Program Overview

The College of Science and Engineering at Texas State offers a cutting-edge interdisciplinary Materials Science, Engineering, and Commercialization Ph.D. program. Students work with faculty in Biology, Chemistry and Biochemistry, Engineering, Engineering Technology, and Physics on the research, development, and validation of materials to be used in the next generation of electronics, medicines, plastics, sensors, infrastructure, and renewable energy. Coupling commercialization with science and engineering, the curriculum infuses an understanding of intellectual property law, skills in business planning, competency in transforming innovations from the lab to commercial production, and the ability to organize and lead interdisciplinary research teams. Our goal is to educate the next generation of scientists and engineers who will perform interdisciplinary research and will emerge as effective entrepreneurial leaders in the advancement of high tech, 21st century global discovery and innovation.

Students are classified as either full-time (minimum of nine hours per term) or part-time. All students are required to initiate, complete, present, and publish original research.

Each student develops an appropriate degree plan to meet their career and academic goals. The degree plan will include a mix of theoretical, analytical, and elective courses that will prepare students to work independently and in multidisciplinary teams.

Educational Goal

The central educational goal of the Ph.D. major in Materials Science, Engineering, and Commercialization at Texas State is to prepare doctoral students with:

- technical skills necessary to conduct high-quality research,
- an orientation toward interdisciplinary research,
- a set of business tools and knowledge of business practice, and
- technical project and business management skills.

Graduates from the program will have:

- Technical skills enabling them to conduct high-quality research. The program has students plan and carry out cutting edge research in materials science and engineering that demonstrates the ability to think through complex problems and arrive at solutions. This goal is supported by rigorous and technically oriented course work that will equip students with the fundamental science and engineering knowledge necessary to conduct research. The student will also, in consultation with his research advisor and dissertation committee, formulate a research project and produce a proposal for carrying out the research.
- The ability to conduct research across scientific and engineering disciplines. Breakthroughs occur when scientists from a variety of disciplines either individually or collaboratively work on important interdisciplinary and multidisciplinary problems. Therefore, we need a new generation of scientists with both rigorous disciplinary training and the ability to communicate and work across disciplines.
- Business skills and knowledge of business practice. Equipping our graduates with the business skills necessary to become entrepreneurs or leaders in industry is a central goal of the program. This educational goal is supported by the core courses in practical and leadership skills in commercialization and entrepreneurship and other elements dispersed throughout the program. These elements include a one-week intensive workshop to be completed in the summer prior to beginning the program. This introductory boot camp outlines fundamental aspects of business and commercialization and equips students with a common language and basic toolkit. A second one-week entrepreneur boot camp is required after the student's first year in the program. In addition, two of the candidacy requirements solidify business skills. The student will produce, present, and defend a full business plan for a start-up company. Students write a Small Business Innovation Research/Small Business Technology Transfer Research (SBIR/STTR) proposal. If appropriate, students are provided the opportunity to work with a small business on the proposal and to submit the final document to a funding agency. Students are further encouraged to submit their business plan to the Texas State Business Plan Competition in an oral presentation before a panel of angel investors, venture capitalists and business owners. In addition, the weekly Commercialization Forum exposes students to successful entrepreneurs and business leaders. This Commercialization Forum is also the venue for oral defense of the student business plans. These requirements ensure that students have developed the business skills necessary to succeed.
- Technical project and business management skills. The ability to manage complex technical projects and businesses is an additional skill that is core to this program. This goal is certainly supported by the core courses. In addition, the Commercialization Forum regularly exposes the students to examples of effective project management and cases of what not to do in managing projects or businesses. The ability of the students to manage projects is assessed based on how they manage the business plan, SBIR/STTR proposal, and the implementation of the proposed research plan.

Financial Assistance

Assistantships and scholarships are available to qualified applicants. Doctoral instructional assistantships and teaching assistantships are offered on a competitive basis to full-time students enrolled in the Materials Science, Engineering, and Commercialization Ph.D. program. An offer of financial support typically will be made at the time that a student is accepted into the program. The Graduate College can provide further information regarding scholarships.

Advising

Each student will develop a degree plan in consultation initially with the doctoral program director and, after selection, their Ph.D. advisor and committee, who identifies the appropriate doctoral prescribed electives necessary for achieving the degree. Students must complete 36 credits prior to taking a three-part Advancement to Candidacy Comprehensive Examination. The exam will consist of the following parts: SBIR/STTR Grant Proposal, Business Plan, and Oral Examination.

Each Ph.D. student is issued a preliminary degree audit by the Graduate College, which should be used to plan the student's course of study. In the first term of enrollment, students should review the degree audit in consultation with their supervising professor and the program director.

With admission into the doctoral program, **it is expected that students will pursue their course work and research activities in an efficient and timely manner**. If it is determined that a student is not making adequate progress toward completion of the doctoral degree requirements, consultations will be undertaken with the student, their Ph.D. advisor and the program director to develop a remediation plan to revise the student's program of study or research. Failure to successfully remedy documented deficiencies will result in termination of the student's enrollment in the doctoral program at the discretion of the program

director. Students removed from the doctoral program in this manner may appeal to the dean of The Graduate College for reinstatement in the program within one academic year.

Application Requirements

The items listed below are required for admission consideration for applicable semesters of entry during the current academic year. Submission instructions, additional details, and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu). International students should review the International Admission Documents page (http://mycatalog.txstate.edu/graduate/admission-documents/international/) for additional requirements.

- completed online application
- $55 nonrefundable application fee

  or

- $90 nonrefundable application fee for applications with international credentials
- baccalaureate degree in biology, chemistry, engineering, materials science, physics, technology, or a closely related field from a regionally accredited university (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.) Students will be required to take leveling courses if background is insufficient. Any required leveling course work must be completed with grades of B or better prior to admission.
- official transcripts from **each institution** where course credit was granted
- minimum 3.3 GPA (on a 4.0 scale) in all completed undergraduate course work.
- GRE scores are not required for applicants with a minimum 3.5 GPA (on a 4.0 scale) in all completed graduate course work.
- GRE scores (general test only) required for applicants with GPA less than 3.5 on all completed graduate course work*
- interviews (conducted via phone, internet, or face-to-face) with core doctoral faculty
- resume/CV
- statement of purpose outlining the student's personal history and life goals that are relevant to obtaining a doctoral degree, and, in particular, the rationale for pursuing the commercialization aspect of the MSEC program. Applicants must indicate a first and second choice of concentration area (Materials Chemistry, Biomaterials, Materials Physics, Materials Technology, Materials Engineering).
- three letters of recommendation evaluating the student's skill and potential to be successful in the MSEC Ph.D. program

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum program requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver).

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

This program does **not** offer admission if the scores above are not met.

*Additional Information

Degree and GRE Requirement
If the GPA in the last 60 hours of completed undergraduate coursework is between 3.3 and 3.5, the student must submit the following:

- official GRE (general test only) with competitive scores in the verbal reasoning and quantitative reasoning sections

Degree Requirements

The Doctor of Philosophy (Ph.D.) degree with a major in Materials Science, Engineering, and Commercialization requires 72 semester credit hours. Students who do not have the appropriate background course work may be required to complete leveling or prerequisite courses. Any required leveling course work must be completed with grades of B or better prior to admission.

Course Requirements

Code	Title	Hours
Required Courses		
MSEC 7101	Commercialization Forum (Taken 2 times)	2
MSEC 7102	MSEC Seminar (Taken 2 times)	2
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	3
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	3
MSEC 7401	Fundamental Materials Science and Engineering	4
MSEC 7402	Advanced Materials Science and Engineering Concepts	4
Prescribed Electives		
Choose 18 hours from the following:		18
MSEC 7103	Research in Materials Science, Engineering, and Commercialization	
MSEC 7203	Research in Materials Science, Engineering, and Commercialization	
MSEC 7303	Research in Materials Science, Engineering, and Commercialization	
MSEC 7304	Collaborative Research/Commercialization Experience	
MSEC 7310	Nanoscale Systems and Devices	
MSEC 7311	Materials Characterization	
MSEC 7315	Quantum Mechanics for Materials Scientists	
MSEC 7320	Nanocomposites	
MSEC 7325	Principles of Technical Project Management	
MSEC 7330	Computational Materials Science	
MSEC 7340	Biomaterials and Biosensors	
MSEC 7350	Frontiers of Nanoelectronics	
MSEC 7355	Fluid Flow in Porous Media	

MSEC 7360	Nanomaterials Processing
MSEC 7370	Advanced Polymer Science
MSEC 7395A	Microwave & Power Device Physics and Materials
MSEC 7395B	Thin Film Photovoltaic Devices
MSEC 7395C	Materials for Sustainable Energy
MSEC 7395D	Polymer Characterization and Processing
MSEC 7395E	Industrial Ecology and Sustainability Engineering
MSEC 7395F	Catalysis in Materials Science
MSEC 7395G	Applied Plasma Physics
MSEC 7395H	Environmental Chemistry
MSEC 7395I	Structure and Properties of Alloys
MSEC 7395J	Advanced Concrete Materials and Durability
MSEC 7395K	Electrical and Magnetic Characterization Methods
MSEC 7395L	Advanced Solid State Physics
MSEC 7395M	Semiconductor Devices and Processing
MSEC 7395N	Advanced Infrastructure Materials
MSEC 7395O	Modern Concepts in Materials Science
CHEM 5395	Fundamentals of Research
CHEM 5381	Physical Biochemistry
CHEM 5386	Proteins
CHEM 5387	Nucleic Acids Chemistry
CHEM 5320	Modern Molecular Modeling
CHEM 5365	Separation Methods in Chemical Analysis
CHEM 5333	Spectroscopy
CHEM 5382	Enzymology
CHEM 5383	Molecular Biology & Molecular Genetics
CHEM 5385	MPMetabolism
CHEM 5384	Current Topics in Biochemistry and Molecular Biology
CHEM 5390	Supramolecular Chemistry
CHEM 5310	Medicinal Chemistry
CHEM 5312	Organometallic Chemistry
CHEM 5351	Introduction to Polymers and Polymer Synthesis
CHEM 5353	Polymer Processing and Characterization
CHEM 7330	Environmental Chemistry
BIO 5295	Fundamentals of Research
BIO 5350G	Medical Microbiology
or BIO 5366	Medical Microbiology
BIO 5350I	Emerging Infectious Diseases
BIO 5480	Cytology and Micro-technique
BIO 5311	Cancer Biology
BIO 7326	Immunobiology
BIO 7405	Statistics and Experimental Design I
BIO 7406	Statistics and Experimental Design II
PHYS 5312	ADVANCED QUANTUM MECHANICS
PHYS 5331	Electromagnetic Field Theory
PHYS 5314	Statistical Physics
PHYS 5395	Fundamentals of Research
TECH 5315	Engineering Economic Analysis
TECH 5382	Industrial Ecology and Sustainability Engineering
TECH 5394	Design of Experiments
TECH 5395A	Structure and Properties of Alloys
ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers
EE 5320	Advanced Computer Architecture and Arithmetic
EE 5350	Advanced Electronic Circuit Design
EE 5331	Machine Learning for Engineering Applications
EE 5354	Flexible Electronics
EE 5355	Electronic Materials and Devices
EE 5360	Thin Film Technology
EE 5361	Nanofabrication Technology for Semiconductor Device Processing
EE 5398A	Antenna Theory, Design and Applications
EE 5398B	Electronic Materials and Beyond for Sustainable Energy
EE 5398D	Electroceramics
IE 5320	Modeling and Analysis of Manufacturing Systems
IE 5310	Advanced Statistical Design of Experiments for Engineers
IE 5330	Advanced Quality Control and Reliability Engineering
IE 5343	Non-Linear Optimization Techniques for Engineers
IE 5398C	Data-Intensive Analysis and Simulation for Engineers
MFGE 5316	Advanced Computer Aided Design and Manufacturing
MFGE 5326	Advanced Robotics in Manufacturing Automation
MFGE 5315	Energy and Thermofluids Engineering
MFGE 5318	Additive Manufacturing
MFGE 5320	Polymer Nanocomposites
MFGE 5398B	Advanced Composite Materials
CE 5331	Computational Methods in Geosystems
CE 5390	Infrastructure Systems Analysis
CE 5340	Advanced Infrastructure Materials
CE 5391	Advanced Mechanics of Materials
Dissertation	
Choose a minimum of 36 hours from the following:	36
MSEC 7199	Dissertation
MSEC 7299	Dissertation
MSEC 7399	Dissertation
MSEC 7599	Dissertation
MSEC 7699	Dissertation
MSEC 7999	Dissertation
Total Hours	**72**

Additional Information

Depending on their interests and availability of faculty advisors, students entering with a baccalaureate degree will take elective courses within one of the following areas: Biomaterials, Materials Chemistry, Materials Engineering, Materials Physics, or Materials Technology.

Advancement to Candidacy

Application for Advancement to Candidacy

Students can download the "Application for Advancement to Candidacy" from The Graduate College website or they can obtain a copy from the doctoral program director. The student should complete and sign

the upper portion of the form and return it to the doctoral program director. Students must complete all required course work with the exception of dissertation credit hours and pass the Advancement to Candidacy Comprehensive Examination prior to applying for candidacy. The Advancement to Candidacy Comprehensive Examination can be taken in the last semester in which the student completes all required course work (with the exception of dissertation credit hours). When all requirements for admission to candidacy have been met (completion of boot camps or equivalents, all required course work (with the exception of dissertation credit hours), prescribed electives, successful performance on the comprehensive examination, approval of dissertation advisor/committee, and submission of an approved dissertation proposal), the doctoral program director will forward the Application for Advancement to Candidacy to the dean of The Graduate College for review and approval.

The dean of The Graduate College approves advancement to candidacy once all requirements are met.

Before advancement to candidacy can be approved, students are required to complete the following:

1. Completion of all required course work (with the exception of dissertation credit hours) toward the doctoral degree with a GPA of 3.0 or higher on a 4.0 scale with no grade earned below "B" on any graduate course work to be applied toward the Ph.D. degree.
2. The student must select a dissertation advisor, and that advisor must be approved by the doctoral program director. The student also must select a dissertation committee comprised of three additional members of the College of Science and Engineering's doctoral faculty and at least one external member from outside the College of Science and Engineering or the university. Other committee compositions are possible but require the approval of the dissertation advisor and the doctoral program director.
3. The student must choose a topic with the approval of the student's dissertation advisor and committee.
4. The student will submit a title and a written proposal for the dissertation to the student's dissertation committee and successfully defend the proposal in an oral presentation with the dissertation committee. The proposal will include a statement of the problem to be studied, a discussion of the relevant literature, and the research method of the proposed dissertation topic.
5. Satisfactory performance on a comprehensive examination consisting of the following parts: DSBIR/STTR Grant Proposal, Business Plan, and Oral Examination.
6. The doctoral program director will make a recommendation to the graduate dean who makes the final decision on the student's advancement to candidacy. The Graduate College will notify the student once the decision has been made.

Advancement to Candidacy Time Limit

Full time students are expected to advance to candidacy at the end of two years of official enrollment in the program. All full time students are required to have advanced to candidacy by the end of their third year in the program. Requests for a time extension must be submitted to the doctoral program director by the student with the concurrence of the Ph.D. research advisor and must be approved by The Graduate College. Non-traditional, part-time students may request extensions from the doctoral program director as long as they maintain a minimum GPA of 3.0 and are making consistent progress toward fulfilling their degree requirements. The doctoral executive council will review part-time students' requests for extensions on an individual, case-by-case basis.

No credit will be applied toward a student's doctoral degree for course work completed more than five years before the date on which the student is admitted to candidacy. This time limit applies to course credit earned at Texas State, as well as course credit transferred to Texas State from other accredited institutions.

Grade-Point Requirements for Advancement to Candidacy

A minimum GPA of 3.0 on all course work undertaken as a doctoral student in the materials science, engineering, and commercialization program is required for admission to candidacy. No grade earned below "B" on any graduate course work may apply toward a Ph.D. degree at Texas State.

Incomplete grades must be cleared through the office of The Graduate College at least ten days before approval for advancement to candidacy will be granted.

Advancement to Candidacy Comprehensive Examination

The Advancement to Candidacy Comprehensive Examination can be taken as early as the last semester in which the student completes all required course work (with the exception of dissertation credit hours) and no later than the end of their third year in the program. Students will be required to pass a comprehensive examination that will assess the student's preparedness to carry out the proposed plan of dissertation research. To be eligible to take the comprehensive examination, students must have a minimum GPA of 3.0 in all the core course work, including any course work that is transferred from another institution. The Advancement to Candidacy Comprehensive Examination will consist of two written components and one oral component. Each student will be required to take the Advancement to Candidacy Comprehensive Examination, which will be conducted by their Ph.D. dissertation committee. All committee members must be in attendance for candidacy examinations. Results of the Advancement to Candidacy Comprehensive Examination will be reported on the Doctoral Comprehensive Examination Report form and submitted to The Graduate College. The Advancement to Candidacy Comprehensive Examination will consist of the following three parts: SBIR/STTR Grant Proposal, Business Plan, and Oral Examination.

Should a student fail the exam, he or she will have the option of taking a second examination, which must be passed by the end of the following term. Failure to pass this exam on two occasions will lead to the student's dismissal from the Ph.D. program.

Dissertation Proposal

A dissertation proposal prepared by the student and approved by the student's Ph.D. advisor and a majority of the other members of the dissertation committee is a requirement for Advancement to Candidacy status. The proposal must outline the substance and scope of the dissertation research, present the methodology to be used, and survey the relevant literature. The dissertation proposal will be defended as part of the Oral segment of the Advancement to Candidacy Comprehensive Exam. The student's Ph.D. advisor and other dissertation committee members must indicate approval of the dissertation proposal on the "Ph.D. Dissertation Proposal" form. This form can be downloaded from The Graduate College website or it can be obtained from the doctoral program director. A final copy of the dissertation proposal, accompanied by the signed approval form, must be turned in to the doctoral program

director, who will forward it to the dean of The Graduate College for review and final approval.

Recommendation for Advancement to Candidacy

The dissertation committee recommends the applicant for Advancement to Candidacy by completing the "Advancement to Candidacy Examination Report" form which can be downloaded from The Graduate College website or obtained from the doctoral program director. The results of the Advancement to Candidacy Comprehensive Examination must be filed in the office of The Graduate College before the dean of The Graduate College gives final approval to candidacy. The doctoral program director is responsible for submitting this report to the office of The Graduate College.

Dissertation Research and Writing

All doctoral students are required to complete a dissertation. The dissertation must represent an original contribution to scholarship based on independent investigation. Preparation of the dissertation should follow the guidelines in the current edition of the American Chemical Society (ACS) or American Institute of Physics (AIP) G37 style manual or in an appropriate professional journal in the designated field, as deemed acceptable by the dissertation committee. After being admitted to candidacy, students must be continuously enrolled for dissertation hours each fall and spring term until the defense of their dissertation. If a student is utilizing university resources toward completion of the dissertation in the summer (including faculty supervision or the use of university facilities), or if the student is graduating in the summer, they must be enrolled in at least one hour of dissertation credit for that term. All candidates for graduation must be enrolled in dissertation hours during the term in which the degree is to be conferred. Students must complete a minimum of 18 semester hours of dissertation research credit.

The student must submit to The Graduate College the approved dissertation in electronic format for publication with the Alkek Library. The graduate dean must approve the dissertation.

Dissertation Enrollment Requirements

After being admitted to candidacy, students must be continuously enrolled for dissertation hours each term until the defense of their dissertation. If a student is utilizing university resources toward completion of the dissertation in the summer (including faculty supervision or the use of university facilities), or if the student is graduating in the summer, they must be enrolled in at least one hour of dissertation credit for that term. All candidates for graduation must be enrolled in dissertation hours during the term in which the degree is to be conferred. Students must complete a minimum of 18 semester hours of dissertation research and writing credit.

Dissertation Time Limit

Students are expected to complete the dissertation within two years after Advancement to Candidacy. Any exceptions to this time limit require the approval of the doctoral program director and the dean of The Graduate College. The doctoral program director will review each student annually to ascertain their progress in pursuing the degree and will consult with the student's Ph.D. research advisor and dissertation committee on this matter as appropriate.

Dissertation Committee

The dissertation committee will be responsible for administering the Advancement to Candidacy Comprehensive Examination and will oversee the research progress of a doctoral student and the writing of the student's dissertation. The committee will consist of at least five members, including the student's Ph.D. research advisor, three other MSEC doctoral faculty and at least one external member from outside the College of Science and Engineering or the university. Other committee compositions are possible but require the approval of the dissertation advisor and the doctoral program director. The student's Ph.D. research advisor will chair the committee. The student, doctoral program director, and the dean of The Graduate College will approve the composition of the dissertation committee. The Dissertation/Research Advisor form and the Dissertation Committee Request form must be completed to form the committee. These forms may be downloaded from The Graduate College's website.

Any changes to the dissertation committee must be submitted using the Dissertation Advisor/Committee Member Change Request form for approval to the dissertation committee chair, the doctoral program director, and the dean of The Graduate College. Changes must be submitted no later than 60 days before the dissertation defense.

The student is responsible for obtaining committee members' signatures on the Dissertation/Research Advisor Assignment form and the Dissertation Committee Request form, which can be downloaded from The Graduate College website.

Committee Changes

Any changes to the dissertation committee must be submitted using the Dissertation Advisor/Committee Member Change Request form for approval to the dissertation committee chair, the doctoral program director, and the dean of The Graduate College. Changes must be submitted no later than 60 days before the dissertation defense.

The Research Advisor/Committee Member Change Request form may be downloaded from The Graduate College website or obtained from the doctoral program director.

Dissertation Defense

The dissertation defense will not be scheduled until all other academic and program requirements for advancement to candidacy have been fulfilled. A complete draft of the dissertation will be given to the members of the dissertation committee with sufficient time for review, typically two month before the date of commencement during the term in which the student intends to graduate. After committee members have reviewed the draft with the student and provided comments, the student, in consultation with the Ph.D. research advisor, will incorporate the recommended changes into a new draft of the dissertation. When each committee member is satisfied that the draft dissertation is defendable, the dissertation defense may be scheduled.

The dissertation defense will consist of two parts. The first part is a public presentation of the dissertation research. Notice of the defense presentation will be posted at least two weeks in advance. The second part of the defense will immediately follow the public presentation but will be restricted to the student's dissertation committee and entail an oral examination over the dissertation research. Approval of the dissertation requires positive votes from the student's Ph.D. research advisor and a majority of the remaining members of the dissertation committee. The Dissertation Defense Report form must be filed in The Graduate College before the dean of The Graduate College gives final approval to the dissertation. This form may be downloaded from The Graduate College website.

The student is expected to orally defend the dissertation in an announced public presentation within two years of the official date of being advanced to candidacy.

Approval and Submission of the Dissertation

Following approval and signing of the Thesis/Dissertation Committee Approval form by the members of the dissertation committee, the student must submit one copy of the dissertation to the office of The Graduate College for final approval. Specific guidelines for approval and submission of the dissertation can be obtained from the office of The Graduate College. Dissertations must be submitted in electronic format.

Doctoral level courses in Materials Science, Engineering and Commercialization: MSEC

Courses Offered

Materials Science, Engineering and Commercialization (MSEC)

MSEC 7100. Doctoral Assistant Development.
The course is designed to equip the doctoral students with skills and an understanding of proper procedures to be effective teaching assistants. This course does not earn graduate degree credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

MSEC 7101. Commercialization Forum.
The course is a seminar series exposing students to commercialization issues. The series includes as speakers: successful entrepreneurs, businessmen, research directors, production and process control engineers, intellectual property and licensing experts, management consultants, and technology transfer specialists. Repeatable four times for credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MSEC 7102. MSEC Seminar.
This course is an introduction to current materials science and engineering topics with presentations by subject matter experts as the basis for weekly discussions. Students participate by asking questions and actively engaging the seminar speaker. Students are also expected to give public presentations based upon their own field of research at the STAR (Student Technology and Research) Showcase. Repeatable four times for credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

MSEC 7103. Research in Materials Science, Engineering, and Commercialization.
This research course is for students in Materials Science, Engineering, and Commercialization who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor. Repeatable (with MSEC 7203 & MSEC 7303 hours) for doctoral credit up to 6 hours.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7199. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Repeatable for credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7203. Research in Materials Science, Engineering, and Commercialization.
This research course is for students in Materials Science, Engineering, and Commercialization who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor. Repeatable (with MSEC 7103 and MSEC 7303 hours) for doctoral credit up to 6 hours.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7299. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Repeatable for credit.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7301. Practical Skills in Commercialization and Entrepreneurship.
This course is the first of a two-course series to impart business and commercialization skills by producing a business plan. Key areas covered include intellectual property law, technology transfer and licensing strategies, business plan development, business finance strategies, management structures, project management methods, statistical quality and process control.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7302. Leadership Skills in Commercialization and Entrepreneurship.
Leadership Skills in Commercialization and Entrepreneurship (3-0). This course is the second of a two-course series to impart business and commercialization skills by producing a business plan. Key areas covered include intellectual property law, technology transfer and licensing strategies, business plan development, business finance strategies, management structures, project management methods, statistical quality and process control. Prerequisite: MSEC 7301 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7303. Research in Materials Science, Engineering, and Commercialization.
This research course is for students in Materials Science, Engineering, and Commercialization who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor. Repeatable (with MSEC 7103 & MSEC 7203 hours) for doctoral credit up to 6 hours.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7304. Collaborative Research/Commercialization Experience.
This course allows Ph.D. level graduate students to initiate, conduct and participate in a collaborative research or commercialization experience with graduate faculty in addition to research conducted under MSEC 7103, MSEC 7303, MSEC 7199 and MSEC 7399. This course recognizes the collaborative nature of the scientific and commercialization enterprise. Repeatable for doctoral credit up to 6 hours.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

MSEC 7310. Nanoscale Systems and Devices.
This course is an in-depth treatment of physical phenomena in nanoscale structures, and consequences for electronic, photonic, mechanical and other types of devices. The course provides a strong background in devices with applications in nanoelectronics, biomedical systems, micro- and nanoscale manipulation, adaptive optics, and microfluidics.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7311. Materials Characterization.
This course covers skills and knowledge required for microscopy methods including transmission electron microscopy, scanning electron microscopy, scanning tunneling electron microscopy, atomic force microscopy, and confocal microscopy. It covers x-ray and neutron diffraction techniques including structure analysis, powder and glancing angle diffraction, pole figure, texture analysis, and small angle scattering.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

MSEC 7315. Quantum Mechanics for Materials Scientists.
This course includes quantum-mechanical foundation for study of nanometer-scale materials, principles of quantum physics, stationary-states for one-dimensional potentials, symmetry considerations, interaction with the electromagnetic radiation, scattering, reaction rate theory, spectroscopy, chemical bonding and molecular orbital theory, solids, perturbation theory, and nuclear magnetic resonance.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7320. Nanocomposites.
Characteristics of nanoparticles utilized in nanocomposites, techniques for surface modification, methods for nanoparticle dispersion forming nanocomposites, types of nanocomposites, characteristics of nanocomposites, analytical methods for characterization of composites, and common applications will be discussed. Particular attention will be given to the science and theories explaining the unique behavior of nanocomposites.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7325. Principles of Technical Project Management.
This course includes planning, budgeting, identification of risks and risk mitigation approaches, resource allocation, review of milestones and schedules, and evaluating projects to measure success. Responsibilities of project managers in the areas of problem solving, motivating and managing creative technical staff in project and matrix organizations will be included.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7330. Computational Materials Science.
Application of computational techniques to molecular and atomic modeling of materials is discussed along with quantum mechanical modeling, density functional theory approaches, forcefield based molecular modeling, mesoscale modeling, energy minimization, molecular dynamics, vibrational spectra, crystal structures, phase equilibria, physical property prediction, and electronic structure related to magnetic and electrical properties. Prerequisite: CHEM 3340 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7340. Biomaterials and Biosensors.
The course covers the growing field of biomaterials science including materials for prosthetics and implants, mimetic materials, biosensors, diagnostic devices, and drug delivery systems. Particular attention will be given to nanomaterials for diagnosis and treatment of diseases including targeted cancer treatments, drug delivery systems, and advanced imaging methods.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7350. Frontiers of Nanoelectronics.
This course provides an introduction to the operating principles of nanoscale electronic and optical devices. The emphasis is on how leading edge nano-fabrication technology takes advantage of quantum mechanics of reduced sizes and dimensions. Specific examples of devices based on quantum wells, wires, dots and molecular electronics are given.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7355. Fluid Flow in Porous Media.
In this course, the fundamental theory of transport and fluid flow in heterogeneous porous media will be presented. First, the equations that govern transport and fluid flow processes will be derived. Both analytical and numerical methods will be used to solve these equations in order to characterize and predict flow fields in porous media. These skills will then be applied to practical problems that involve porous media such as soils, rocks, biological tissues, concrete, etc. The knowledge gained from studies of fluid flow in natural porous materials will be employed to design/optimize systems with engineered porous media.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7360. Nanomaterials Processing.
The course will cover various aspects of materials processing related to semiconductor devices. Topics covered include properties of electronic materials, thin film deposition, etching, lithography, and related device physics with an emphasis on the nanoscale. Fabrication and characterization techniques will be covered, including clean room usage. Prerequisite: MSEC 7401 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7370. Advanced Polymer Science.
Advanced topics in polymer science are discussed with a focus on high performance polymers such as high impact, conducting, shape memory, high temperature and the underlying phenomena that provide these unusual properties, and advanced polymer topic areas such as flame retardancy, barrier properties, dielectric properties, rheology, and fiber reinforced composites.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7395A. Microwave & Power Device Physics and Materials.
This course will develop an understanding of basic microwave and power device physics and technology and the advanced materials that are used in today's cutting-edge research & development. The primary focus will be wide bandgap semiconductor materials and devices, and their performance metric versus the industry standard Si-based devices. Prerequisite: MSEC 7401 and MSEC 7402 both with grades of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395B. Thin Film Photovoltaic Devices.
This course is a survey of the Materials Science of photovoltaic devices with emphasis on device physics including the photovoltaic effect, photon absorption, electrons and holes, generation and recombination, the pn-junction, charge separation, monocrystalline solar cells, thin film solar cells, III-V solar cells, and losses. Prerequisite: MSEC 7401 and MSEC 7402 both with grades of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395C. Materials for Sustainable Energy.
This course introduces principles and applications of sustainable energy materials used for energy generation, conversion, and storage. Topics of study include principles (thermodynamics, kinetics, transport phenomena, equivalent circuits, catalysis, and electrochemistry) and selection and performance criteria important for applications including batteries, supercapacitors, fuel cells, electrolyzers, dielectrics, biomass, and piezoelectrics. Prerequisite: MSEC 7401 and MSEC 7402 both with grades of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395D. Polymer Characterization and Processing.
This course will cover the concepts critical to the characterization and processing of organic polymers. Topics critical to characterization will include molecular weight determination, thermo/mechanical characterization, X-ray scattering, and polymer spectroscopy. Processing topics will include polymer rheology, principles of polymer processing, solution processing, and extrusion. Prerequisite: CHEM 4351 or CHEM 5351 or MSEC 7370 any with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395E. Industrial Ecology and Sustainability Engineering.
This course covers the basic principles of life cycle analysis (LCA) of engineered products, materials, and processes. Topics covered include: biological ecology, industrial ecology, resource depletion, product design, process design, material selection, energy efficiency, product delivery, use, end of life and LCA.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395F. Catalysis in Materials Science.
This course introduces principles and applications of catalysis in materials science. The primary topics of study will include catalysis as a means of synthesizing materials and materials as catalysis. Subtopics will focus on specific catalysts (Ziegler-Natta, ROMP, and cross-coupling catalysts) and specific catalytic processes (hydrogenation, photoredox, and electrocatalysis).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395G. Applied Plasma Physics.
Applied plasma physics focusing on the broad range of technical plasma devices, and to analyze and describe the main plasma physical characteristics and principles of operation. Emphasis will be on physical insight, application, and problem solving. Prerequisite: MSEC 7401 and MSEC 7402 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395H. Environmental Chemistry.
Advanced study in environmental chemistry, with an emphasis on aquatic resources and materials science and engineering. Principles of geochemistry and atmospheric chemistry will be covered as they relate to environmental pollution monitoring and control. Principles and applications of green chemistry will also be discussed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395I. Structure and Properties of Alloys.
This course in an advanced exploration of the structure and properties of engineering alloys. Strengthening mechanisms of alloys are explored with specific applications to the alloys studied. The processing, properties, and structure of ferrous and nonferrous alloys are explored including new and emerging alloys. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395J. Advanced Concrete Materials and Durability.
This course delves into a comprehensive coverage of Portland cement concrete materials as well as resilient and sustainable materials used for building and transportation infrastructure. Topics include cement and aggregate properties, chemical and mineral admixtures, mixture proportioning, concrete microstructure, concrete durability, long-term performance, durability prediction and modeling, durability of alternative cement, multi-scale assessment, and dimensional stability.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395K. Electrical and Magnetic Characterization Methods.
This course introduces electric and magnetic characterization methods important to metals, magnetic and semiconductor materials and devices. Various measurement techniques and methods will be reviewed. Students will learn to work with characterization tools.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395L. Advanced Solid State Physics.
This course reviews models of a solid and energy band theory. Additional topics may include interaction of electromagnetic waves with solids, lattice vibrations and phonons, many body effects in solids, device physics, quantum phenomena, carrier transport properties, current device configurations, and materials interface problems. Prerequisite: MSEC 7401 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395M. Semiconductor Devices and Processing.
This course addresses the basics of semiconductor devices, silicon and compound semiconductor material fabrication, photolithography, etching, control of dopant profiles for the formation of shallow junctions needed for nanoscale devices, ion implantation and microstructure engineering, different types of doping phenomena, the carrier action and charge transport properties, defect microstructures, low-resistivity Ohmic contacts, and different fabrication concepts of conventional and emerging micro-/nano-electronic devices. In addition, students will be involved in laboratory projects and seminar presentations. Prerequisite: MSEC 7401 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395N. Advanced Infrastructure Materials.
This course provides a comprehensive presentation of advanced infrastructure materials including cement concrete, asphalt concrete, wood, steel, etc. Emphasis is placed on a fundamental understanding of the raw ingredients of cement concrete and how these ingredients affect concrete fresh and hardened properties. A brief introduction of other common infrastructure materials is also included in this course. Students will be asked to solve an infrastructure material related problem using advanced analytical and simulation tools.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7395O. Modern Concepts in Materials Science.
This course provides an overview of the modern concepts and principles that are used to describe and predict the physical properties of materials. An emphasis will be placed on developing and applying fundamental materials science concepts: atoms and atomic bonding, fundamentals of crystallography, elementary diffraction by solid-state materials, defects, solid solution and phase equilibrium. Particular attention will be given to the science and theories explaining the unique behavior of different classes of materials, i.e. ceramics, metals, polymers, electronic materials and composites.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

MSEC 7399. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Repeatable for credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7401. Fundamental Materials Science and Engineering.
Course covers fundamentals of chemical kinetics, physical properties, and continuum mechanics. Topics include electronic and atomic structure, structure of crystalline materials, imperfections, thermodynamic and kinetic principles and equations for closed and open systems, statistical models, phase diagrams, diffusion, phase transformations, conservation laws, and kinematics.
4 Credit Hours. 4 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7402. Advanced Materials Science and Engineering Concepts.
Fundamentals of quantum mechanics, physics of solid state, and physical electronics and photonics for advanced materials will be discussed. Topics will include quantum basis for properties of solids, lattice vibration, free electron model for magnetism, semiconductors, nanostructures and mesoscopic phenomena, superconductivity, and recent advances in new types of materials. Prerequisite: MSEC 7401 with a grade of "C" or better.
4 Credit Hours. 4 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

MSEC 7599. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Repeatable for credit.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7699. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester. Repeatable for credit.
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

MSEC 7999. Dissertation.
Original research and writing in Materials Science, Engineering, and Commercialization, is to be accomplished under direct supervision of the PhD Research Advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit