Instructor
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Professor, Chemistry and Biochemistry
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Text
Beer: Tap into the Art and Science of Brewing
By Charles Bamforth
Oxford University Press, USA; 3 edition (April 3, 2009)
ISBN-10: 0195305426

Various additional sources will be recommended and/or provided throughout the course.

Course Times
Tuesday and Thursday, 2:00-2:50, Neckers 218

Course Description
The course covers the science and chemistry of beer and brewing. The history of beer and brewing will be introduced to follow the evolution of beer as a food and beverage, including how beer has impacted society and how brewing has been affected by society. The chemistry of the four basic ingredients of beer (water, malt, hops and yeast) will be explored, as well as the chemistry of the brewing process. The various styles of beer will be introduced and discussed with respect to how the styles can be achieved based on the chemistry of the ingredients and process. Home brewing and commercial brewing will be compared. The course does not presume a background in chemistry and various chemical concepts will be introduced on an as needed basis.

Course Objectives
Students will learn basic aspects of beer and brewing. They will know how to identify the various styles of beer and how the styles are achieved from basic ingredients. They will also develop a basic understanding of the various chemical, biological and physical science principles that are necessary to understand beer and the brewing process.

Grading
The final grade will be based on the total points accumulated from the following sources:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Work</td>
<td>15%</td>
</tr>
<tr>
<td>Style Paper and Recipe</td>
<td>25%</td>
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<tr>
<td>Exams</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam (May 12, 2:45-4:45pm)</td>
<td>20%</td>
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</tbody>
</table>

Letter grades will be assigned as follows:
This grading policy will be strictly enforced. Please note that the university policy regarding incompletes states: An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. In other words, under no circumstances, will an INC be given to a failing student to prevent him or her from receiving an F.

Notes

1) The course syllabus is intended to provide students with basic information concerning the course. The syllabus can be viewed as a “blueprint” for the course; changes in the syllabus can be made and students will be informed of any substantial changes concerning exams, grading or attendance policy and/or changes to reading or homework assignments.

2) Pagers and cellular phones must be turned off and/or in vibrate mode in class. If you must leave the room to answer a call (emergency), please do so quietly.
Topical Outline

1. Introduction course and beer

2. Historical Aspects of Beer and Brewing
   a. Sumerian beer and archeological studies of brewing
   b. Discussions of first accounts of beer and brewing
   c. Developments in Germany and Britain
      i. Monasteries and brewing
      ii. Herbs versus hops
      iii. Development of lager
   d. Bringing beer to the New World
      i. Pilgrims and beer
      ii. Brewing during colonial and early American history
   e. Rise and fall, and rise of brewing in the U.S.
      i. Brewing in the late 19th and early 20th century
      ii. Prohibition and effect on brewing industry
      iii. Development and legality of Homebrewing
      iv. Microbrewery movement
      v. Craft Beer movement
   f. Future prospects

3. Basic Chemical concepts (some concepts will be introduced throughout course)
   a. Basic atomic theory and ions
   b. Chemical bonding and compounds/molecules
   c. Molecular shape
   d. Polarity and electronegativity
   e. Intermolecular forces
      i. Ionic
      ii. Ion-dipole
      iii. Dipole-dipole
      iv. Induced dipole-dipole
      v. Dispersion (induced dipole-induced dipole)
   f. Water, solvents and solubility
   g. Chemical functional groups
   h. Sugars and starches
      i. Enzymes
   j. Concentration
   k. pH
   l. Chemical reactions

4. Brewing in depth
   a. Process
      i. Crushing/milling
ii. Mashing
iii. Lautering
iv. Boiling
v. Chilling
vi. Fermentation
vii. Conditioning

b. Ingredients
   i. Water
   ii. Fermentables
   iii. Adjuncts
   iv. Hops
   v. Clarifying agents
   vi. Yeast

c. Beer styles
   i. Beer judge certificate program (BJCP) Style Guide

d. Beer quality
   i. Factors affecting beer quality
   ii. Evaluating beer

e. Beer and food pairings

f. Analysis of beer
<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Chemistry Concept</th>
<th>Reading Assignment (Bamforth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>Introduction to course and beer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Overview of Brewing Process (continued)</td>
<td></td>
<td>Ch2</td>
</tr>
<tr>
<td>27</td>
<td>Historical aspects of Beer and Brewing</td>
<td></td>
<td>Ch1</td>
</tr>
<tr>
<td>29</td>
<td>Historical aspects of Beer and Brewing</td>
<td>Basic Atomic Theory and Ions</td>
<td>Ch1</td>
</tr>
<tr>
<td>February</td>
<td>Physiology and Health of Beer Consumption (TBD)</td>
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<td>p93-102</td>
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<tr>
<td>3</td>
<td>Historical aspects of Beer and Brewing</td>
<td></td>
<td>Ch 3</td>
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<td>5</td>
<td>Historical aspects of Beer and Brewing</td>
<td></td>
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<tr>
<td>10</td>
<td>Historical aspects of Beer and Brewing</td>
<td></td>
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<tr>
<td>12</td>
<td>Beer Styles</td>
<td>Molecules and Intermolecular Interactions</td>
<td>Ch 3</td>
</tr>
<tr>
<td>17</td>
<td>Beer Styles</td>
<td></td>
<td></td>
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<tr>
<td>19</td>
<td>Ingredients / Malt</td>
<td>Sugars/starches</td>
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</tr>
<tr>
<td>24</td>
<td>Malt Continued</td>
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<tr>
<td>26</td>
<td>Exam 1</td>
<td></td>
<td>Ch 7</td>
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<tr>
<td>March</td>
<td>Malt Continued (Style paper due)</td>
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<tr>
<td>3</td>
<td>Hops</td>
<td>Concentration</td>
<td></td>
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<tr>
<td>10</td>
<td>SPRING BREAK</td>
<td></td>
<td>Ch 9</td>
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<tr>
<td>12</td>
<td>SPRING BREAK</td>
<td></td>
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<tr>
<td>17</td>
<td>Hops</td>
<td></td>
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<tr>
<td>19</td>
<td>Yeast</td>
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<tr>
<td>24</td>
<td>Yeast</td>
<td></td>
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<tr>
<td>26</td>
<td>Water</td>
<td>Water, Solvents and Solubility</td>
<td>Ch 6</td>
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<tr>
<td>31</td>
<td>Brewing Process (in depth)</td>
<td>pH</td>
<td>Ch 8</td>
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<tr>
<td>April</td>
<td>Brewing Process (in depth)</td>
<td>Phase, vapor pressure</td>
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<td>7</td>
<td>Brewing Process (in depth)</td>
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<td>Ch 10</td>
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<tr>
<td>9</td>
<td>Beer Design / Recipe Development</td>
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<tr>
<td>14</td>
<td>Beer Design / Recipe Development</td>
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<td>16</td>
<td>Exam 2</td>
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<tr>
<td>21</td>
<td>Flavor and Tasting Evaluation (Recipe Due)</td>
<td>Analytical Chemistry</td>
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<td>28</td>
<td>Beer Flaws</td>
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<td>Ch 11</td>
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<td>30</td>
<td>Beer Quality and Analysis</td>
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<tr>
<td>May</td>
<td>Beer and Food</td>
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<td>5</td>
<td>Review</td>
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<td>12</td>
<td>Final Exam (Neckers 218, 2:45-4:45 pm)</td>
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Syllabus Attachment
Spring 2015

IMPORTANT DATES *
Semester Class Begins: 01/20/2015
Last day to add a class (without instructor permission): 01/20/2015
Last day to withdraw completely and receive a 100% refund: 02/01/2015
Last day to drop a course using SalukiNet: 04/05/2015
Last day to file diploma application (for name to appear in Commencement program): 03/13/2015
Final examinations: 5/11–5/15/2015

Note: For outreach, internet, and short course drop/add dates, visit Registrar's Academic webpage http://registrar.siu.edu/

SPRING SEMESTER HOLIDAYS
Martin Luther King, Jr.’s Birthday 01/19/2015
Spring Vacation 03/07—03/15/2015

WITHDRAWAL POLICY ~ Undergraduate only
Students who officially register for a session may not withdraw merely by the stopping of attendance. An official withdrawal form needs to be initiated by the student and processed by the University. For the proper procedures to follow when dropping courses and when withdrawing from the University, please visit http://registrar.siu.edu/pdf/ugradcatalog1314.pdf

INCOMPLETE POLICY~ Undergraduate only
An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within one semester following the term in which the course was taken, or graduation, whichever occurs first. Should the student fail to complete the course within the time period designated, that is, by no later than the end of the semester following the term in which the course was taken, or graduation, whichever occurs first, the incomplete will be converted to a grade of F and the grade will be computed in the student's grade point average. For more information please visit: http://registrar.siu.edu/grades/incomplete.html

REPEAT POLICY
An undergraduate student may, for the purpose of raising a grade, enroll in a course for credit no more than two times (two total enrollments) unless otherwise noted in the course description. For students receiving a letter grade of A,B,C,D, or F, the course repetition must occur at Southern Illinois University Carbondale. Only the most recent (last) grade will be calculated in the overall GPA and count toward hours earned. See full policy at http://registrar.siu.edu/pdf/ugradcatalog1314.pdf

GRADUATE POLICIES
Graduate policies often vary from Undergraduate policies. To view the applicable policies for graduate students, please visit http://gradschool.siu.edu/about-us/grad-catalog/index.html

DISABILITY POLICY
Disability Support Services provides the required academic and programmatic support services to students with permanent and temporary disabilities. DSS provides centralized coordination and referral services. To utilize DSS services, students must come to the DSS to open cases. The process involves interviews, reviews of student-supplied documentation, and completion of Disability Accommodation Agreements.
http://disabilityservices.siu.edu/

SAFETY AWARENESS FACTS AND EDUCATION
Title IX makes it clear that violence and harassment based on sex and gender is a Civil Rights offense subject to the same kinds of accountabil-ity and the same kinds of support applied to offenses against other protected categories such as race, national origin, etc. If you or someone you know has been harassed or assaulted, you can find the appropriate resources here: http://safe.siu.edu

SALUKI CARES
The purpose of Saluki Cares is to develop, facilitate and coordinate a university-wide program of care and support for students in any type of distress—physical, emotional, financial, or personal. By working closely with faculty, staff, students and their families, SIU will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. For Information on Saluki Cares: (618) 453-5714, or siucares@siu.edu, http://salukicares.siu.edu/index.html

EMERGENCY PROCEDURES
Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. We ask that you become familiar with the SIU Emergency Response Plan and Building Emergency Response Team (BERT) programs. Please reference the Building Emergency Response Protocols for Syllabus attachments on the following pages.
It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.

INCLUSIVE EXCELLENCE
SIU contains people from all walks of life, from many different cultures and sub-cultures, and representing all strata of society, nationalities, ethnicities, lifestyles, and affiliations. Learning from and working with people who differ is an important part of education as well as an essential preparation for any career. For more information please visit: http://www.inclusiveexcellence.siu.edu/

LEARNING AND SUPPORT SERVICES
Help is within reach. Learning support services offers free tutoring on campus and math labs. To find more information please visit the Center for Learning and Support Services website:
Tutoring: http://tutoring.siu.edu/
Math Labs http://tutoring.siu.edu/math_tutoring/index.html

WRITING CENTER
The Writing Center offers free tutoring services to all SIU students and faculty. To find a Center or Schedule an appointment please visit http://write.siu.edu/

AFFIRMATIVE ACTION & EQUAL OPPORTUNITY
Our office's main focus is to ensure that the university complies with federal and state equity policies and handles reporting and investigating of discrimination cases. For more information visit: http://diversity.siu.edu/

Additional Resources Available:
SALUKINET: https://salukinet.siu.edu/cp/home/displaylogin
ADVISEMENT: http://advisement.siu.edu/
SIU ONLINE: http://online.siu.edu/

Spring 2015 R.O'Rourke