning their M.S./Ph.D. degree path.

The MSEN graduate program has no B.S. degree to protect, therefore allowing the undergraduate deficiencies to be defined only using the criteria "what is needed to assure a MSEN student's success in the graduate courses for which they enroll?"

The first answer to that question is based on the broad background needed for many of the graduate courses taken by MSEN students. Every student is required to take three semesters of calculus based physics (through an introduction to quantum mechanics) and mathematics through differential equations.

The second answer to that question is based on what specific knowledge is needed by a student to be successful in a graduate course of interest. MSEN students work directly with the faculty member teaching the graduate course to understand the critical knowledge in the listed undergraduate pre-requisite courses needed to be successful in the graduate course. If the critical pre-requisite knowledge is narrow in scope, then that knowledge might be gained through self-study with tutorials from MSEN colleagues from that academic tradition. If the critical pre-requisite knowledge is broad, then the student will be encouraged to take the undergraduate course as the most efficient method to ensure success in the graduate course.

The key element of this discussion is that students are key participants in understanding what is necessary to increase the probability of their success as they take the graduate course. Our goal is to ensure graduate success, not to increase the enrollment in our undergraduate classrooms.

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE

A student who completes the MSEN M.S. degree program is granted a Master of Science in Materials Science (MATS) or Master of Science in Materials Engineering (MATE).

PREREQUISITES TO DEGREE PROGRAM

Applicants to the program must satisfy the requirements of the Graduate School as described in the Graduate School Catalog and have the approval of the GSCMSEN.

Prerequisites to Degree Program: Applicants to the program must satisfy the requirements of the Graduate School as described in this catalog and have the approval of the Graduate Studies Committee of the Materials Science & Engineering program (GSCMSEN). Candidates typically have completed a Bachelor of Science degree in either engineering or science, and candidates' academic backgrounds will be evaluated by the GSCMSEN for suitability to the graduate program. If selected, students with a B.S. degree in engineering from an ABET accredited university or equivalent (by the Washington Accord) will be admitted to the Materials Engineering M.S. program; students with a B.S. degree in science will be admitted to the Materials Science M.S. program. To be admitted to graduate study in Materials Science & Engineering without deficiency, candidates are required to have completed a math course sequence through differential equations and an introduction to quantum mechanics through courses such as PHYS 3613 or CHEM 3504. Other undergraduate deficiencies may be identified during the evaluation process, and degree completion will be contingent on successful completion of these identified deficiencies.

Prospective students from foreign countries in which English is not the native language must submit nationally recognized standardized testing results on written English proficiency for consideration to the Graduate School during the admission process. Students may be given conditional admittance pending demonstration of English language skills in appropriate courses at the University of Arkansas. Students wishing to apply for graduate assistantships that require direct contact with students in a teaching or tutorial role in a department must meet the Graduate School's English Language proficiency test requirements.

REQUIREMENTS FOR THE DEGREE

Requirements for the Master of Science Degree (MATE or MATS): Students in these degree programs will work with the Director of the MSEN program to define their M.S. path to best support their career goals after graduation, with three curriculum paths available to MSEN students.

- Non-Thesis path: Students who are funded by personal resources, education grants, or by graduate assistantships not associated with research may complete a M.S. degree with additional coursework in place of independent research. While there may be specific narrow career options where this is an appropriate path, the MSEN program strongly recommends the Professional or Academic paths as providing a much better overall career preparation for working in a technical position. Students completing this path cannot be accepted for the Ph.D. MSEN program. Non-thesis students are required to pass MSEN 5393 Product Development Process as their comprehensive examination. The MSEN PhD candidacy exam is used for MSEN 5393 and it is administered concurrently with the candidacy exam.
- Professional path: Students who plan to enter the technical marketplace after M.S. completion will find this path most beneficial, as it requires independent graduate level research in collaboration with an external technical organization. The research may be in the form of a traditional M.S. six-hour research topic and thesis, or may instead be in the form of two three-hour independent research efforts resulting in written reports with the clarity, style, analysis, and conclusions expected of a journal paper submission. Both the thesis and the written reports will be orally defended before the appropriate thesis or advisory committee. Students in this path will also be required to complete at least one internship with at least six weeks duration to

experience a non-academic technical environment. Students completing this path may be considered by the GSCMSEN for admission to the Ph.D. MSEN program based on the strength of their academic course grades, their independent research depth, and quality of the written research document.

- Academic path: Students who plan to complete an academic campus-based research thesis will take this path, although the research topic may include funding and collaboration with outside technical organizations. Students who complete all requirements for M.S. graduation, including an independent research project and thesis acceptable to their thesis committee, will be eligible without GSCMSEN review for admission to the Ph.D. MSEN program.

Each student will form either a thesis committee or an advisory committee after they have chosen their M.S. path, defined any independent research areas, and been accepted into a research group if appropriate. A thesis committee will be made up of at least three faculty members, with at least one faculty member each from the Fulbright College of Arts and Sciences and the College of Engineering (the student's research professor will chair the thesis committee). The advisory committee will include at least one GSCMSEN member, the supervising faculty member for a research experience, and the MSEN program director. If the student is Professional path then either committee must also include at least one technical professional from the partner external organization as either an adjunct or an Ex Officio faculty member.

COURSE HOUR REQUIREMENTS

Each student is required to enroll in a least one hour of course work each fall and spring semester until the M.S. degree is issued. If all required course work has been completed, the student may enroll in one hour of master's thesis, or in one hour of a special problems course for credit only.

Students in this MATS or MATE degree program can choose an Academic path, a Professional path, or a Non-thesis path. Students in both M.S. degree programs and all three M.S. degree paths must also select a concentration. The concentrations are:

- Biological Materials and Devices
- Energy Materials and Devices
- Mechanical and Structural Materials
- Microelectronic-Photonics Materials and Devices
- Nanoscale Materials and Devices
- Materials Modeling
- 2D Quantum Materials and Devices

The course hours to meet the minimum hours for each path in both M.S. degrees are as follows:

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

M.S. Materials Engineering

Subject Area	Academic Path/Hours	Professional Path/Hours	Non-Thesis Path/Hours
Fabrication at the Nanoscale (MSEN 5733L), Microelectronic Fabrication Techniques and Procedures (ELEG 5243L), Integrated Circuits Fabrication Laboratory (ELEG 5293L), or Additive Manufacturing (MEEG 5633)	3	3	3
MSEN 5322 Materials Characterization	2	2	2
MSEN 5313 Fundamentals of Materials Science	3	3	3
MSEN 5383 Research Commercialization and Product Development	3	3	3
MSEN 5811 / MSEN 5911 / MSEN 6811 / MSEN 6911 Operations Management Seminar Series	4	4	4
MSEN 6323 Materials Engineering Design	3	3	3
Technical Electives from Concentration List*	9	9	9
MSEN 600V Research Thesis	6	(Option) 6	0
MSEN 5513 Applied Research in External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 5523 Applied On-Campus Collaborative Research with External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 555V Internship in External Technical Organization or GNEG 5811 Alternating Cooperative Education	Optional (hours do not apply to degree requirement)	>/= 1	Optional (hours do not apply to degree requirement)
MSEN 5821 Ethics for Scientists and Engineers	1 (Applied in Ph.D. curriculum)	1	1
Additional Technical Elective	0	0	>/=2
MSEN 5253 Emerging Technologies in Industry	Recommended in Ph.D. studies	Recommended in Ph.D. studies	3
MSEN 5393 Product Development Process	Not Available	Not Available	3
Total hours	**33**	**35-38**	**36**

*For NSF NRT 2DQMaD Trainees, these electives are determined and considered core requirements noted below

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

M.S. Materials Science

Subject Area	Academic Path/Hours	Professional Path/Hours	Non-Thesis Path/Hours
MEEG 5343 Computational Materials Science	3	3	3
Fabrication at the Nanoscale (MSEN 5733L), Microelectronic Fabrication Techniques and Procedures (ELEG 5243L), Integrated Circuits Fabrication Laboratory (ELEG 5293L), or Additive Manufacturing (MEEG 5633)	3	3	3
MSEN 5322 Materials Characterization	2	2	2
MSEN 5313 Fundamentals of Materials Science (Core)	3	3	3
MSEN 5383 Research Commercialization and Product Development	3	3	3
MSEN 5811 / MSEN 5911 / MSEN 6811 / MSEN 6911 Operations Management Seminar Series	4	4	4
Technical Electives from Concentration List*	9	9	9
MSEN 600V Research Thesis	6	(Option) 6	0
MSEN 5513 Applied Research in External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 5523 Applied On-Campus Collaborative Research with External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 555V Internship in External Technical Organization or GNEG 5811 Alternating Cooperative Education	Optional (hours do not apply to degree requirement)	>/= 1	Optional (hours do not apply to degree requirement)
MSEN 5821 Ethics for Scientists and Engineers	1 (Applied in Ph.D. curriculum)	1	1
Additional Technical Elective	0	0	>/=2
MSEN 5253 Emerging Technologies in Industry	Recommended in Ph.D. studies	Recommended in Ph.D. studies	3
MSEN 5393 Product Development Process	Not Available	Not Available	3
Total hours	**33**	**35-38**	**36**

*For NSF NRT 2DQMaD Trainees, these electives are determined and considered core requirements noted below

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

TECHNICAL ELECTIVES FOR CONCENTRATIONS

Concentration in Biological Materials and Devices

Choose nine hours of the following:		9
BENG 4123	Biosensors & Bioinstrumentation	
BENG 5103	Advanced Instrumentation in Biological Engineering	
BMEG 5213	Tissue Mechanics	
BMEG 5313	Advanced Biomaterials and Biocompatibility	
ELEG 5773	Electronic Response of Biological Tissues	
MEEG 5253	Bio-Mems	
MEEG 5343	Computational Material Science	
MSEN 6323	Materials Engineering Design	
PHYS 5613	Introduction to Biophysics and Biophysical Techniques	

Concentration in Energy Materials and Devices

Choose nine hours from the following:		9
CHEM 5283	Energy Conversion and Storage	
ELEG 5223	Design and Fabrication of Solar Cells	
MEEG 5343	Computational Material Science	
MEEG 5353	Lithium Ion Batteries and Beyond: Materials, Characterization, and Performance	
MSEN 5713	Advanced Nanomaterials Chemistry	
MSEN 5733L	Fabrication at the Nanoscale	
MSEN 6323	Materials Engineering Design	

Concentration in Mechanical and Structural Materials

Choose nine hours of the following:		9
MEEG 5033	Advanced Mechanics of Materials I	
MEEG 5163	Advanced Product Design	
MEEG 5303	Physical Metallurgy	
MEEG 5343	Computational Material Science	
MEEG 5953	Fundamentals of Fracture and Fatigue in Structures	
MEEG 5963	Advanced Fracture Mechanics and Structural Integrity	
MSEN 6323	Materials Engineering Design	
PHYS 5713	Condensed Matter Physics I	
PHYS 6713	Condensed Matter Physics II	

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

Concentration in Microelectronic-Photonic Materials and Devices

ELEG 5203	Semiconductor Devices	3
Choose six hours from the following:		6
ELEG 5213	Integrated Circuit Fabrication Technology	
ELEG 5223	Design and Fabrication of Solar Cells	
ELEG 5243L	Microelectronic Fabrication Techniques and Procedures	
ELEG 5273	Electronic Packaging	
ELEG 5293L	Integrated Circuits Fabrication Laboratory	
ELEG 5313	Power Semiconductor Devices	
ELEG 5323	Semiconductor Nanostructures I	
ELEG 5333	Semiconductor Nanostructures II	
ELEG 5353	Semiconductor Optoelectronic Devices	
ELEG 5363	Semiconductor Material and Device Characterization	
ELEG 5383	Introduction of Integrated Photonics	
ELEG 5393	Electronic Materials	
ELEG 5543	Introduction to Power Electronics	
MEEG 5263	Introduction to Micro Electro Mechanical Systems	
MEEG 5343	Computational Material Science	
MSEN 6323	Materials Engineering Design	
PHYS 5713	Condensed Matter Physics I	
PHYS 5734	Laser Physics	
PHYS 5753	Applied Nonlinear Optics	
PHYS 5773	Introduction to Optical Properties of Materials	
PHYS 6613	Quantum Optics	
PHYS 6713	Condensed Matter Physics II	

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

Concentration in Nanoscale Materials and Devices

Choose nine hours of the following:		9
CHEM 5443	Physical Chemistry of Materials	
ELEG 5303	Introduction to Nanomaterials and Devices (Introduction to Nanomaterials and Devices)	
MEEG 5263	Introduction to Microelectromechanical Systems	
MEEG 5333	Introduction to Tribology	
MEEG 5343	Computational Material Science	
MSEN 5713	Advanced Nanomaterials Chemistry	
MSEN 5733L	Fabrication at the Nanoscale	
MSEN 6323	Materials Engineering Design	
PHYS 5713	Condensed Matter Physics I	
PHYS 5723	Physics at the Nanoscale	
PHYS 5783	Physics of 2D Materials	
PHYS 6713	Condensed Matter Physics II	

Concentration in Materials Modeling

Choose nine hours of the following:		9
CVEG 5383	Finite Element Methods in Civil Engineering	
MEEG 5343	Computational Material Science	
MEEG 5733	Advanced Numerical Methods	
MSEN 6323	Materials Engineering Design	
PHYS 5093	Applications of Group Theory to Physics	
PHYS 5363	Scientific Computation and Numerical Methods	
PHYS 5713	Condensed Matter Physics I	
PHYS 6713	Condensed Matter Physics II	

Concentration in 2D Quantum Materials and Devices (2D QMaDs)

Choose nine hours of the following (**required for NSF NRT Trainees*):		9
MSEN/PHYS 588V*	Functional Materials: From Synthesis to Properties*	
MSEN/PHYS 588V*	Electrodynamics of Quantum Devices*	
ELEG 587V (5373) /MSEN 587V*	Materials & Mechanisms for Quantum Computing*	
MSEN/PHYS 588V*	Functional Materials Laboratory*	
CSCE 5063	Machine Learning	

CSCE 5073	Data Mining
PHYS 5423	Advanced Quantum Mechanics

Note that courses not listed in the concentration list, but clearly pertaining to the concentration area, may be substituted with the approval of the student's research adviser and the MSEN Program Director.

If a University of Arkansas undergraduate student is pursuing a Bachelor of Science degree in a department that has implemented an accelerated B.S./M.S. program (typically allowing six hours of graduate-level course work to be shared between the two degrees), the student may implement the same acceleration to a B.S. departmental degree/M.S. MATS or MATE degree set. Both the undergraduate department and the MSEN Program Director must approve the shared courses prior to enrollment.

DEGREE REQUIREMENTS – MASTER OF SCIENCE DEGREE (CONTINUED)

Additional core courses to develop operations management skills have also been defined for MSEN students. During year one of their graduate studies at the University of Arkansas, students are required to take MSEN 5811 Infrastructure Management and MSEN 5911 Personnel Management in the fall and spring semesters, and MSEN 5821 Ethics for Scientists and Engineers in their first summer. During year two, students are required to take MSEN 6811 Management and Leadership and MSEN 6911 Advanced Management and Leadership in the fall and spring semesters. In addition, all cohort members participate in one day of industrial-style inventiveness and team training during the week directly preceding the start of fall classes.

Students are required to attend monthly MSEN Research Communication Seminars during the first four semesters of their M.S. degree program, and will enroll in MSEN 5611 Research Communication Seminar for MS Students in their third semester.

Research thesis hours will be taken as MSEN 600V and will require a written thesis successfully defended in a comprehensive oral exam given by the thesis committee. A research thesis is required for Academic path students, and is optional for Professional path students. Professional path thesis research must include direct collaboration with an external technical organization.

A student on the Professional path may substitute two Applied Research efforts for a thesis under MSEN 5513 (External location) or MSEN 5523 (Internal on-campus location), provided each semester's research is of graduate quality level and is reported at the end of the semester through a written paper and in an oral presentation to the advisory committee (note that the written paper must match the clarity, style, analysis, and conclusions expected of a journal paper submission). Regardless of where the research is performed, it must include direct collaboration with an external technical organization.

Independent project hours may be either MSEN 588V Special Problems in Materials Science and Engineering or a departmental Special Problems course number and a syllabus for the course must be provided to the Materials Science & Engineering program by the professor administering the course.

NOTE 1: SPECIAL CONDITIONS FOR NON-THESIS OPTION

The MSEN faculty feels that the best preparation for a career in this field is through a research-based degree, with a written thesis and defense. All traditional M.S. MSEN students are initially enrolled as a research thesis or professional path student, but it is recognized that at times a non-thesis option may better support a student's career plans. Before a student will be considered for admission to the non-thesis M.S. MSEN degree program, the following steps and conditions must be met:

- The student must submit a document to the MSEN Director explaining in detail why the non-thesis option is better preparation for his/her career than a research-based degree.

- The student must meet with the MSEN Director to discuss the cost/benefit balance of both M.S. options.
- If the student has received any Research Assistant funding, that professor must send the MSEN Director written notice that (a) the student has been released from any thesis obligation under that funding and that (b) the student is approved to convert to a non-thesis option.

An independent project course is equivalent to a three hour graduate course, which has 45 contact hours and an assumption of at least 90 hours of out of class preparation. The project's acceptable level of effort should be judged by this 135 hour baseline time commitment.

MASTER'S CALENDAR

ADVISORY COMMITTEE

The Graduate Advisory Committee consists of at least the MSEN Director and the faculty member under whom the student is working on a trial basis in a research group. The faculty member will be identified by the MSEN Director as Chair of the Committee through email communication to the Graduate School.

THESIS COMMITTEE

The thesis committee consists of the thesis advisor (as chair) and at least two other members of the faculty. The committee must contain at least one faculty member each from the College of Engineering and the Fulbright College of Arts and Sciences. The director of MSEN will also be on all committees as Ex Officio. The thesis committee assumes co-responsibility with the MSEN Director for student guidance and graduation compliance. The proposed thesis committee form must be submitted to the Graduate School before registering for the semester following the student's acceptance into a research group. The form can be found in the forms section of this handbook or at https://graduate-and-international.uark.edu/graduate/current-students/forms.php.

THESIS AND PRESENTATIONS

Only a full and complete copy of the thesis may be submitted to the Committee Chair for final draft approval. This approved draft will then be submitted to the MSEN Director for review, and will be released by the Director upon verification that all required elements of the thesis exist. Upon release authorization, this final draft of the thesis will be submitted to the thesis committee for approval. The committee must receive the thesis no later than the date of the public presentation of the student's work. The thesis defense cannot be scheduled earlier than one week after the public presentation, and the defense must be scheduled at least five business days before the deadline for submission of the final thesis to the graduate school (typically on Dead Day) to allow time for any corrections or additions identified during the defense. The student must provide hardcopies of the PowerPoint presentation slides to the MSEN Director at the public presentation and to the Director and all committee members at the thesis defense.

ANNOUNCEMENT OF THE MASTER DEFENSE

Announcement of the master candidate's defense and a copy of the abstract must be submitted by email to the MSEN office at least one week prior to the date of the public presentation. This email must also contain the scheduled time and place of both the public presentation and the thesis defense. Only the student and committee members may attend the defense, unless the student specifically invites other visitors to the defense by email notification to the MSEN Director.

FINAL THESIS COPIES

All completed forms and documentation must be submitted per current Graduate School requirements after the thesis defense and final approval by the thesis committee and director. Submission must occur to the Graduate School by their specified deadline (typically on dead day). An unbound signed hard copy on 20 lb cotton paper must be delivered to the MSEN program office, along with copies of all Graduate School forms, electronic copies (.pdf, .ppt and .doc(x)) of the thesis document, the public PowerPoint presentation, and the thesis defense PowerPoint presentation, in order to meet the MSEN Graduate Program requirements for graduation. Other unbound copies can be delivered for binding to the MSEN office for committee chair, committee members, parents, personal copy, etc. The MSEN program will pay for the binding of the program copy, the committee chair copy, and one personal copy for the student.

MASTER'S EXAMINATION

The final master's comprehensive oral examination will be conducted as part of the thesis defense meeting.

MASTER'S CALENDAR (CONTINUED)

APPLICATION FOR THE DEGREE

A student cannot be cleared for graduation until all MSEN, Graduate School, and University of Arkansas documentation requirements have been met. Please refer to the Graduate School web site for current requirements for graduation.

DEGREE REQUIREMENTS – DOCTOR OF PHILOSOPHY DEGREE

PREREQUISITES TO DEGREE PROGRAM

Applicants to the Ph.D. program are expected to have a Master of Science degree in either engineering or science, and each candidate's academic background is evaluated by the GSCMSEN. Doctoral candidates in Materials Science & Engineering are expected to achieve proficiency in the requirements for the Master of Science in Materials Engineering or Master of Science in Materials Science degree at the University of Arkansas before their Ph.D. degree completion.

Students who have graduated with a M.S. in Materials Engineering or Materials Science from the University of Arkansas are expected to take the Materials Science & Engineering candidacy exam in the spring semester after M.S. graduation. Students requesting admittance to the Ph.D. program with an M.S. degree in another discipline must take their research candidacy exam within four semesters after enrollment. This exam is a proposal/presentation of the student's planned research to their committees and the MSEN Director.

Students who fail to pass the research candidacy exam may re-take the exam one time, per committee availability during the following semester. Any student who fails the research candidacy exam a second time will not be allowed to continue in the MSEN graduate program and will be confirmed by recommendation of their committee and the MSEN Director to be removed from the program.

If the student's PhD adviser / dissertation committee chair believes the student has not established sufficient experience through their past MS research (and/or PhD research completed), the student may be allowed a one-year, one time extension provided that a course of action is identified to address the deficiency and it is approved by the student's dissertation committee and the MSEN Program Director.

COURSE HOUR REQUIREMENTS

A Ph.D. curriculum will be defined to meet each student's research interests as well as ensure the Materials Science and Engineering program's core courses have been taken. The course plan for each student must include a minimum of 27 hours of graduate coursework beyond the Master of Science degree requirements. Specific courses will be chosen by the student and must be approved by the student's major professor and the MSEN Program Director. The coursework list for the Ph.D. degree will be dependent upon the M.S. degree with which the student enters the program:

Subject Area	M.S. in Materials Engineering or Materials Science from UA / Hours	M.S. in Materials Engineering or Materials Science from another institution / Hours	Other Science or Engineering M.S. degrees / Hours
MSEN 6313 Advanced Materials Science & Engineering	3	3	3
BENG 5703 Design and Analysis of Experiments for Engineering Research OR INEG 5333 Design of Industrial Experiments OR other Design of Experiments course	3	3	3
MSEN 5821 Ethics for Scientists and Engineers	1 (Applied from MS curriculum)	1	1

Subject Area	M.S. in Materials Engineering or Materials Science from UA / Hours	M.S. in Materials Engineering or Materials Science from another institution / Hours	Other Science or Engineering M.S. degrees / Hours
MSEN 6323 Materials Engineering Design	If not taken in MS curriculum	3	3
MSEN 5811 / MSEN 5911 / MSEN 6811 / MSEN 6911 Operations Management Seminar Series (Core)	Taken in MS curriculum	4	4
MSEN 5383 Research Commercialization and Product Development	Taken in MS curriculum	3	3
5000- and 6000-level elective courses in science and engineering	17-20	10	5
MEEG 591V Special Topics (Introduction to Manufacturing)	Taken in MS curriculum	Rec. elective	Rec. elective
MSEN 5322 Materials Characterization	Taken in MS curriculum	Rec. elective	2
MSEN 5313 Fundamentals of Materials Science	Taken in MS curriculum	Rec. elective	3
MSEN 5253 Emerging Technologies in Industry	Recommended elective	Rec. elective	Rec. elective
MSEN 700V Dissertation	21	21	21
Total	48	48	48

Note:
1. The Ph.D. curriculum will contain no more than nine hours of special topics coursework.
2. The Ph.D. curriculum will contain no more than six hours of independent study coursework.

Students are required to attend monthly MSEN Research Communication Seminars during the first five semesters of their Ph.D. degree program and will enroll in MSEN 6611 Research Communication Seminar of PhD Students in their fifth semester.

In addition to these conditions, at least twenty-one hours of research dissertation will be taken as MSEN 700V as appropriate to match the section of each student's major research professor.

Ph.D. students must complete at least one three-hour course in Design of Experiments as part of their graduate curriculum. If a DOE course has not been completed as part of the M.S. curriculum, it is highly recommended that this course be taken the first semester of the Ph.D. program.

DOCTORAL CALENDAR

DECLARATION OF INTENT

Prospective doctoral candidates must enroll in the Ph.D. MSEN graduate program after completion of an appropriate M.S. degree. This will establish residency as a prospective doctoral candidate.

ADVISORY COMMITTEE

The Graduate Advisory Committee consists of at least the MSEN Director and the faculty member under whom the student is working on a trial basis in a research group. The faculty member will be identified by the MSEN Director as Chair of the Committee through email communication to the Graduate School.

DISSERTATION COMMITTEE

The dissertation committee consists of the dissertation major professor (as chair) and at least three other members of the faculty. The committee must contain at least one faculty member each from the College of Engineering and the Fulbright College of Arts and Sciences. The director of MSEN will be on all committees as Ex Officio. The dissertation committee assumes co-responsibility with the MSEN Director for student guidance and graduation compliance. The proposed dissertation committee form must be submitted to the Graduate School before registering for the semester following the student's acceptance into a research group. The form can be found in the forms section of this handbook or at https://graduate-and-international.uark.edu/graduate/current-students/forms.php.

CANDIDACY EXAMINATION

The full details of the candidacy process are included elsewhere in this handbook. It is expected that the research candidacy examination be completed at least one year before completing all other requirements for the degree. The Graduate School Associate Dean will be notified by the MSEN Director when the student has passed the exam.

DISSERTATION TITLE

The title of the dissertation must be submitted to the Graduate School before the research proposal portion of the candidacy process is completed.

DISSERTATION FORMAT

The MSEN program considers a dissertation to be both a teaching and archival document that demonstrates to the reader the candidate's ability to clearly describe the Ph.D. level work in his or her own words. If a student wishes to use the bound published papers format for their dissertation, it must contain a minimum of three peer-reviewed archival journal articles which have been published or accepted for publication and the student must be the first author on all articles used. The dissertation must contain additional text to connect the articles in the context of the overall research effort in accordance with Graduate School guidelines and must include program required front matter and appendices. If submission of a third paper is held up due to IP filing, the third paper prepared for submission for a peer-reviewed archival journal may be included in the dissertation to meet the three paper requirement if a patent disclosure covering the IP has been approved for provisional filing by the University of Arkansas patent committee. The patent disclosure and documentation of approval for provisional filing must be contained within an appendix to the dissertation.

DISSERTATION AND PRESENTATIONS

Only a full and complete copy of the dissertation may be submitted to the Committee Chair for final draft approval. This approved draft will then be submitted to the MSEN Director for review and will be released by the Director upon verification that all required elements of the dissertation exist. Upon release authorization, this final draft of the dissertation will be submitted to the dissertation committee for approval. The committee must receive the dissertation no later than the date of the public presentation of the student's work. The dissertation defense can be scheduled no earlier than one week

after the public presentation, and the defense must be scheduled at least five business days before the deadline for submission of the dissertation to the graduate school (typically on Dead Day) to allow time for any corrections or additions identified during the defense. The student must provide hardcopies of the PowerPoint presentation slides to the MSEN Director at the public presentation and to the Director and all committee members at the dissertation defense.

ANNOUNCEMENT OF THE DISSERTATION DEFENSE

Announcement of the doctoral candidate's defense and a copy of the abstract must be submitted by email to the MSEN office at least one week prior to the date of the public presentation. This email must also contain the scheduled time and place of both the public presentation and the dissertation defense.

FINAL DISSERTATION COPIES

All completed forms and documentation must be submitted per current Graduate School requirements after the dissertation defense and final approval by the dissertation committee and MSEN Director. Submission must occur to the Graduate School by their specified deadline (typically on dead day). An unbound signed hard copy on 20 lb cotton paper must be delivered to the MSEN program office, along with copies of all Graduate School forms, electronic copies (.pdf, .ppt and .doc(x)) of the dissertation document, the public PowerPoint presentation, and the dissertation defense PowerPoint presentation, in order to meet the MSEN Graduate Program requirements for graduation. Other unbound copies can be delivered for binding to the MSEN office for committee chair, committee members, parents, personal copy, etc. The MSEN program will pay for the binding of the program copy, the committee chair copy and one personal copy for the student.

APPLICATION FOR THE DEGREE

A student cannot be cleared for graduation until all MSEN, Graduate School, and University of Arkansas documentation requirements have been met. Please refer to the Graduate School web site for current requirements and deadlines for graduation.

PH.D. CANDIDACY EXAM

INTRODUCTION

The MSEN faculty has defined the candidacy process for students seeking a Ph.D. MSEN degree.

NATURE OF THE CANDIDACY EXAM

The MSEN Ph.D. candidacy process was defined based on the other STEM graduate programs on campus and the following guiding principles:

1. The historical methods used by the underlying traditional departments at the University of Arkansas for Ph.D. candidacy/qualifier testing have produced skilled Ph.D. graduates for many years and should be closely examined to utilize recognized strengths.
2. The resulting MSEN Ph.D. candidacy process does result in an accurate assessment of a MSEN Ph.D. candidate's likelihood of successful completion of the Ph.D. degree program as early as possible after completing the M.S. degree and entering the Ph.D. program.

PH.D. CANDIDACY EXAM OVERVIEW

A student must be in good academic standing with the Graduate School of the University of Arkansas before beginning the MSEN Ph.D. candidacy process.

The Ph.D. candidacy exam consists of one component. It is a written research proposal with oral defense describing the student's research thrust. A student must pass both components in order to be admitted as a MSEN Ph.D. candidate by their committee and the MSEN Director.

A student with an M.S. MSEN degree (MATE or MATS) is expected to complete the exam in the spring and summer semesters following his/her completion of graduation requirements for the M.S. MSEN (MATE or MATS) degree. A student entering MSEN with a M.S. degree from another degree field is expected to complete the exam in the spring and summer semesters of his/her second calendar year of the program. A student should have completed MSEN 5383 and MSEN 6323 prior to taking the exam.

Any student who does not pass the research candidacy examination may take the exam a second time, but it may not be taken a third time without full approval of the GSCMSEN and then the MSEN faculty (a third exam opportunity would be an extremely unusual event). Failure to pass this candidacy exam will result in the student leaving the MSEN Ph.D. program.

A student that does not have a completely defined written research proposal will be told the proposal's deficiencies. The student will then be given an opportunity to resubmit an amended proposal. This candidacy component is designed to assure that the research project is fully optimized early in the research project. Even so, a student that refuses to create a timely and complete research proposal or one who is not making satisfactory progress toward the work described may be removed from the program on that basis.

PH.D. CANDIDACY EXAM (CONTINUED)

CANDIDACY RESEARCH PROPOSAL - WRITTEN AND ORAL PRESENTATION

The candidacy exam is composed of a written research proposal submitted by the candidate to their committee and the MSEN graduate program for review, followed by an oral presentation of the proposal by the candidate (with a minimum of one week between submission of written proposal and oral).

The student's PhD Dissertation Committee must accept the proposal by no later than 30 months after entry into the PhD program or the student will be removed from the PhD program.

The purpose of this exam is for the Ph.D. candidate to describe the proposed research, including the background and outline of investigation, to his or her committee. The student has the responsibility to create the document but is expected to do so in strong consultation with his or her Major Professor.

The proposal can be no more than 15 pages including diagrams and illustrations. The font is 12 point Times New Roman, single spaced, with one inch margins on the page top, bottom, and sides. The pages are numbered at the bottom using the form "Page n of N pages".

The proposal format is flexible and may be organized in a way that will best support its content migrating to the Ph.D. dissertation. It is suggested that the following information be addressed and included in the document when appropriate.

1. Executive Summary (1 page maximum, included in 15 page limit)
2. Project description
    a. Introduction of proposed investigation
    b. Current state of the art in proposed research area
    c. Research objectives (With illustrative examples of preliminary/exploratory work if appropriate)
    d. Feasibility of research, including high risk elements (with backup plan)
    e. Experimental/investigative method to be used (see Appendix b. notes below)
    f. Equipment list needed for research
3. References (not included in 15 page limit)
4. Required appendix (not included in 15 page limit)
    a. Microsoft Project printout with major research and administrative events to graduation.
5. Appendices if needed (not included in 15 page limit)
    a. Additional local research group activities in research area
    b. Theoretical calculations as needed
    c. Detailed experimental/simulation matrix
    d. Other (with Permission)

PH.D. CANDIDACY EXAM (CONTINUED)

The proposal will be delivered to the MSEN office via one hardcopy document signed on all pages by the student. The document will be submitted electronically as one Microsoft Word document and to all committee members and the MSEN office one week prior to the committee presentation.

The oral defense of the research proposal is attended by all committee members and open to the public for observation and discussion unless otherwise requested by the major professor three weeks in advance (closed sessions are allowed only if needed to protect intellectual property under development). Questions to the student will be strongly based on items in the written proposal but are not limited to the contents of the proposal. The student is responsible for scheduling the exam and should reserve the appointment (committee member calendar and conference room calendar) for 1.5-2 hours.

It is strongly recommended that the student review the proposal with the MSEN Director prior to distribution to the committee. A practice presentation is also encouraged.

The oral presentation should include a slide listing the key research goals/tasks categorized as follows:

Minimal:
- These are the minimum research goals which should be met for the committee to accept for approval of the Ph.D. degree in the event something catastrophic occurred which terminated the research.

Expected:
- These are the expected research goals (beyond those listed in minimal) which should be met for the committee to accept for approval of the Ph.D. degree.

Stretch:
- These are research goals which the student will strive to achieve beyond those expected to be met for the committee to accept for approval for the Ph.D. degree.

The student should be in agreement with their major professor(s) on these research goals and their categorization (minimal, expected, stretch) before the proposal defense.

Within three days of the oral defense, the student will be notified if his/her research proposal is acceptable to the MSEN program. The student will be given a summary of faculty comments and suggestions concerning their proposal.

<u>Notes on Detailed experimental/simulation matrix appendix:</u>

When considering the overall research approach to a Ph.D. early in the process, it is obvious that the final experimental details cannot be predicted. At the same time, if only a qualitative description of the experimental space is included without a first pass understanding of the types of experiments that will be run with the levels of variation – then the scope of work may be entirely too large for a single Ph.D. project. Microsoft Project is useful when creating a first pass detailed conceptual experimental plan, as it allows adjusts downstream dates automatically to early task timing changes.

One approach to creating this conceptual detailed experimental plan is:

- Take it one step at a time. Every time the step you are working on spawns the need for a screening experiment, stop and fully describe the screening experiment.

- Some experiments will have multiple sub-steps for each data point (for example: create sample, map film thickness and composition across substrate, prepare device masks, process substrate to create devices, characterize all devices with substrate location included, analyze data, etc). In this case, create a detailed description of experiment (a) in Microsoft Project, and then just have a single task of appropriate length for experiments (b) through (n).

- As you define each experiment, sketch out the graphs, charts, and figures that you expect to have to generate to fully investigate your premise and defend your conclusions. Think about causes of variation that might require extra metrology steps, and do not forget to think of variability of your independent variables as well as your dependent variables. Think about if a single device will do, or will you have to have multiple devices/data for each particular data point on your graph. Make sure you put on the graphs what you think will be the minimum and maximum values you will be measuring, and what amount of accuracy may be required for each measurement - which will lead you to consider if you have an appropriate metrology tool for your experiment.

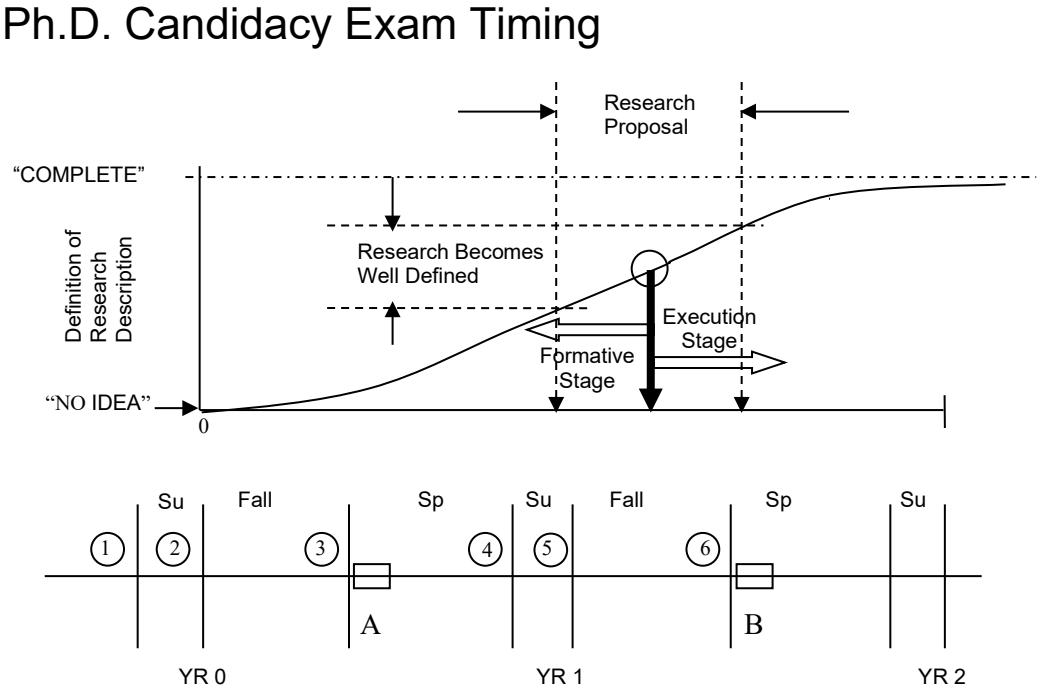
- After you have all your relationships defined that you wish to investigate, consider if you are doing a screening experiment with low resolution to confirm an earlier reported result - or if you need a higher resolution experiment to determine the true value of a local maxima or minima.
  Which brings to mind, if you are depending on a prior reported result for your starting point, have you considered if you trust that they have found the optimum operating point - or just possibly a local minimum/maximum.

- You will find your number of experiments growing at a near exponential rate at some time in this process - which is very discouraging. Ignore the feeling and continue defining your experimental sequence. Remember that it is much easier to go back and change a full factorial experimental set to a DOE (thereby reducing the number of needed experiments to get a complete picture of your experimental space, but at the cost of less resolution in your mapping of the space) than it is to go back and desperately try to fill in a critical hole in your experimental work the week before your defense.

- Going back to the first point. Put all this into Microsoft Project as linked tasks and let it keep up with the projected time to completion for you. This is why we have asked you to learn the software, and this is where it will do you a lot of good in deciding if your scope of project is too large for a single Ph.D. project.

EXAM TIMELINE

The figure below illustrates the timing of both components of the candidacy exam in terms of both the calendar time since entry, and in terms of number of semesters.



MSEN M.S. = Exam 1ST Spring Semester after Degree
Degree Issued at ①,② OR③ ⟹ Written Candidacy Exam Spring Semester [A]

OTHER M.S. = Exam 1ST OR 2ND Spring Semester after Degree
Degree Issued at ①,② OR③ ⟹ Written Candidacy Exam Spring Semester [A] or [B]

M.S. THESIS AND PH.D. DISSERTATION COMPONENTS

The length of the M.S. MATE or MATS thesis and Ph.D. MSEN dissertation is not defined by the program due to the large variation in research topics investigated by each student. However, as a minimum, each thesis or dissertation must contain the following sections:

1) All components as defined in the graduate school thesis and dissertation preparation guide (including fonts, margins, table of contents, etc.). Current guidelines are found at https://graduate-and-international.uark.edu/_resources/forms/thesisdissertationguide-12-2020.pdf.
2) An acknowledgements page, which will include at least recognition of the agencies providing financial sponsorship to the student.
3) An abstract of your work is now required for all theses and dissertations.
4) There are two signature pages. See the MSEN template, which is an approved variation of the Graduate School Thesis and Dissertation guides. The Director of the MSEN Graduate Program is an ex-officio member of all committees and should be included on the signature page.
5) An organization structure must be defined to include a list of figures and tables and:
    a) Prior state of the art in the research area
    b) Overview of completed investigation
    c) Experimental/investigative method used
    d) Research outcomes (data and analytical methods)
    e) Discussion of research outcomes (what it all means)
    f) Future work suggested by current research conclusions
6) Appendices must be included that contain:
    a) Description of research for popular publication (five page maximum length, single spaced, written in a similar fashion to a "Science News" article)
    b) Executive summary of newly created intellectual property. This a numbered concise listing of the major new IP that you created during your research.
    c) Potential patent and commercialization aspects of each numbered item in appendix B.
        i) Patent prospects IP (***can*** each be patented)
        ii) Commercialization possibilities of IP (***should*** each be patented)
        iii) Possible prior disclosure of IP (list of possible prior patents or scientific publications that address each IP item)
    d) Broader impact
        i) Applicability of research methods to other problems
        ii) Impact of research results on US and global society
        iii) Impact of research results on the environment
    e) Microsoft Project printout of research project plan
    f) Identification of all software used in research and thesis/dissertation for each computer used (laboratory, home, laptop, etc)

        Computer #1:
        Model Number and Serial Number:
        Location:
        Owner:

        Software #1: Name: Purchased by: License #:
        Software #2: Name: Purchased by:
        Et cetera

        Computer #2: Continue until all computers and software are listed.
    g) All publications published, submitted and planned
7) Appendices may be included that contain:
    a) Equipment used in research (list of type, manufacturer, model number)
    b) Detailed analytical techniques
    c) Et cetera

M.S. THESIS AND PH.D. DISSERTATION COMPONENTS (CONTINUED)

You are required to submit your thesis or dissertation to the plagiarism check web site designated by the MSEN Graduate Program (www.turnitin.com). You are encouraged to submit your working document to the draft assignments throughout your writing process, but you are required to submit the final copy you are about to submit to the Graduate School to the Final Submission assignment in the web site. Appropriate logon information to www.turnitin.com will be supplied by the MSEN program.

DO'S AND DON'TS OF M.S. THESIS AND PH.D. DISSERTATION WRITING

1) Read the entire Thesis/Dissertation Writing Guide on the Graduate School website https://graduate-and-international.uark.edu/_resources/forms/thesisdissertationguide-12-2020.pdf. Check every item against your template before you start adding significant content, including the template you can download from the MSEN web site (there may be a recent change from the Graduate School that has not yet migrated to the MSEN template). Do NOT use old MSEN thesis/dissertations as a model.

2) Read the prior page in this handbook again. No thesis or dissertation will be approved without all required appendices done with the same professionalism as the rest of the document.

3) Electronic Files
   a) Keep your work in a single electronic file from the start - it will save you heartache at the end.
   b) Always start an editing session by doing a "Save as" command as a new revision number.
   c) Always end an editing session by saving your new revision ***in at least three different physical locations***.

4) Plagiarism check
   a) Always write from a blank page. You cannot cut, paste, and alter any text block enough to make it different from the original author's work. Read, learn, and then teach the information to your reader in your own words.
   b) Do routine plagiarism checks of your work in progress (maybe after each chapter is substantially completed). If you have any questions about whether or not something is really plagiarism, immediately discuss it with the Program Director.
   c) A final plagiarism check is required of your completed document before submission to the Graduate School.
   d) Do not use any directly copied text from your own prior publications without prior approval from the MSEN Program Director (the thesis/dissertation requires a much different writing style, and it is impossible to separate who wrote what part of a publication if it has multiple authors).
   e) Any plagiarism found in the final submission ***will result in dismissal from the program***.

5) Naming Convention – Use the correct word for your document
   a) M.S. work is contained in a "Thesis"
   b) Ph.D. work is contained in a "Dissertation"

6) Acknowledgements of funding and support
   a) If the NSF has funded your work, use the following language at the end of your acknowledgements "This program is financially supported by the National Science Foundation under Grant No. xxx-nnnnnnn. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation."
   b) If you work included work done in HiDEC, use the following language "Research possible through the use of the High Density Electronics Center at the University of Arkansas, Fayetteville campus". Use similar language if you did a major element of your work in a lab other than that of your major professor.
   c) Consider whether you should specifically recognize a staff person who has given you significant help in executing some design or fabrication element of your work.

DO'S AND DON'TS OF M.S. THESIS AND PH.D. DISSERTATION WRITING (CONTINUED)

7) References
   a) Must be in one combined list at the end of the document rather than at the end of each chapter.
   b) Must appear in numerical order as they appear from front to back of your thesis or dissertation.
   c) References used in an appendix are listed at the end of that appendix.
   d) If you use a web URL as a reference (not a recommended practice) then the hyperlink must be removed and the date you accessed the information must be included.
   e) Do NOT use any Wikipedia reference.

8) Graphs (note that all comments in Section 13 – Figures may also apply to graphs)
   a) Use clear backgrounds, not the default white in Microsoft Excel.
   b) Use both lines and symbol styles, not just color changes, to display different data sets.
   c) Use the same format on titles, figure captions, graph axis, etc. throughout paper.
   d) Expand axis of dependent variable by using portrait layout instead of the default landscape format in Word (increase physical size of Y axis to increase ability to separate data points).
   e) Most experimental data should use XY scatter style graphs, not the default Excel style with data displayed in even increments along the X axis.
   f) When creating a graph in Excel, always create the graph on a separate page (the last option step in the graph wizard). Make the graph look good on that page, then copy it to the clipboard. Use the Paste Special option to put it into your document as a picture. Format the picture under advanced layout to force text lines to be only above and below it, which will then allow you to size the graph as needed and the text will scale with the graph.
   g) Do not wrap text around a figure. This works well in some journal formats, but in a thesis or dissertation it makes the figure difficult to see and often results in text that is difficult to read.
   h) Grow all graphs proportionally to full page width unless it reduces clarity of your graph.

9) Formatting Issues
   a) Use third throughout the document. An exception for first person is in the Acknowledgements and Dedication.
   b) Experiments were in the past – **always** use past tense verbs when describing your work.
   c) No footnotes are allowed.
   d) All page numbers must be right aligned in the table of contents, list of figures, list of tables, etc.
   e) Page numbers should be located at the center bottom of the page. The page number must touch a line drawn 0.75 inches from the bottom of the page to be acceptably placed.
   f) No italics, bold, or whatever can be used in the body text to make a point. Use of these techniques may be good in a proposal, but are bad in a thesis or dissertation.
   g) Buy your good 20lb, 100% cotton paper early in the semester, as they do run out sometimes at the end.
   h) Print the watermark upright & readable from the front of your printed page.
   i) Use no qualitative terms, only quantitative comparisons.
      i) Correct: Within 10%, 10 times greater, less than 10 years, both were square but of different color, etc
      ii) Wrong: Words such as almost, significantly, close, similar, etc
   j) Titles of your thesis/dissertation must be in "Title Case".
   k) When referring to figures, chapters, tables, sections, etc. in the text body, the item is considered a proper noun that should be capitalized and spelled in full (Figures x.x, Equation x.x, Chapter Two, etc.)
   l) Titles of chapters, sections, etc. may be no more than one point larger than the body text.
   m) Font style must remain the same for ALL elements of your thesis/dissertation.

DO'S AND DON'TS OF M.S. THESIS AND PH.D. DISSERTATION WRITING (CONTINUED)

10) Equations
    a) Should be outside the text body on a separate line.
    b) Should be labeled with (Equation X) right justified against right margin on the same line.
    c) Variables in the equation must have the exact font style and size when used in the body text as was shown in the numbered equation. This includes such things as italics.

11) Numbers
    a) Only display the correct number of significant digits.

12) Statistics and variation
    a) Always indicate variation in data by error bars on and data point graphed that contains consolidated data.
    b) Consider if all data should be included on graph if each data point would only consolidate a few number of points – making the concept of average and standard deviation meaningless.

13) Figures
    a) Must be directly after mention in text (within a couple of lines) if at all possible – **without generating white space.**
    b) Figures must be mentioned in text.
    c) Figures placed in landscape mode always have their tops to the left (toward the binding).
    d) Captions should be single spaced in a text box that is grouped with the image will not cause a problem when the figure is shifted. Use of the "insert caption" option is preferred to support automatic generation of Lists of Figures.
        i) Correct: captions need to be grouped with the picture
        ii) Wrong: text going to the next page
    e) If you have scanned a figure from a reference to include in your document, the scan quality must be high enough resolution to match your document. Use the "Paste Special" to paste it as different kinds of objects/pictures to see which looks best.
    f) A figure must be fully contained on one page.
    g) Captions should only label the figure. Descriptive text must be in the body text.
    h) Your figure should reduce the amount of text needed. Do not describe in detail what the figure looks like – describe what knowledge it demonstrates.

14) Tables
    a) Must be directly after mention in text (within a couple of lines) if at all possible – **without generating white space.**
    b) Tables must be mentioned in text.
    c) Tables may be rotated 90 degrees if needed, but top of table is to the left (toward the binding).
    d) Text in cells is usually left justified unless it is text labeling a column of numbers. Then the numbers and the label should be right-justified. If the numbers contain a decimal point, always use the same number of decimal points on each number and be sure you properly represent the accuracy and repeatability of your measurements).

DO'S AND DON'TS OF M.S. THESIS AND PH.D. DISSERTATION WRITING (CONTINUED)

15) Presentations

a) Must be reviewed and approved by your major professor before making your public presentation a week before your thesis or dissertation defense.
b) There should be a footer on each page outside of your content area that contains "Name, Date, and Slide n/Total Number".
c) Always test your color scheme using a projector for readability from the back of the room. For instance, red letters on dark blue background look OK on the computer screen but cannot be read when projected on a screen during your defense.
d) Label all figures used in your presentation with the figure number used in the thesis or dissertation.
e) Presentations for thesis / dissertation public presentations and for candidacy exams cannot be electronically recorded unless using MSEN recording equipment with pre-approval of the MSEN Director.

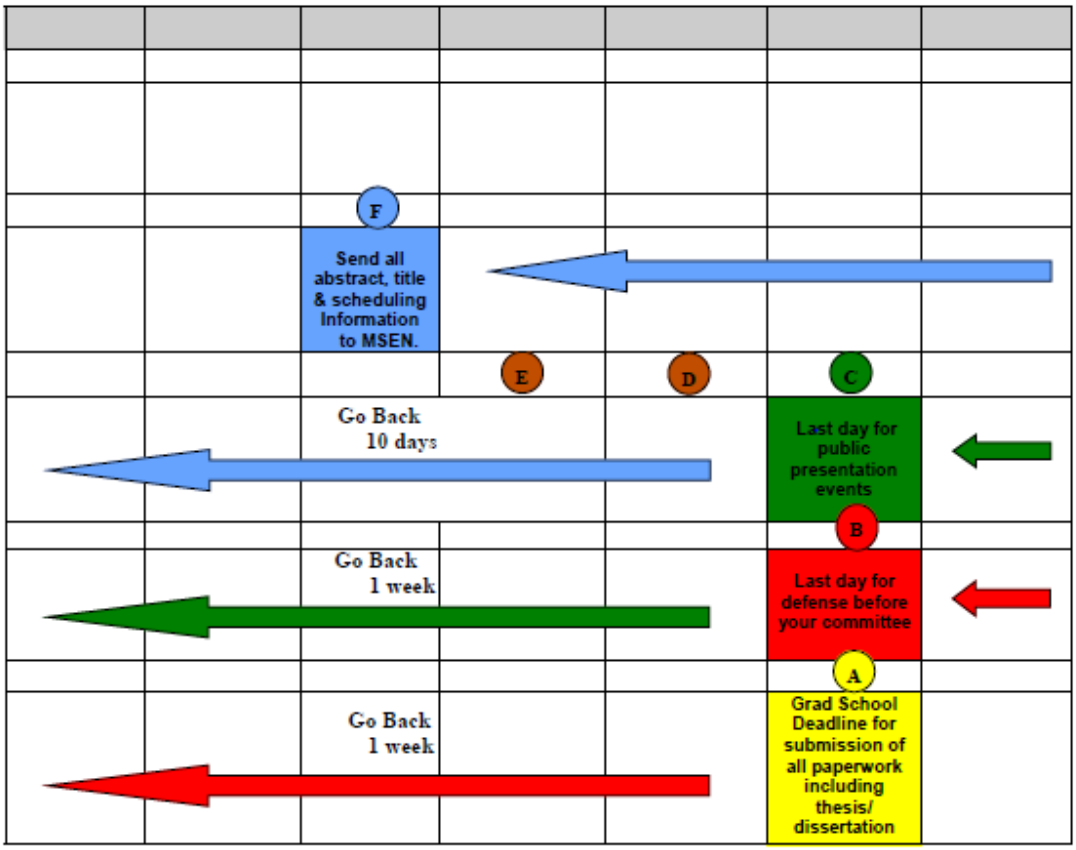
16) Signature Page

a) The one exception to following the Graduate School guide is in the signature page. The MSEN program has an approved exception to the standard page to include signoff of plagiarism check and software usage. Please see the MSEN web site for the proper format of your plagiarism signature page.
b) The Director of the MSEN Graduate Program is an ex-officio member of the thesis and/or dissertation committee of each MSEN student. His or her name should be included on the signature page as a committee member.
c) Bring all needed copies of the signoff page, plus extra cotton and paper pages, to your defense.

SEQUENCING AND TIMING OF FINAL DEFENSE COMPONENTS

Please enter your dates and remember if any event is missed then you will not graduate that semester.

Calendar



A Deadline for completion and submission of all graduation paperwork, including delivery of final thesis/dissertation printouts to the Graduate School.

B Latest date for Defense before your committee.

C Latest date for Public Presentation.

C The final draft of your thesis/dissertation must be delivered to all your committee members prior to your Public Presentation. (Requires signed approval page by major professor and MSEN director before distribution to committee members)

D Last date for Director of MSEN Graduate Program to authorize final draft for delivery to committee.

E Last date for Major Professor to approve the final draft for submission to MSEN . This must be a complete document, exactly as specified in the Graduate School preparation guide and containing ALL MSEN specific appendices.

F Student sends via email the reserved time and location of both the Public Presentation and the Defense to MSEN office. The email also contains the Title and the Abstract. Public Presentations should have a three hour reservation, MS Thesis defenses a two hour reservation, and PhD defenses a two and a half hour reservation.

CLASSIFICATIONS OF ADMISSION TO GRADUATE STANDING

Full Graduate Standing, Regular Admission: Graduate School.

Before admission to the MSEN program, applicants must obtain full graduate standing, regular status, in the Graduate School. To be considered for full graduate standing, regular status, applicants must have a baccalaureate or a master's degree from the University of Arkansas, Fayetteville, or from a regionally-accredited institution in the United States with requirements for the degrees substantially equivalent to those of this University, or from a foreign institution with similar requirements for the degrees.

Admission to graduate standing does not automatically constitute acceptance to the MSEN Graduate Program leading to a M.S. MATE or MATS or Ph.D. MSEN degree. To pursue these degrees, a person must also be accepted by the MSEN Graduate Program after gaining regular admission to graduate standing. International applicants cannot be admitted to graduate standing unless they are accepted into the MSEN Graduate Program at the same time.

Requirements for regular admission to graduate standing and acceptance in a program of study leading to a graduate degree can be found on-line at the web site http://grad.uark.edu/.

FORMS

Degree Plan

Annual Review

Quadslide

Thesis/Dissertation Title

Master's Committee

Doctoral Dissertation Committee

The Intellectual Property Disclosure Form

Electronic versions of these forms are available under the "Documents" link at https://materials-science-engineering.uark.edu/or from the Graduate School website at http://grad.uark.edu/.