

## Course Outline

### Instruction Team

- Dr. Mashiur Rahman  
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### Student Hours

- Individual assistance is available by appointment.

### Teaching Assistant

- Md. Shadhin  
(shadhinm@myumanitoba.ca)

### Location

**EITC E2 164**

### Contact Hours

- 3 credit hours
- Lectures:  
3 hours x 12 weeks = 36 hours

### Prerequisites:

- Registered in the Biosystems Engineering program

### Course Website:

<http://umanitoba.ca/umlearn>

The Department of Biosystems Engineering has devised a plan so that there is minimal impact on the delivery and content of the course, should the instructor fall sick and be unable to continue lectures in-person. Please be assured that the alternative plan outlining any deviation from the normal mode of instruction will be communicated to you as quickly as possible if/when the need arises.

## BIOE 7370 Engineering Properties of Fibres for Industrial Uses

Winter 2024

### Course Description

This course will delve into the engineering properties of fibers and nurture scientific thinking skills associated with these properties in textile products. Students will gain proficiency in engineering fibres and assessing them for various applications such as biomedical, geotechnical, agricultural, and athletic purposes.

### Course Objectives

The main objectives that students will achieve upon completing the course include:

- (1) Selecting the appropriate fibre for a specific engineering application;
- (2) Understanding the manufacturing process of a fibre tailored to meet engineering application requirements;
- (3) Implementing modification techniques to fibres for engineering applications;
- (4) Identifying and evaluating procedures for engineering fibres;

### Class Schedule

- |                 |   |
|-----------------|---|
| <b>Week 1:</b>  | <b>Jan 9:</b> The course overview, attendance requirement, and <b>Introduction to Fibre and Engineering Fibres (Topic 1)</b> will cover four subtopics. These include: fibre classification for engineering applications (Topic 1.1), products manufactured from engineered fibres (Topic 1.2), reasons for selecting fibres in engineering applications over other material (Topic 1.3), and engineering properties of fibres (Topic 1.4). |
| <b>Week 2:</b>  | <b>Jan 16: Topic 1: Introduction to Fibre and Engineering Fibres</b>  |
| <b>Week 3:</b>  | <b>Jan 23: Topic 2: Manufacturing Process of Engineering Fibre</b> – This topic will encompass the selection process for natural fibres (Topic 2.1), manufacturing techniques for synthetic fibres in engineering applications (Topic 2.2), and engineering fibres (Topic 2.3).   |
| <b>Week 4:</b>  | <b>Jan 30: Topic 2: Manufacturing Process of Engineering Fibre</b> - This topic will encompass the selection process for natural fibres (Topic 2.1), manufacturing techniques for synthetic fibres in engineering applications (Topic 2.2), and engineering fibres (Topic 2.3).   |
| <b>Week 5:</b>  | <b>Feb 6: Topic 2: Manufacturing Process of Engineering Fibre</b> - This topic will encompass the selection process for natural fibres (Topic 2.1), manufacturing techniques for synthetic fibres in engineering applications (Topic 2.2), and engineering fibres (Topic 2.3).  |
| <b>Week 6:</b>  | <b>Feb 13: Topic 2: Manufacturing Process of Engineering Fibre</b> - This topic will encompass the selection process for natural fibres (Topic 2.1), manufacturing techniques for synthetic fibres in engineering applications (Topic 2.2), and engineering fibres (Topic 2.3).   |
| <b>Weeks 7:</b> | <b>Feb 27: Topic 3: Finishing to Impart Engineering Performance</b> – This topic will discuss engineering of fibres through finishing techniques, including antibacterial finishes, preparatory and maintenance finishes. Additionally, this  |

## Important Dates

• **Early Withdrawal Deadline**  
Jan 19, 2024

• **Winter Term Break**  
Feb 19 - 23  
No classes or examinations

• **Good Friday**  
March 29

• **Voluntary Withdrawal Deadline**  
March 20, 2024

• **Last Day of Classes**  
April 10, 2024

## Grading Scale

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

## Assignment Feedback

Students can expect to receive graded assignments within two weeks of their submission.

## Late Submission Policy

Assignments submitted after the due date will be docked 10% per day.

## Referencing Style

Students are expected to follow the citation style that is used by the *Canadian Biosystems Engineering* journal when citing references in course assignments.

## Weeks 8:

topic will address the decision-making process to determine the suitability of fibre properties imparted by finishing processes for specific engineering applications.

**March 5: Topic 3: Finishing to Impart Engineering Performance** – This topic will discuss engineering of fibres through finishing techniques, including antibacterial finishes, preparatory and maintenance finishes. Additionally, this topic will address the decision-making process to determine the suitability of fibre properties imparted by finishing processes for specific engineering applications.

## Week 9:

**March 12: Topic 3: Finishing to Impart Engineering Performance** – This topic will discuss engineering of fibres through finishing techniques, including antibacterial finishes, preparatory and maintenance finishes. Additionally, this topic will address the decision-making process to determine the suitability of fibre properties imparted by finishing processes for specific engineering applications.

## Week 10:

**March 19: Topic 4: Fibre Structure Analysis, Identification and Testing** – This topic will explore the analysis of macro, micro and submicroscopic structures analysis of fibres. It will also cover testing methodologies aimed at identifying engineering fibres from their counterparts.

## Week 11:

**March 26: Topic 4: Fibre Structure Analysis, Identification and Testing** – This topic will explore the analysis of macro, micro and submicroscopic structures analysis of fibres. It will also cover testing methodologies aimed at identifying engineering fibres from their counterparts.

## Week 12:

**April 02: Topic 4: Fibre Structure Analysis, Identification and Testing** – This topic will explore the analysis of macro, micro and submicroscopic structures analysis of fibres. It will also cover testing methodologies aimed at identifying engineering fibres from their counterparts.

## Week 13:

**April 9:** Course review for final exam.

## Textbook, Readings and Course Materials

- El-Mogahzy, Y.E. (2009). *Engineering Textiles: integrating the design and manufacture of textile product*, Woodhouse Publishing, Cambridge, England.
- Adanur, S. (1995). *Wellington Sears Handbook of Industrial Textiles*, Technomic Publishing Co. Inc. Lancaster, USA.
- Alagirusamy, R., Das, A. (2010). *Technical textile yarns: industrial and medical applications*, Boca Raton, CRC Press, 2010.
- Tao, X (edited), (2005). *Wearable electronics and photonics*, Boca Raton, CRC Press, 2005.
- Maraveas, C. (2020). The Sustainability of Plastic Nets in Agriculture, *Sustainability*, 12, 3625; doi:10.3390/su12093625.
- Sharma N, Allardyce B, Rajkhowa R, Adholeya A and Agrawal R (2022) A Substantial Role of Agro-Textiles in Agricultural Applications. *Front. Plant Sci.* 13:895740. doi: 10.3389/fpls.2022.895740

**\*\*Lecture notes will be posted on the UM Learn portal.**

## Evaluation

Assignment	Allocation	Description	Due Date
Assignment 1: Selection of Fibre for an Engineering Product	15%	In this assignment, students will select an engineering product from the provided list, which they will work on throughout the course. This assignment comprises multiple sections, including the engineering application of the chosen product, the anticipated exposure conditions it will face, the necessary engineering fibre properties for this application with the rationale, and the selection of competitive fibres for the product. Detailed assignment instructions and marking rubrics are outlined in <a href="#">Assignment 1 Guidelines</a> .	Week 4 Jan 30
Assignment 2: Process of Making Engineered Fibre/*product	25%	In this assignment, students will analyze the process and its parameters that used to make a fibre/filament tailored for a particular engineering application, considering specific engineering properties. Additionally, students will compare and contrast this engineering property with at least one other engineering application of the same fibre. Detailed instructions are provided in <a href="#">Assignment 2 guidelines</a> .	Week 9, March 12
Assignment 3: Finishing Treatments for Engineering Properties	15%	In this assignment, students will gather and analyze academic articles concerning finishing techniques used to improve the engineering properties associated with their chosen product. Within their analysis, students will emphasize the chemicals employed and treatment parameters, discuss the method used to ascertain the enhanced property, and offer insights on the suitability of the improved property for the selected engineering application. Detailed instructions are outlined in <a href="#">Assignment 3 guidelines</a> .	Week 11, March 26
Assignment 4:	15%	You've been progressing with an engineering product, having identified the required fibre/s and properties, the manufacturing process of these fibres, and chemical treatments enhancing their properties. This assignment focuses on identifying various aspects of these fibres - macroscopic, microscopic, submicroscopic, chemical, health, and safety considerations. Measurement techniques, along with standard test methods will also be identified and described briefly. While certain properties are essential for all engineering applications, others might be non-essential, for example, health effects may not be mandatory for a product used in a retaining wall. Detailed instructions are outlined in <a href="#">Assignment 4 guidelines</a> .	April 20
Final Exam	30%	Registrar Office will announce the exam date.	Exam period

## Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations on Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

## Requirements/Regulations

- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication, or data storage devices) are allowed in examinations unless approved by the course instructor.
- All email communication must conform to the Communicating with Students university policy.

 [Communicating with Students](#)

- Attending lectures and laboratories is essential for the successful completion of this course.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences ( $\leq 72$  hours) for extenuating circumstances. Students don't need to share

personal information about their situation beyond declaring the nature of the extenuating circumstance on the self-declaration form.

 [Self-Declaration Form for Brief or Temporary Absence](#)

- This form cannot be used for planned absences like vacations. It is also not to be used for longer-term absences, or ongoing circumstances (e.g., Authorized Withdrawals, Leaves of Absence, or other accommodations), which will still require additional documentation.

 [Self-Declaration Policy for Brief or Temporary Absences](#)

- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should familiarize themselves with the University's *General Academic Regulations*.

 [General Academic Regulations](#)

- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

 [Supplemental Resources](#)

## Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

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 [Copyright Office](#)