Institute of Zoology
Faculty of Life Sciences
University of the Punjab, Lahore

Course Outline

Programme	BS Zoology	Course Code	ZOOL-410	Credit Hours	2
Course Title	Industrial Biotechnology				

Course Introduction

Industrial Biotechnology is the field of study that involves the adaptation and modification of biological organisms and systems found in nature. This course will expose students to both basic and industrial aspects of producing a wide range of products from bio-based raw materials. Industrial Biotechnology provides access to a wide range of professions in global endeavors. Graduates can work as clinical researchers, food scientists and more. The most well-liked industries for students to pursue lucrative careers include agricultural & environment control, and beverage industries.

Learning Outcomes

On the completion of the course, the students will be able:
1. To appreciate the need for sustainable innovation and how biotechnology and biobased production can contribute to this.
2. To describe the global context of biobased production.
3. To map the biobased economy, from research to application and from raw materials to products.
4. To solve basic level calculations in bioprocess engineering.
5. To develop and assess the conditions for efficient and sustainable design of bioprocesses.
6. To solve undergraduate engineering level calculations in bioprocess engineering.
7. Verified learners will have the added benefit of being able to integrated scientific and technological knowledge on the use of bioprocesses for industrial products on the cell and process level.

	Course Content	Assignments/Readings
Week 1	❖ Introduction to industrial biotechnology. ❖ Scope of industrial biotechnology. ❖ Microorganisms and industry.	Assignments + Readings
Week 2	❖ Industrial media and the nutrition of industrial organisms: the basic nutrient requirements of industrial media, criteria for the choice of raw materials used in industrial media. ❖ Some potential sources of components of industrial media. ❖ Screening for productive strains and strain improvement.	Assignments + Readings
Week 3	❖ Sources of microorganisms used in biotechnology. ❖ Isolation of organisms producing desired metabolites. ❖ Strain improvement.	Assignments + Readings

Week 4	❖ **Microbiology of industrial fermentation.** ❖ Current trends in the fermentation and pharmaceutical industry. ❖ Applications of batch-fed two-stage fermentation in the production of biopharmaceuticals. ❖ Microbial fermentations and the production of biopharmaceuticals.	Assignments + Readings
Week 5	❖ Single cell protein (SCP). ❖ Substrates for SCP. ❖ Microorganisms used in SCP production. ❖ Use of autotrophic microorganisms in SCP production. ❖ Safety of SCP. ❖ Nutritional value of SCP.	Assignments + Readings
Week 6	❖ Microalgal biotechnology.	Assignments + Readings
Week 7	❖ Wastewater microbiology and biotechnology. ❖ Wastewater treatment/bioremediation.	Assignments + Readings
Week 8	❖ Microbial flora of fresh foods.	Assignments + Readings
Week 9	❖ Microbial spoilage of foods.	Assignments + Readings
Week 10	❖ Preservation of foods.	Assignments + Readings
Week 11	❖ Fermented foods.	Assignments + Readings
Week 12	❖ Industrial uses of bacteria. ❖ Industrial uses of yeasts. ❖ Industrial uses of molds.	Assignments + Readings
Week 13	❖ Hybridomas and monoclonal antibodies. ❖ Biologics for immunization.	Assignments + Readings
Week 14	❖ Petroleum microbiology.	Assignments + Readings
Week 15	❖ Microbiology and mining.	Assignments + Readings
Week 16	❖ Deterioration of materials. ❖ Analytical microbiology.	Assignments + Readings

Textbooks and Reading Material

1. Microbiology: An Introduction, 12th ed. (2018) by Gerard J. Tortora, Berdell R. Funke, Christine L. Case.
2. Prescott's Microbiology,10th ed. (2017) by Joanne Willey, Linda Sherwood and Christopher J. Woolverton.
3. Modern Industrial Microbiology and Biotechnology ByNduka Okafor
4. Food Biotechnology by Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto and Robert E. Levin.
5. In introduction to Industrial Microbiology by K. Sukesh

6. Modern Industrial Microbiology and Biotechnology - CRC Press Book

Teaching Learning Strategies

The basic learning strategies for this course will be:

- ❖ Lectures
- ❖ Presentations
- ❖ Group discussions
- ❖ Assignments
- ❖ Quiz

Assignments: Types and Number with Calendar

Each student will be assigned a separate topic as his/her assignment related to the subject matter for his/her better understanding and having grip on the subject.

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.