# Bioprocessing Science Courses

**BBS 201 Introduction to Biopharmaceutical Science 3(3-0-0) S**
Through this course, students will experience laboratory and manufacturing terminology relevant to the biomanufacturing industries. Students will also gain exposure to regulatory and compliance procedures and issues facing this industry. This course will provide an introduction to prepare students to meet the demands and expectations of this industry and the bioprocessing science program.

**BBS 301 Process Validation Science 3(3-0-0) F**
Process validation is a tested and documented subset of the panel of activities that are performed during the production of a biopharmaceutical. This course will introduce the concept of process validation as it applies to the biotechnology industry, and more specifically, to the manufacture of protein molecules as therapeutic agents.

**BBS (BAE) 425 Industrial Microbiology and Bioprocessing 3(3-0-0) S**
Introduction to the structure and functions of microbial cells and their cultivation and utilization in bioprocess engineering. Fermentation systems and downstream processing methods. Enzyme kinetics, production and application. Biomanufacturing of fuels, industrial chemicals, pharmaceuticals, food additives and food products such as beer, wine, cheese and yogurt Microbial biomass production. Introduction to environmental biotechnology including waste water treatment, bioremediation and biomining. Biodeterioration and its control. Product development, regulations and safety. Field trip(s) are an essential educational component of the course and are required. Credit will not be given for both BAE(BBS) 425 and BAE 525.

**BBS 426 Industrial Microbiology & Biomanufacturing Laboratory 2(0-6-0) F**
This course is designed as the laboratory complement to BBS/BAE 425, and will provide students hands-on experiences with key microbiological techniques and processes used by biomanufacturing industries. Specific areas of focus will include fermentation technology, separation methods, and enzyme kinetics.

**FS 231 Principles of Food and Bioprocess Engineering 4(3-3-0) S**
Engineering concepts and their applications to the food and bioprocessing industries. Mass and energy balances and principles related to fluid flow, heat transfer, refrigeration and freezing, psychrometrics, and selected unit operations found in these industries.

**FS 290 Careers in Food and Bioprocessing Sciences 1(1-0-0) F**
Careers and opportunities related to food and bioprocessing industries and regulatory agencies. Development of professional enhancement skills. Resume preparation, interviewing techniques, leadership development, oral and written communication, and team building. Benefits of undergraduate research, internships, and graduate education.

**FS 402 Chemistry of Food and Bioprocessed Materials 4(3-3-0) F**
The course focuses on the properties of biological molecules (e.g., proteins, enzymes lipids, carbohydrates and pigments) found in foods and pharmaceuticals. Basic elements of molecules, such as structure and reactive groups, are presented in regard to how they affect the properties of foods and pharmaceuticals. Reactions such as Maillard browning and lipid oxidation are discussed regarding mechanisms, products and controlling processes. Laboratory experiments emphasize basic concepts discussed in lecture and provide a practical working knowledge of select analytical equipment.

**FS 403 Analytical Techniques in Food & Bioprocessing Science 4(2-6-0) S**
Principles, methods and techniques for quantitative physical and chemical analyses of food, nutraceutical, and pharmaceutical products. Results of analyses evaluated in terms of quality standards and governing regulations.

**FS 416 Quality Control in Food and Bioprocessing 3(2-3-0) S**

Organization and principles of quality control in the food and bioprocessing industries. Regulations and process control to maintain safety and quality. Evaluation of physical, microbiological, chemical, sensory, and stability testing for food and bioprocessed materials. Risk assessment, hazard analysis and critical control point (HACCP), process control, water quality, waste water analysis and reduction. Cleaning and sanitation and compliance inspection.

**FS 475 Problems and Design in Food and Bioprocessing Science 3(2-2-0) S**

Team approach to problem solving and product/process design and development. Ingredient functionality; formulation, safety, processing, packaging, sensory evaluation, regulatory issues, hazard analysis, critical control points (HACCP), nutritional labeling and other pertinent scientific, technical, marketing and financial aspects. Oral and written presentations are required.