

Program Overview

The Department of Engineering Technology offers an applied construction management Ph.D. program that incorporates commercialization, entrepreneurship, data-driven decision making, and sustainability to prepare students to navigate multiple career environments within the construction industry. The program is 100% online, which enables both part-time and full-time students, from all over the world, to earn their doctorate in construction management. The program facilitates the development of multiple skillsets required by the modern construction company such as

intercultural communication, interdisciplinary understanding, research design, grant writing, project management, ethics and professional conduct, methods of data collection, and the use of theory in the interpretation of data.

Educational Goal

Based on the curricular areas and expectations described above, the main educational objectives of the Texas State program are to equip program graduates with:

1. Equip program graduates with technical knowledge in complementary areas of applied construction management.
1. Equip program graduates with skills for conducting cutting-edge research that advances the state-of-the-art in construction management.
1. Equip program graduates with leadership, innovation, communication, and entrepreneurial skills that prepare students to take on challenges in multiple career environments, including their own startup companies.

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 non-refundable application fee
- or
- \$90 non-refundable application fee for applicants with international credentials
- completed master's degree in construction management or a closely related discipline from an accredited college or university
- official transcripts from **each institution** where course credit was granted
- competitive GPA
- GRE not required

- resume/CV outlining education, work experience, scholarships/grants, publications/presentations, other accomplishments
- statement of purpose outlining the applicant's personal history and goals that are relevant for why the applicant wants to pursue this degree at Texas State University
- three letters of recommendation evaluating the applicant's skill and potential in this degree program

TOEFL, PTE, or IELTS Scores

Non-native English speakers who do not qualify for an English proficiency 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

Additional Information:

A committee including the doctoral program director will conduct a holistic review of all applications. Students will be assessed for readiness to enroll in our doctoral program based on their background in construction management, interest in our program and faculty research, and potential for research.

The program will admit full-time and part-time students three times per year (Fall, Spring, and Summer).

Degree Requirements

The Doctor of Philosophy (Ph.D.) degree with a major in Construction Management requires 54 semester credit hours.

Course Requirements

Code	Title	Hours
Required Courses		
CSM 7300	Research Methods	3
CSM 7310	Leadership in the Construction Industry	3
CSM 7315	Emerging Construction Technologies	3
CSM 7320	Advanced Productivity and Lean Construction	3
CSM 7325	Construction Risk Management	3
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	3
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	3
Prescribed Electives		
Choose 9 hours from the following:		9
CSM 7330	Constructability of Structures	
CSM 7380	Construction Externship	
MSEC 7101	Commercialization Forum	
MSEC 7304	Collaborative Research/Commercialization Experience	
MSEC 7325	Principles of Technical Project Management	
MSEC 7395J	Advanced Concrete Materials and Durability	
MSEC 7395N	Advanced Infrastructure Materials	
MSEC 7395E	Industrial Ecology and Sustainability Engineering	

Dissertation

Choose a minimum of 24 hours from the following: 24

CSM 7199	Dissertation
CSM 7299	Dissertation
CSM 7399	Dissertation
CSM 7599	Dissertation
CSM 7699	Dissertation
CSM 7999	Dissertation

Total Hours 54

Advancement to Candidacy

Candidacy Criteria

Students will advance to candidacy after they have completed all required and elective course work (except for dissertation credit hours), passed their comprehensive exam, and successfully defended their dissertation proposal. This will typically occur after the completion of the second year in the program (for full time students). Once all requirements are met, the doctoral program director will forward the Application for Advancement to Candidacy form to the Dean of The Graduate College for review and approval.

Comprehensive Exam

Each doctoral student must pass a comprehensive examination. This should be done by the time the student has completed 30 semester credit hours and can only be done after identifying the dissertation committee. Any student who does not pass the comprehensive exam by the time 45 semester credit hours have been accrued will be dismissed from the program. If the comprehensive exam is not passed, the student will have the option of taking a second and final comprehensive exam in the following long semester. Students will be dismissed from the program if they do not pass the comprehensive exam the second time.

The comprehensive examination consists of a written and an oral component. The written component will constitute either a business plan for developing one's own construction company or a grant proposal in the area of construction management. The grant proposal does not have to be submitted to a real/existing call for proposals, however, a "mock" proposal can be prepared that meets the guidelines of an existing call for proposal as decided by the student's dissertation committee chair. The oral component is administered by the dissertation committee, typically right after the dissertation proposal (see below). The oral exam consists of questions covering the business plan or the grant proposal. To pass the oral exam, the student's dissertation advisor and a majority of the remaining members on the dissertation committee must agree that the student has passed. The student's dissertation committee members must indicate the result on the Doctoral Comprehensive Form, which is to be submitted to The Graduate College. This form is available on The Graduate College's website.

Dissertation Proposal and Proposal Defense

Each Ph.D. student must prepare a written dissertation proposal and defend it orally. This should be done by the time the student has completed 30 semester credit hours and after identifying the dissertation committee and passing the comprehensive exam. Any student who does not defend his/her dissertation proposal by the time 45 semester credit hours have been accrued will be dismissed from the program. If the proposal defense is not passed, the student will have the option of taking a second and final defense in the following long semester. Students will

be dismissed from the program if they do not pass the proposal defense the second time.

The proposal must outline the substance and scope of the planned dissertation research and explain its merits. It has to include at least an introduction, methodology to be used, a survey of the relevant literature, and preliminary results that demonstrate the feasibility. The goal of the proposal is to establish that the student has a sufficient grasp of the fundamentals of the chosen dissertation topic to execute the research.

The proposal defense entails a public presentation of the student's dissertation proposal followed immediately by a closed defense of the proposal attended only by the student and his/her dissertation committee. The dissertation proposal must be approved by the student's dissertation advisor and a majority of the remaining members on the dissertation committee. The student's dissertation committee members must indicate their approvals on the doctoral Dissertation Proposal Form as well as on the Defense of Dissertation Proposal Form. These forms are available on The Graduate College's website.

A final copy of the dissertation proposal, accompanied by the signed approval forms, must be turned in to the doctoral program director, who will forward them to the dean of The Graduate College for review and final approval.

Candidacy and Dissertation

When all requirements for admission to candidacy have been met, the doctoral program director forwards the Application for Advancement to Candidacy to the Dean of The Graduate College for review and approval. This application form is available on The Graduate College's website.

A minimum GPA of 3.0 on all coursework undertaken in the doctoral program is required for admission to candidacy. Grades below a B on any graduate coursework cannot be applied toward the doctoral degree. Incomplete grades must have been cleared before approval for advancement to candidacy can be granted. No more than six semester credit hours of dissertation research can be taken before advancing to candidacy. No credit will be applied toward a student's doctoral degree for coursework 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 institutions.

All doctoral students must complete a dissertation that consists of original research and demonstrates mature scholarship and critical judgment in addition to familiarity with tools and methods in the chosen area. The dissertation project must adhere to the dissertation proposal and cover the topic approved by the student's dissertation committee.

After being admitted to candidacy, students must be continuously enrolled for dissertation hours each fall and spring semester until the defense of their dissertation. Typically, at least 18 semester credit hours of dissertation research must be taken after having advanced to candidacy. If a student is receiving supervision on a dissertation during the summer or if the student is graduating in the summer, the student must be enrolled in dissertation hours for the summer. All candidates for graduation must be enrolled in dissertation hours during the semester in which the degree is to be conferred, even if they have already satisfied the minimum dissertation hours.

Dissertation Research and Writing

Dissertation Committee

The initial dissertation committee chair assignment, and its continuation, is subject to the approval of both parties. A dissertation committee chair can be changed with the approval of a student's assigned dissertation committee chair, a student's new dissertation committee chair, and the doctoral program director. If a dissertation committee chair withdraws mentorship, the student must secure a new dissertation committee chair within one long semester to stay on track in the program. Failure to do so will result in dismissal from the program.

The Dissertation Committee will be responsible for administering the Comprehensive Exam and the Dissertation Proposal Defense and will oversee the research and writing of the student's dissertation. The committee will consist of 4 members, including the student's dissertation committee chair who must be a regular graduate faculty member in the program, two other graduate faculty members from the Engineering Technology department, and one doctoral graduate faculty from another department at Texas State University or from another university. The student's dissertation committee chair will chair the committee. The student, the dissertation committee chair, and the Dean of The Graduate College will approve the composition of the dissertation committee.

As per The Graduate College policy, the Dissertation Committee Chair Assignment form and the Dissertation Committee Request form must be completed and approved by the Dean of The Graduate College to form the dissertation committee. Any changes to the dissertation committee must be submitted using the Dissertation Committee Chair/Committee Member Change Request form for approval of the dissertation committee chair, the doctoral program director, and the Dean of The Graduate College. Committee changes must be submitted no later than 60 days before the dissertation defense.

Dissertation Defense

Once the dissertation has been completed, a final exam (referred to as the dissertation defense) on the dissertation must be conducted. The dissertation defense cannot be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least one month before the defense. However, students are highly encouraged to provide drafts earlier so that the committee members can provide feedback, which the student, in consultation with the dissertation advisor, will address in later drafts to ensure that the dissertation is defensible, and each committee member is satisfied before the dissertation defense takes place.

The dissertation defense consists of two parts. The first part is a public presentation of their dissertation research. The second part of the defense immediately follows the public presentation. It is restricted to participation of the student's dissertation committee and entails an oral examination of the dissertation research. Approval of the dissertation requires positive votes from the student's dissertation advisor and from the majority of the remaining members of the dissertation committee. Notice of the defense presentation will be publicly posted at least two weeks in advance.

If the dissertation defense is not approved, the student will have the option of taking a second and final dissertation defense in the following long semester. Students who do not pass the dissertation defense the second time will be dismissed from the program.

The results of the dissertation defense must be recorded in the Dissertation Defense Report Form and submitted to The Graduate College before the Dean of The Graduate College can give final approval of the dissertation. This form can be downloaded from The Graduate College's

website. The student must submit his/her dissertation to The Graduate College for final approval. The guidelines for submission and approval of the dissertation can be obtained from The Graduate College.

Students must pass the dissertation defense by the time 90 semester credit hours have been accrued. The doctoral program will review each student annually to ascertain his/her progress towards the degree and will consult the student's dissertation advisor and dissertation committee on this matter as needed. Any student who does not pass the dissertation defense by the time 90 semester credit hours have been accrued will be dismissed from the program.

Doctoral level courses in Construction Management: CSM (p. 3), MSEC (p. 4)

Courses Offered

Construction Science and Management (CSM)

CSM 7199. Dissertation.

This course includes original research and writing in construction science and management, 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.

1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.

Course Attribute(s): Exclude from 3-peat Processing

Grade Mode: Credit/No Credit

CSM 7299. Dissertation.

This course includes original research and writing in construction science and management, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.

Course Attribute(s): Exclude from 3-peat Processing

Grade Mode: Credit/No Credit

CSM 7300. Research Methods.

This course focuses on the research enterprise around construction management. Methods and procedures required to complete research in construction management will be discussed. Specific topics covered are research topics, research techniques/methods, data analysis, data management, statistical approaches to analyze data, technical writing, presenting, and publishing.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7310. Leadership in the Construction Industry.

This course provides an in-depth investigation into leadership in construction corporations. The course covers topics including strategic planning, business planning, organizational theory, competition analysis, risk management, financial analysis, human resources, management information systems, leadership, codes of ethics, and best practices.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7315. Emerging Construction Technologies.

This course is focused on covering new and emerging construction technologies for the 21st century and beyond. Specific topics covered are theoretical, practical, and strategic development in contemporary construction systems, exploration of state-of-the-art innovations in environmental control systems, sustainability, structural principles and practices, integration of innovations with information technologies, 3D printing, artificial intelligence, virtual reality, and other development of additional insights.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7320. Advanced Productivity and Lean Construction.

This course offers students insight into advanced production techniques through lean construction. Specific topics include an introduction to lean construction, concepts and methods, deduction of basic training models in lean project delivery, and application of lean management in construction projects.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7325. Construction Risk Management.

This course provides students with technical depth and understanding of how decisions are made based on available data. This course covers big data, big data management, big data analytics and visualization, data collection, analysis, interpretation, and advanced statistical analysis required for decision making and risk analysis in the construction industry.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7330. Constructability of Structures.

This course provides students with the opportunity to evaluate the design and constructability of all major construction materials. The course investigates practical applications of structural materials and how they are used in construction.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Standard Letter

CSM 7380. Construction Externship.

This course provides students the opportunity to participate in a construction externship to advance their knowledge of leadership in a modern construction company. The externship will allow students to shadow multiple leaders within a construction company, gaining experience leading multiple personnel and large-scale construction projects.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Grade Mode: Credit/No Credit

CSM 7399. Dissertation.

This course includes original research and writing in construction science and management, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.

Course Attribute(s): Exclude from 3-peat Processing

Grade Mode: Credit/No Credit

CSM 7599. Dissertation.

This course includes original research and writing in construction science and management, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.

Course Attribute(s): Exclude from 3-peat Processing

Grade Mode: Credit/No Credit

CSM 7699. Dissertation.

This course includes original research and writing in construction science and management, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.

6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.

Course Attribute(s): Exclude from 3-peat Processing

Grade Mode: Credit/No Credit

CSM 7999. Dissertation.

This course includes original research and writing in construction science and management, to be accomplished under direct supervision of the dissertation 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

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.

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 is 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 7395P. Optical properties of solids.

This course introduces the optical properties of solids, including electronic and vibrational transitions in inorganic and organic thin films and multilayers. Various optical characterization methods and techniques will be reviewed including UV/VIS spectroscopy, ellipsometry, Raman spectroscopy, Fourier transfer infrared spectroscopy, photoluminescence spectroscopy, and X-ray fluorescence spectroscopy. Students will learn to work with spectroscopy characterization methods and learn how to interpret the various spectra.

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 7395Q. Scanning probe microscopy and nanoscience.

In this course, various topics of nanoscience such as nanomechanics, nanoelectronics, and nano-optics will be introduced through the lens of scanning probe microscopy (SPM). Students will learn various scanning probe microscopy techniques along with their physical principles and applications to nanoscience. Instrumentation aspects of the SPM techniques will also be covered.

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