

# Textile Technology (TT)

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## **TT 105 Introduction to Textile Technology** (3 credit hours)

Introduction to Textile and Apparel, Technology and Management. Structures and production methods for fabrics, yarn, and fibers. Introduction to the nature of polymers and the characteristics of polymers which make them useful for producing fibers that are practically and aesthetically desirable. Design of end products as well as fundamental economic and supply chain issues.

*Typically offered in Fall, Spring, and Summer*

## **TT 221 Yarn Production and Properties I** (2 credit hours)

The techniques available for manufacturing yarns from staple fibers. A review of yarn numbering and fiber properties. The principles involved in opening, cleaning, blending, drafting, twisting and winding. Short and long staple spinning systems including a review of opening and cleaning lines, carding, draw frames, roving frames and different spinning machines. Filament yarn processing.

Prerequisite: TT 105 or MT 105; Corequisite: MA 131 or MA 141

*Typically offered in Fall, Spring, and Summer*

## **TT 252 Formation and Structure of Textile Fabrics** (4 credit hours)

Fundamentals of the conversion of fibers and yarns into woven, knitted, and nonwoven fabrics, and fabrics' conversion systems. Introduction to woven, knitted and nonwoven fabric design structure. Structure, property, and performance relations of textile fabrics. Testing and evaluation of textile structures.

Prerequisite: TT 221 or TTM 106

*Typically offered in Fall, Spring, and Summer*

## **TT 305 Introduction to Nonwoven Products and Processes** (3 credit hours)

Fiber web/nonwoven fabrics produced directly from fibers or their precursors. Physical and chemical nature of local bonding and fiber entanglement. Viable processes for producing these fabrics. Economic justification for process and production. Product/process interaction. Plant visits whenever possible.

Prerequisite: TMS 211 and (MA 131 or MA 141) and (PY 211 or PY 205 and 206); Corequisite: ST 311 or ST 370

*Typically offered in Fall, Spring, and Summer*

## **TT 327 Yarn Production and Properties** (4 credit hours)

The processing of natural and synthetic, fibers and filaments into yarns. The impact of fiber selection and processing parameters on the quality of the yarn and subsequent products. Major processing routes for staple fibers and filaments together with recent developments in applicable technologies.

Prerequisite: (MA 231 or MA 241) and (PY 211 or (PY 205 and PY 206)); Corequisite: TMS 211 or TE 201

*Typically offered in Fall only*

**TT 331 Performance Evaluation of Textile Materials** (4 credit hours)  
Standards, principles and effects of test conditions in measuring basic physical and mechanical properties of textile materials. Design of test and interpretation of test results in relation to end-use performance, product development, process control, research and development and other requirements.

Prerequisite: (ST 311 or ST 370) and (TT 327 or TE 301) and (PY 211 or (PY 205 and PY 206)) and (MA 231 or MA 241)

*Typically offered in Spring only*

## **TT 341 Knitted Fabric Technology** (3 credit hours)

Review of knitted fabric production techniques. Technology of more advanced weft and warp knitting. Jersey and rib fabric modification techniques, yarn knitability and productivity, yarns, creels, patterning and machinery developments, manufacture and properties of warp knit fabrics such as mesh, laid-in, weft insertion and plush. Quality measures, measurement and standards, defects and problem solving. Management of knitting operations.

Prerequisite: TT 327

*Typically offered in Spring only*

## **TT 351 Woven Products and Processes** (3 credit hours)

Design and development of various woven textile products including their component properties, performance, requirements, structures, and methods of production. The primary objective of the course is to introduce students to various woven textile products, including those used in automotives, agriculture, construction, ETC. and stimulate understanding of their structure, performance requirements, and relevant manufacturing principles including braiding.

Prerequisite: TT 327 and (PY 211 or (PY 205 and PY 206))

*Typically offered in Fall only*

## **TT 380/FTM 380 Management and Control of Textile and Apparel Systems** (3 credit hours)

Management approaches, practices and basic economic considerations in the development, production and distribution of industrial and consumer textile and apparel products.

Prerequisite: FTM 217

*Typically offered in Fall only*

## **TT 401 Textile Technology Senior Design I** (4 credit hours)

This is Part 1 of 2 for the Senior Capstone Design Course. Students work in cross-functional teams to research and solve real-world problems in fibers, polymers, and textile science utilizing their foundation skills in Textile Technology. TT 401 and TT 402 must be taken in the same academic year as the class is project and team dependent. Students will be required to meet outside the normal class times as well as expected to participate in various off-campus field trips and activities for successful completion of the project. Project sponsors will cover any transportation costs that are incurred. TT majors only.

Prerequisite: TT 331 and TT 341 and (TT 404 or NW 404); Corequisite: TT 351

*Typically offered in Fall only*

**TT 402 Textile Technology Senior Design II** (4 credit hours)

This is Part 2 of 2 for the Senior Capstone Design Course. Students work in cross-functional teams to research and solve real-world problems in fibers, polymers, and textile science utilizing their foundation skills in Textile Technology. TT 401 and TT 402 must be taken in the same academic year as the class is project and team dependent. Students will be required to meet outside the normal class times as well as expected to participate in various off-campus field trips and activities for successful completion of the project. Project sponsors will cover any transportation costs that are incurred. TT majors only.

Prerequisite: TT 401

*Typically offered in Spring only*

**TT 404/TT 504/NW 504/NW 404 Introduction to Nonwovens Products and Processes** (3 credit hours)

This course introduces the fundamentals of nonwoven structures, process, and products. It provides performance criteria, raw materials, manufacturing methods, and market outlooks of major nonwoven application segments including hygiene, wipes, filters, medical, automotive, and geotextile. Emphasis is placed on building basic understandings of process/structure/property relationship in nonwoven product and the economic justification for process and production.

Prerequisite: (MA 131 or 141), PY 205; Corequisite: TT 503

*Typically offered in Fall only*

**TT 405/TT 505/NW 505/NW 405 Advanced Nonwovens Processing** (3 credit hours)

Mechanisms used in the production of nonwoven materials. Design and operation of these mechanisms. Process flow, optimization of process parameters, influence of process parameters on product properties.

Prerequisite: MA 231 or MA 241, PY 211 or (PY 205 and PY 206), TT 305 or TT 404

*Typically offered in Spring only*

**TT 407 Characterization Methods in Nonwovens** (3 credit hours)

Fundamentals of methods used in evaluating properties and performance of nonwovens. Assessment of thermal, mechanical, moisture transport and barrier properties of nonwovens. Reliability and interpretation of test results.

Prerequisite: ST 311 or ST 370; and TT 305 or TT 404

*Typically offered in Spring only*

**TT 408/TT 508/NW 508/NW 408 Nonwoven Product Development** (3 credit hours)

Fundamentals of nonwoven product development. In-depth knowledge of the materials, processes and nonwovens products. Design of a set of experiments intended for product development. Students work in teams to design, fabricate and evaluate nonwoven products.

Prerequisites: TT 405 and TT 407

*Typically offered in Spring only*

**TT 431 Quality Management and Control In Textile Manufacturing** (3 credit hours)

Principles of quality and process management and control in textile/apparel manufacturing with emphases in quality management systems, quality costs, statistical control chart procedures, process capability, acceptance sampling, and optimal process and product design and improvement methods.

Prerequisite: ST 311 or ST 370

*Typically offered in Spring only*

**TT 451/TT 551 Advanced Woven Fabric Design** (3 credit hours)

Design and production requirements for highly specialized woven fabric structures. The laboratory activities will include a project on design from concept to final production and finishing.

Prerequisite: (TT 252 or TT 351) and Senior Standing

*Typically offered in Fall only*

**TT 470 Jacquard Woven Fabric Design** (3 credit hours)

This course is dedicated to the study of Jacquard woven fabric design and structural technology through the use of CAD as both an aesthetic and technical tool, and will culminate in each student producing a unique fabric collection based upon his/her developed area of interest. Jacquard design for many different end uses is addressed, from art fabrics to unique specialty products. A field trip in this course will require personal transportation.

Prerequisite: TT 252, TT 371

*Typically offered in Fall only*

**TT 480/FTM 480 Operations Management Decisions for Textiles** (3 credit hours)

Quantitative techniques for decision making and management in the textile complex. Applications include vendor selection, plant location, retail inventory management, forecasting demand, project management, and logistics planning. Techniques covered include simulation, PERT/CPM, mathematical modeling.

Prerequisite: TT/FTM 380 and ACC 210 and ST 311 or ST 370 and ((MA 131 and 132) or MA 141)

*Typically offered in Fall only*

**TT 481 Design and Technology of Technical Textiles** (3 credit hours)

Performance requirements of various technical textiles. Underlying principles of design, application, manufacture, and evaluation of fibrous structures intended to meet specific end-use requirement.

Prerequisite: (TT 305 or TT 404) and TT 341 and TT 351

*Typically offered in Fall only*

**TT 485/FTM 485 Textile Computer Integrated Enterprise** (3 credit hours)

Survey of information technology in textile and apparel industries. Topics discussed include: computer aided design (CAD); computer aided manufacturing (CAM); computer aided engineering (CAE); material handling systems; automation and robotics; logistics and warehousing systems; retail product tracking, and Internet resources.

Prerequisite: TT/FTM 380

*Typically offered in Fall only*

**TT 486/FTM 486 Supply Chain Management in the Textile Industry** (3 credit hours)

Study of the operations necessary to produce and distribute a product, starting with the procurement of the raw material used in making the goods and ending with the delivery of the finished product. Topics covered include approaches to solving problems in manufacturing, sourcing, transportation logistics, and retail operations within the Integrated Textile Complex. Credit cannot be given for both TAM486 and MT386.

Prerequisite: TT/FTM 380

*Typically offered in Spring only*

**TT 499 Textile Senior Project** (4 credit hours)

This is a project based course to be taken in the last semester of the Senior year. In this capstone course the students work in cross-functional teams to research and solve applied problems in textile related fields. The results of the projects will be presented formally at the end of the semester. Course should be taken in the last semester of the Senior year. It cannot be substituted by other project courses

Prerequisite: Senior standing

*Typically offered in Fall and Spring*

**TT 500 Understanding the Textile Complex** (3 credit hours)

This course provides an overview of product development, processing, managing, financing, etc., for the textile industry. It is designed to give new graduate students basic preparations for more advanced, required textile courses. Students will also gain insight into the research being conducted within the College of Textiles.

Prerequisite: Graduate standing

*Typically offered in Fall only*

**TT 503/NW 503 Materials, Polymers, and Fibers used in Nonwovens** (3 credit hours)

Fundamentals of raw material used in nonwoven processes. Raw material production, chemical and physical properties of nonwoven raw materials and assessment of material properties. Introduction of structure/property relationships for these materials and how these relationships influence end use applications.

Prerequisite: MA 141, PY 205, PCC 203

*Typically offered in Fall and Spring*

**TT 504/NW 504/NW 404/TT 404 Introduction to Nonwovens Products and Processes** (3 credit hours)

This course introduces the fundamentals of nonwoven structures, process, and products. It provides performance criteria, raw materials, manufacturing methods, and market outlooks of major nonwoven application segments including hygiene, wipes, filters, medical, automotive, and geotextile. Emphasis is placed on building basic understandings of process/structure/property relationship in nonwoven product and the economic justification for process and production.

Prerequisite: (MA 131 or 141), PY 205; Corequisite: TT 503

*Typically offered in Fall and Spring*

**TT 505/NW 505/NW 405/TT 405 Advanced Nonwovens****Processing** (3 credit hours)

Mechanisms used in the production of nonwoven materials. Design and operation of these mechanisms. Process flow, optimization of process parameters, influence of process parameters on product properties.

Prerequisite: MA 231 or MA 241, PY 211 or (PY 205 and PY 206),

TT 305 or TT 404

*Typically offered in Spring only*

**TT 507/NW 507/TE 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*

**TT 508/NW 508/NW 408/TT 408 Nonwoven Product Development** (3 credit hours)

Fundamentals of nonwoven product development. In-depth knowledge of the materials, processes and nonwovens products. Design of a set of experiments intended for product development. Students work in teams to design, fabricate and evaluate nonwoven products.

Prerequisites: TT 405 and TT 407

*Typically offered in Fall and Spring*

**TT 520 Yarn Processing Dynamics** (3 credit hours)

Principles and practice involved in modern yarn and manufacture; including machine-fiber interactions occurring during different processing stages. Not normally for credit for undergraduate textile majors.

Prerequisite: Graduate standing or PBS status

*Typically offered in Fall and Spring*

**TT 521/TMS 521 Filament Yarn Production Processing and Properties** (3 credit hours)

Structure, properties and processes for manufacturing and treating continuous filament yarns. Response of fibers to elevated temperatures, twist, false twist and various bulking processes. Yarn structures and properties required for stretch and molded fabrics. Independent laboratory and critical literature review in general area of filament yarn processing, properties and test methods. credit not allowed for both TT 521 and TT 425

Prerequisite: Graduate standing or PBS status

*Typically offered in Fall, Spring, and Summer*

**TT 530/TTM 530 Textile Quality and Process Control** (3 credit hours)

Quality control and improvement methods for textile processes and products including quality systems, statistical control chart procedures, process capabilities, acceptance sampling plans, textiles process and product designs, on-line and off-line control systems and specific quality factors governing textile products and processes and their variabilities.

Prerequisite: TT 420, Corequisite: ST 511 or ST 515

*Typically offered in Spring only*

**TT 532 Evaluation of Biotextiles** (3 credit hours)

Evaluation of the performance of biotextiles and medical polymers in biological and microbiological environments, with an emphasis on "in vitro" and "in vivo" techniques for testing the biocompatibility and biostability of implantable biomedical products. Related issues will deal with quality assurance systems, inspection and sampling plans, ISO certification, GMP's, reference materials and organisms, and the use of accelerated tests an animal trials so as to meet regulatory requirements.

Prerequisite: BIO 183 and TT327

*Typically offered in Fall only*

**TT 533/TTM 533/TE 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*

**TT 535/TTM 535 Research Methods and Management** (3 credit hours)

This course provides students with an understanding and appreciation of the basic principles of research methods when using qualitative, quantitative or a mixed methods approach. This course will provide guidance to students in conducting their thesis project and cover all aspects of a thesis project, including but not limited to the first three chapters, defining the problem, conducting and writing the literature review, use of theories and a conceptual framework, data collection and analyses, ethical considerations and IRB approval, and the Electronic Thesis Dissertation requirements. Students will be assigned additional readings and learning activities that will expand the understanding of the research process. This course is geared to students who have narrowed down their research topic in collaboration with their committee chair.

Restriction: TTM Students, FPS Students, or a Master's of Science in Textiles, Textile Engineering, or Textile Chemistry. Graduate standing or permission of instructor.  
*Typically offered in Fall and Spring*

**TT 549 Warp Knit Engineering and Structural Design** (3 credit hours)

Engineering analysis of tricot and raschel machinery. Design of yarn let-off and fabric take-up mechanisms. Studies of fabric production techniques and quality control systems. Theory of production optimization and the properties of fabrics. Complexgeometrical loop models and their application.

Prerequisite: TT 443  
*Typically offered in Spring only*

**TT 550 Production Mechanics and Properties of Woven Fabrics** (3 credit hours)

Interrelation between mechanics of production and mechanical properties of woven fabric; unit operations required to prepare yarns for weaving and the mechanism employed in weaving; fabric structure, geometry and mechanical properties; designing for specific fabrics properties. Not normally for credit for undergraduate textiles majors.

Prerequisite: Graduate standing or PBS status  
*Typically offered in Spring only*

**TT 551/TT 451 Advanced Woven Fabric Design** (3 credit hours)

Design and production requirements for highly specialized woven fabric structures. The laboratory activities will include a project on design from concept to final production and finishing.

Prerequisite: (TT 252 or TT 351) and Senior Standing  
*Typically offered in Fall only*

**TT 553 Formation and Structure of Woven and Knitted Fabrics** (3 credit hours)

The interrelation between the mechanics of production and mechanical properties of woven and knitted fabrics; unit operations required to prepare yarns for weaving and knitting and mechanisms employed in weaving and knitting; fabric structure, geometry and mechanical properties; designing for specific fabric properties. Students will not be allowed credit for TT 553 and (TT 541, TT 549, and TT 550).

*Typically offered in Spring only*

**TT 561/TE 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*

**TT 570 Textile Digital Design and Technology** (3 credit hours)

This course focuses on design of textile products balancing industry and creative foci. Students will study a range of industry focused technologies and techniques essential to creation of textile products in a technology intensive environment. Basics of textile product design and relevant technologies will be covered along with methods and techniques to improve commercial textile product design process. Students will research in-depth a topic related to textile product design, and present their research in an oral format.

Prerequisite: Graduate standing  
*Typically offered in Fall only*

**TT 571 Professional Practices in Textile Design and Technology** (3 credit hours)

This course builds on the concepts introduced in TT 570 with increased focus on professional practice and methods. Focus on advanced textile product design topics incorporating an industry focus and utilizing commercial technologies. Students will investigate in depth a textile product design industry application, technique or method of interest using individual and team based strategies. Topics include advanced study of textile product design concepts, techniques and preparation for professional competitions, displays and conferences.

Prerequisite: TT 570  
*Typically offered in Spring only*

**TT 581 Technical Textiles** (3 credit hours)

Performance requirements of various technical textiles. Underlying principles of design and manufacturing of fibrous structures to meet specific needs in mechanical and other behaviors.

Prerequisite: TT 520 or TT 521, and TT 550  
*Typically offered in Fall only*

**TT 591 Special Studies in Textile Technology** (1-4 credit hours)  
Special Studies in Textile Technology to fulfill needs not covered by current offering. Student and faculty required to submit topics to be covered to director of graduate programs within first week of semester.

Prerequisite: Graduate standing or PBS status  
*Typically offered in Fall, Spring, and Summer*

**TT 601 Seminar** (1 credit hours)  
Discussion of scientific articles of interest to the textile industry; review and discussion of student papers and research problems.

*Typically offered in Fall and Spring*

**TT 630 Independent Study in Textile Technology** (1-3 credit hours)  
Problems of specific interest in textile technology. Preparation of report, in format suitable for publication required. One-page outline signed by advisor must be submitted to director of graduate programs within first week of semester. A maximum of 3 credit hours will be allowed towards Master of Textiles Degree. No credit is allowed towards MS (Textiles).

*Typically offered in Fall, Spring, and Summer*

**TT 676 Special Projects Textile Technology** (1-3 credit hours)  
*Typically offered in Fall and Spring*

**TT 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*

**TT 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 and Spring*

**TT 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*

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

Prerequisite: Master's student  
*Typically offered in Spring only*

**TT 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*

**TT 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.

Prerequisite: Master's student  
*Typically offered in Spring only*

**TT 896 Summer Dissert Res** (1 credit hours)