**ESSEX COUNTY COLLEGE**

**Biology & Chemistry Division**

**BIO 237 – Genetics with Laboratory**

**Course Outline**

**Course Number & Name:** BIO 237 Genetics with Laboratory

**Credit Hours:**  4.0 **Contact Hours:**  6.0 **Lecture:** 3.0 **Lab:**  3.0 **Other:**  N/A

**Prerequisites**:  Grade of “C” or better in BIO 103 or placement

**Co-requisites:** BIO 104 **Concurrent Courses:** None

**Course Outline Revision Date:**  Fall 2010

**Course Description**: This is an introductory course in Genetics for biology majors. The course follows a lecture/laboratory format to cover traditional topics in transmission genetics, gene mapping, molecular genetics, the organization of viral, prokaryotic and eukaryotic genes, regulation of gene expression, recombinant DNA technology, and population genetics. The laboratory places emphasis on techniques and instrumentation used in recombinant DNA technology, as well as other techniques that are used to investigate the structure, function, and transmission of inheritable information.

**Course Goals:** Upon successful completion of this course, students should be able to do the following:

1. demonstrate knowledge of the fundamental concepts and theories that are the foundation of current understanding and application of genetic principles;

2.    utilize critical thinking and problem solving skills to determine mechanisms of inheritance;

3. properly use equipment and access information sources that are commonly utilized in the manipulation, study, and analysis of genetic information.

**Measurable Course Performance Objectives (MPOs)**: Upon successful completion of this course, students should specifically be able to do the following:

1. Demonstrate knowledge of the fundamental concepts and theories that are the foundation of current understanding and application of genetic principles:

* 1. *critique Gregor Mendel’s experiments with the garden pea, Pisum sativum;*
  2. *identify landmark experiments that led to the discovery of DNA as the genetic material*;
  3. *discuss the landmark experiments and techniques that were used to determine the structure of DNA;* and
  4. *describe how recombinant DNA technology is being used today in the treatment of disease, in agriculture and in animal husbandry*

**Measurable Course Performance Objectives (MPOs)** (continued):

2. Utilize critical thinking and problem solving skills to determine mechanisms of inheritance;

2.1 *explain the basic principles of the scientific method and laboratory safety;* and

2.2 *determine the mechanism(s) of inheritance involved in the assigned Zea maize problem kit*

3. Properly use equipment and access information sources that are commonly utilized in the manipulation, study, and analysis of genetic information:

3.1 *insert (harmless) viral DNA into a plasmid vector, transform bacteria with recombinant vectors, clone bacteria, recover and purify recombinant DNA;*

3.2 *perform gel electrophoresis on donar DNA, recombinant and non-recombinant plasmids;*

3.3 *determine the size of the above components using a DNA ladder and standard curve;* and

3.4 *perform a Southern Blot*

**Methods of Instruction**: Instruction will consist of a combination of lecture, class discussion, class activities, Power Point presentation, laboratory exercises, outside reading assignments and data analysis.

**Outcomes Assessment:** Exam and laboratory exam questions are blueprinted to course objectives. A checklist rubric is used to score student presentations for the presence of course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

**Course Requirements:** All students are required to:

1. Attend class regularly. Excessive absences or late arrivals negatively affect student understanding of material and, therefore, performance in the course.

2. Complete assigned reading and homework in a timely manner and contribute to class discussions. It is important to note that science cannot be understood without doing a significant amount of outside study.

3. Take all exams and deliver presentations when scheduled. Note: Policies regarding make-up exams depend on the individual instructor of the class.

**Methods of Evaluation:** Final course grades will be computed as follows:

**% of**

**Grading Components final course grade**

* **3 or more Hourly Exams** (dates specified by the instructor)  **40 – 60%**

Exams will show evidence of the extent to which students meet course objectives, including but not limited to, identifying and applying concepts, analyzing and solving problems, estimating and interpreting results, and stating appropriate conclusions using correct terminology.

* 1 or more Cumulative Lab Exam & 2 presentations 15 – 25%

The lab exams and presentations will assess the extent to which students meet course objectives, including, but not limited to, identifying and applying concepts of the scientific method, following correct laboratory procedure and performing accurate data analysis.

* **Final Exam** **25 – 35%**

The final exam will examine the extent to which students meet course objectives, synthesize course content and retain fundamental concepts.

Note: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

* plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
* cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
* interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
* fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.

**Course Content Outline:** The lecture component is based on the text **iGenetics: A Molecular** **Approach**, 3rd edition, by Peter J. Russell; published by Pearson Benjamin Cummings, San Francisco, CA, 2010; ISBN #: 0-321-56976-8/978-0-321-56976-9. The laboratory component is based on the following manuals:

1. **Carolina Drosophila Manual**, by Ramond O. Flagg; published by Carolina Biological Supply Company, Burlington, NC, 1988; ISBN # 0-89278-027-4.
2. **A Laboratory Course in Molecular Biology, 5. Genetic Engineering,** by John N. Anderson; published by John N. Anderson, Dept. of Biological Sciences, Purdue University, West Lafayette, IN, 1989.

**Week Chapter/Topics/Lab Exercises**

1 CHAPTER 1 Genetics: An Introduction

CHAPTER 2 DNA: The Genetic Material

2 CHAPTER 3 DNA Replication

CHAPTER 4 Gene Function

3 CHAPTER 5 Gene Expression: Transcription

Lab 1: Lab Orientation, Safety, Ethics and the Scientific Method

4 **HOURLY EXAM I**

CHAPTER 6 Gene Expression: Translation

Lab 2: Techniques: Measurements, Micropipetting, DNA Isolation and

Qualitative Spectrophotometric Analysis

5CHAPTER 6 Gene Expression: Translation (continued)

Lab 3: Determining the Bacterial Growth Curve: Sterile Technique & Serial

Dilutions

6 CHAPTER 7 DNA Mutation, DNA Repair, and Transposable Elements

Lab 4: Eco R1 Digest of *Φ λ* and its Insertion into EcoR1-Digested pUC18

7 CHAPTER 8 Genomics: The Mapping and Sequencing of Genomes

Lab 5: Electrophoretic Characterization of Recombinant Molecules

8 CHAPTER 8 Genomics: The Mapping and Sequencing of Genomes (continued)

Lab 6: Transformation of *E. coli*

9 **HOURLY EXAM II**

CHAPTER 10 Recombinant DNA Technology

Lab 7: Mini-prep Isolation of Plasmids From Transformed Cultures of *E. coli*

10 CHAPTER 11 Mendelian Genetics

Lab 8: EcoR1 & BamH1 Digests and Size determination of Plasmids

11 CHAPTER 12 Chromosomal Basis of Inheritance

Lab 9: Southern Blotting of DNA Fragments in Gel

**Week Chapter/Topics/Lab Exercises**

12 **HOURLY EXAM III**

CHAPTER 13 Extensions of and Deviations from Mendelian Genetics

CHAPTER 14 Genetic Mapping in Eukaryotes [Note: At present, because of

laboratory renovations the 3-point gene mapping of *Drosophila*

chromosomes cannot be performed.]

Oral/Poster Presentations begin

13 CHAPTER 16 Variations in Chromosome Structure and Number

CHAPTER 17 Regulation of Gene Expression in Bacteria & Phages

Oral/Poster Presentations (continued)

14 CHAPTER 18 Regulation of Gene Expression in Eukaryotes

CHAPTER 21 Population Genetics

Oral/Poster Presentations (continued)

15 Continue unfinished chapters

**CUMMULATIVE LAB EXAM**

Review for Final Exam

16 **FINAL EXAM**