



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

**LAST REVIEW: 2008-2009**

*(i.e. 2003-2004)*

**NEXT REVIEW: 2013-2014**

*(i.e. 2008-2009)*

**STATUS: A**

*(A, I, D)*

**COURSE TITLE: Introduction to Biotechnology**

**COMMON COURSE NUMBER: BSC 2421**

**CREDIT HOURS: 3**

**CONTACT HOUR BREAKDOWN**

*(per 16 week term)*

**CLOCK HOURS:**

*(Voc. Course ONLY)*

Lecture: **48**

Lab:

Clinic:

Other:

**PREREQUISITE(S): BSC 1005, BSC 1005L**

**COREQUISITE(S): BSC 2421L**

**PRE/COREQUISITE(S):**

**COURSE DESCRIPTION** **This lecture based course provides an introduction to concepts and principles associated with current accepted biotechnological practices in the areas of laboratory safety cell culture techniques, laboratory skills (measurements and calculations, preparation of solutions, use of various instruments) and microscopy. In addition, methods of DNA extraction, amplification, gene cloning, nucleic acids and protein electrophoresis and finger printing will be covered.:**

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

## **UNIT TITLES**

- 1. History and General Concepts in Biotechnology**
- 2. Types of Biotechnology**
- 3. Biosafety and Regulation in Biotechnology**
- 4. Introduction to Ethics in Biotechnology**
- 5. Introduction to Bioinformatics**
- 6. Genomics**
- 7. Proteomics**
- 9.**
- 10.**
- 11.**
- 12.**
- 13.**



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## ASSESSMENT:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

Written tests, reports to demonstrate student competency in field.
Formulate problem, make observations, derive and test hypothesis and make conclusions.
Students use analytical reasoning skills to solve problems on written tests .
Students use demonstrations, group discussions, written tests, laboratory reports, research projects and/or field experiences to illustrate competence in recognizing and evaluating various scientific processes.
Results from class demonstrate student awareness of science and society.

*\*\*\* Complete the following only if course is seeking general education status \*\*\**

## GENERAL EDUCATION Competencies and Skills\*:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

<b>1. Read with critical comprehension</b>	
<b>2. Speak and listen effectively</b>	
<b>3. Write clearly and coherently</b>	
<b>4. Think creatively, logically, critically, and reflectively</b> (analyze, synthesize, apply, and evaluate)	
<b>5. Demonstrate and apply literacy in its various forms:</b> (highlight in green ALL that apply) ( 1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental )	
<b>6. Apply problem solving techniques to real-world experiences</b>	
<b>7. Apply methods of scientific inquiry</b>	
<b>8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings</b>	
<b>9. Demonstrate an understanding of and appreciation for human diversities and commonalities</b>	
<b>10. Collaborate with others to achieve common goals.</b>	
<b>11. Research, synthesize and produce original work</b>	
<b>12. Practice ethical behavior</b>	
<b>13. Demonstrate self-direction and self motivation</b>	



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14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

*\* General Education Competencies and Skills endorsed by '05-'06 General Education Task Force*

**Common Course Number:**

## UNITS

### Unit 1: History and General Concepts in Biotechnology

**General Outcome:**

**1.0 The students should be able to describe the history of biotechnology from selective breeding of livestock and crops up to Recombinant DNA Technology and Genetic Engineering. In addition, students should be able to explain and describe the process of the scientific method and the roles of objectivity and statistical significance in interpreting experimental data.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 1.1 Recognize a clear concept of biotechnology in a historical and current context, and refer to the many different scientific disciplines that directly contribute to the development of this science.**
- 1.2 Discuss the advantage of modern biotechnology over conventional crossbreeding for new plant products.**
- 1.3 Illustrate the importance of the scientific method in the context of biotechnology.**



**Common Course Number:**

**Unit 2: Types of Biotechnology**

**General Outcome:**

**2.0 The student shall be able to describe the different areas within biotechnology and their impact on our lives.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 2.1 Provide examples of current applications and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, forensic, and even regulatory biotechnology.**
- 2.2 Explain the concept of environmental biotechnology, bioremediation and the distinction between aerobic and anaerobic biodegradation.**
- 2.3**
- 2.4**
- 2.5**
- 2.6**
- 2.7**
- 2.8**
- 2.9**
- 2.10**



**Common Course Number:**

**Unit 3: Biosafety and Regulation in Biotechnology**

**General Outcome:**

**3.0 The student shall learn about general concepts in biosafety, biosafety levels, types of containment, and risk assessment in the laboratory. In addition, students should understand the role of regulatory agencies, testing and approval of new products, experimental use permits, and patents and trademarks.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 3.1 Apply the concept of biosafety and the personal mandatory practices.**
- 3.2 Differentiate the levels of biosafety in biotechnology laboratories.**
- 3.3 Describe the general principles of biotechnology regulation, the criteria and guidelines for plants and products of biotechnology and the protection of patents.**
- 3.4 Recognize the main regulatory agencies for biotechnology.**
- 3.5 Summarize the main steps of the notification process, testing of new products, and obtaining experimental use permits for laboratory biotechnology.**
- 3.6 Explain the process of the approval process for new biotechnological products, and labeling.**
- 3.7 Outline the procedures for the submission and obtaining patents and trademarks.**
  
- 3.8**
- 3.9**
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- 3.14**
- 3.15**



**Common Course Number:**

**Unit 4: Introduction to Ethics in Biotechnology**

**General Outcome:**

**4.0 The student shall understand the role of ethics in biotechnology, specifically applying to genetically modified crops and animals, regenerative medicine and stem cell research, animal and human cloning, and bioterrorism.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 4.1** Identify the main ethical concerns about the different areas of biotechnology.
- 4.2** Review the bioethics components associated with biotechnological research and particularly the ethical issues surrounding genetic testing, stem cell use, and human cloning
- 4.3** Outline the environmental impacts of crops enhanced by biotechnology and analyze the health concerns.
- 4.4** Discuss the problematic around biotechnology as a tool for detection, identification and combating bio-weapons in the context of bio-terrorism.
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- 4.14**
- 4.15**



**Common Course Number:**

**Unit 5: Introduction to Bioinformatics**

**General Outcome:**

**5.0 The student shall understand the integration of techniques in applied mathematics, informatics, statistics, computer science, chemistry and biochemistry to solve biological problems on a molecular level.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 5.1 Describe bioinformatics and explain its relevance.**
- 5.2 Explain the concept of pharmaco-genomics and its applications, as well as the future implications.**
- 5.3 Give examples of how to retrieve DNA databases, and explore Gen Bank networks.**
- 5.4 Describe and explain the utilization of topology in bioinformatics.**
- 5.5 Define the concept of firewalls, and search engines in bioinformatics.**
- 5.6 Describe the modeling simulation in bioinformatics.**
- 5.7 Explain the implications and the basic idea behind micro-arrays, in the context of bioinformatics.**
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- 5.14**
- 5.15**



**Common Course Number:**

**Unit 6: Genomics**

**General Outcome:**

**6.0 The student shall understand the structure, function and expression of DNA and techniques in DNA technology, including recombinant DNA technology, genetic engineering, cleavage of DNA, and cloning.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 6.1 Discuss the basic principles of genomics, including mainly the DNA structure, replication and function, as well as the concept of gene, and genomes.**
- 6.2 Outline the process of transcription and the mRNA processing as well as the translation and specific roles of mRNA, tRNA, and rRNA in protein synthesis.**
- 6.3 Discuss the concept of recombinant DNA technology or genetic engineering and include the topics of restriction enzymes or restriction endonucleases, DNA cloning, plasmids, vectors, transformation, DNA libraries and amplification by PCR, DNA micro array or gene chip, hybridization and probes.**
- 6.4 Identify the process of DNA amplification by polymerized chain reaction (PCR).**
- 6.5 Describe how molecular biology techniques and the human genome project are being used to create human disease gene maps.**
- 6.6**
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- 6.12**
- 6.13**
- 6.14**



**Common Course Number:**

**Unit 7: Proteomics**

**General Outcome:**

**7.0 The student shall describe protein: structure/function, synthesis, modification, engineering, expression and purification, production and processing and the application of proteomics in biotechnology.**

**Specific Measurable Learning Outcomes:**

**Upon successful completion of this unit, the student shall be able to:**

- 7.1 Summarize the basic principles of proteomics, including protein synthesis and posttranslational modifications and glycosylation.
- 7.2 Critique the main ways for purification of proteins in the biotechnology laboratory.
- 7.3 Explain and outline the concept of protein engineering, and protein production and processing.
- 7.4 Outline the main systems of protein expression in the biotechnology laboratory.
- 7.5 Describe the main application of proteomics to biotechnology.
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- 7.12
- 7.13
- 7.14
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