

CHBE/ME 4803 Biofuels, Bleaching, and Papermaking (Elective)

Catalog Description: CHBE/ME 4803 Biofuels, Bleaching, and Papermaking (3-0-3)
Prerequisites: Senior standing
Crosslisted with CHBE and ME.
Pulp bleaching and formation of paper/board products are studied along with testing, end uses, chemical and mechanical treatment of pulp, non-wood and recycled fiber utilization.

Textbook: Gary A. Smook, *Handbook for Pulp and Paper Technologists*, 3rd Edition, Angus Wilde Publication, 2003.

Topics Covered:

1. Introduction to biofuels
2. Biorefineries based on thermochemical processing
3. Lignocellulosic biorefinery: feedstock, process, byproducts
4. Lignocellulosic biomass pretreatment using: liquid hot water, ammonia fiber expansion
5. Pulp bleaching: chemical, mechanical, and non-chlorine
6. Bleach plant effluent
7. Papermaking: stock prep, refining, non-fibrous additives
8. Paper manufacture: forming and wet-end operations, pressing and dry-end operations
9. Multiply paperboard and surface treatments
10. Secondary fiber processing and sustainability
11. Emerging technologies

Course Outcomes:

Outcome 1: To familiarize students with major paper industry biofuels, bleaching, and papermaking processes.

- 1.1 The student will demonstrate the ability to apply knowledge of mathematics, science, and engineering.
- 1.2 The student will demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data.

Outcome 2: To teach students the fundamental mechanisms of biofuels, bleaching, and papermaking processes.

- 2.1 The student will demonstrate the ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- 2.2 The student will demonstrate the ability to function on multidisciplinary teams.

Outcome 3: To provide the student with some specific knowledge regarding reaction kinetics in mechanical engineering systems, such as diffusion and mass transfer rate, to minimize the economic and environmental impact on society globally.

- 3.1 The student will demonstrate the ability to identify, formulate, and solve engineering problems.
- 3.2 The student will demonstrate the ability to use the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

Outcome 4: Improve the student’s research and communication skills using a self-directed, group study of a specific problem related to biofuels, bleaching, and papermaking with results that will be communicated in both oral and written form.

- 4.1 The student will demonstrate the ability to recognize the need for and to engage in lifelong learning and an understanding of professional and ethical responsibility.
- 4.2 The student will demonstrate the ability to function on multidisciplinary teams and to communicate effectively.
- 4.3 The student will demonstrate the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Correlation between Course Outcomes and Student Outcomes:

ME 4803											
	Mechanical Engineering Student Outcomes										
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k
Course Outcome 1.1	X										
Course Outcome 1.2		X									
Course Outcome 2.1			X								
Course Outcome 2.2				X							
Course Outcome 3.1					X						
Course Outcome 3.2								X			
Course Outcome 4.1						X			X		
Course Outcome 4.2							X			X	
Course Outcome 4.3											X

GWW School of Mechanical Engineering Student Outcomes:

- (a) an ability to apply knowledge of mathematics, science and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice