

Upper-Division Major Course Work					
Course Name	Course Descriptor	Units	Semester Offering*	Prerequisites	Catalog Description
Supply Chain and Enterprise Resource Planning in Biomanufacturing	BTEC 300	3 units (LEC)	Year Three, Spring	BTEC 120	Students gain knowledge of how companies manage the complete flow of materials in a supply chain from suppliers to customers. This course covers the design, planning, execution, monitoring, and control of raw materials, personnel resources, inventory management, and distribution. At the end students will have the knowledge required to take the CPIM (Certified in Production and Inventory Management) certification test administered by APICS (the American Production and Inventory Control Society).
Biomanufacturing Process Sciences	BTEC 310	5 units (3 LEC; 2 LAB)	Year Three; Fall	BTEC 221 BTEC 222	This lecture/laboratory course examines the biological, physical, and chemical scientific principles that support the design, development, and optimization of key parameters in a biomanufacturing process. Process sciences covers the essential theories that underpin the biomanufacturing operations from product formation through product purification and how those operations scale up and scale down. The topics include fermenter and bioreactor design and the design of downstream processes that maximize the yield, safety, and efficacy of a protein pharmaceutical
Design of Experiments for Biomanufacturing	BTEC 320	4 units (3 LEC; 1 LAB)	Year Three; Spring	BTEC 110 BTEC 180	This course teaches formalized design of experiments (DOE), a system that optimizes a process through the methodical varying of key parameters and a formalized approach to analyzing, interpreting, and applying the results. DOE is designed to make any process more robust and minimize variability from external sources. The course builds upon the statistical concepts required for DOE, including hypothesis testing, confidence intervals, statistical models, and analysis of variance (ANOVA). The DOE approach systematically varies the parameters of a biomanufacturing process to improve its operation
Advanced Topics in Quality Assurance and Regulatory Affairs	BTEC 330	4 units (LEC)	Year Three; Fall	BTEC 120	This course builds upon previous knowledge of quality assurance and regulatory affairs to study the harmonized quality system approaches of the International Council for Harmonisation Q8 through Q11. The course pays special attention to the topics of quality risk management, qualification, and validation
Six Sigma and Lean Manufacturing	BTEC 340	3 units (LEC)	Year Three; Spring	BTEC 120 BTEC 180	This course covers the Six Sigma approach to the maintenance and improvement of biomanufacturing processes. It incorporates the DMAIC phases: design, measure, analyze, improve, and control. The course covers the use and implementation of lean manufacturing tools that biomanufacturing companies use to reduce waste. At the end of the course, students will be prepared to take the certification test administered by the American Society for Quality for qualification with a white belt in Six Sigma.
Design of Biomanufacturing Facilities, Critical Utilities, Processes, and Equipment	BTEC 360	3 units (LEC)	Year Three; Fall	BTEC 120 BTEC 221 BTEC 222	Students evaluate how the design of a biomanufacturing facility maintains appropriate levels of cleanliness and sterility and promotes the production of safe and effective products. Students analyze the design of the processes, equipment, and instrumentation used in biological production to generate critical utilities, aseptic systems, environmental control and monitoring, upstream production, and downstream (recovery and purification) production within a regulated environment

Upper-Division Major Course Work					
Course Name	Course Descriptor	Units	Semester Offering*	Prerequisites	Catalog Description
Bioprocess Monitoring and Control	BTEC 400	4 units (3 LEC; 1 LAB)	Year Four; Fall	BTEC 310	This course covers the measurement, monitoring, modeling, and control of biomanufacturing processes and the statistical methodology used for measuring, analyzing, and controlling quality during the manufacturing process, including control charts and the analysis of process capabilities.
Methods in Quality, Improvements, Investigations, and Audits	BTEC 410	4 units (LEC)	Year Four; Spring	BTEC 330 BTEC 340	This course examines investigational methods used by quality assurance departments to analyze process deviations and make decisions about severity of deviation. Students learn to write industry-standard corrective and preventive action (CAPA) reports to conclude what corrective and preventive actions result from the investigation. The course also covers how a company would perform an audit in anticipation of an inspection by the Food and Drug Administration or for the supplier of a key raw material. Course content is aligned with the American Society for Quality's Body of Knowledge for a Certified Quality Technician examination.
Capstone Seminar in Biomanufacturing Technologies	BTEC 460	3 units (LEC)	Year Four; Fall	BTEC 310	This course examines the breadth of products that are produced through biological processes. The course will focus on the advances and emerging technologies in biological production and purification operations.
Capstone Seminar in Biomanufacturing Quality	BTEC 470	3 units (LEC)	Year Four; Spring	BTEC 330	This course examines the process by which the quality systems of biomanufacturing evolve by examining a selected current trend in the laws and regulations governing biopharmaceutical manufacturing. Students evaluate the effectiveness of the laws and regulations governing biopharmaceutical manufacturing. This course serves as a capstone experience for students in biomanufacturing quality.

Upper-Division General Education Course Work					
Course Name	Course Descriptor	Units	Semester Offering	Prerequisites	Catalog description
Molecular Mechanisms of Disease	BIO340	3 units (LEC)	Year Four, Fall	BIO100 or BIO101 or BIO105 or BIO204 or BIO204H; CHEM110 or CHEM110H	This course focuses on the molecular basis of human disease. Topics include genetic, metabolic, signaling, developmental, and infectious diseases as well as the biological mechanisms of immunity, cancer, and aging. This course develops students' understanding of the biological basis of human disease that will allow them to evaluate technological advances in therapeutics and diagnostics.

Upper-Division General Education Course Work

Course Name	Course Descriptor	Units	Semester Offering	Prerequisites	Catalog description
Leadership and Personal Development	BUS302	3 units (LEC)	Year Four, Spring	ENGL100	This course explores how leaders influence organizations. It focuses on leadership and management topics related to communication, groups and teams, motivation, personal values, professional behavior, organizational structure, and diversity. The course integrates theory and practice.
Bioethics	PHIL302	3 units (LEC)	Year Three, Spring	ENGL100	This course examines the application of ethical theory to issues in biology and medicine through case studies and classical and contemporary readings in ethical theory and applied ethics. It explores major ethical theories, including utilitarianism, Kantian ethics, natural law theory, social contract theories, and feminist ethics, as they apply to contemporary issues in biology and medicine, such as cloning, transplantation, defining life and death, genetic testing and manipulation, the ethical conduct of research and experimentation, and the just distribution of scarce medical resources.