Two-term Skill Development Lab-based, Concept-Supported Course Plan

Suggested Lesson Planning Guide
32 weeks, 5-6 hours of lab and lecture/discussion meetings/week

Activities may require adjustment to meet the time limitations of a particular course.

Week	Lab(s)	Lab Lesson Focus	Text Section Support and Lecture Discussion Focus	Key Lab Skill Objectives Students will:
1	1a 1b	Scientific Notebook Laboratory Safety	1.1 Defining Biotechnology 1.2 Biotechnology Products 1.3 Selecting Potential Products	- Start and maintain a legal scientific notebook - Learn emergency procedures and the location of safety hazards and emergency equipment
2	1c	Cheese Production	1.4 Scientific Methodology 1.5 Biotech Careers 1.6 Bioethics	- Conduct a controlled experiment, analyze and report data
3	2b 2c	Model Organisms Microscopy	2.1 Organisms and their Parts 2.2 Cellular Organization	- Grow, maintain, and monitor bacteria and fungi - Learn microscope use for prepared and wet mount slides
4	2d 2e	Microscopic Measurement Properties of Carbohydrates	2.2 Cellular Organization 2.3 Molecules of Cells	- Learn to estimate the size of microscopic specimen. - Study the structure and characteristics of different carbohydrates
5	3a 3b	Pipeting Micropipeting	3.1 Measuring Volumes	- Demonstrate skill using pipets and pipet pumps - Demonstrate skill using micropipets
6	3c 3e	Mass Measurement Mass/Volume Solutions	3.2 Making Solutions 3.3 Mass/Volume Solutions	- Demonstrate skill using balances - Prepare various mass/volume solutions
7	3f 3g	Percent Mass/ Volume Solutions Molar Solutions	3.4 Percent Mass/ Volume Solutions 3.5 Molar Solutions	- Prepare various percent mass/volume solutions - Prepare various molar solutions
8	3h 4a 4b	Dilutions DNA Isolation Solutions DNA Spooling	3.6 Dilutions 4.1 DNA Structure and Function	- Prepare dilutions of solutions - Prepare buffers and reagents for DNA isolation - Conduct alcohol precipitation of pure DNA sample
9	4e 4f	Media Prep Sterile Technique	4.2 Sources of DNA	- Prepare LB agar and LB broth - Pour sterile LB agar Petri plates

10	4g 4h	Bacteria Cell Culture Bacteria DNA Extraction	4.2 Sources of DNA 4.3 Isolating and Manipulating DNA	- Streak isolated colonies and start broth cultures - Isolate genomic DNA from bacteria
11	4i 4j	Agarose Gel Prep Agarose Gel Electrophoresis	2.4 The "New" Biotechnology 4.4 Gel Electrophoresis	- Prepare an agarose gel - Load, run, stain and analyze DNA on a gel
12	13e	Lambda PCR	13.1 Making DNA	- Perform a PCR reaction
13	13f 13g	Human DNA Extraction Alu PCR Genotyping	13.3 Polymerase Chain Reaction 13.4 Applications of PCR Technology	- Isolate DNA from cheek cells for PCR - Use PCR to test DNA for a specific genotype.
14	5a 5b	Antibody Function Enzyme Function	5.1 Structure and Function of Proteins 5.3 Enzymes: Protein Catalysts	- Simulate antibody-antigen testing - Test enzyme activity at different concentrations
15	5f	PAGE	5.4 Studying Proteins	- Prepare protein samples and load, run, stain and characterize proteins on a PAGE gel
16	5g	Identifying Proteins	5.5 Applications of Protein Analysis	- Prepare animal muscle tissue samples and run gels to study differences in protein composition
17	6b 6c	Starch and Sugar Assays Amylase Assay	6.1 Sources of Potential Products 6.2 The Use of Assays	- Conduct aldose and starch indicator tests - Test saliva for alpha-amylase activity
18	14a	ELISA	14.3 Advanced Protein Studies	- Conduct a qualitative ELISA (antibody assay)
19	6d	Testing Plants Substances	6.3 Products from Nature 6.4 Plant Proteins as Products	- Extract compounds from plants and test the extracts' antimicrobial activity on the growth of *E. coli*
20	6e 7a	Searching for Native Amylase Using the Spectrophotometer	6.5 Producing Recombinant DNA Protein Products 7.1 Using the Spectrophotometer	- Predict where amylase-producing bacteria might be found in nature and attempt to isolate colonies - Learn how to operate a spectrophotometer and how light corresponds to colors of the visible spectrum
21	7b 7c	Using the Spec to Study Molecules Measuring pH	7.1 Using the Spectrophotometer 7.2 Introduction to pH	- Use a VIS-spec to determine the absorption spectra and $Lambda_{max}$ for three colored solutions - Learn to use pH paper and a pH meter
22	7d 7e	Making Buffer Demonstrating Buffer Efficacy	7.3 Buffers	- Prepare a buffer to use in making a protein solution - Prepare buffers and test their ability to resist changes in pH

23	7f 7g	Spec Amylase Study Determining Amylase Concentration	7.4 Determining Protein Concentration	- Determine the absorbance spectrum for amylase-Bradford reagent to learn $Lambda_{max}$ - Use a best-fit standard curve to determine the concentrations of unknown amylase solutions
24	7i 8b	UV Spec to Study Proteins Restriction Digestion of pAmylase	7.4 Determining Protein Concentration 8.1 Overview of Genetic Engineering	- Use a UV-VIS spec to determine the $Lambda_{max}$ for a sample of colorless protein - Conduct a restriction digestion of the pAmylase to confirm prior to transformation of *E. coli* cells
25	8c	Transformation	8.2 Transforming Cells	- Transfer plasmids into *E. coli* and select transformants
26	8e	Scaling-up Transformed Cells	8.3 After Transformation 8.4 Fermentation, Manufacturing, and GMP	- Select colonies and scale them up from a selection plate to selection broth media.
27	9a 9b	Harvesting Amylase Dialysis of Protein Buffers	9.1 Harvesting a Protein Product 9.2 Using Chromatography to Study and Separate Molecules	- Separate transformed cells from broth and test the broth for amylase activity - Use dialysis tubing to conduct a buffer exchange prior to column chromatography
28	9c	Using Ion-Exchange Chromatography	9.3 Column Chromatography	- Separate lysozyme from albumin on an ion-exchange column
29	9d	Ion-Exchange Purification of Amylase	9.4 Product Quality Control 9.5 Marketing and Sales	- Use an ion-exchange column to determine the overall charge of amylase at pH7.2 and isolate amylase from a broth culture.
30	12a 12b	Using the UV Spec to Study Caffeine MSDS to Recognize Compounds	12.1 Drug Discovery	- Use the UV spectrophotometer to characterize, a colorless organic compound, caffeine - Access MSDS data to learn the characteristics of compounds
31	12c	Synthesis of Aspirin	12.2 Creating Pharmaceuticals by Combinatorial Chemistry	- Synthesize acetylsalicylic acid through combinatorial chemistry
32	12d	Melting Point Determinations for Quality Control	12.3 Creating Pharmaceuticals by Peptide and DNA synthesis 12.4 Pharmaceuticals by Protein Engineering	- Conduct melting point determinations the product of their acetylsalicylic acid production