The University of Western Ontario  
Faculty of Engineering  

DEPARTMENT OF CHEMICAL AND BIOCHEMICAL ENGINEERING  

CBE 4422a – Nanobiotechnology  
Course Outline  

Description  
Nanobiotechnology is an emerging frontier in nanotechnology. It integrates materials science, chemical engineering, physics and life science toward the biological and biochemical applications. This course introduces the fundamental concepts of nanobiotechnology and the up-to-date application of nanotechnology in biomedical industries. This course is toggled with graduate course, CBE 9241a.  

Course Goals  
1. This course aims to strengthen and broaden the skill and knowledge of senior undergraduate in modern chemical and biochemical engineering.  
2. Students will work with each other through team-based activities to facilitate interdisciplinary collaborations.  

Prerequisites:  
Completion of 3rd year of Engineering in Chemical, Electrical, Civil and Mechanical & Materials Engineering  

Antirequisites:  
None  

Contact Hours:  
3 lecture hours, 1 tutorial, 0.5 course  

Instructors:  
Dr. Jin Zhang (TEB 465); Tel: 519-661-2111 ext: 88322.; e-mail jzhang@eng.uwo.ca  
Undergraduate Assistant: Lisa Drysdale (TEB 477); Tel: 519-661-2131  
e-mail: cbeundergraduate@uwo.ca  

Required Texts:  
None  

Course Notes:  
Lecture notes are available on the WebCT.  

Reference Texts:  

Laboratory:  
None
Units:
SI and other engineering units

General Learning Objectives

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<th>Ethics and Equity</th>
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<td>Problem Analysis</td>
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<td>Team Work</td>
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<td>Economics and Project Management</td>
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<td>Engineering Tools</td>
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<td>Impact on Society</td>
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Learning Objectives:
1. Understand the fundamental concepts of nanotechnology and nanobiotechnology
2. Analyze and apply nanofabrication processes
3. Interpret the interaction between nanostructured materials and biological system
4. Generalize how to apply nanotechnology in the fields of pharmaceuticals and healthcare
5. Evaluate regulatory and ethical concerns on nanotechnology used in life science

Topics:
1. Introduction: From Nanotechnology to Nanobiotechnology
   - Evolution of nanotechnology
   - Emerging field: Nanobiotechnology

2. Nanostructured Materials (Nanomaterials)
   - Basic principles of nanotechnology
   - Quantum size effect in nanomaterials
   - Property changes due to nanostructuring

3. Interaction between Nanomaterials and Biological System
   - Protein-based nanostructures
   - DNA-based nanostructures
   - Cell-nanostructure interactions

4. Nanofabrication and Materials Characterization
   - Chemical and physical techniques
   - Nano self-assembly
   - Nanolithography
   - X-ray diffraction (XRD)
   - Electron microscopy
   - Atomic force microscopy (AFM)
   - Scanning Tunneling Microscope (STM)

5. Nanotechnology in Biological and Biomedical Applications
CBE 4413a course outline

- Nanostructured biosensor
- Nanocrystals used in bio-imaging
- Nanostructures in drug delivery
- Other applications of nanobiotechnology
- Design: nanobiosensor devices

6. Assessing Potential Risks

7. Perspective Commercializing Nanobiotechnology

8. Future Nanotechnology used in life science

9. Summary

Evaluation:
The final course mark will be determined as follows:
Assignments and test 25%
Project * 20%
Final exam 55%

* Undergraduate students need to finish one project report

Note: Students must pass the final examination to pass this course. Students who fail the final examination will be assigned 48% if the aggregate mark is higher than 50%, or the aggregate mark. Assignments are to be handed into the CBE 4422a course (locker # located in the Thompson Engineering Building, on the specified due date provided by the Instructor.

Use of English:
In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance:
Attendance at all lectures, tutorials and laboratories is mandatory. Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with permission of the Dean, the student will be debarred from taking the regular examination in the course.

Cheating:
University policy states that cheating is a scholastic offense. The commission of a scholastic offense is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

Plagiarism:
University policy states that plagiarism is a scholastic offense. Plagiarism is defined as appropriating and passing off writings or ideas of another person’s as one’s own. Penalties may include failure or automatic withdrawal from the course.

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence.

The University of Western Ontario has software for plagiarism checking. Students may be required to submit their work in electronic form for plagiarism checking.

For further information on plagiarism, consult the Scholastic Offence Policy in the Western Academic Calendar.

**Sickness and Other Problems:**
Students should immediately consult with the instructor or Department Chair if they have any problems that could affect their performance in the course. The student should seek advice from the Instructor or Department Chair regarding how best to deal with the problem. Failure to notify the Instructor or Department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

**Notice:**
Students are responsible for regularly checking their email and notices posted on Instructors' doors.

**Consultation:**
Office hours will be posted. Individual consultation may be arranged by appointment with the instructor.

**Note:**
The above topics and outline are subject to adjustments and changes as needed.

**Accreditation (AU) Breakdown**
Engineering Design  = 30%
Engineering Science  = 70%