ENGG*6090 Bioenergy & Biofuels
Winter 2014

School of Engineering

(Revision 1: January 03, 2014)

1 INSTRUCTOR

Instructor: Animesh Dutta, Ph.D., P.Eng.
Office: RICHARDS 3509, ext. 52441
Email: adutta@uoguelph.ca
Office hours: TBA on Courselink or by appointment

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*6090 Courselink site. You are responsible for checking the site regularly.

2.2 Required Resources

None

2.3 Recommended Resources


Journals and Magazines:
1. Energy
2. Energy Sources
3. Biomass conversion and biorefinery
4. Energy & Fuels
5. International Journal of Energy Research
6. Biomass and Bioenergy
7. Chemical Engineering Science
8. Fuel
9. Fuel processing technologies

2.4 Additional Resources

Lecture Information: Copies of lecture presentation materials, plus supplemental material, will be posted on Courselink. (Note: posting of all materials shown or discussed in class is not guaranteed.)

Lab Information: The handouts for all the lab sessions are within the lab section. All types of resources regarding tutorials, links to web pages can be found in this section.

Assignments: Download the assignments according to the schedule given in this handout. All the solutions will be posted as indicated.

3 ASSESSMENT

3.1 Dates and Distribution

Labs/Assignments/Debates: 20%

Project: 40%

Final Exam: 40% (Wednesday April 09, 10:00-12:00, Room TBA on Webadvisor)

3.2 Course Grading Policies

When You Cannot Meet a Course Requirement: When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course in writing, with your name, id#, and e-mail contact. See the graduate calendar for information on regulations and procedures for Academic Consideration:

http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1400.shtml
Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations: http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml

Passing grade: In order to pass the course, you must pass both the project and exam course portions. Students must obtain a grade of 65% or higher on the exam portion of the course in order for the laboratory write-up portion of the course to count towards the final grade.

Missed tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be added to the final exam. There will be no makeup midterm tests.

Lab/Assignment Work: You must attend and complete all laboratories/assignments. If you miss a laboratory/assignment due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab/Assignment Reports: Late submissions of lab/assignment reports will not be accepted.

4 AIMS & OBJECTIVES

4.1 Calendar Description
A course of directed study involving selected readings and analyses in developing knowledge areas which are applicable to several of the engineering disciplines in the School of Engineering.

4.2 Course Aims

- To provide a thorough understanding of various renewable feedstocks of importance to Ontario, their availability and attributes for biofuels production.
- To provide a thorough understanding of the broad concept of second and third generation biofuel production from biomass and other low-cost agri-residues and biowastes.
- To provide students with tools and knowledge necessary for biofuel facility operations.
- To teach our students to analyze and design processes for biofuel production.

4.3 Learning Objectives
At the successful completion of this course, the student will

- Gain a comprehensive understanding of the principle and application of bioenergy systems
- Understand the availability of biomass feedstocks in different area and weather condition and their potential attributes to biofuels production.
• Understand concepts of the second and third generation of biofuels, and the conversion processes of biomass feedstock to biofuels.
• Explain the key points in the operation of bioenergy facility.
• Learn how to analyze and design a bioenergy system according to the availability of feedstock.

4.4 Instructor’s Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink/D2L but these are not intended to be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.5 Students’ Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

E-mail Communication: As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Recording of Materials: Presentations which are made in relation to course work—including lectures—cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a classmate or guest lecturer.

4.6 Relationships with other Courses

Previous Courses: None
Follow-on Courses: None

5 Teaching and Learning Activities

5.1 Timetable

Lectures:  
RICHARDS 3527 From 11 am to 2 pm

Laboratory:  
Courselink
5.2 Course Topics and Schedule

I. Introduction (Week 1)
   1. Biomass Resources
   2. Modes of Biomass Utilization for Energy
   3. Routes of Biomass Conversion Processes and biofuels production technologies

II. Characteristics of Biomass Fuels (Week 2)
   1. Composition
   2. Ultimate and Proximate Analyses
   3. Heating Value

III. Physical Conversion (Week 3)
   1. Dewatering and drying: Fundamentals, moisture content and conversion requirements, methods
   2. Size reduction: Fundamentals, Steam explosion
   3. Densification: Types of Densification Devices, Properties of Densified Fuels
   4. Separation: Municipal solid waste, Virgin biomass, Extraction

IV. Thermochemical Conversion (Week 4-8)
   3. Combustion: Fundamentals, Furnaces, Fixed bed systems, Fluidized bed systems, Emission reduction, Steam cycle, Residential and small commercial systems, Solid waste incineration, Electric power production, operating problems

V. Biological Conversion (week 9-10)
   2. Ethanol Production: Basic Production Processes from Sugar Biomass, Starch Biomass, lignocellulosic materials, Distillation
   3. Methanol Conversion Technologies: Methanol properties, Methanol Production from biomass
   4. Biodiesel Conversion Technologies: Properties (vegetable oil, biodiesel, diesel), Biodiesel Production from vegetable oil, and biomass

VI. Environmental Impacts and presentation (week 11 -12)

5.3 Lab/assignment Schedule

Detailed information will be provided in the Courselink
5.4 Other Important Dates

**Drop Date:** The last date to drop one-semester courses, without academic penalty, is March 7. Two-semester courses must be dropped by the last day of the add period in the second semester. Refer to the Graduate Calendar for the schedule of dates:  
[http://www.uoguelph.ca/registrar/calendars/graduate/current/sched/sched-dates-f10.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/sched/sched-dates-f10.shtml)

6 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

7 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. The Academic Misconduct Policy is detailed in the Graduate Calendar:  
[http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1687.shtml](http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1687.shtml)

7.1 Resources

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:  
[http://www.academicintegrity.uoguelph.ca/](http://www.academicintegrity.uoguelph.ca/)

The School of Engineering has adopted a Code of Ethics that can be found at:  
[http://www.uoguelph.ca/engineering/undergrad-counselling-ethics](http://www.uoguelph.ca/engineering/undergrad-counselling-ethics)

The Graduate Calendar is the source of information about the University of Guelph’s procedures, policies and regulations which apply to graduate programs:  
[http://www.uoguelph.ca/registrar/calendars/graduate/current/](http://www.uoguelph.ca/registrar/calendars/graduate/current/)