APPLICATION FOR NEW COURSE

1. Submitted by the College of Engineering Date: 8/4/09

   Department/Division proposing course: Biosystems and Ag Engineering

2. Proposed designation and Bulletin description of this course:

   a. Prefix and Number BAE 504

   b. Title* Biofuels Production and Properties

   *If title is longer than 24 characters, offer a sensible title of 24 characters or less: Biofuels Production

   c. Courses must be described by at least one of the categories below. Include number of actual contact hours per week..

   (___) CLINICAL (___) COLLOQUIUM (___) DISCUSSION (___) LABORATORY (3) LECTURE

   (___) INDEPEND. STUDY (___) PRACTICUM (___) RECITATION (___) RESEARCH (___) RESIDENCY

   (___) SEMINAR (___) STUDIO (_____) OTHER - Please explain:

   d. Please choose a grading system: ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

   e. Number of credit hours: 3

   f. Is this course repeatable? YES ☐ NO ☒ If YES, maximum number of credit hours: _____

   g. Course description:

   This course introduces students to the science and engineering of liquid biofuels for transportation. Topics include:

   physical and chemical properties; engine performance; processing technologies; and environmental impact of biofuels.

   h. Prerequisite(s), if any:

   BAE 503 or consent of instructor

   i. Will this course also be offered through Distance Learning? YES ☐ NO ☒

   If YES, please check one of the methods below that reflects how the majority of the course content will be delivered:

   Internet/Web-based ☐ Interactive video ☐ Extended campus ☐

3. Supplementary teaching component: ☒ N/A ☐ Community-Based Experience ☐ Service Learning ☐ Both

4. To be cross-listed as: _____ / _____

   Prefix and Number Cross-listing Department Chair

5. Requested effective date (term/year): Fall / 2010

6. Course to be offered (please check all that apply): ☒ Fall ☐ Spring ☐ Summer

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7. Will the course be offered every year? ☒ YES ☐ NO

If NO, please explain: _____

8. Why is this course needed?

Topic is timely given the emphasis on biofuels and biosystems engineering students need a background in biofuels to be well-prepared for the current job market. This is an elective course.

9. a. By whom will the course be taught? Dr. Sue Nokes

b. Are facilities for teaching the course now available? ☒ YES ☐ NO

If NO, what plans have been made for providing them?

_____

10. What yearly enrollment may be reasonably anticipated?

25

11. a. Will this course serve students primarily within the department? ☒ Yes ☐ No

b. Will it be of interest to a significant number of students outside the department? ☒ YES ☐ NO

If YES, please explain.

May be of interest to other engineering students interested in biofuels.

_____

12. Will the course serve as a University Studies Program course[1]? ☐ YES ☒ NO

If YES, under what Area? _____

[1]AS OF SPRING 2007, THERE IS A MORATORIUM ON APPROVAL OF NEW COURSES FOR USP.

13. Check the category most applicable to this course:

☐ traditional - offered in corresponding departments at universities elsewhere

☒ relatively new – now being widely established

☐ not yet to be found in many (or any) other universities

14. Is this course applicable to the requirements for at least one degree or certificate at UK? ☒ Yes ☐ No

15. Is this course part of a proposed new program? ☐ YES ☒ NO

If YES, please name: _____

16. Will adding this course change the degree requirements for ANY program on campus? ☐ YES ☒ NO

If YES[2], list below the programs that will require this course:

_____

_____

[2]In order to change the program(s), a program change form(s) must also be submitted.

17. ☒ The major teaching objectives of the proposed course, syllabus and/or reference list to be used are attached.

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18. ☒ Check box if course is 400G or 500. If the course is 400G- or 500-level, *you must include a syllabus showing differentiation* for undergraduate and graduate students by (i) requiring additional assignments by the graduate students; and/or (ii) the establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4)*

19. Within the department, who should be contacted for further information about the proposed new course?

Name: Sue E. Nokes Phone: 7-3000 x215 Email: snokes@bae.uky.edu

20. Signatures to report approvals:

09-16-09 DATE of Approval by Department Faculty	Scott A. Shearer printed name / signature Reported by Department Chair
11-20-09 DATE of Approval by College Faculty	Richard J. Sweigard printed name / signature Reported by College Dean
1-19-2010 * DATE of Approval by Undergraduate Council	Sharon Gill printed name / signature Reported by Undergraduate Council Chair
* DATE of Approval by Graduate Council	Jeannine Blackwell 2010.04.19 16:00:40 -04'00' printed name / signature Reported by Graduate Council Chair
* DATE of Approval by Health Care Colleges Council (HCCC)	printed name / signature Reported by Health Care Colleges Council Chair
* DATE of Approval by Senate Council	Reported by Office of the Senate Council
* DATE of Approval by University Senate	Reported by Office of the Senate Council

*If applicable, as provided by the *University Senate Rules*. (http://www.uky.edu/USC/New/RulesandRegulationsMain.htm)

BAE 504: SECTION 001
BIOFUELS
SYLLABUS

INSTRUCTOR: Dr. Sue Nokes

OFFICE: Room 215, C.E. Barnhart Building

OFFICE HOURS: M 1:30-3 pm
Or by appointment

PHONE: 257-3000 x215

EMAIL: snokes@bae.uky.edu

LECTURE: MWF 1:00 p.m. to 1:50 p.m. in Room 236 C.E. Barnhart

COURSE DESCRIPTION: An introduction to the basic principles for the production and utilization of biofuels with special emphasis on ethanol and biodiesel. Process chemistry of biofuel manufacturing, fuel properties and the use of ethanol in internal combustion engines and biodiesel in diesel engines will be discussed.

PREREQUISITE: Minimum of Junior level standing in an Engineering discipline.

COURSE OBJECTIVES: The objective of this course is to train engineers in the processing and properties of liquid transportation fuels made from biorenewable resources (starch, lignocelluloses, and plant oils).

COURSE LEARNING OUTCOMES: When you complete this course you should be able to:

1) List the major renewable feedstocks for ethanol and biodiesel.
2) Discuss the pre-treatment options for biomass, and the advantages and disadvantages of each.
3) Describe the biochemical conversion from thermal conversion processes for producing biofuels.
4) Describe Life Cycle Analysis and how it is used in the context of biofuels.
5) Find and explain the fuel properties associated with each biofuel, and know the associated standard.
6) Explain in layman's terms the potential impact biofuels might have on a particular engine.

ADDITIONAL LEARNING OUTCOMES

In addition, at the completion of this course, the student should be able to intelligently discuss the following issues as they relate to liquid biofuels:

1) food vs. fuel
2) global warming/carbon credits
3) net energy gain/loss from fuel production
4) environmental benefits and costs of biofuels

REFERENCE MATERIALS

TEXTBOOK (REQUIRED): Biofuels Engineering Process Technology 2008. C.M. Drapcho, N. P. Nhuan, And T. H. Walker. Mcgraw Hill . ISBN #: 978-0-07-148749-8

TEXTBOOK (OPTIONAL): biofuels for transport: global potential and implications for sustainable energy and agriculture. 2007. Worldwatch Institute. ISBN #: 978-84407-422-8

CLASS HOMEPAGE:

BAE 599 has a webpage which can be accessed through your link blue; blackboard site. The Class page will be used for posting of the syllabus, the topic outline, homework assignments, and announcements, as well as video lectures and slide handouts.

CLASS ORGANIZATION:

At the start of each class, the following information will be written on the board:

a) What topic we covered last time
b) What topic we will cover this class
c) What homework/reading is due for next class.

Reading assignments will be from the textbook (and occasional supplemental reading) and **you are responsible for the material in the text whether it is covered in class or not**. Questions on the exams may come from the text or from lecture.

COURSE GRADING:

I expect a lot from you! You should be spending **at least** 3 hours working on this material **outside of class** for every hour the class "meets"; so at least 9 hours outside of class.

Here is a breakdown of how you will be evaluated if you are an undergraduate:

Category	Percentage
Weekly homework	10
Midterm exam	20
Class participation	10
Project 1A	15
Project 2A	15
Comprehensive final exam	30
Total Points	**100**

Here is a breakdown of how you will be evaluated if you are a graduate student:

Category	Percentage
Weekly homework	15
Midterm exam	20
Class participation	0
Project 1B	20
Project 2B	20
Comprehensive final exam	25
Total Points	**100**

Weekly Homework:
Homework will be assigned weekly, to be turned in before or at the beginning of class the next week. Assignments may be turned in using the drop box on the class web page, or hard copy given to me at the start of class. Please restate the problem, state all assumptions, and show all the steps of your solution. Typically assignments will include a base set of questions for all students, and some more advanced questions for the graduate students. So graduate students will be answering more questions than the UG students.

Midterm Exam:
The midterm exam will be open book, and closed notes. Anything from the assigned readings or from class may be on the exam.

Class participation: Participation for Undergraduates will be graded based on in-class worksheets, handed in during class and/or active participation in group discussion, with clear evidence that you were well prepared by completing the prior assignments. Graduate students will not earn formal points for class participation, however it is expected you will participate.

Projects for Undergraduates: Undergraduates are expected to watch the documentaries "Who killed the electric car" and "An

inconvenient truth". The project will entail analyzing each documentary using facts you learned in class and in your reading. Instructions for the requirements for the analysis, and the grading expectation will be handed out at the appropriate time during the course.

Projects for Graduate Students: Graduate students are expected to view the same two videos, and provide an analysis based on what you learned in class, the textbook *AND three related journal articles.* The articles will be turned in with your analysis. Instructions for the requirements for the analysis, and the grading expectation will be handed out at the appropriate time during the course.

The **Final Exam** is cumulative, covering material from the entire semester. You must be able to demonstrate knowledge and comprehension of the material from the entire course, and apply the material to an actual problem or life event.

GRADING SCALE: UNDERGRADUATES
The scale for grades is as shown in percentage of total points.

A=90-100%
B=80-89%
C=70-79%
D=60-69%
E= <60%

GRADING SCALE: GRADUATE STUDENTS
The scale for grades is as shown in percentage of total points.
A=90-100%
B=80-89%
C=70-79%
E= <70%

Important Dates

Date	**Event**
September 30, 2009	Project 1 due
October 14, 2009	Midterm
November 18	Project 2 due
December 14 at 1:00 pm	Final exam

Course Policies:
What if I need to be absent and miss an assignment or exam?

You are an adult, and as such I leave the decision about attending class up to you. However attendance in class is directly related to your success in the course.

You will not be allowed a make-up for missing in-class activities unless you are absent for a UK recognized reason:

- Serious illness
- Serious illness or death of a family member
- University-related trips
- Religious holiday

For UK events, you must provide a written notice signed by the instructor or coach to the professor (Dr. Nokes) IN ADVANCE of the event. For religious holidays, I must have, in writing, the days of the semester you will miss, no later than September 2, 2009. For medical and family emergencies, you may have to present documentation of the event, proving your need to be absent. If you cannot document an excuse, it is not a legitimate absence. For illness or emergencies, I must receive documentation no later than one week after the absence.

What if I turn in an assignment late?
No late assignments are accepted unless you are turning it in late due to a University excused absence.

Academic integrity
Academic integrity is essentially honesty at all levels of learning. Forms of dishonesty include (but are not limited to) plagiarism (copying or using someone else's work as your own), use of unauthorized materials during exams (cheat sheets, cell phone, etc) and giving or receiving unauthorized assistance during evaluations (i.e. collaborating on a take-home exam). The penalty for academic misconduct depends on the severity of the offense, and ranges from a zero on the assignment in question to failing the course (with an XE on your transcript, indicating that you failed for academic misconduct reasons).

What if I need extra time on an exam or other accommodations?
If you have a documented learning disability that required academic accommodations, please see me as soon as possible during scheduled office hours (or by appointment) to discuss this. Be aware that you must provide me with a letter from the Disability Resource Center (room 2, Alumni Gym, 257-2754, jkarnes@uky.edu) stating the requested accommodations.

Biofuels Topic Outline

1. Background
    a. Overview on biofuels
    b. Review of organic chemistry
        i. Discussion of fundamental differences in feedstock type
    c. Fuels and engines
2. Gasoline Substitutes
    a. Corn Grain Ethanol – an example
        i. Definitions
        ii. Feedstocks (brief)
        iii. Processing
            1. Underlying principles (mechanical, chemical, physical)
            2. Process flow diagrams
            3. Economics
            4. Energy balance
            5. By-products
        iv. Characteristics of the fuel
        v. Utilization
    b. 2nd-generation alcohol biofuels: Ethanol & biobutanol
3. Diesel Substitutes
    a. Soy Biodiesel – an exemplar
    b. Alkanes from synthesis gas via FT
4. Crude Oil Substitutes
    a. Pyrolysis Oil
        i. challenges of upgrading (refining) these materials
5. Gaseous fuels
    a. Energy density, storage, and transportation challenges/advantages
    b. Potential alternate conversion devices (i.e., fuel cells instead of ICEs)
    c. Bio-hydrogen
    d. Methane

The points 2a(i) through 2a(v) would be repeated for each of the fuels