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# Textile Technology and Textile Chemistry

## Faculty and Fields of Interest

**Calvert, Paul** (Chairperson Department of Textile Science) Professor of Textile Sciences (2003), BA 1967 Cambridge University, PhD 1971 Massachusetts Institute of Technology. *Specializations:* Material Science, polymer and ceramic structure/property relations, biomaterials, nonconventional ink jet printing.

**Fan, Qingou** Assistant Professor of Textile Science (1998), BS 1982, MS 1988 China Textile University, PhD 1995 University of Leeds. *Specializations:* Textile chemistry, dyeing and finishing, chemical analysis, organic synthesis.

**Kim, Yong Ku** (Graduate Program Director) Professor of Textile Sciences (1981), BS 1970, MS 1974 Seoul National University, Korea, PhD 1980 North Carolina State University. *Specializations:* Fiber/polymer physics, composite materials, structural mechanics of fibrous structures, medical textiles.

**Langley, Kenneth** Chancellor Professor of Textile Sciences (1968), BS 1964 Southeastern Massachusetts Technological Institute (UMass Dartmouth), MS 1968 Institute of Textile Technology. *Specializations:* Microscopy and statistics, yarn manufacturing.

**Lewis, Armand F** Adjunct Professor. PhD Lehigh University, MS Oklahoma State University, BS Southeastern Massachusetts University (UMass Dartmouth). *Specializations:* Dyeing, material sciences, polymer chemistry.

**Ugbolue, Samuel C** Visiting Lecturer in Textile Sciences (1998), Ctext 1968 Blackburn College of Technology and Design, MSc 1971, PhD 1974 University of Strathclyde. *Specializations:* Polymer and fiber science, yarn manufacture, textile evaluation, clothing engineering.

**Warner, Steven** Professor of Textile Sciences (1994), SB 1973, SM 1973, ScD 1976 Massachusetts Institute of Technology. *Specializations:* Fibers, composites, non-wovens, microscopy, wicking, and wetting.

# Graduate Textile Technology/Textile Chemistry at UMass Dartmouth

## Department of Textile Sciences College of Engineering

The objectives of the Master of Science degrees in Textile Technology and Textile Chemistry are

- To supply graduates qualified to assume leadership roles in the textile industry
- To provide a sound education essential to developing the student's ability to initiate and conduct independent investigations.
- To develop a comprehensive understanding of the student's major area of interest through course work, independent study, and a thesis endeavor that ensures the student has developed a logical and creative mind.

Graduate studies in textile technology provide advanced studies in the science and technology of fibrous materials, the conversion of these into related structures and, as well, their chemical and physical performance. Students of textile chemistry study advanced applications of chemistry to the coloration and alteration of the functional properties of textile structures. Both programs address fundamental science and technology and, as well, the applicable technology of manufacturing. We encourage our students to participate in our extensive internship program.

The Textile Sciences building has large laboratory spaces devoted to research and education, with equipment for the processing of yarn from the raw material and the conversion of these yarns into various textile structures from wovens and knits to composites and specialty products. Equipment is also available for dyeing small lots of fibers, yarns, and fabrics both atmospherically and under pressure; applying various chemical finishes; experimenting with wet finishing operations, and evaluating performance properties during all processing stages. Textiles graduate students have done research and development work in many industry settings in the area as well as in the on-campus Advanced Technology and Manufacturing Center.

UMass Dartmouth has joined five different universities in membership in the National Textile Center. This Center has awarded at least a \$500,000 grant for each of the past four years, to support textile research projects by the Department of Textile Sciences. The grant funds research and provides stipends for graduate student assistantships.

## Admission Requirements

Applicants must submit the required application materials to the Graduate Office. In addition, the following considerations apply:

- The Graduate Record Exam (GRE) is required of all applicants.
- Applicants are further required to submit a comprehensive statement of educational objectives and goals, which would accompany the student's application.
- Each applicant will be examined in light of his or her academic record as well as specific work experience.

Candidates for Textiles graduate programs will have completed BS degrees in Textile Sciences, Textile Engineering, Textile Technology, or other engineering or applied science and technology fields. Successful applicants with degrees in other disciplines may be required to undertake foundation courses prior to advancement to candidacy for a degree in Textile Sciences. The foundation courses required will be determined in accordance with the student's background, interests, and goals.

## Financial Assistance

A number of assistantships are available on a competitive basis. Indicate your interest on the admissions application form. The department offers research assistantships associated with a variety of research grants and contracts, including projects sponsored by the National Textile Center.

Other assistance, such as loans or work-study, may be available to you. In addition, graduate students in both Textile Technology and Textile Chemistry at UMass Dartmouth who come from Connecticut, Maine, New Hampshire, Rhode Island, or Vermont qualify under the New England Regional Student Program for a significant reduction in out-of-state tuition. For information on both aspects, please refer to the chapter on "Expenses and Financial Assistance."

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### Degree Requirements in Textile Technology (MS degree)

The student is required to complete 30 graduate credits of study. There is no foreign language requirement. The program will normally require two years of study.

#### Fall Semester I

**TET 503** one credit  
Research Techniques  
**TET 563** three credits  
Fibrous Structure  
**TET Elective** three credits  
Graduate course in textile technology  
**Elective** three credits  
Appropriate 400, 500, or 600 level course  
in a Textiles-related field

**Total: 10 credits**

#### Fall Semester II

**TET 504** three credits  
Graduate Seminar  
**TET 500** eight credits  
Thesis

**Total: 11 credits**

#### Spring Semester I

**TET 508** three credits  
Design and Analysis of Experiments  
**TET Elective** three credits  
Graduate course in textile technology  
**Elective** three credits  
Appropriate 400, 500, or 600 level course  
in a Textiles-related field

**Total: 9 credits**

#### Spring Semester II

Continue with thesis research and writing

**Total Program Credits: 30**

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### Degree Requirements in Textile Chemistry (MS degree)

The student is required to complete 30 graduate credits of study. There is no foreign language requirement. The program will normally require two years of study.

#### Fall Semester I

**TET 503** one credit  
Research Techniques  
**TEC 502** three credits  
Physical Chemistry of Dyeing  
**TEC 509** three credits  
Chemical Techniques of Finishing  
**Elective** three credits  
Appropriate 400, 500, or 600 level course  
in a textiles-related field

**Total: 10 credits**

#### Fall Semester II

**TET 504** three credits  
Graduate Seminar  
**TEC 500** eight credits  
Thesis

**Total: 11 credits**

#### Spring Semester I

**TET 508** three credits  
Design and analysis of Experiments  
**TEC 510** three credits  
Polymer Chemistry  
**TEC 533** three credits  
Computer Color Matching

**Total: 9 credits**

#### Spring Semester II

Continue with thesis research and writing

**Total Program Credits: 30**

### Thesis — Both Degrees

Every student will do a master's thesis. The thesis requirement may be fulfilled in the textile sciences or may be of an interdisciplinary nature. In the latter instance, however, the emphasis must be on some aspect of either textile chemistry or textile technology, depending on the student's chosen program. Students with an undergraduate specialty in an area other than textiles have the opportunity to couple this knowledge with textiles in either a scientific, theoretical, or more applied project. The student should meet at the earliest possible date after the start of studies with the Textile Sciences Graduate Program Director to discuss his or her interests regarding thesis study. At that time, the student will be assigned a thesis committee of faculty whose background is compatible with the student's area of interest. The student will also receive a copy of the outline for a thesis proposal.

Upon the completion of a thesis proposal, the Committee will meet with the student to finalize the proposed work. The proposal should be made available to the Committee members at least one week prior to the scheduled meeting.

Each committee member should be provided with a draft copy of the completed thesis, no later than two calendar months prior to the scheduled graduation date. An oral examination in defense of the thesis is required to be given before the Committee at least six weeks prior to graduation. At this time, the rough-draft copies, comments and corrections having been made, will be returned from each committee member.

The approved thesis must be available at least three weeks prior to graduation. In addition to the two copies prepared for deposit in the University of Massachusetts Dartmouth library, two bound copies will be given respectively to the student's main advisor and the Department of Textile Sciences.

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### Contact

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## Textile Chemistry Courses

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**TEC 500** eight credits

### **Thesis**

Written presentation of an original research topic in Textile Chemistry, which demonstrates analysis, ability, and proficiency in the solution. The thesis shall be conducted under the supervision of a faculty advisor. An oral examination in defense of the thesis is required. Graded CR/F.

**TEC 501** four credits

### **Chemistry of Dyestuffs**

This course deals with the chemistry and technology of dyestuffs. The raw materials, intermediates and finished dyestuffs are studied in detail. The effect of the constitution on color and fastness properties is emphasized. Theoretical as well as practical, economic, and ecological points of view are presented. The preparation of typical intermediates and dyestuffs is carried out in the laboratory.

**TEC 502** three credits

### **Physical Chemistry of Dyeing**

This is a lecture course concerned with the physiochemical theories of the application of dyestuffs to textile and related materials, including the thermodynamics and kinetic principles involved.

**TEC 503** three credits

### **Physical Chemistry of Surface Active Agents**

This lecture course is concerned with physiochemical principles involved in surface-active agents. The chemical nature of the agents is studied and related to their properties. The technical uses are evaluated on this basis.

**TEC 506** three credits

### **Survey of Current Textiles**

Studies in this course include a survey of the fundamental reference works and literature of Textile Chemistry. Timely reports are required concerning recent advances in the manufacture, modification, dyeing and finishing of synthetics and blends.

**TEC 508** three credits

### **Advanced Textile Printing**

Prerequisite: TEC 411

The more complex styles of printing, discharge and resist, are covered in detail. The preparation of white and colored print paste for all classes of dyed backgrounds is investigated. Attention is given in dyeing ground shades for discharge printing. Special effects such as Plisse, Burn-out and Vigoreaux styles are considered.

**TEC 509** three credits

### **Chemical Technology of Finishing**

This course is more comprehensive than that given in the undergraduate course. Greater detail is provided concerning the mechanisms used in the application of specialized finishes and the chemical reactions involved.

**TEC 510** three credits

### **Polymer Chemistry**

The physical and organic chemistry of monomers and polymers, including a consideration of bonding forces, spectroscopic methods of structure determination, structure and property correlations, fractionation, thermodynamics, and methods of molecular weight determination for polymers in solution; the kinetics of condensation and additional polymerization as applied to polymers and copolymers, mechanism of free radical and ionic polymerization, stereospecific polymers, the chemistry of the more common polymers systems, and preparation of their corresponding monomers.

**TEC 521** three credits

### **Textile Chemistry I**

The mechanics of dyeing, printing, and finishing. The structures of dyes and textile fibers, detergency and scouring, and dyeing equipment and procedures.

**TEC 522** three credits

### **Textile Chemistry II**

The principles involved in the application and printing of dyes and pigments on textile materials. Topics include textile finishing and functional requirements of permanent press, softness, water repellancy, and fire retardance.

**TEC 523** one-half credit

### **Textile Laboratory Practice I**

Practice and experimentation in the dyeing of fibers with various dyes, wash and lightfastness properties, finishing.

**TEC 524** one-half credit

### **Textile Laboratory Practice II**

A continuation of TET 524, includes fiber microscopy, textile printing exercises, experiments in color science including measurement and assessment.

**TEC 525** three credits

### **Fiber Materials**

The structure and production of fibers, including molecular arrangements and morphologies. The conversion of fibers into textile yarn structures and the relationship between physical and chemical properties of fibers and processing dynamics on the yarn properties will be studied.

**TEC 533** three credits

### **Computer Color Matching**

Prerequisite: Graduate standing in textiles  
A complete discussion of color science and computer match prediction in dyeing fibers, yarns, and fabrics. Objective specification of color, color difference, measurements, and various color spaces are introduced. Based on color theory and numerical analysis, computer match prediction algorithms are discussed. Practical fiber/dye data files are created and used to reproduce dyed samples with the match prediction software in accompanying computer color matching labs.

**TEC 595**

### **Independent Study**

Prerequisites: Permission of instructor, graduate director, and college dean  
Study under the supervision of a faculty member in an area not otherwise part of the discipline's course offerings. Conditions and hours to be arranged.

**TEC 596** three credits

### **Directed Study**

Prerequisites: Permission of the instructor, graduate director, and college dean  
Study under the supervision of a faculty member in an area covered in a regular course not currently being offered. Conditions and hours to be arranged.

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## Textile Technology Courses

Note: Graduate Textile Technology and Textile Chemistry courses (500-level) are open only to students with graduate standing.

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**TET 500** eight credits

### Thesis

Written presentation of an original research topic in Textile Technology, which demonstrates analysis, ability, and proficiency in the solution. The thesis shall be conducted under the supervision of a faculty advisor. An oral examination in defense of the thesis is required. Graded CR/F.

**TET 501** three credits

### Yarn Technology

Prerequisite: TET 511

Aspects of yarn processing which affect the properties of the product during the various stages of manufacturing. Extensive use of reference materials is required in completion of written reports on subject matter assigned. To familiarize the student with research procedures and the evaluation of results, actual project reports will be studied.

**TET 502** three credits

### Yarn Technology

Continuation of TET 501.

**TET 503** one credit

### Research Techniques

Aids the student in better understanding research approach and techniques. To develop an insight as to the evaluation of research results. A proposal on an original research topic must be submitted and approved.

**TET 504** three credits

### Graduate Seminar

Student discussions on selected topics will be carried out under the supervision of a faculty member. Written papers to be submitted on those topics assigned.

**TET 506** three credits

### Independent Study

Prerequisite: graduate standing

Individual study under the supervision of a faculty member in an area of textiles not otherwise a part of the course offerings. Students shall be held responsible for meeting the requirements of independent study as outlined in an approved proposal.

**TET 507** three credits

### Textile Microscopy and Photomicrography

Prerequisite: TET 462

The use of the microscope in relation to fiber identification and structure, composition of blends, physical, chemical, and biological condition of yarns and fabrics. Recording of data by photomicrography is included.

**TET 508** three credits

### Design and Analysis of Experiments

A study of the statistical methods and systems employed in the design of experiments, the testing of materials, and the evaluation of test data.

**TET 511** three credits

### Fabric Technology

An investigation into advanced styling and the development of methods of textile fabrication. Requirements of modification and the introduction of new procedures are studied pertaining to new design in fabric construction for improved performance and specific uses. Extensive research of reference material is conducted with written reports submitted on assigned related subject matter.

**TET 512** three credits

### Fabric Technology

Prerequisite: TET 511

Continuation of TET 511.

**TET 517** three credits

### Fiber Reinforced Polymeric Materials

2 hours lecture, 3 hours laboratory

Prerequisite: Graduate or senior standing

An introduction to advanced composite materials employing fiber reinforcement. Also studied are resins for polymeric matrices, reinforcing fibers, and properties of the resulting structures. Manufacturing techniques and testing of composite materials are examined.

**TET 521** three credits

### Statistical Methods of Quality Control

A study of methods and systems by the use of statistical analysis in the design of experiments, in the testing of materials and in the evaluation of test data as applied in the interest of improvement and control of quality, as well as studies of processing efficiency.

**TET 522** three credits

### Statistical Methods of Quality Control

Prerequisite: TET 521

Continuation of TET 521.

**TET 526** three credits

### Textile Manufacturing Processes

The conversion of fibers and yarns into fabric structures by weaving and nonwoven processes. Also studied are the interaction of material, design, and processing conditions on the quality of fabric and fabric structures as they relate to dyeing and finishing applications.

**TET 563** three credits

### Fibrous Structure

The molecular structure and arrangements of molecules in fibers are considered with respect

to giving a foundation to the understanding of the physical and mechanical properties and behavior of textile raw materials. The properties are examined from a fundamental viewpoint so that a sound approach to the technological utilization of fibers in textiles can be established. An introduction is made to the interrelation between fiber properties and yarn and fabric geometry in determining the behavior of textiles.

**TET 564** three credits

### Mechanics of Fibrous Structures

A study of the mechanics of fibrous assemblies such as twisted structures (yarns, rope, braid), woven, knitted, and non-woven fabrics. The methods of continuum mechanics and differential geometry to interrelate material properties and end-use properties are considered.

**TET 595** variable credit

### Independent Study

Prerequisites: Permission of instructor, graduate director, and college dean  
Study under the supervision of a faculty member in an area not otherwise part of the discipline's course offerings. Conditions and hours to be arranged.

**TET 596** three credits

### Directed Study

Prerequisites: Permission of the instructor, graduate director, and college dean  
Study under the supervision of a faculty member in an area covered in a regular course not currently being offered. Conditions and hours to be arranged.