

Textile Engineering (TE)

TE 105 Textile Engineering: Materials and Systems (2 credit hours)

Introduction to textile engineering, polymers and fibers with emphasis on applications. Discussions of what makes macromolecules unique and pairing of material properties to a given application. Other discussions by various TE faculty giving students a picture of the breadth of the program. This course will also help develop leadership/team work skills and oral/written communications.

Corequisite: CH 101

Typically offered in Spring only

TE 110 Computer-Based Modeling for Engineers (3 credit hours)

Introductory course in computer-based modeling and programming using Visual Basic for Applications. Emphasis on algorithm development and engineering problem solving. Methodical development of VBA within applications like Microsoft Excel and Access from specifications; documentation, style; control structures; classes and methods; data types and data abstraction; object-oriented programming and design; graphical user interface design. Projects: design problems from electrical, industrial, textile, and financial systems. Functional relationships will be given and programs will be designed and developed from a list of specifications.

Prerequisite: E 115, Corequisite: MA 141

Typically offered in Fall only

TE 200 Introduction to Polymer Science and Engineering (3 credit hours)

Science and engineering of large molecules. Correlation of molecular structure and properties of polymers in solution and in bulk. Introductory polymer synthesis and kinetics. Analysis of physical methods for characterization of molecular weight, morphology, rheology, and mechanical behavior. The content will be focused on polymer synthesis, structure, and properties. The course will focus on a thorough understanding of polymer concepts and definitions, equations to calculate properties, and equipment used to measure properties.

Prerequisite: Grade of C- or better CH 101

Typically offered in Fall and Spring

TE 201 Fiber Science (4 credit hours)

Structure, physical and mechanical properties of fibers; structure of fiber assemblies. Structure/property relations. Laboratory exercises in characterization of fiber properties.

Prerequisite: CH 101 and (Grade of C- or better in MA 131 or MA 141)

Typically offered in Spring only

TE 205 Analog and Digital Circuits (4 credit hours)

Fundamentals of analog and digital circuit analysis and design. The course will present the systematic analysis and design of AC and DC circuits using Ohms and Kirchhoff's laws, the node voltage method, Thevenin and Norton's theorem, Laplace Transforms, resistance, capacitance, inductance, operational amplifiers, and frequency response. Next, the design of combinatorial and synchronous sequential circuit design will be covered using Karnaugh maps, laws of Boolean algebra, flip-flops, state machines, and latches. Laboratory exercises will supplement the topics presented in class.

Prerequisite: C- or better in TE 110, PY 208, Corequisite: MA 341

Typically offered in Spring only

TE 301 Engineering Textile Structures I: Linear Assemblies (3 credit hours)

Engineering analysis of textile structures, especially yarns. Unit processes of production, handling and packaging. Production sequences, intermachine effects, machine design and their consequences on the textile product.

Prerequisite: (MAE 206 or CE 214) and MA 242

Typically offered in Fall only

TE 302 Textile Manufacturing Processes and Systems II (4 credit hours)

Mechanisms used in the production of woven, knitted and nonwoven fabrics. Design and operation of these mechanisms and their impact on the fabric. System dynamics of the different fabric forming processes.

Prerequisite: TE 301 and C- or better in TE/ISE 110

Typically offered in Spring only

TE 303 Thermodynamics for Textile Engineers (3 credit hours)

Introduction to the concept of energy and the laws governing the transfer and transformation of energy with an emphasis on thermodynamic properties and the First and Second Laws of Thermodynamics. The fundamentals of thermodynamics will be emphasized, although more applied examples and problems will be heavily used.

Prerequisite: MA 242, PY 208

Typically offered in Fall only

TE 401 Textile Engineering Design I (4 credit hours)

The design process including initial specification, design constraints, sources of information and design strategy. Development of fact-finding ability in areas unfamiliar to the student. Analysis of existing designs and the development of improved or new designs.

Prerequisite: TE 302

Typically offered in Fall only

TE 402 Textile Engineering Design II (4 credit hours)

Application of textile engineering principles using team approach to design, construct and analyze novel engineering solutions to textile industry problems. Evaluation of design to assess the impact on worker, industry and society.

Prerequisite: TE 401

Typically offered in Spring only

TE 404 Textile Engineering Quality Improvement (3 credit hours)

Defining and quantifying quality of textile products; quality improvement using statistical process control (SPC) and design of experiment (DOE) techniques.

Prerequisite: ST 370 and C- or better in TE/ISE 110

Typically offered in Spring only

TE 424 Textile Engineering Quality Improvement Laboratory (1 credit hours)

Application of process improvement methods to textile systems using statistical software. Laboratory supplements lecture material presented in TE 404.

Corequisite: TE 404

Typically offered in Spring only

TE 435/CHE 435 Process Systems Analysis and Control (3 credit hours)

Dynamic analysis and continuous control of chemical and material engineering processes. Process modeling; stability analysis, design and selection of control schemes. Solution of differential equations using Laplace transform techniques.

Prerequisite: (MA 341 and TE 205) or CHE 312

Typically offered in Spring only

TE 440/TE 540 Textile Information Systems Design (4 credit hours)

Textile information system design, real-world constraints. Principles of hardware, software, security and ethics issues. Emphasis on solving a real world problem. Credit will not be given for both TE 440 and TE 540.

Prerequisite: C- or better in TE 110 and JR standing

Typically offered in Fall only

TE 463 Polymer Engineering (3 credit hours)

Chemical and physical properties of polymers and fibers; thermodynamics of crystallization, time dependent phenomena, fracture mechanics and rheology. Advanced topics in extrusion.

Prerequisite: MSE 201 or BME 203; and Corequisite: TE 303, MAE 301, or MSE 301

Typically offered in Fall only

TE 466/BME 466/TE 566/BME 566 Polymeric Biomaterials Engineering (3 credit hours)

In-depth study of the engineering design of biomedical polymers and implants. Polymeric biomaterials, including polymer synthesis and structure, polymer properties as related to designing orthopedic and vascular grafts. Designing textile products as biomaterials including surface modification and characterization techniques. Bioresorbable polymers.

Prerequisite: PY 208 and (TE 200 or CH 220 or CH 221 or CH 225) and (MAE 206 or CE 214)

Typically offered in Spring only

TE 467/BME 467 Mechanics of Tissues & Implants Requirements (3 credit hours)

Application of engineering and biological principles to understand the structure and performance of tendons, ligaments, skin, and bone; bone mechanics; viscoelasticity of soft biological tissues; models of soft biological tissues; mechanics of skeletal muscle; and tissue-derived devices as well as interfaces between native tissues and synthetic devices.

Prerequisite: (ZO 160 or BIO 183) and (MAE 214 or CE 225)

Typically offered in Spring only

TE 492 Special Topics in Textile Engineering (1-3 credit hours)

Presentation of material not normally available in regular course offerings or offering of new courses on a trial basis. Credits and content determined by faculty member in consultation with the Department Head.

Typically offered in Fall and Spring

TE 505 Textile Systems and Control (3 credit hours)

Theory and application of instruments and control systems used in modern textile plants. Description of basic instruments and computer systems along with their use in process control, production control, research and development.

Prerequisite: TE 305, CSC 114

Typically offered in Spring only

TE 507/TT 507/NW 507 Nonwoven Characterization Methods (4 credit hours)

Fundamentals of methods used in evaluating structures & properties of nonwoven and related materials that influence nonwoven product performance and manufacturing processing. Principles and Characterization methods of polymer thermal & rheological properties, nonwoven structural characteristics, mechanical, fluid transport, and barrier properties of nonwovens. Reliability and interpretation of test results.

Prerequisite: ST 361, Corequisite: TT/NW 505

Typically offered in Spring only

TE 518 Textile Electronics - Materials and Systems (3 credit hours)

For electronics integration, textiles are considered an unconventional substrate and a potentially disruptive technology space within wearable electronics. The objective of this course is to survey concepts in textile electronics including devices (communication, sensors, energy storage, digital processing) and use cases (military, health, wellness, infotainment). Students will examine materials and processing methods used in textile electronic development. Finally, students will use entrepreneurial design concepts to fabricate a textile electronic system.

R: Masters level standing or Senior standing with GPA >3.25

Typically offered in Spring only

TE 533/TT 533/TTM 533 Lean Six Sigma Quality (3 credit hours)

Systematic approach (Lean Six Sigma philosophy) for improving products and processes. Defining the improvement opportunity, measurement system analysis, data collection, statistical analysis, design of experiment (DOE) methods, and statistical process control (SPC) methods. Application of Lean Six sigma methods to improve product or process.

Prerequisite: ST 361 and ST 371, or equivalent

Typically offered in Spring only

TE 540/TE 440 Textile Information Systems Design (4 credit hours)

Textile information system design, real-world constraints. Principles of hardware, software, security and ethics issues. Emphasis on solving a real world problem. Credit will not be given for both TE 440 and TE 540.

Prerequisite: C- or better in TE 110 and JR standing

Typically offered in Fall only

TE 547/OR 547 Introduction to System Reliability Engineering (3 credit hours)

Quantitative methods of measuring the reliability of complex engineering systems, including statistical analysis, stochastic process, and optimization theory. Emphasis on solving real-world problems through hands-on experience from class projects.

Prerequisite: ST 370 or ST 421 or ST 501 or ST 511 or ST 515 or equivalent

Typically offered in Fall and Spring

TE 550 Clothing Comfort and Personal Protection Science (3 credit hours)

The course presents scientific principles for characterization and development of comfortable and/or protective textiles and clothing. Properties associated with human tactile response, thermal comfort and heat stress are emphasized. Inherent issues of balancing comfort versus protection are illustrated by research studies on performance garments or protective clothing systems. Methods and standards for evaluating comfort and protective performance range from bench level instruments to system level tests for ensembles using instrumented manikins, human clothing wear trials, and physiological tests.

R: Graduate Standing or Permission of Instructor
Typically offered in Fall only

TE 560 Fiber Manufacturing Technology (3 credit hours)

TE 560 is a 3-credit, intermediate course on fiber manufacturing technologies for the major classes of polymeric and inorganic fibers. The course explores innovations in fiber spinning that were necessitated by advances in polymer chemistry, the need for advanced material properties, as well as socio-economic concerns. The chemistry of polymers is discussed in terms of its role on fiber manufacturing by melt and solution spinning technologies. The microstructure and performance properties of fibers are discussed in context of the manufacturing technology.

R: Senior or Graduate Student Standing
Typically offered in Fall only

TE 561/TT 561 Human Physiology for Clothing and Wearables (3 credit hours)

This course will provide students with the knowledge of scientific principles on the interactions between textiles and the human body. The students will learn some basics of human physiology, specifically as it relates to the interactions of the human with clothing and other related body worn products (protective wear, e-textile products and sensors). An important part of this course will focus on the thermal strain of humans when being active and wearing (protective) clothing. As the thermal heat balance is an important part of this course, students will learn to do a basic thermal analysis and computation of the human heat balance, including the influence of clothing. Also test and evaluation methods to assess clothing performance will be addressed on thermal aspects as well as addressing other ergonomics aspects of clothing, such as restriction of movement, visual and auditory aspects.

R: Graduate Standing or Permission of Instructor
Typically offered in Fall only

TE 562/OR 562/ISE 562 Simulation Modeling (3 credit hours)

This course concentrates on design, construction, and use of discrete/continuous simulation object-based models employing the SIMIO software, with application to manufacturing, service, and healthcare. The focus is on methods for modeling and analyzing complex problems using simulation objects. Analysis includes data-based modeling, process design, input modeling, output analysis, and the use of 3D animation with other graphical displays. Object-oriented modeling is used to extend models and enhance re-usability.

Typically offered in Spring only

TE 565/TMS 565 Textile Composites (3 credit hours)

Fiber architecture of textiles used for composites. Manufacturing processes and geometric quantification. Basic analysis for predicting elastic properties. Interrelationship of elastic properties and geometric quantities. Failure criteria for these materials.

Prerequisite: MA 341, MAE 206
Typically offered in Fall only

TE 566/BME 566/TE 466/BME 466 Polymeric Biomaterials Engineering (3 credit hours)

In-depth study of the engineering design of biomedical polymers and implants. Polymeric biomaterials, including polymer synthesis and structure, polymer properties as related to designing orthopedic and vascular grafts. Designing textile products as biomaterials including surface modification and characterization techniques. Bioresorbable polymers.

Prerequisite: PY 208 and (TE 200 or CH 220 or CH 221 or CH 225) and (MAE 206 or CE 214)
Typically offered in Spring only

TE 570/PY 570 Polymer Physics (3 credit hours)

Polymer microstructures, solutions, physical states (including amorphous polymers, crystalline polymers, polymer melts, melting of polymers, glass-transition, and other transitions), polymer blends, mechanical properties, and viscoelasticity and flow, multicomponent polymer systems, and modern polymer topics. The physics of polymer fibers. Graduate standing or permission of instructor.

Typically offered in Fall only

TE 575 Composite Materials Processing (3 credit hours)

Advanced fiber reinforced composites are considered the best candidates for many important applications in aerospace, transportation, civil infrastructures, and sporting goods industries. This course will give an in-depth look into the raw materials and processing methods to produce these composite materials. In addition to production, topics will be covered on the machining and assembly of composite components, testing, and evaluation of the components.

Typically offered in Spring only

TE 589/TMS 589/TC 589 Special Studies In Textile Engineering and Science (1-4 credit hours)

New or special course on developments in textile engineering and science. Specific topics and prerequisites identified vary. Generally used for first offering of a new course.

Prerequisite: Senior standing or Graduate standing
Typically offered in Fall, Spring, and Summer

TE 601 Seminar (1 credit hours)

Typically offered in Fall and Spring

TE 630 Independent Study (1-3 credit hours)

Typically offered in Fall, Spring, and Summer

TE 676 Special Projects (1-3 credit hours)

Typically offered in Spring only

TE 685 Master's Supervised Teaching (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Master's student

Typically offered in Fall only

TE 690 Master's Examination (1-9 credit hours)

For students in non thesis master's programs who have completed all other requirements of the degree except preparing for and taking the final master's exam.

Prerequisite: Master's student

Typically offered in Fall, Spring, and Summer

TE 693 Master's Supervised Research (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Master's student

Typically offered in Fall and Spring

TE 695 Master's Thesis Research (1-9 credit hours)

Thesis Research

Prerequisite: Master's student

Typically offered in Spring only

TE 696 Summer Thesis Research (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Master's student

Typically offered in Summer only

TE 699 Master's Thesis Preparation (1-9 credit hours)

For students who have completed all credit hour requirements and full-time enrollment for the master's degree and are writing and defending their thesis. Credits arranged

Prerequisite: Master's student

Typically offered in Fall only