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

Course Prefix and Number: Biotech 211

Course Title: Laboratory Math for Biotechnology

Length of Course: 16 weeks

PCS Code: 1.2

IAI Code:

Semester Credit Hours: 2.0

Contact Hours (minutes): 2 (1600 minutes)

Lecture Hours (minutes): 2 (1600 minutes)

Lab Hours (minutes): N/A

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

Course Catalog Description: This course introduces mathematical tools that are used in the biotechnology laboratory. Students apply mathematical concepts to solve problems such as calculating quantities of chemicals required to make solutions, graphing and interpreting data, and calibrating instruments. Basic statistical and algebraic concepts are covered. Writing assignments, as appropriate to the discipline, are part of the course.

Prerequisites: Pursuit of an Associates of Applied Science Degree in Biotechnology (0215).

Course Objectives:
This course covers:

1. How to set up and solve calculations required for solution-making in the biotechnology laboratory
2. How to present and analyze laboratory data using graphical analysis
3. How to develop an appreciation of the importance of being meticulous in laboratory calculations
4. How to create dilutions of stock solutions in the laboratory.

Student Learning Outcomes:

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

1. Solve problems required to make solutions in the biotechnology laboratory.
2. Prepare and analyze dilutions for solutions in the laboratory.
3. Convert between units in the metric system for use in the laboratory.
4. Create and analyze graphs from data generated in the biotechnology laboratory.
5. Solve problems using the ratio and proportion and unit cancelation methods.

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	EXPONENTS AND SCIENTIFIC NOTATION	Reading: Special points to study: • Rules for calculations involving exponents in Box 1 (pp.) • Definition of a "number in scientific notation" at the top of page • Mechanism for entering numbers in scientific notation into calculators on p. Examples to try: • p. (#1a – f, #2g – l) • p. (#2a – f, #3a – d) • p. (#1a and c) Homework: Problem sets	Classroom Activities 1 Introductory activity reviewing exponents and illustrating their use/importance Classroom activities 2 practice problems	• Perform basic manipulations involving exponents • Convert between standard and scientific notation • Use calculators for exponents and scientific notation	
Unit 2	LOGARITHMS	Reading: Special points to study: • Define a "common log" and "antilogarithm" • Use a scientific calculator to determine both common logarithms and antilogarithms • ESTIMATE the values of common logarithms and antilogarithms • Define and calculate pH Examples to try:	Classroom activities reviewing logs, antilogs, and the use of calculators for these functions Classroom activities • "The relationship between pH and hydrogen ion concentration" Classroom Activities 2 practice problems	□ Determine logs and antilogs for powers of ten only □ Use calculators to determine logs and antilogs □ Convert between pH and hydrogen ion concentration	Quiz 1

		• p. #4, #6 (a –c), #7 (a & b), #9 (a & b) Homework: Problem sets			
Unit 3	UNITS OF MEASUREMENT AND SIGNIFICANT FIGURES	Reading: Special points to study: □ Memorize the underlined prefixes in the metric system in Table 1, p. □ Examine Table 3, p. □ Study the example problems on p. covering conversion between metric units Examples to try: • p. #3 and #4 Chapter Special points to study: □ Understand Section 4.1, which explains how significant figures are used to express uncertainty in measurements. Focus on Example 1 on p. as a nice illustration of the concept of "uncertainty" in measurements. □ Examine Box 1 on pp. □ Read through Box 2 on pp. and then read the three examples on p. Examples to try: • p. #1, #5, #7 Homework: Problem sets	Classroom activity on units of measurement and conversions Classroom activity 2 "Getting some perspective: mass, length and volume" Classroom Activities 3 practice problems	□ Convert between metric units □ Understand the meaning of significant figures	

Unit 4	USING EQUATIONS TO DESCRIBE RELATIONSHIPS	Reading: Special points to study: □ Understand the concepts of “constants” and “variables” in equations (Section), and how the solution of an equation varies by changing these parameters □ Study Section, as the importance of being able to express solutions with the PROPER UNITS cannot be overemphasized!!! Examples to try: □ p. #8 and #9 □ p. #5 Homework: Problem sets	classroom activity on order of operations: rules and calculator use	• Predict the behavior of one variable in an equation with changes in another variable	Quiz 2
Unit 5	RATIOS AND PROPORTIONS	Reading: Special points to study: □ Master the process of cross-multiplication illustrated in ‘The Chocolate Cake Problem’ on p. □ Understand the importance of keeping units with your proportions as explained in point 2 on p. Examples to try: • p. (1, 5, 7, 9, 11, 13, 17) Homework: Problem sets	Classroom activity on ratios and proportions Classroom activities 2 “Ratios and proportions: an Introduction”	• Understand the difference between “ratios” and “proportions”	
Unit 6	UNIT CONVERSION,	Reading:	Classroom	□ Use ratios	Quiz 3

	DENSITY AND DOSAGES	Special points to study: □ Study Box 1 on p., which compares the two methods of unit conversion □ Closely examine the multistep example problems in Section 7.5 Examples to try: □ #16, 21 and 26 on pp. and #5 on pp. Chapter Special points to study: • Study the concept of "density" discussed in Section 8.1 Examples to try: • #2 and 3 on p. Chapter Special points to study: • Study the two examples problems on pp. Examples to try: • #1 and 2 on p. Homework: Problem sets	activity "Working with impure chemicals" and "Density: an Introduction to the concept" and proportions applications practice problems □ Practice concepts by using multistep practice problems	and proportions for unit conversion □ Use unit cancellation for unit conversion □ Solve multiple step problems using ratios and proportions □ Solve problems involving density □ Solve problems involving dosage	
Unit 7	PERCENTS AND INTRODUCTION TO CONCENTRATION PROBLEMS	Reading: Special points to study: □ Study Box I on pp. □ Study the example problems on p. that illustrate the concept of percent error. Examples to try: • #2, 4 and 6 on p. Chapter 1 Special points to study: □ Study Figure 1 on p. □ Review the example problem on p.	Classroom activity Chapter • "Percent as ratios: how to treat percents as ratios can simplify your work " Classroom activity 2 discussing percents as ratios □ Practice concepts by using percent's practice problems	□ Perform basic calculations using percent's □ Convert between different units of concentration	

		□ Review the example problem on pp. □ Examine the example problem on p. Examples to try: □ #1 and #2 on p. 132 □ #3 on p. □ #1 on p. □ #1 and #3 on p. Homework: Problem sets	worksheet as a self-test □ Practice concepts by using Introduction to concentration practice problems		
Unit 8					Quiz 4 Mid Term Exam
Unit 9	PREPARING LABORATORY SOLUTIONS THAT CONTAIN ONE SOLUTE	Reading: Special points to study: • Briefly read Sections 12.1 and 12.2 • Study carefully Boxes 1, 2 and 3 in Section 12.3 • Examine the discussion of parts on p. □ Review the example problems on p. □ Study Box 4 on p. and the associated example problem on p. □ Study the definitions of mM and mM solutions on p. Examples to try: • #2, 3, 10 and 12 on pp. • #2, 3 and 4 on pp. □ #1, 3, 5, and 6 on p. □ #8, 9, and 10 on p. Homework: Problem sets	Classroom activity “The basics of solution making” Classroom activity 2 Molarity, percent solution, and parts per million	□ Set up and solve problems involving percent solutions □ Set up and solve problems involving molarity □ Set up and solve problems using ppm and ppb	

Unit 10	DILUTIONS 1	Reading: Special points to study: • Master the material in Box 1 on p., which contrasts the different ways to express dilutions • Study Figure 2, which shows how dilutions are made in the lab, and expressed as fractions Examples to try: • #2 and #3 on p. • #6 – 10 on p. • #2 on p. Homework: Problem sets	Classroom activity "What dilution did I make?"	• Prepare dilutions of a particular volume	
Unit 11	DILUTIONS 2	Reading: Special points to study: • Carefully review Section 13.4 • Study Figure 3 on p. • Review the examples on p. Examples to try: □ #5, 7, an 8 on p. □ #1, 4, and 5 on p. □ #1, 6 and 9 on p. Homework: Problem sets	Classroom activity "Dilutions: an Introduction" Classroom activity • Dilutions and concentration of solutions study guide and practice problems	□ Determine the concentration of a solution following dilution □ Determine the concentration of a stock solution from a dilution	Quiz 5
Unit 12	DILUTIONS 3	Reading: Special points to study: □ Carefully review Figure 4 on p. 196 and the accompanying sample calculations provided on	Classroom activity "Serial dilutions" Classroom activity 2 □ Practice concepts using the dilution series	□ Perform calculations involving serial dilutions □ Correctly apply the C1V1 = C2V2	

		p. □ Examine Box 2 on p. Examples to try: □ #1 and 3 on pp. □ #2, 4, 5, and 6 on pp. □ #7, 9, and 10 on p. Homework: Problem sets	problem set □ Practice concepts using the C1V1 = C2V2 practice problems		
Unit 13	PREPARING LABORATORY SOLUTIONS THAT CONTAIN MORE THAN ONE SOLUTE	Reading: Special points to study: □ Study Section 14.2 which shows two ways of preparing the same multicomponent solution from pure solutes, and from stock solutions □ Review the steps in Box 1 for the proper method to adjust the pH of a solution Examples to try: • #3 and #4 on pp. Homework: Problem sets	Classroom activity “Making solutions with multiple components: Parts I and II”	□ Prepare solutions containing multiple solutes from stock chemicals □ Prepare solutions containing multiple solutes from stock solutions	Quiz 6
Unit 14	GRAPHING LINEAR EQUATIONS	Reading: Special points to study: □ Review Figure 5 on p. which shows how to graphically determine the slope of a line □ Review Box 1 on p. which shows how to graphically determine the equation of a line □ Study closely all of section 15.3 □ Examine Figure	Classroom activity Practice concepts by using the linear equations practice problems	□ Determine slope and intercept using the equation of a line □ Graph linear equations □ Apply graphing to standard curves	

		11 Examples to try: □ #1, 2, 7, 8, 11 and 16 on pp. □ a and b on p. □ #1 and #2 on pp. Homework: Problem sets			
Unit 15	GRAPHING EXPONENTIAL EQUATIONS	Reading: Special points to study: □ Examine Figure 1 on p. , which shows the shape of an exponential curve □ Study Figures 4 and 5 on p. , which show how to label the axes of semi-log graphing paper □ Examine Figure 8 on p. , which graphically shows the process of radioactive decay □ Review the "General Equation for Radioactive Decay" on p. Examples to try: □ #1, 2 and 5 on p. Homework: Problem sets	Classroom activity "Linear vs. exponential graphing: understanding the difference"	□ Understand the difference between linear and exponential relationships □ Plot exponential relationships using semi log graph paper	Quiz 7
Unit 16					Final Comprehensive Exam

Students Course Is Expected to Serve: Students may take this course to meet concentration requirements for an Associates of Applied Science Degree in Biotechnology.

Suggested Texts, Materials, and Resources:

Text: Basic Laboratory Calculations for Biotechnology, by L. A. Seidman, CRC Press, 3rd Ed. 2022.
Materials:
Resources:
Supplies:

Suggested Methods of Instruction: We will utilize lecture and discussion and group discussions/activities.

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

Suggested Grading Scale:

Assignments:	Grade Distribution: 90 % to 100 % = A 80 % to 89% = B 70 % to 79 % = C 60 % to 69 % = D Below 60% = F

Suggested Exit Assessment/Competencies (as applicable):

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: _____