Guidelines For Graduate Students and Faculty

In The Materials Science Ph.D. Program

2018

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1 Welcome to the Materials Science Ph.D. Program

The Materials Science Ph.D. is an interdisciplinary, interdepartmental, and intercampus doctoral program linking the three universities that comprise the University of Alabama System – The University of Alabama (UA), in Tuscaloosa, The University of Alabama -Birmingham (UAB), and The University of Alabama - Huntsville (UAH).

Through this interdisciplinary graduate education approach, students tailor their course work across department, college, and university campus boundaries. In doing so, students have greater options to maximize their academic, research, and professional interest. Students typically have undergraduate degrees in physics, chemistry, or materials-related engineering disciplines.

Since Materials Science is a graduate program, and not a department, nominally a student will select a “home department” where his/her advisor resides. With the advisor and graduate committee, the student will develop a plan of study that satisfies each campus’s Ph.D. requirements. Students who successfully complete the program receive a Ph.D. degree in Materials Science from the University of Alabama System.

The following information is designed to guide you in procedures used by the program in completing the graduate degree. This should be regarded as a supplement to, but not a replacement for, the material at each respected campus’ Graduate School Catalog. Any possible errors in these guidelines do not supersede or can replace those outlined in the Graduate Catalog. If individuals have questions concerning the guidelines, they are encouraged to discuss their concerns with their graduate advisor and/or the campus director of the Materials Science Ph.D. program. This will ensure all the requirements are being meet and each student is making adequate progress towards graduation.

Students in the Materials Science Ph.D. program apply to and are admitted to the Graduate School at their home campus.

Admission to the Graduate School and the Materials Science Ph.D. program does not imply admission of a student to candidacy for a degree. Admission to candidacy is contingent upon the recommendation of the student's committee and the approval of the home campus graduate dean after the student has met the formal requirements for candidacy listed below as well as demonstrated sufficient preparation to pursue the graduate study and research required for the degree.

The Materials Science Ph.D. program joint meetings between the campuses are nominally coordinated and announced to the respective faculty/students via the Directors of their campuses. When such events are organized, we appreciate your participation and involvement.

2 Graduate Committee

During the first year, a Materials Science student should compose his/her doctoral dissertation committee under the guidance of the primary advisor, who serves as the committee chair. The committee is charged to help design a set of Materials Science courses that addresses the basics of Materials Science and the general themed areas of (1) Structure and Properties of Materials (2) Characterization and Testing and (3) Thermodynamics and Processing. The specifics of the courses are described later in these guidelines.

Students should complete their home institution **Appointment/Change of a Doctoral Dissertation Committee** within the Graduate Student once all the committee members are identified under the guidance of the primary advisor. The committee should include at least five (5) members with the committee comprising a majority of Material Science faculty and at least one member from one of the other off-campus universities who is on the Materials Science faculty. Identification of potential faculty members can be found by consulting each institution's Materials Science homepage:

The University of Alabama – Birmingham
http://www.uab.edu/engineering/mse/graduate/tri-campus-phd-program

The University of Alabama - Huntsville
https://www.uah.edu/science/departments/materials-science

The University of Alabama - Tuscaloosa
https://materialsscience.ua.edu/

Note that all members of a dissertation committee must be members of the Graduate Faculty for each home institution. If an outside member is not a full or associate member of the Graduate Faculty (e.g., a highly qualified person from another university, a business or industry), the home campus graduate dean needs to appoint that member by approving Temporary Graduate Faculty status for the specific purpose for serving on the student's dissertation committee. Unless there are extraordinary circumstances meriting approval by the graduate dean before the final oral defense of the dissertation, all members of the dissertation committee must attend the defense of the dissertation. Gaining Temporary Graduate Faculty status for this member is done by submitting a letter from the primary advisor and approved by the home campus Director of the Materials Science program to the home campus Graduate Dean outlining the attributes and needs to include this person. This packet should also include a curriculum vita of the proposed committee member.

If the student does not have an advisor at the time of arrival into the program, the respective campus Director of the Materials Science Ph.D. program serves in that role as an academic course advisor until a permanent advisor is secured.

3 Requirements for the Ph.D. Degree

The doctor of philosophy degree is granted on the basis of scholarly proficiency, distinctive achievement in a special field, and capacity for independent, original investigation. A combination of these accomplishments, rather than the mere accumulation of residence and course credits, is the essential consideration in awarding the Ph.D. degree. Two assess a student's ability, the Materials Science Ph.D. program has a preliminary competency examination and a research proposal examination. These are described below. Admission to the doctoral program is limited to students whose scholastic records show distinct promise of success in the doctoral study. Admission to the Ph.D. program does not guarantee acceptance into a doctoral candidacy program.

3.1 Ph.D. degree course work requirements:

A defined field of specialization is required of all candidates for the doctor of philosophy degree, which for this program is the Materials Science Ph.D. Each student must complete the minimum doctoral credit requirement as outlined by each home institution's Graduate Catalog. Students should consult their primary advisor and supervisory committee (described above) on courses that are suited to fulfilling the course of study and research interest. A sampling of courses at each institution is listed in **Appendix A**. Materials Science, by virtue being multidisciplinary, enables the student to tailor the courses across departments, colleges, and institutions to meet the graduate education and research needs and interest of the student.

Depending upon the graduate school guidelines for each home institution, entering Materials Science Ph.D. students that have earned a M.S. degree can apply a portion of those graduate credits towards the total number of doctoral credits required. For these hours to be credited, students must show equivalent standing of the former courses to ones offered on the campuses and their relationship to materials science as well as having earned a B or higher in that course. Students should consult their respective home institution's Graduate Catalog for specific details. The petition form for these credit transfers can be found on each Graduate School's website. Students who seek approval for these equivalent credit hours should discuss these courses with their primary advisor and/or committee prior before formal approval is done by the home campus Director of the Materials Science Ph.D. program and the Graduate School Dean.

In addition to the academic course requirements, a student must **complete a minimum number of dissertation research credits** under their primary advisor as outlined in the Graduate Catalog at each home institution. The specific course designation is listed in the primary advisor's home department's course catalog.

Other requirements:

- If the student is conducting research prior to being a Ph.D. candidate, the student should ideally enroll in non-dissertation research credits with his/her advisor. The specific course catalog number should be consulted with the student's advisor. Once a student completes the Ph.D. candidacy requirements (given below), the student should then formally enroll in the dissertation research credits to meet the minimum number of dissertation research credits.
- **Residency requirements**. The intent of the residency requirement is to ensure that doctoral students contribute to and benefit from the complete spectrum of educational, professional, and enrichment opportunities. Please consult the home institution Graduate Catalog for the several ways to meet the residency requirement.
- All requirements for the doctoral degree must be completed within a specific span of time following admission to the doctoral program. Please consult the home institution Graduate Catalog for specific details.

- **Application for Graduation.** Each candidate for a doctoral degree must apply for the degree at specific deadlines outlined in each institution's Graduate Catalog. That day is typically published for each semester at the website of the **University Registrar** for each institution.
- **Clearing the Academic Record for Commencement.** At least one week before commencement, the candidate's record must have been cleared for graduation.
- **Attendance at Commencement.** A candidate for a doctoral degree must be present at a scheduled commencement to receive the diploma and hood, unless excused by the home campus graduate dean.
- **Withholding or Withdrawing an Advanced Degree.** The University of Alabama System reserves the right to withhold or withdraw an advanced degree on the recommendation of the graduate faculty.

3.2 Plan of Study

Early in the graduate program, each Ph.D. program student must confer with his/her advisor and committee in the development of a Plan of Study (i.e. courses) and research direction. For specific home institutions, this Plan of Study is a form that must be completed and turned into the Graduate School. Students should consultant their Graduate School for any specific details and time frames for completing concerning a PhD Plan of Study.

Specific details on course requirements for the **Plan of Study** for all program students include completion of at least 6 courses (or at least 18 credits, whichever is larger) that satisfy the *Preliminary Competency Examination* guidelines given in Section 3.4. In addition, a student must complete 2 dissertation relevant courses (or 6 credits, whichever is larger) that are outside the student's home department. This latter requirement is to ensure that the student achieves an understanding of the multi-disciplinary nature of materials science. These out-of-home-department courses can be part of the Plan of Study used to satisfy the 6 courses that are part of the *Preliminary Competency Examination*. This out-of-home-department course requirement must be completed prior to the *Ph.D. Dissertation Proposal Examination* described in Section 3.4. If a student's Plan of Study changes, an amended Plan of Study should be submitted to the committee and, if required by the home institution, Graduate School when the student submits the form for **Admission to Candidacy for the Doctoral Degree**.

3.3 Taking courses not on your home campus

One of the advantages of the Materials Science Ph.D. program is the opportunity for students across the campuses to take (for credit) classes that can be added to their academic progress for their degree. This is because the degree is shared between all three campuses and is a system granted degree. This enables a truly multi-disciplinary educational experience for the student and leverages the expertise of faculty on all three campuses.

For a student to enroll in an 'off campus' course under the Materials Science Ph.D. program, the student must be admitted to the other campus' graduate school. As the student has already paid an application fee and has been admitted to the home campus graduate school, these formalities are waived. However, the student needs to fill out the specific form "University of Alabama

System: Cooperative Exchange Program" from your campus with these forms located in **Appendix B**. The student will secure signatures from the advisor and respective graduate dean and return the form to the respective university registers office from which the student's official enrollment to the off campus class will occur. At the end of the course, the register office will contact the off campus faculty member to receive the grade earned which will be entered into the transcript. Depending on the course, these may be offered via distant learning and/or require the student to travel to the campus.

If the student has any questions concerning off campus enrollment, please see your home campus Materials Science Ph.D. Director.

3.4 Assessment of Core Competency - Course Requirements

Passage of the core courses demonstrates competency and is a requirement for all candidates for the Doctor of Philosophy Degree. This is achieved by the student taking at least two (2) courses in each of the three (3) topical areas below (such that the course credits sum to at least 18 credits) within the first 24 months of enrollment into the program as part of the Plan of Study.

(1) Structure and Properties of Materials
(2) Characterization and Testing
(3) Thermodynamics and Processing

These courses provide a core curriculum to the program and serve as the preliminary assessment of the student's competency with respect to the substantive knowledge regarding experimental and theoretical subjects in materials science. The specific examinations given in each of these courses then assess the breadth and depth of the students' knowledge.

A student must receive $\geq$ B in that course to meet this competency requirement. If the student receives less than a B, he/she can either re-take the course or replace the course with an alternative course. If the student is unable to achieve this passing grade after a second attempt, the student is ineligible to proceed in the Materials Science Ph.D. program.

As material science is inherently a multi-disciplinary subject, fulfillment of this course requirement to the specific topic can be met across a variety of courses in different home departments on each of the campuses. In **Appendix A**, a catalog of approved courses at each home institution for each topic is given. *However, this listing is not intended to be a complete entry but a guide to the type of courses that satisfy this requirement*. If a student takes a course not on this list and would like it to fulfill the core topic requirement above, he/she must consult with his/her advisor and verify the course's suitability for meeting this core topic requirement; this substitution must also be approved through consultation with the Materials Science Director on his/her home campus. Though a single course may cover more than one of the identified topic areas of (1) Structure and Properties of Materials, (2) Characterization and Testing, and (3) Thermodynamics and Processing, each course taken can only be ascribed to one topic, or in other words, a minimum of six (6) distinct courses must be taken with at least two (2) courses meeting each of the three (3) topical areas.

3.5 Assessment of Core Competency - Dissertation Proposal Examination

After completing the core competency course requirements above, the student is now eligible to complete the Dissertation Proposal Examination. The guidelines for the proposal examination are as follows:

a) The student will present a research proposal to the graduate committee that integrates the graduate course work and a literature review of the topic that demonstrates scholarly proficiency and capacity for independent, original investigation in his/her specialized field of research. This proposal should be given to the committee within two semesters after completing the core competency course requirements. This should be completed less than three years of continuous graduate school attendance.

b) The research proposal will follow the National Science Foundation (NSF) grant proposal guidelines. This includes no more than a one-page length abstract summary that outlines both intellectual and broader impact of the research, a table of contents, and up to 15-pages of technical content. References are treated as a separate section and do not count in the page limit and should follow the NSF guidelines for referencing (i.e., full author list, title of article, etc.). The student should provide a CV, a facilities section for the resources needed to complete the research, and a budget and justification as additional resource material to the proposal which are also not part of the 15-page limit of technical content. The technical content of the proposal should include (1) the integration of prior, referenced literature to the proposed topic which demonstrates adequate understanding for doctoral level research, (2) clearly defined scientific questions and/or technical objectives that the dissertation will address, and (3) proposed methods of investigation to address those questions posed. Prior work completed in the lab by the student should be used sparingly; **the proposal is not a summary of research completed but what is being planned.**

c) The proposal is given to the supervisory committee **no later than three (3) weeks before a commonly agreed date to orally defend the proposal,** where the student will answer questions related to relevant course work and the research proposal which satisfies the oral examination requirement for the doctoral degree examination.

d) The committee will read the proposal and each committee member can provide up two (2) written questions within ten (10) days of receiving the proposal. These questions provide the written portion of the doctoral degree exam. The committee chair will coordinate the collection of these questions, assemble them, and then disseminate them to the student. These questions are based upon fundamental materials science principles that can be derived from the proposal and prior course work in the plan of study. For example, if a student proposes the use of Scanning Electron Microscopy (SEM) as a technique, a question could be on image formation. Similarly, if the student proposes mechanical creep testing, a committee member could pose a specific question on the mechanisms of creep. These questions are to ensure that the fundamental understanding of materials science is understood by the student, as the proposal may not necessarily address those items in detail. **The student will provide a written response to each question and submit them to the committee chair within five (5) days of receiving them**. The committee chairperson will then disseminate the student answers to the committee members for evaluation. As a courtesy to the committee, the primary advisor should submit the student responses to the committee at least five (5) days prior to the oral exam date.

e) At the oral examination of the proposal, the student will present a series of slides (which should be numbered) based on the written proposal. It is recommended that the number of slides be no more than twenty (20). This presentation can be open to the public and is recommended to be thirty (30) minutes. At the conclusion of the presentation, the public is excused and the oral examination by the committee members occurs. The closed-door examination is not to exceed ninety (90) minutes. The committee will ask questions related to the topic of the proposal to ascertain the student's competency of the subject, ability to compile information to conduct doctoral-level research, and follow-up questions (if necessary) related to the written responses to the questions previously provided by the committee.

f) At the completion of the oral examination, the student will be excused and the committee will discuss the quality of the student's written proposal and oral responses to the questions centered on the proposal topic as well as responses to the written questions provided earlier. A majority vote of the committee approves the student to candidacy. If the student does not receive a majority vote, the student is eligible to resubmit a revised proposal, if directed by the committee, and the examination procedure is repeated within the next following semester. If the student is unable to receive a majority vote upon the second proposal examination, the student is ineligible to receive a doctoral degree from the program. If the vote is tied, this is equivalent to not receiving a majority positive vote.

3.6 Grievance

If a student is concerned about the grading and/or decision of the examination or other relevant academic matters, the student can file a grievance for resolution. The details of the process can be located in the home institution's Graduate Catalog.

3.7 Admission to Candidacy

Successful completion and passing of the Ph.D. preliminary competency examination and then the Dissertation Proposal Examination and Defense transfers a Ph.D. student to a Ph.D. candidate and the student is admitted to candidacy for the doctoral degree. The **Admission to Candidacy for the Doctoral Degree** form is then submitted to the Graduate School and should be done the semester when the Dissertation Proposal Examination requirement has been passed. Please consult the home academic Graduate School for required forms.

Once a student has met the requirements for admission to candidacy, please consult each home campus' Graduate Catalog for specific details regarding further enrollment requirements regarding dissertation credit enrollment. For example, the student should now enroll and complete at least the dissertation research needed for graduation. Upon enrollment in dissertation research credits, this should occur without interruption by enrolling each fall and spring semester of the academic year for at least 3 credits of dissertation research. The amount of dissertation research credit may exceed this minimum per semester and should be commensurate with the progress a student is expected to make on the dissertation, as well as reflective of the extent to which University facilities and faculty time are invested in the proposed activities.

If certain conditions are met for the student's final semester, the student may qualify to enroll for fewer than 3 credits of dissertation research, but only in that final semester and within the time frame of submitting the required paperwork for graduation that semester. See the home campus' Graduate Catalog for further details.

Summer enrollment for Dissertation Research is *required* for dissertation research when a doctoral student is graduating in August or defending the dissertation during the summer semester. This is true whether or not the student has submitted an **Application for Admission to Candidacy**.

4 Dissertation

A dissertation shows the ability to conduct independent research and the skills in organization, writing and presentation on a topic in the major field. It must constitute an original contribution to knowledge. The subject of the dissertation must be approved by the dissertation committee of the Materials Science Ph.D. program and by the dean of the Graduate School. The dissertation committee must be approved by the Graduate Dean, and any later changes to the committee also require Graduate School approval. **The dissertation should be given to the committee with at least two (2) weeks before the mutually agreed defense date.**

The dissertation must comply with the regulations set forth by each home's Graduate School. Specific Graduate School deadlines, including each semester's dissertation deadline, are available at the home campus Graduate School's homepage.

Dissertations can be compiled in the "traditional style" or the "article style" option. Students, Advisors, and Graduate Committee members should consult the student's home campus' Graduate Catalogue on the formatting requirements.

The decision of the dissertation style is determined by the student's primary advisor. Please see the home campus Graduate Catalog for further details.

5 5. Evaluation Rubrics:

As a metric for the evaluation of the Materials Science Ph.D. program, committee members will rate the student using a variety of rubrics that can be found in the attached evaluation form in **Appendix C**. This rubric form is independent of the home campus Graduate School candidacy forms and is for assessment purposes only. The rubrics are done at the time of the Ph.D. Final Dissertation Defense.

Protocol:

1) **The Committee Chair will provide each committee member the evaluation rubric form and a sealed envelope**. The committee members will fill in their evaluation, place it in the envelope and return it to the Materials Science campus director at the home campus of the student. **Each examining committee member must complete the rubric form.** Committee members who receive permission to attend the examination remotely may send in the completed rubric form separately.

2) Each completed rubric form will be placed in a confidential folder, under the student's name, at the home campus Materials Science Graduate Office. This information is to develop a database of the rubric outcomes to be analyzed later to evaluate learning outcomes being achieved and those requiring attention in the Materials Science program. The rubric outcomes will be anonymous in the database.

3) **The Graduate School exam form(s) will be signed by the Chair of the Graduate Committee and returned to the Graduate School only when all the rubric form has been completed**.

The decision to share the responses of committee members with the student being examined will be left to the discretion of the student's advisor and committee.

If any individual has any concerns or questions, he/she should consult the Materials Science Ph.D. campus director.

6 Academic eligibility during graduate school

Students should consult the Graduate Catalogue on academic eligibility requirements. Students are required to maintain an average of a 3.00 GPA during their progression to their graduate degree. If a student receives a cumulative GPA below this minimum, they are placed on academic probation for one academic semester. If a student does not achieve a 3.00 GPA the following academic term, the student is dismissed from the department and graduate school. If a student goes onto probationary status for a second (non-consecutive) semester, the student is dismissed from the Materials Science program.

7 Academic Misconduct

Academic misconduct is defined as all acts of dishonesty in any work which can include, but is not limited to, cheating, plagiarism, fabrication of information, misrepresentation, and abetting any of the above. The definitions of cheating, plagiarism, fabrication of information, and misrepresentation are as follows:

cheating - using or attempting to use unauthorized materials, information, study aids, etc.
plagiarism - representing the words, data, works, ideas, computer program or output, or anything not generated in an authorized fashion, as one's own.
fabrication - presenting as genuine any invented or falsified citation or material.
misrepresentation - falsifying, altering, or misstating the contents of documents or other materials related to academic matters, including schedules, prerequisites, and transcripts.

Penalties for academic misconduct can range from a reprimand to a penalty as severe as suspension for a definite time or even expulsion. In the event that academic misconduct occurs, The Academic Misconduct Disciplinary Policy will be followed.

8 Protection of Human Subjects for Research

Scientific research involving human subjects has produced substantial benefits for society, but it also can pose troubling ethical questions. The mission of the University's **Institutional Review Board (IRB)** for Protection of Human Subjects is to ensure that research involving human subjects is conducted ethically. University and federal policies require that review and approval to use human subjects in research precede the research. In the case of thesis research that involves the use of human subjects in any way, the principal investigator is responsible for contacting the college Human Research Review Committee to obtain approval for the planned research. If you are using human subjects in your research, please consult your graduate advisor for specific training and compliance to human subject research.

9 Safety training

Safety is of utmost concern during your graduate education and research in your individual laboratories. Every individual who works in a lab should complete the basic lab safety courses that is handled by the Environmental Health and Safety office on each campus. In some of your research, you may be required to complete and pass safety examinations to demonstrate competency in the laboratory. This could include Radiation Safety (for example, if you use X-ray diffraction), laser safety, etc. Please consult each campus' office for further information that is related to your particular research for training and certification.

Each laboratory you are assigned to work in should have signage posted outside the door identifying the possible health hazards, including chemical and flammability dangers in the lab. A Materials Safety and Data Sheet (MSDS) of every chemical in the laboratory should also be provided for each lab. This book will give you the protocols of handling any and all chemicals. Please be informed of this information. If your laboratory does not have these items, please see the primary advisor, the laboratory contact person and/or your campus' Environmental and Health Safety officer.

If you have any questions concerning safety, please contact the primary advisor, supervisory committee and the Environmental and Health Safety office.

10 Other resources

For your information, there are several fellowships you may be eligible for during your graduate education. These are listed below and students are encouraged to talk with their advisor and/or supervisory committee for details. Many of these have specific deadlines for applying and eligibility requirements.

- National Science Foundation Graduate Fellowships – www.nsf.gov
- NASA Graduate Fellowships - https://fellowships.nasaprs.com/gsrp/nav/
- National Defense Science & Engineering Graduate Fellowship - http://ndseg.asee.org/
- Department of Energy Graduate Fellowships - http://scgf.orau.gov/
- Stewardship Science Graduate Fellowship - http://www.krellinst.org/ssgf/sitemap

Other forms of financial assistance, including Graduate Research Assistantships or Graduate Teaching Assistantships, which are handled by the primary advisor, home department heads/chairs, and/or Director of the Materials Science program. Students should consult these individuals for specific details and eligibility.

The Materials Science Ph.D. Program wishes you the best in your research and graduate career.

Appendix A – Selected List of Materials Science Related Courses

This is not intended to be a complete or required course listing. In some cases, the courses will have natural overlap to other themed areas. It serves only as a guide to possible courses that can satisfy the three themed areas as well as potential electives. Questions for the selection of classes and compliance to the Materials Science program should be reviewed by the advisor, dissertation committee and home campus Materials Science Director. Offerings of each course should be determined by consulting the register catalog for each academic term on the specific campus.

Structure and Properties of Materials

University of Alabama-Birmingham

- **MSE 724 Physical Metallurgy** Course will consider the fundamental thermodynamic and kinetic principles governing the behavior of metals and alloys, particularly with respect to their influence the formation and evolution of microstructure. Topics will include liquid-solid and solid-state phase transformations, nucleation, growth, solidification and diffusion.
- **MSE 729. Polymer Structure and Morphology** Polymer structures and morphology and it's relationships with applications, multicomponent polymer systems (polymer blends, copolymers, micro and nanocomposites), liquid crystalline polymers, polymer crystals, oriented polymers, morphological aspects of deformation and advances in polymers (biomimetic and bioinspired polymer systems).
- **MSE 733. Advanced Mechanics of Deformation** Basics and intermediate mechanics of deflection of beams and columns, mechanics of impact, failure theories, plastic deformation of materials, fracture mechanics, fatigue, creep and vibration. The topics will be supported by industry relevant case studies.
- **MSE 735. Advanced Mechanics of Composites** Classical lamination theory, analysis and failure of reinforced composite material systems, anisotropic elasticity, stress analysis and design of laminated composites including 3D effects, stress concentrations, free-edge effects, hygrothermal behavior, adhesive and mechanical connections.
- **MSE 736. Engineering Fibers** Processing-microstructure-properties of different fibrous materials: natural polymeric fibers (jute, sisal, silk, etc.) synthetic polymeric fibers (aramid and polyethylene, etc.), metallic fibers, and high performance ceramic fibers (alumina and silicon carbide). Application of Weibull statistics to strength of fibrous materials, techniques of mechanical testing of fibers and applications of fibers in various fields.
- **CE 750. Advanced Structural Steel** Beams, columns, tension members, and connections; current research.
- **PH 553. Solid State Physics I** Properties of crystal lattices, lattice dynamics, lattice imperfections, and bonding energies; electronic properties of dielectrics, semiconductors, and metals; ferroelectric, magnetic, and optical properties of solids.
- **PH 554. Solid State Physics II** Properties of crystal lattices, lattice dynamics, lattice imperfections, and bonding energies; electronic properties of dielectrics, semiconductors, and metals; ferroelectric, magnetic, and optical properties of solids.

- **PH 586. Semiconductor Materials in Modern Technology** Brief review of electronic materials with emphasis on traditional and cutting edge Si technology. Competing and complementary semiconductors covered in standard lecture and seminar style. Materials: compound and tertiary semiconductors, organic semiconductors, wide bandgap semiconductors. Applications: optical and chemical sensors, microwave electronics, high power electronics, lasers. Specific applications/ materials determined by student interest.
- **PH 587. Nanoscale Science and Applications** Nanoscale Science and Applications. Physics of electronic, mechanical, and biological properties of materials at the nanoscale level approaching one billionth of a meter. The applications of nanoscale materials in electronic, mechanical, and biomedical systems will be emphasized. Special tools in synthesis and characterization of nanomaterials will be discussed.
- **PH 753. Solid State Physics I.** Properties of electrons and photons in crystal lattices; electromagnetic interactions with solids; lattice defects.
- **PH 754. Solid State Physics II.** Properties of electrons and photons in crystal lattices; electromagnetic interactions with solids; lattice defects.
- **CH 783. Chemistry of Polymers and Polymeric Materials I.** Basic chemical principles of polymers with the focus on synthesis, characterization, and applications of synthetic and biological macromolecules.
- **CH 784. Chemistry of Polymers and Polymeric Materials II.** Fundamentals of chemical, physical and molecular aspects of polymers in bulk and solutions.

University of Alabama - Huntsville

- **MTS 601 - NATURE OF MATERIALS**: Fundamental chemistry and structure of metals, ceramics, semiconductors, and polymers. Mol%, wt%, ppx, number densities, nad polymer molecular weights. Covalent, ionic, metallic, and intermolecular bonding. Crystallography and disorder. Point, line, and volume defects. Phase diagrams.
- **MTS 602 - PROPERTIES OF MATERIALS**: Properties of metals, ceramics, semiconductors, and polymers. Elastic or plastic deformation, fracture, and strengthening. Oxidation and corrosion. Dielectics, semiconductors, and conductors. Thermal conductivity and heat capacity. Transmission, adsorption, and reflection. Magnetic susceptibility. Prerequisites: MTS 601.
- **MTS 660 - INTRO SOLID ST PHY I**: Crystal binding and crystal structure. Crystal structure determination. Phonons and lattice vibrations. Free electron gas. Electronic energy band theory. Prerequisite: PH 551 or CH 553 or MTS 651 or OSE 555.
- **MAE 678 - MECH COMPOSITE MATERIALS:** Introduction to composite materials, micro- and macro-mechanical behavior of laminae; bending, buckling and vibration of laminated plates. (Same as CE 678.) Prerequisites: MAE 671 and MAE 672.
- **MAE 495/595 – MECHANICAL METALLURGY:** Mechanical metallurgy examines the behavior of materials under load and their reaction to a variety of environments including loading rate and temperature. It takes into account the underlying microstructure and how the various parameters affect the response to the various environments. The material response will be related to how it behaves during various manufacturing conditions that involve plasticity in metals such as pressing, rolling, forging, or welding.
- **MAE 672 - Elasticity**
- **MAE 673 - Plasticity**

University of Alabama – Tuscaloosa

- **AEM 552 Composite Materials**: Mechanisms and influence of heterogeneity/anisotropy on thermomechanical behavior. The behavior, manufacturing, and test methods of continuous fiber reinforced polymeric composites are emphasized.
- **AEM 637 Theory of Elasticity:** Equations of linear elasticity, principal stresses and strains, stress and displacement potentials, energy principles, and numerical methods. Boundary value problems of elasticity.
- **AEM 648 Theory of Plasticity**: Fundamentals of inelastic behavior of solids. Basic stress-strain relations for plastic action, yield criteria of metals, plastic instability, and slip-line field theory. Applications to axial, flexural, torsional, and cylindrically symmetric loads.
- **CH 501 Introduction to Graduate Inorganic Chemistry**: this course is for entering graduate students whose undergraduate training in inorganic chemistry is insufficient.
- **CH 643 Quantum Mechanics:** This course covers topics in molecular reaction dynamics. We will study how reactions occur in the gas-phase, at surfaces and in liquids. We will also study molecular photochemistry and describe modern experimental techniques.
- **ECE 530 Solid-State Devices**: The study of solid-state devices based on the principles of solid-state physics. Devices for study include PN junction, Schottky diodes, BJTs, MOSFETs, and organic thin-film devices (thin-film transistors, light-emitting diodes, solar cells) and their applications for flexible displays. The objective of this course is to gain an in-depth understanding of solid-state devices, in particular their non-ideal behaviors.
- **PH 541 - Quantum Mechanics**: Solution of the Schroedinger equation, matrix methods, angular momentum, and approximation methods.
- **MTE 579 Advanced Physical Metallurgy**: Graduate-level treatments of the fundamentals of symmetry, crystallography, crystal structures, defects in crystals (including dislocation theory), and atomic diffusion.
- **PH 581 Solid-State Physics**: Structure of simple crystals; thermal, electrical, and magnetic properties of solids; the free-electron model and the band approximation; and semiconductors.

Characterization and Testing

University of Alabama-Birmingham

- **MSE 533. Nondestructive Evaluation of Materials. 3 Hours.** Principles, applications, and limitations of ultrasonic vibrations, acoustic emission, radiographic, magnetic particle, eddy current, and other nondestructive testing methods. Intelligent sensors and health monitoring of real structures.
- **MSE 728. Thermal Characterization** This lab-oriented course will be focused to give graduate students the theory and hands-on experience in operation, data acquisition and interpretation of widely used thermal characterization techniques such as differential scanning calorimeter (DSC), thermo gravimetric analyzer (TGA) , Simultaneous TGA-DTA, Thermo mechanical analyzer (TMA), Dynamic mechanic analyzer (DMA) and rheological and viscosity analyses of polymeric resins and composite materials. Exposure to the surface characterizations techniques such as contact angle goniometer for wettability,

Fourier Transform infrared spectrometer (FT-IR) and X-ray-photoelectron spectroscopy (XPS) for surface chemical analyses and atomic force microscopy for roughness and morphology.

- **MSE 770. Physical Characterization.** Theory and practice of materials characterization, with emphasis on optical metallography, quantitative metallography, scanning electron microscopy, crystallography, and x-ray diffraction. Specific application in metals and ceramics considered.
- **BME 535. Tissue Engineering** Principles underlying strategies for regenerative medicine such as stem cell based therapy, scaffold design, proteins or genes delivery, roles of extracellular matrix, cell-materials interactions, angiogenesis, tissue transplantation, mechanical stimulus and nanotechnology.
- **BME 776. Fracture Mechanics.** This course is geared for graduate students in a mechanics curriculum with an interest in advanced techniques and concepts in fracture mechanics. The course covers linear elastic fracture mechanics, including fatigue crack growth, and nonlinear elastic fracture mechanics. Experimental and computational methods are also introduced
- **PH 732. Growth and Characterization of Thin Films I.** Basics of vacuum science. Methods of thin film deposition. Nucleation, evolution of microstructure and surface morphology of thin films. Simulation of growth processes. Thin film characterization techniques (SEM/SIM, TEM, SPM, SPS/AES, XRD, optical and and mechanical measurements). Demonstrations on thin-film deposition and basic characterization of tilm microstructure and properties.
- **PH 733. Growth and Characterization of Thin Films II.** Basics of vacuum science. Methods of thin film deposition. Nucleation, evolution of microstructure and surface morphology of thin films. Simulation of growth processes. Thin film characterization techniques (SEM/SIM, TEM, SPM, XPS/AES, XRD, optical and mechanical measurements). Demonstrations on thin-film deposition and basic characterization of film microstructure and properties.
- **PH 745. Molecular Spectroscopy.** Infrared, Raman, and ultraviolet techniques applied to study of molecular properties, including rotation-vibration spectra and spectra of crystalline solids.
- **CH 550. Instrumental Analysis for Graduate Study.** Focus on modern analytical chemistry instrumentation including chemical separations, spectroscopies (atomic absorption, infrared, UV-visible, fluorescence), nuclear magnetic resonance spectroscopy, mass spectroscopy, and thermal analysis.
- **CH 774. X-Ray Crystallography.** Fundamental principles of X-ray crystallography. Students gain enough information to be able to collect meaningful data and analyze and refine structures. Students learn how to collect, process and analyze x-ray data, focus on heavy atom phasing techniques and use state of the art software for refinement.

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- **CH 521 - CHEMICAL INSTRUMENTATION:** Use of basic instrumentation in NMR, mass spectrometric, chromatographic, and spectrophotometric analysis.
- **MAE 677 - OPTICAL TECH IN SOLID MECH:** Overview of conventional methods for experimental stress analysis. Introduction to applied optics with emphasis on non-

destructive, laser-based testing methods, fiber optic recording systems,photoelectronic-numerical data acquisition, and computer aided analysis. (Same as CE 677.)

- **CHE 594 - APPLIED MATERIALS PROCESSING**: Synthesis and processing methods of materials for engineering applications. Selection and use of materials performance factors for design of structural and functional components. Use of computational methods in solving open-ended design problems that depend on an understanding of the nature and properties of materials will be emphasized. All classes of materials are covered.
- **CHE 595 - POLYMER ENGINEERING:** Engineering principles of polymers and their role in manufacturing processes. Aspects of polymer phenomena and their relationship to processing of structural and functional components.
- **MAE 576 - COMP MATLS: FABRIC/DES/ANALY**: Introduction to the mechanics of advanced composite materials. Design and analysis of composite structures. Analysis of orthotropic and transversely isotropic materials and systems. Hands on fabrication of a composite structure.
- **MAE 577 - EXP TECH SOLID MECHANICS**: Experimental methods to determine stress, strain, displacement, velocity, and acceleration in various media. Theory and laboratory applications of electrical resistance strain gages, brittle coatings, and photoelasticity. Application of transducers and experimental analysis of engineering systems.
- **MAE 577 - EXP TECH in Materials Research:** Three categories of techniques used in materials research are covered pertaining to structural materials. 1) Methods to evaluate mechanical behavior are covered and correlated with underlying microstructure. 2) Methods to prepare samples for imaging of the microstructure at different length scales are presented. 3) Methods are presented for evaluation of chemical composition and crystalline structure.

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- **AEM 644 Fracture Mechanics:** Linear elastic and elastic-plastic fracture mechanics. Fracture analysis using Griffith 's criterion, stress intensity factors, CTOD methods, and the J-Integral.
- **AEM 649 Fatigue Analysis:** Presentation of the strain life and fracture mechanics approaches to fatigue analysis. Review of damage parameters, mean stress effects, and cycle counting methods for uniaxial and multiaxial loading.
- **AEM 655 Advanced Composite Materials:** Advanced topics in composite materials, including theories of linear orthotropic elasticity, micro-mechanics of composites, nano-composites, and sandwich structures.
- **CH 524 Spectroscopic Methods of Analysis** Provides graduate students with knowledge of the fundamental aspects of various modern methods of spectroscopic analysis. Reference to analytical applications and experimental methods is made, where relevant.
- **CH 626 Surface Analytical Techniques** Introduces the student to the instrumentation and techniques used to study surfaces and interfaces. Spectroscopic, microscopic, desorption, and vacuum techniques are covered.
- **CH 627 Mass Spectrometry** Deals with all areas of mass spectrometry (MS), including single and multiple stage MS and chromatography/MS. The emphasis is on fundamental principles and instrumentation, as well as applications and data interpretation.

- **CHE 518 Tissue Engineering**: Tissue engineering is an emerging dynamic, experimental science in which engineering and biological science principles are used to develop techniques for improving or restoring the structure and function of tissue
- **ECE 563 Magnetic Materials and Devices** Three hours. Prerequisites: ECE 340 or consent of instructor. Diamagnetism and paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism, magnetic anisotropy, domains and the magnetization process, fine particles and thin films, magnetization dynamics.
- **MTE 556 Advanced Mechanical Behavior:** Topics include elementary elasticity, plasticity, and dislocation theory; strengthening by dislocation substructure, and solid solution strengthening; precipitation and dispersion strengthening; fiber reinforcement; martensitic strengthening; grain-size strengthening; order hardening; dual phase microstructures, etc.
- **MTE 655 Electron Microscopy of Materials**: Topics include basic principles of operation of the transmission electron microscope, principles of electron diffraction, image interpretation, and various analytical electron-microscopy techniques as they apply to crystalline materials.
- **MTE 670 Scanning Electron Microscopy**: Theory, construction, and operation of the scanning electron microscope. Both imaging and X-ray spectroscopy are covered. Emphases is placed on application and uses in metallurgical engineering and materials-related fields.

Thermodynamics and Processing

University of Alabama-Birmingham

- **MSE 501. Materials Processing:** Processing of metals, glasses, ceramics, and composites. Powder, casting, welding, rapid solidification, and other advanced approaches.
- **MSE 509. Principles of Metal Casting** Production and evaluation of cast ferrous metals (gray iron, ductile iron, steel) and non-ferrous metals (brass, bronze, aluminum). Design of castings and molds. Laboratory on the gating, risering and molten metal treatment, analysis and handling techniques required to produce high quality castings. MSE 280 is recommended.
- **MSE 703. Thermodynamics of Materials:** Atomistic and classical approaches to the understanding of the thermodynamics of solids, phase transformations, chemical reactions, and alloy systems.
- **MSE 767. Process Modeling/Simulation** Theory and practice of analytical methods and computation modeling for manufacturing processes of metals, ceramics, polymers and composites. Applications on processes such as metal cutting, welding, casting, massive forming, solidification, rapid prototyping, injection molding, and resin transfer molding.
- **MSE 768. Applied Finite Element Analysis** Finite Element Analysis (FEA) is used widely for design optimization and failure prediction in automobile, energy, aerospace, and other industries. This course primarily looks at how practically to set up static structural models and get meaningful results. The focus will be on applying loading and boundary conditions, good meshes, convergence of results, and correct interpretation of results. Students will learn how to set up models using programs such as Pro/Engineer and ANSYS.

- **MSE 769. Degradation of Materials** The course will introduce the thermodynamics and kinetics of materials degradation; degradation mechanisms and types; degradation of different material systems (metals, alloys, ceramics and glasses, polymers and composites) for multifaceted applications; protection from degradation and materials design; Environmental and biological aspects; societal impact.
- **ME 742. Statistical Mechanics** Explanation of macroscopic thermodynamic and transport properties, based upon classical and quantum mechanical descriptions of elementary particles, atoms, and molecules. Analysis of the distributions of these objects over their allowed energy states and the relationships between those distributions and macroscopic properties.
- **PH 510. Physics of Fluids and Polymer Solutions** This course provides an overview of fluid mechanics and polymer physics appropriate for physics, engineering, chemistry, and biology majors. Topics include the concept of a fluid, the fluid as a continuum, properties of the velocity field, thermodynamic properties of a fluid, viscosity, pressure distribution in a fluid, basic physical laws of fluid mechanics, the Reynolds transport theorem, differential relations for a fluid particle, viscous flow, polymer solutions and thermodynamics, Brownian motion, diffusion equation, Fick's law, Stokes-Einstein equation and hydrodynamic radius of a polymer chain, and viscosity of polymer solutions.
- **PH 532. Statistical Thermodynamics I** Statistical basis of laws of thermodynamics; ensembles and partition functions; quantum statistics of ideal gases, including photons and electrons; applications to solids, real gases, liquids, and magnetic systems; transport theory.
- **PH 533. Statistical Thermodynamics II** Statistical basis of laws of thermodynamics; ensembles and partition functions; quantum statistics of ideal gases, including photons and electrons; applications to solids, real gases, liquids, and magnetic systems; transport theory.
- **PH 635. Advanced Statistical Mechanics** Applications of statistical laws to modern topics such as quantum fluids, critical phenomena, and nonequilibrium systems.
- **PH 715. Advanced Statistical Mechanics** Applications of statistical laws to modern topics such as quantum fluids, critical phenomena, and nonequilibrium systems.
- **PH 716. Advanced Statistical Mechanics** Applications of statistical laws to modern topics such as quantum fluids, critical phenomena, and nonequilibrium systems.
- **CH 525. Physical Chemistry I for Graduate Study.** Thermodynamics and chemical equilibria; and chemical kinetics.

- **CH 526. Physical Chemistry II for Graduate Study** Quantum mechanics, chemical bonding, and molecular spectroscopy

University of Alabama – Huntsville

- **CH 640 - ADV CHEMICAL THERMODYNAMICS**: First, second, and third laws of thermodynamics. Thermodynamic functions. Applications to thermal properties of gases, liquids, solids, and solutions. Chemical reactions, phase transitions, and electrochemistry.
- **CH 642 - ADV CHEMICAL DYNAMICS**: Non-equilibrium thermodynamics, macroscopic and microscopic theories of diffusion, chemical reaction rate laws and mechanisms, transition state theory, gas phase molecular dynamics, electrical conduction in electrolyte solutions, electrode kinetics. Prerequisite: CH 640.

- **CHE 646 - THERMODYNAMICS OF MATRLS:** Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics.
- **MAE 746 - CONVECTIVE HEAT TRANSFER:** Advanced theory of convective transport processes in fluids, including transport of momentum and energy in laminar flow, boundary layers and turbulent transport in shear flow. Engineering applications include boiling and two phase processes.

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- **CH 541 Kinetics and Statistical Thermodynamics**
- **CH 531 Physical Organic Chemistry** Theory and mechanism of organic transformations, detailed evaluation of organic structure, molecular dynamics, molecular orbital interactions, molecular symmetry, sterochemistry of reactions, and energetics of reaction paths.
- **CH 532 Synthetic Organic Chemistry** Fundamentals of organic transformations and advanced synthetic methodology with application to the synthesis of complex organic structures.
- **CH 609 Organometallic Chemistry** Structure, bonding, and reactivity of organotransition metallic compounds, mechanisms of transformations and fundamental reaction types, applications to catalysis and organic synthesis.
- **CHE 551 - Adv Thermodynamics I**: Application of thermodynamic principles to chemical and phase equilibria
- **CHE 512 Polymer Materials Engineering:** Introduction to the manufacture, processing, and applications of organic polymeric materials. This course covers the chemistry of polymer manufacture, the molecular structures of polymers, and the structure-property relationship for thermoplastic and thermosetting polymers.
- **CHE 552 - Transport Phenomena:** Development of the analogy between momentum, energy, and mass transport, with applications
- **CHE 554 - Chemical Reaction Engr:** Chemical kinetics theory and experimental techniques. Industrial reactor design by advanced methods.
- **CHE 651Statistical Mechanics and Multi-Scale Simulation Methods**: This course will begin by briefly covering the underlying quantum mechanical principles relevant to chemical bonding, intermolecular interactions, and reactivity. Statistical mechanics will be discussed in-depth, including the underlying theories behind Monte Carlo and molecular dynamics simulations. Various methods will be presented for modeling larger systems, such as dissipative particle dynamics and lattice-Boltzmann. These simulation techniques will be applied to model liquids, polymers, and adsorption on surfaces and within porous materials
- **ME 506 - Found Thermal Power Gen:** Thermal power systems; components, process analysis and modeling, fuels, combustion, environmental aspects, and availability analysis in steam and gas turbine plants. Examination of recent trends such as cogeneration and combined cycles
- **ME 509 - Intermed Heat Transfer:** Intermediate treatment of conduction, convection, and radiation heat transfer.

- **ME 605 - Classical Thermodynamics:** Classical macroscopic thermodynamic analysis of systems, pure substances, mixtures, and reacting systems
- **ME 607 - Conduction Heat Transfer:** Transient, multidimensional heat conduction in various geometries, and the mathematical and numerical means to analyze them
- **ME 609 - Convection Heat Transfer:** Laminar and turbulent internal and external flow, natural convection, and the mathematical and numerical means to analyze them
- **MTE 549 Powder Metallurgy**: Describing the various types of powder processing and how these affect properties of the components made. Current issues in the subject area from high-production to nanomaterials will be discussed.
- **MTE 562 Metallurgical Thermodynamics**: Laws of thermodynamics, equilibria, chemical potentials and equilibria in heterogeneous systems, activity functions, chemical reactions, phase diagrams, and electrochemical equilibria; thermodynamic models and computations; and application to metallurgical processes.
- **MTE 622 Solidification Processes and Microstructures**: This course will cover the fundamentals of microstructure formation and microstructure control during the solidification of alloys and composites.
- **MTE 680 Advanced Phase Diagrams**: Advanced phase studies of binary, ternary, and more complex systems; experimental methods of construction and interpretation.
- **PH 571 Statistical Physics**: Ensembles, partition function, quantum statistics, Bose and Fermi systems, phase transitions and critical phenomena, and applications.

Appendix B – Off Campus Enrollment forms

As outlined in Section 3.3, the following forms are used for students to enroll in course offerings available on the other UA-system campuses. Please select the form that is connected to your home campus on the next few pages.

University of Alabama System

Cooperative Exchange Program

Registration Form

Complete the blank for the term you wish to participate at the visiting campus:

Fall 20 _______ Spring 20_______ Summer 20_______

Campus at which the course is being taught: Birmingham _______ Huntsville _______

Level: Undergraduate _______ Graduate _______

Name (Last, First, Middle)	Participation with less than full-time hours requires approval by the Vice President for Academic Affairs and payment of full time fees to the Student Receivables office.
CWID	
Mailing Address (street)	
City, State, Zip Code	
Phone number	
Birthdate	Signature of Vice President
School Major	Date

Course & section number	Course Title	Semester Hours	Instructor

Advisor's signature

Dean's signature

Registrar's signature

Student's signature

Date

University of Alabama at Birmingham
Cooperative Exchange Program

Registration Form

Indicate the academic year and the term you expect to attend the host campus:

Academic Year: 20-_____ - 20-_____ Fall Semester _____ Spring Semester _____ Summer Term _____

I wish to participate in the following exchange:

BACHE (Birmingham Area Consortium of Higher Education)

_____Birmingham-Southern College

_____Miles College

_____University of Montevallo

_____Samford University

University of Alabama System

_____University of Alabama

_____University of Alabama in Huntsville

Any full-time, degree-seeking UAB student who is in good academic standing may take a course at another cooperative exchange institution with the proper approvals (see below) if it is deemed to be beneficial to the student's overall educational program. Students may register through the cooperative exchange program only for undergraduate courses not offered at UAB or for graduate courses required by their program (as with joint programs with UA and UAH). Only one course per term may be taken at a cooperative institution.

Course and Section Number	Course Title	Sem. Hrs. Credit	Instructor

I verify the above course is not taught/available at UAB.

_____ Date

_____ Department Chair (for the department in which the course would be offered)

I verify the course is beneficial to/required in this student's educational program.

_____ Date

_____ Academic Advisor (for the student's major)

_____ Student's Name (Last, First, Middle Initial)

[redacted] Student #

_____ Mailing Address _____ City _____ State _____ ZIP Code

_____ Telephone (Work)

_____ Telephone (Home)

_____ School/Major

_____ Student's Signature

Any exception to UAB's policy for cooperative exchange must be approved by the designated representative of the Office of the Provost (contact the director of Academic Programs and Policy, HUC 460, 934-9560).

Reason an exception is requested:_____

_____ Approved _____ Position _____ Date

Registrar's use only:

_____ course enrolled in _____ date _____ approved by

EVALUATION RUBRIC:
PhD DISSERTATION DEFENSE

Student Name: ____

Date: ____

Evaluation/Guidance	Poor (1)	Marginally Acceptable (2)	Acceptable/ Good (3)	Very Good (4)	Excellent (5)	Not Applicable
1. **Problem Definition:** Stated the research problem clearly, provided motivation for undertaking the research.						
2. **Literature and Previous Work:** Demonstrated sound knowledge of literature in the area, and of prior work on the specific research problem.						
3. **Impact of Proposed Research:** Demonstrated the potential value of solution to the research problem in advancing knowledge (a) within and (b) outside the area of study. **(a)**						
(b)						
4. **Solution Approach:** Applied sound state-of-the-field research methods/tools to solve the defined problem and has described the methods/tools effectively.						
5. **Results:** Analyzed and interpreted research results/data effectively.						
6. **Quality of Written and Oral Communication:** Communicated research results and implications clearly and professionally in both (a) written and (b) oral form. **(a)**						
(b)						
7. **Critical Thinking:** Demonstrated capability for independent research in the area of study, significant expertise in the area, and ability to make original contributions to the field.						
8. **Broader Impact:** Demonstrated awareness of broader implications of the concluded research Broader impacts may include social, economic, technical, ethical, and business aspects.						
9. **Publications:** Journal or conference publications have resulted (or are anticipated) from this research.						

Overall Assessment: The assessment of the overall performance of the candidate based on the evidence provided in items 1 – 9 above.

CRITERIA	**PERFORMANCE RATINGS**				
	Does Not Pass Dissertation Defense Exam	**Passes Dissertation Defense Exam**			
OVERALL, My Rating of the Dissertation:	**Poor (1)**	**Marginally Acceptable (2)**	**Acceptable/ good (3)**	**Very Good (4)**	**Excellent (5)**