

# Introduction to Biofuels BIBC 140

## Course Syllabus – Spring 2014

### Prerequisites:

BILD 1 & CHEM 6A

### Course Description:

This course will provide an overview of existing energy utilization, production and infrastructure, as well as the consequences of our energy choices on the environment. The course will also introduce the impact of energy on food production and delivery. We will then examine the growing field of renewable energy by introducing the basics of biofuel production. The topics covered will include the chemistry of biofuels, the biology of important feedstocks, the biochemical, genetic and molecular approaches being developed to advance the next generation of biofuels and the economical and global impacts of biofuel production. Overall, the course will emphasize the importance of biofuel development as a contributor to replacing the diminishing supplies of fossil fuels, and on reducing the consequences of carbon dioxide release into the environment. We will also cover the importance of creating a sustainable energy future for society.

### Course Goals/ Learning Objectives:

- 1) Students will recognize the types and differences between existing energy resources, understand their procurement and utilization, and their impacts on society and the environment.
- 2) Students will be knowledgeable of the existing and potential future sources of renewable energy, and be able to intelligently analyze reported aspects of the energy and renewable energy fields.
- 3) Students will be introduced to the scientific literature, and will learn to interpret the mass media presentation of energy issues, and be able to access the primary scientific literature to help make informed decisions on renewable energy choices.

### Lectures:

Although this class is scheduled for M-W-F from 4 to 4:50, students are required to attend only be the first class on Monday - March 31, and then every Wednesday from 4 to 4:50. All of the class lectures have been recorded and will be available for viewing at any time during the course as videos on TED. Wednesday classes are for the 2 midterm exams (April 23<sup>rd</sup> and May 21<sup>st</sup>), a few special lectures, and open discussions of the lectures scheduled for viewing that week. The recorded lectures for each week are listed on the schedule below.

### Sections:

Students are REQUIRED to sign up for a section and to attend those section for 1 hour each week.

### Section activities:

**Quizzes:** During each section there will be a short quiz focused on the journal paper(s) assigned the previous week. Note: These journal papers will be posted on TED. There will be 8 quizzes total, and there are no make-ups for missed quizzes. You can miss one quiz without any impact on your overall grade, as the lowest quiz grade will be dropped.

**Final Project:***What is your carbon footprint?*

Tell us why and how you might be able to use sustainable energy to improve your carbon footprint. Project details will be provided during Section.

**Grading:**

40% Midterm Exams

20% midterm 1

20% midterm 2

30% Final Exam

30% Section Activities

10% quizzes

20% final project

**Textbook:**

No textbook is required, but the draft "Introduction to Biofuels" textbook will be available (as PDF on TED) and can be used as supplemental reading.

Day	Topic	Date
1	Introduction to Biofuels	<b>March 31</b>
2	<ul style="list-style-type: none"> <li>Climate Change</li> <li>A New Approach to Slowing Down Climate Change and Sea Level Rise in Our Life Time (Ramanathan)</li> <li>Climate Change and the Impact of Carbon Dioxide (Somerville)</li> </ul>	April 2 No class
3	<ul style="list-style-type: none"> <li>Climate Change and Food Security (Burney)</li> <li>Water and Climate Change in California (Cayan)</li> </ul>	April 4 No class
4	Renewable Energy Sources <ul style="list-style-type: none"> <li>What Energy Sources Scale to Meet Human Needs (Tynan)</li> <li>Future Energy Needs From a Physical Sciences Perspective (Thiemens)</li> <li>The Future of Nuclear-based Energy Sources (Tynan)</li> </ul>	April 7 No class
5	Renewable Energy Sources <ul style="list-style-type: none"> <li>Solar Energy (Coimbra)</li> <li>Wind Power and Turbine Technologies (Bazilevs)</li> </ul>	<b>April 9</b>
6	Industrial Agriculture, Part 1 <ul style="list-style-type: none"> <li>Energy and Modern Agriculture (Briggs)</li> </ul>	April 11 no class
7	Industrial Agriculture, Part 2 <ul style="list-style-type: none"> <li>Introduction to Food and Energy (Mayfield)</li> </ul>	April 14 No class
8	Renewable fuels Biological <ul style="list-style-type: none"> <li>Where Do We Go From Here? - Biological Options (Golden)</li> </ul>	<b>April 16</b>
9	Bio-prospecting, Genetic and Synthetic Biology of Algae (McBride)	April 18 No class
10	Synthetic biology for enhanced biofuel production	April 21 No class
11	1 <sup>st</sup> Mid-term Exam	<b>April 23</b>
12	<ul style="list-style-type: none"> <li>Corn Ethanol (Smith)</li> </ul>	April 25 No class
13	1 <sup>st</sup> Generation Biofuels – Biodiesel	April 28 No class
14	Alternative Sources of Biomass Jatropha (Schmidt)	<b>April 30</b>
15	<ul style="list-style-type: none"> <li>Economics of Energy (Graff Zivin)</li> <li>Regulation of Energy Use and Energy Efficiency (Jacobsen)</li> </ul>	May 2 No class

16	2 <sup>nd</sup> Generation Biofuels – Cellulosic Ethanol • Cellulosic Ethanol (Rubino)	May 5 No class
17	3rd Generation Aquatic Biomass – Cyanobacteria, Diatoms & Algae • Cyanobacteria (Golden) • Diatoms (Hildebrand)	<b>May 7</b>
18	• Green Algae (Mayfield)	May 9 No class
19	• Metabolic Engineering of Fatty Acid Metabolism in Single Cellular Algae (Burkart)	May 12 No class
20	• Thermochemical Conversion of Biomass to Fuel and Electricity (Herz)	<b>May 14</b>
21	• Biogas (Hein)	May 16 No class
22	Nutrient Utilization and Recycling	May 19 No class
23	2 <sup>nd</sup> Mid-term Exam	<b>May 21</b>
24	• Biodiesel Chemistry and Analysis (Pomeroy)	May 23 No class
	<i>Memorial Day</i>	May 26 No class
25	• Production Process for Biofuels from Algae (McBride)	<b>May 28</b>
26	• Importance of Energy for the Bottom Billion	May 30 No class
27	• Lifecycle Assessment of Fossil and Renewable Fuels (Kendall)	June 2 No class
28	Speaker from Biofuels Company – Biofuels Commercialization	<b>June 4</b>
29	• Policy and Politics of Energy (Douglas) • The International Politics of Climate Change Outline (Victor)	June 6 No class
	Final Week	June 7 - 12