Biotechnology

COURSE OUTLINE

1. Course Title: **Biotechnology 1, 2**
2. CBEDS Title: **Other health careers course**
3. CBEDS Number: 4298
4. Job Titles:

Quality Control Analyst	Biochemist/Research Assistant
Materials Assistant	Molecular Biologist/Professor
Staff Research Associate	Sales Representative
Lab Assistant/Technician	Molecular Biologist
Plant Biologist	Forensic Scientist
DNA Analyst	Research Scientist

5. Course Description:

This course explores major themes in Biotechnology: *What is Biotechnology, DNA, and Genetics.* Focus will be on anatomy and physiology with dissections of various mammals. Additional topics include pathogens, illnesses, cancer, nutrition, eating disorders, drugs, alcohol and tobacco. Related topics regarding energy, environmental issues, forestry, farming and viticulture will also be explored. Students will develop laboratory skills, critical thinking and communication skills currently used in the fields of genetics, microbiology and biotechnology.

6. Objectives:

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

A. Understand the role of biotechnology in society including the risks and benefits.
B. Understand the basic biological and chemical processes of cells, tissues, and organisms.
C. Gain a deeper understanding of the significance of biotechnology in pharmaceutical development, agriculture, forensics, genetic testing, industrial products, and scientific research.
D. Learn basic laboratory skills used in academic and industrial biotechnology laboratories.
E. Model the steps involved in the production of a recombinant DNA biotechnology product.
F. Gain an understanding and exposure to assorted topics and concepts in biotechnology.

Pathway

Recommended Sequence	Courses
Introductory	Biology or Health Science Investigation I
Skill Building	**Biotechnology 1, 2** Health Science Investigation II
Advanced Skill	Health Science Investigation III or Senior Science Seminar

6. Hours: *Students receive up to<u>180</u> hours of classroom instruction.*

7. Prerequisites: Biology
8. Date (of creation/revision): July 2011

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Upon successful completion of this course, students will be able to demonstrate the following skills necessary for entry-level employment.

Instructional Units and Competencies Guaranteed curriculum = regular font Negotiated curriculum = italicized	**Course Hours**	**Model Curr. Standards**	**CA Academic Content Standards**	**CAHSEE**
I. CAREER PREPARATION A. Career Planning and Management. 1. Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers. a. Students will identify skills needed for job success b. Students will identify the education and experience required for moving along a career ladder. 2. Understand the scope of career opportunities and know the requirements for education, training, and licensure. a. Students will describe how to find a job. b. Students will select two jobs in the field and map out a timeline for completing education and/or licensing requirements. 3. Know the main strategies for self-promotion in the hiring process, such as completing job applications, resume writing, interviewing skills, and preparing a portfolio. a. Students will write and use word processing software to create a resume, cover letters, thank you letters, and job applications. b. Students will participate in mock job interviews. 4. *Develop a career plan that is designed to reflect career interests, pathways, and postsecondary options.* *a. Students will conduct a self—assessment and explain how professional qualifications affect career choices.* *5. Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.* *a. Contact two professional organization and identify the steps to become a member.* *6. Understand the past, present and future trends that affect careers, such as technological developments and societal trends, and the resulting need for lifelong learning.* *a. Students will describe careers in the business industry sector.* *b. Students will identify work-related cultural differences to prepare for a global workplace.* B. Technology. 1. Understand past, present and future technological advances as they relate to a chosen pathway and on selected segments of the economy. 2. Understand the use of technological resources to gain access to, manipulate, and produce information, products and services. 3. Use appropriate technology in the chosen career pathway. C. Problem solving and Critical Thinking. 1. Understand the systematic problem-solving models that incorporate input, process, outcome and feedback components, and apply appropriate problem-solving strategies and critical thinking to work-related issues and tasks.	20 Additional hours are integrated throughout the course.	Finance & Business Industry Sector, Model Curriculum Standards 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0	Language Arts (8) R 1.3, 2.6 W1.3, 2.5. LC 1.4,1.5, 1.6 LS1.2, 1.3, (9/10) R2.1,2.3,2 W2.5 LC1.4 LS 1.1, 2.3 (11/12) R2.3 W2.5 LC1.2 Math (7) NS1.2, 1.7 MR 1.1,1.3 2.7,2.8, 3.1	Lang. Arts R 8.2.1 (9/10) R 2.1, 2.3 W2.5 Math (7) NS 1.2, 1.3, 1.7 MR 1.1, 2.1, 3.1

Italicized texts references "negotiated" curriculum; all other text references "guaranteed" curriculum.

2. Use and apply critical thinking and decision making skills to make informed decisions, solve problems, and achieve balance in the multiple roles of personal, home, work and community life. D. Health and Safety. 1. Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities. 2. Understand critical elements of health and safety practices related to a variety of business environments. E. Responsibility & Flexibility. 1. Understand the qualities and behaviors that constitute a positive and professional work demeanor. 2. Understand the importance of accountability and responsibility in fulfilling personal, community, and work-place roles and how individual actions can affect the larger community. 3. Understand the need to adapt to varied roles and responsibilities. F. Ethics and Legal Responsibilities 1. Know the major local, district, state, and federal regulatory agencies and entities that affect the industry and how they enforce laws and regulations. 2. Understand the concept and application of ethical and legal behavior consistent with workplace standards. *a. Contact a business and obtain a copy of their rules for employment.* *b. Role play difference ethical scenarios.* 3. Understand the role of personal integrity and ethical behavior in the workplace. G. Leadership and Teamwork. 1. Understand the characteristics and benefits of teamwork, leadership, citizenship in the school, community, and workplace settings for effective performance and attainment of goals. 2. Understand the ways in which professional associations and competitive career development activities enhance academic skills, career choices, and contribute to promote promote employability. 3. Know multiple approaches to personal conflict resolution and understand how to interact with others in ways that demonstrate respect for individual and cultural differences and for the attitudes and feelings of others.				

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
I Introduction A. Class policy B. Syllabus	1		1.2 Sci (9-12) (1.a) (1.c) (1.d) (1.j) (2.f) (5.e) (9.f) 1.3 Hist-SS (11) (11.8.1) 2.1R (2.1)(9-10) (1.2)(11-12) 2.2W (11-12) (1.6) (2.4) 2.3WO (11-12) (1.2)	**(10)WA1.1** **(10)R2.7** **(10)WS1.1, 1.4, 1.5** **(7)NS1.2, 1.3, 1.6** **(6)P2.5, P3.3** **(7)MR2.3, 2.4**
II. What is Biotechnology A. Students will describe the science of biotechnology and identify its product domains. B. Students will outline the steps in producing and delivering a product made through recombinant DNA technology. C. Students will describe how scientific methodologies are used to conduct experiments and develop products. D. Students will apply the strategy for values clarification to bioethical issues.	20	Health Science & Medical Technology Industry Sector Biotech. Research & Development Pathway A1.0 A1.1 A1.3 A6.0		
III. The Raw Materials of Biotechnology A. Students will identify the levels of biological organization and explain their relationships. B. Students will describe cell structure and its significance in biotechnology research and product development. C. Students will discuss the types of organisms researched and the types of cells grown and studied in biotechnology facilities plus the products with which they are associated. D. Students will distinguish between the cellular organization of prokaryotic and eukaryotic cells. E. Students will list the four main classes of macromolecules and describe their structure and function. F. Students will define genetic engineering and identify products created with this technology. G. Students will explain the Central Dogma of Biology and its importance in genetic engineering.	30	Health Science & Medical Technology Industry Sector Biotech. Research & Development Pathway A1.2 A2.2 A2.3		
IV. Molecular Biology A. Students will describe the structure and function of DNA and explain the process by which it encodes for proteins. B. Students will differentiate between eukaryotic and prokaryotic chromosomal structure and explain how this difference impacts gene regulation in the two cell types. C. Students will discuss the characteristics of viruses and their importance in genetic engineering.	30			

Instructional Units and Competencies	Hours	Industry Standards.	CA Academic Standards	CAHSEE
D. Students will explain the fundamental process of genetic engineering and give examples of the following applications: recombinant DNA technology, site-specific mutagenesis, and gene therapy.				
V. Nutrition A. Students will explain and give examples of key nutrients, nutrient cycles, photosynthesis and cellular respiration. B. Students will describe the importance of good personal nutrition and exercise, the impact of organic and non-organic foods, and labeling information and requirements. C. Students will identify various eating disorders and their causes, as well as the social, cultural and influences on diet.	15	Health Science & Medical Technology Industry Sector Biotech. Research & Development Pathway A1.1 A1.2 A2.3 A3.2 Hospitality, Tourism & Recreation Industry Sector Food Science, Dietetics, & Nutrition Pathway A4.0 A5.0		
VI. Biotechnology in Medicine A. Students will discuss the scope and role of medical biotechnology in the healthcare industry. B. Students will explain the function of drugs and discuss how they maybe created using combinatorial chemistry. C. Students will describe the various high-throughput screening processes for potential drug activity. D. Students will explain the methods for synthesizing peptides and oligonucleotides and discuss the uses of each. E. Students will detail the multiple uses of antibodies in medical biotechnology and discuss the immune response that results from vaccinations.	20			
VII. Biotechnology Techniques A. Students will outline the important applications of the growing biotechnology fields of pharmacogentics, environmental and marine biotechnology, and bioterrorism/biodefense.	10			
VIII. Medical Terminology A. Students will demonstrate an understanding of commonly used terms in the Biotechnology.	15			

IX. Human Anatomy and Physiology A. Students will describe the purpose of various human systems including the skeletal, muscular, circulatory, lymphatic, excretory, integumentary and digestive.	20			

10. Additional recommended/optional items
   a. Articulation: None
   b. Academic credit: N/A
   c. Instructional strategies:
      Methods of Instruction:
         a. Lecture
         b. Audio Visual Materials
         c. Research Readings and Written Presentations
         d. Homework Assignments
         e. Group & Individual Activities
         f. Quizzes, Tests & Final Exam
         g. Internet Exploration
         h. Job Shadowing & Internships
   d. Instructional materials: **Biotechnology, Science for the new Millennium.** Ellen Daugherty, MST., San Mateo Biotechnology Career Pathway, Paradigm Publishing, 2007.
      Teacher Generated
   e. Certificates: CPR