Master Course Syllabus
Kennedy King College
One of the City Colleges of Chicago
Biotechnology
Semester/Academic Year (20__ - 20__)

Course Prefix and Number: Biotech 235

Course Title:
Length of Course: 16 weeks

PCS Code: 1.2

IAI Code:

Semester Credit Hours: 3.0

Contact Hours: 5 (4000 minutes)

Lecture Hours: 1 (800 minutes)

Lab Hours: 4 (3200 minutes)

Method of Delivery (mark all that apply): Face to Face __x__ Online ____ Hybrid _X___

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Course Catalog Description: This course covers intermediate concepts in molecular biology emphasizing topics that are important in the biotechnology industry. This course will explore cell and gene therapy techniques, biofuels production and production of biopharmaceutical products and devices. Writing assignments, as appropriate to the discipline, are part of the course.

Prerequisites: Grade of C or better in Biotech 225 and Biotech 230 or Consent of Department Chairperson.

Course Objectives:
This course covers:
1. How damaged DNA is repaired by the cell.
2. How to produce various biopharmaceutical products using bacteria, yeast and animal cells using biotechnology lab skills.
3. How to set up a bioreactor, use a pH meter for hydrogen production experiments.
4. The process of transcription in prokaryotes and eukaryotes.
5. How prokaryotes control transcription versus eukaryotes.
6. The process of post transcriptional modification.
7. The process of RNA interference.
8. How to grow and culture bacteria and analyze their results and proper storage of bacteria
9. How to grow and analyze the growth of algae
10. How to use a spectrophotometer to analyze their results
11. How to produce ethanol using bacterial enzymes and how to analyze the results
12. How to produce hydrogen (g) using bacteria and analyze the results

Student Learning Outcomes:
Upon successful completion of the course, students will be able to:

1. Develop a Standard Operating Procedure (SOP) for biofuel production using one of several microorganisms (bacteria, yeast, algae).
2. Analyze the growth of microorganisms (bacteria, yeast, algae) during and after the production of biofuels within the SOP guidelines.
3. Compare the different methods of DNA repair in the cell.
4. Compare and contrast prokaryotic transcription to eukaryotic transcription.
5. Compare and contrast prokaryotic control of transcription to eukaryotic control of transcription.
6. Distinguish the various aspects of post transcriptional modification in eukaryotes.
7. Outline the steps of RNA interference in eukaryotic genes.
8. Construct a model for translation in prokaryotes and eukaryotes.
9. Demonstrate and utilize basic biotechnology lab skills and practice hazard awareness protocols.
10. Discuss how a spectrophotometer is used to analyze bacterial and algal growth in biofuel production.
11. Build a bioreactor set up to produce hydrogen using various microorganisms (bacteria, yeast, algae).
12. Construct a concept map which demonstrates their understanding of how to produce a vector (AAV) for gene therapy.

| Suggested Topical Outline | | | | | |
|---|---|---|---|---|---|
| Class Units (# of units is dependent on course – adjust accordingly) | Topic (Required) | Content (Optional - provide details) | Lab Information | Desired Outcome(s) | Suggested Assessment Method(s) |
| | | | | | |
| Unit 1 | Lecture: DNA Repair Pathways | Reading:<br><br>Problem sets: Various texts (see note) | Introduction to biofuels production. Choose the production microorganism | 1,3 | |
| Unit 2 | How to use cellulosic enzymes to produce bioethanol | | Use the chosen microorganism to produce a biofuel | 1, 10, 11 | Quiz on chap. Lab notebook check |
| Unit 3 | Lecture: Transcription in Bacteria<br><br>How to use bacteria to produce biohydrogen | Reading:<br><br>Problem sets: Various texts (see note) | Use the chosen microorganism to produce a biofuel | 2, 4, 10, 11 | |
| Unit 4 | How to use algae to produce biodiesel | | Use the chosen microorganism to produce a biofuel | 1, 2,10, 11 | Quiz on chap. Lab notebook check |
| Unit 5 | Lecture: Transcription in Eukaryotes<br><br>Introduction to biomanufacturing | Reading:<br><br>Problem sets: Various texts (see note) | Choose the organism to produce the biopharmaceutical product | 1, 4, 5, 9, 11 | |
| Unit 6 | Upstream processing using bacteria, yeast, or animal cell lines. | | Use the chosen organism to carry out the production | 11, 12 | Quiz on chap. Lab notebook check |
| Unit 7 | Lecture: Epigenetic Mechanisms of Gene Regulation<br><br>Downstream processing of bacteria, yeast or animal cell lines. | Reading:<br><br>Problems: Various text | Use the chosen organism to carry out the production | 6, 7, 11, 12 | Quiz on Chap. |
| Unit 8 | QC Biochemistry for biopharmaceutical products | | Use the chosen organism to carry out the production | 11, 12 | Mid Term Exam<br><br>Lab notebook check |
| Unit 9 | Lecture: RNA Processing and | Reading: | Gene therapy process | 6, 7, 11, 12 | |

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| | Posttranscriptional Gene Regulation<br><br>Introduction to cell and gene therapies | Problems: Various text | | | |
| Unit 10 | How to produce viral vectors (AAV) using SF9 cells | | Carry out the gene therapy process | 9, 11, 12 | Quiz on Chap.<br><br>Lab notebook check |
| Unit 11 | Lecture: The Mechanism of Translation<br><br>How to use Single use bioreactors to produce therapeutic products: Vector amplification | Reading:<br><br>Problems: Various text | Carry out the gene therapy process | 8, 10, 12 | |
| Unit 12 | How to use Single use bioreactors to produce therapeutic products: Vector expansion | | Carry out the gene therapy process | 11, 12 | Quiz on Chap.<br><br>Lab notebook check |
| Unit 13 | Lecture: Medical Molecular Biology<br><br>Purification of the vector using Affinity Chromatography | Reading:<br><br>Problems: Various text | Carry out the gene therapy process | 9, 11, 13 | |
| Unit 14 | Polishing of the vector using several filtration methods | | Carry out the cell or gene therapy process | 9, 12 | Quiz on Chap.<br><br>Lab notebook check |
| Unit 15 | Fill finish – storage and cryopreservation methods | | Carry out the gene therapy process | 9, 12 | Quiz on Chap. |
| Unit 16 | Final Presentations (Group) | | | | Final Comprehensive Exam<br>Lab notebook submission |

Students Course Is Expected to Serve: Students who are pursuing an Associates of Applied Science degree in Biotechnology.

Suggested Texts, Materials, and Resources:

Fundamental Molecular Biology, 3rd Edition, Lizabeth A. Allison, Wiley – Blackwell, July 2021
and Biomanufacturing Laboratory Manual by Northeast Biomanufacturing Center and Collaborative ($NBC^2$)

Materials:
Resources:
Supplies: a lab coat, goggles and gloves are helpful

Suggested Methods of Instruction: We will utilize lectures, discussion, laboratories, group activities.

Suggested Methods of Assessment and Evaluation:
(Formative and Summative) We will utilize quizzes, exams, lab reports, homework, problem sets and papers to assess students in this course.

Suggested Grading Scale:

| Assignments: | Grade Distribution:<br><br>90 % to 100 % = A<br>80 % to 89% = B<br>70 % to 79 % = C<br>60 % to 69 % = D<br>Below 60% = F |
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Suggested Exit Assessment/Competencies (as applicable):

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Processing Validation (To be completed by College)

Add – Effective Term/Year: _____ Reactivate – Effective Term/Year: _____
Inactivate – End Term/Year: _____ Withdraw – End Term/Year: _____

Approved College(s):

DA: ___ HW: ___ KK:_X_ MX:___ OH:___ TR:___ WR:___

Syllabus Preparer/Advocate: _____Clifford Wilson, III_____

Title of Advocate: _____Assistant Professor_____

College of Advocate: _____Kennedy King College_____

ICCB Submission Date: ( / / )
ICCB Approval Date: ( / / )
IAI Submission Date: ( / / ) IAI Panel: _____
IAI Approval Date: (if applicable) ( / / ) IAI Code: _____

PACC Master Course Syllabus Template –August 2020