

Central Carolina Community College
Program Planning Guide
Bioprocess Technology
Credential: Associate in Applied Science Degree in Bioprocess Technology (A50440)

The Bioprocess Technology curriculum is designed to prepare individuals to work as Process Operators in biological products manufacturing facilities. Students will combine basic science and communication skills, manufacturing technologies, and good manufacturing practices in the course of study. Students will be expected to develop a strong basic science foundation with a sound understanding of the major technologies employed in the industry. They will also be expected to develop collaborative and disciplined work ethics while consistently practicing problem-solving skills.

Upon successful completion of the program, individuals should possess the necessary skills to qualify for employment in a variety of bioprocessing industries.

Program Length: 5 semesters

Career Pathway Options: Associate in Applied Science in Bioprocess Technology; Certificate in Bioprocess Technology

Program Sites: Lee Campus - Day Program

Suggested Course Schedule:	HOURS			Grade	Semester	Notes
	Class	Lab	Credit			
1st Semester (Fall)						
BIO 110	Principles of Biology	3	3	4		
CHM 131	Introduction to Chemistry	3	0	3		
CHM 131A	Introduction to Chemistry Lab	0	3	1		
CIS 110	Introduction to Computers	2	2	3		
MAT 121	Algebra/Trigonometry I	2	2	3		
OR MAT 161	College Algebra	3	0	3		
PTC 110	Industrial Environment	3	0	3		
		13/14	8/10	17		
2nd Semester (Spring)						
BIO 175	General Microbiology	2	2	3		
BPM 110	Bioprocess Practices	3	4	5		
CHM 132	Organic/Biochemistry	3	3	4		
ENG 111	Expository Writing	3	0	3		
ENG 111A	Expository Writing Lab	0	2	1		
ISC 121	Environmental Health & Safety	3	0	3		
		14	11	19		
3rd Semester (Summer)						
COE 112	Co-op Work Experience I	0	20	2		
OR EGR 285	Design Project	0	4	2		
4th Semester (Fall)						
BIO 176	Advanced General Microbiology	1	2	2		
BPM 111	Bioprocess Measurements	3	3	4		
COM 120	Interpersonal Communication	3	0	3		
OR COM 231	Public Speaking	3	0	3		
	Humanities/Fine Arts Elective	3	0	3		
		10	5	12		
5th Semester (Spring)						
BPM 112	Upstream Bioprocessing	3	4	5		
BPM 113	Downstream Bioprocessing	3	3	4		
ENG 114	Professional Research & Reporting	3	0	3		
ISC 221	Statistical Quality Control	3	0	3		
	Social/Behavioral Science Elective	3	0	3		
		15	7	18		

Total Semester Hours Credit: 68

Revised July 2011

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Course Descriptions: Bioprocess Technologies

BIO 110 Principles of Biology 3-3-4

This course provides a survey of fundamental biological principles for non-science majors. Emphasis is placed on basic chemistry, cell biology, metabolism, genetics, taxonomy, evolution, ecology, diversity, and other related topics. Upon completion, students should be able to demonstrate increased knowledge and better understanding of biology as it applies to everyday life. Under the CAA and ICAA, this course satisfies the general education Natural Science requirement for the AA and AFA degrees. It does not satisfy the general education Natural Science requirement for the AS degree.

BIO 175 General Microbiology 2-2-3

Prereq: Take one: BIO 110, BIO 111, BIO 163, BIO 165, or BIO 168

This course covers principles of microbiology with emphasis on microorganisms and human disease. Topics include an overview of microbiology and aspects of medical microbiology, identification and control of pathogens, disease transmission, host resistance, and immunity. Upon completion, students should be able to demonstrate knowledge of microorganisms and the disease process as well as aseptic and sterile techniques. This course has been approved for transfer under the CAA and ICAA as a premajor and/or elective course requirement.

BIO 176 Advanced General Microbiology 1-2-2

Prerequisite: BIO 175

This course is a continuation of BIO 175. Emphasis is placed on microbial metabolism, genetics, and environmental and food microbiology. Upon completion, students should be able to identify unknown microbes and demonstrate an understanding of the fundamentals of molecular biology and microbial ecology. This course has been approved for transfer under the CAA and ICAA as a premajor and/or elective course requirement.

BPM 110 Bioprocess Practices 3-4-5

This course provides a study of plant operations including various plant utility systems and detailed study of the varied plant environments in a bioprocessing facility. Emphasis is placed on quality mindset and principles of validation through applications of monitoring procedures. Upon completion, students should be able to demonstrate the rigors of industry regulation and its necessity.

BPM 111 Bioprocess Measurements 3-3-4

Prerequisite: BIO 110 and BPM 110

This course covers a variety of physical measurements. Emphasis is placed on pH, temperature, pressure and flow rates, as well as spectrophotometry, and biochemical and chemical analysis methods. Upon completion, students should be able to demonstrate and perform many aspects of process monitoring.

BPM 112 Upstream Bioprocessing 3-4-5

Prerequisite: BPM 111

This course introduces techniques involved in cell growth and fractionation. Topics include fermentation theory and application, as well as cell harvesting, cell disruption, and fractionation methods. Upon completion, students should be able to grow cells as well as isolate and collect various fractions.

BPM 113 Downstream Bioprocessing 3-3-4

Prerequisites: BPM 111, CHM 131, and CHM 131A

This course introduces a variety of techniques involved in separation procedures. Topics include extraction and precipitation, concentration and molecular filtration methods, as well as different types of chromatography. Upon completion, students should be able to perform separation procedures with an understanding of industrial-scale procedures.

CHM 131 Introduction to Chemistry 3-0-3

Corequisite: CHM 131A

This course introduces the fundamental concepts of inorganic chemistry. Topics include measurement, matter and energy, atomic and molecular structure, nuclear chemistry, stoichiometry, chemical formulas and reactions, chemical bonding, gas laws, solutions, and acids and bases. Upon completion, students should be able to demonstrate a basic understanding of chemistry as it applies to other fields. This course has been approved for transfer under the CAA and ICAA as a general education course in Natural Science.

CHM 131A Introduction to Chemistry Lab 0-3-1

Corequisite: CHM 131

This course is a laboratory to accompany CHM 131. Emphasis is placed on laboratory experiences that enhance materials presented in CHM 131. Upon completion, students should be able to utilize basic laboratory procedures and apply them to chemical principles presented in CHM 131. Also included are EMR, spectrophotometry, extraction, safety, and feed analysis. This course has been approved for transfer under the CAA and ICAA as a general education course in Natural Science.

CHM 132 Organic and Biochemistry 3-3-4

Prerequisite: Take one set: CHM 131 and CHM 131A or CHM 151

This course provides a survey of major functional classes of compounds in organic and biochemistry. Topics include structure, properties, and reactions of the major organic and biological molecules and basic principles of metabolism. Upon completion, students should be able to demonstrate an understanding of fundamental chemical concepts needed to pursue studies in related professional fields. Additional topics are spectrophotometer, extraction, MSDS, and a project. This course has been approved for transfer under the CAA and ICAA as a general education course in Natural Science.

CIS 110 Introduction to Computers 2-2-3

This course introduces computer concepts, including fundamental functions and operations of the computer. Topics include identification of hardware components, basic computer operations, security issues, and use of software applications. Upon completion, students should be able to demonstrate an understanding of the role and function of computers and use the computer to solve problems. This course has been approved for transfer under the CAA and ICAA as a premajor and/or elective course requirement.

COE 112 Co-op Work Experience I 0-20-2

This course provides work experience with a college-approved employer in an area related to the student's program of study. Emphasis is placed on integrating classroom learning with related work experience. Upon completion, students should be able to

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evaluate career selection, demonstrate employability skills, and satisfactorily perform work-related competencies.

COM 120 Introduction to Interpersonal Communication 3-0-3

This course introduces the practices and principles of interpersonal communication in both dyadic and group settings. Emphasis is placed on the communication process, perception, listening, self-disclosure, speech apprehension, ethics, nonverbal communication, conflict, power, and dysfunctional communication relationships. Upon completion, students should be able to demonstrate interpersonal communication skills, apply basic principles of group discussion, and manage conflict in interpersonal communication situations. This course has been approved for transfer under the CAA and ICAA as a general education course in Humanities/Fine Arts.

COM 231 Public Speaking 3-0-3

This course provides instruction and experience in preparation and delivery of speeches within a public setting and group discussion. Emphasis is placed on research, preparation, delivery, and evaluation of informative, persuasive, and special occasion public speaking. Upon completion, students should be able to prepare and deliver well-organized speeches and participate in group discussion with appropriate audiovisual support. This course has been approved for transfer under the CAA and ICAA as a general education course in Humanities/Fine Arts.

EGR 285 Design Project 0-4-2

This course provides the opportunity to design an instructor-approved project using previously acquired skills. Emphasis is placed on selection, proposal, design, testing, and documentation of the approved project. Upon completion, students should be able to present and demonstrate projects.

ENG 111 Expository Writing 3-0-3

Prerequisites: Take one set: RED 090 and ENG 090, ENG 095, or appropriate placement test scores.

Corequisites: ENG 111A

This course is the required first course in a series of two designed to develop the ability to produce clear expository prose. Emphasis is placed on the writing process including audience analysis, topic selection, thesis support and development, editing, and revision. Upon completion, students should be able to produce unified, coherent, well-developed essays using standard written English. This course has been approved for transfer under the CAA and ICAA as a general education course in English Composition.

ENG 111A Expository Writing Laboratory 0-2-1

Prerequisites: Take one set: RED 090 and ENG 090, ENG 095, or appropriate placement test scores.

Corequisites: ENG 111

This writing laboratory is designed to apply the skills introduced in ENG 111. Emphasis is placed on the editing and revision components of the writing process. Upon completion, students should be able to apply those skills in the production of final drafts in ENG 111. The computer is used as a writing and design tool for this course.

ENG 114 Professional Research and Reporting 3-0-3

Prerequisite: ENG 111

This course, the second in a series of two, is designed to teach professional communication skills. Emphasis is placed on research, listening, critical reading and thinking, analysis, interpretation, and design used in oral and written presentations. Upon completion,

students should be able to work individually and collaboratively to produce well-designed business and professional written and oral presentations. The computer is used as a writing and design tool for this course. This course has been approved for transfer under the CAA and ICAA as a general education course in English Composition.

ISC 121 Environmental Health and Safety 3-0-3

This course covers workplace environmental, health, and safety concepts. Emphasis is placed on managing the implementation and enforcement of environmental health and safety regulations and on preventing accidents, injuries, and illnesses. Upon completion, students should be able to demonstrate an understanding of basic concepts of environmental, health, and safety.

ISC 221 Statistical Quality Control 3-0-3

This course covers the principles and techniques of statistical process control for the improvement of productivity. Emphasis is placed on basic statistics for quality control, organization and procedures for efficient quality control including inspections, process control, and tests of significance. Upon completion, students should be able to apply statistical principles and techniques to enhance production.

MAT 121 Algebra/Trigonometry I 2-2-3

Prerequisite: Take one set: MAT 060 and MAT 070, MAT 060 and MAT 080, MAT 060 and MAT 090, MAT 095, MAT 120, MAT 121, MAT 161, MAT 171, MAT 175, or appropriate placement test scores.

This course provides an integrated approach to technology and the skills required to manipulate, display, and interpret mathematical functions and formulas used in problem solving. Topics include simplification, evaluation, and solving of algebraic and radical functions; complex numbers; right triangle trigonometry; systems of equations; and the use of technology. Upon completion, students should be able to demonstrate an understanding of the use of mathematics and technology to solve problems and analyze and communicate results.

MAT 161 College Algebra 3-0-3

Prerequisite: Take one set: MAT 060 and MAT 080, MAT 060 and MAT 090, MAT 095, or appropriate placement test scores.

This course provides an integrated technological approach to algebraic topics used in problem solving. Emphasis is placed on applications involving equations and inequalities; polynomial, rational, exponential, and logarithmic functions; and graphing and data analysis/modeling. Upon completion, students should be able to choose an appropriate model to fit a data set and use the model for analysis and prediction. Under the CAA and ICAA, this course satisfies the general education Mathematics requirement for the AA and AFA degrees. It does not satisfy the general education Mathematics requirement for the AS degree.

PTC 110 Industrial Environment 3-0-3

This course introduces the pharmaceutical industry, including a broad overview of work in this field. Emphasis is placed on good manufacturing practices (GMP), work conduct, company organization, job expectations, personal safety, hygiene, and company rules and regulations. Upon completion, students should be able to follow good manufacturing practice regulations and inspect a pharmaceutical manufacturing facility for compliance with GMP.