

**Institute of Microbiology and Molecular Genetics**  
**Faculty of Life Sciences**  
**University of the Punjab, Lahore**  
**Course Outline**



<b>Programme</b>	BS	<b>Course Code</b>	MMG401	<b>Credit Hours</b>	3(2+1)
<b>Course Title</b>	<b>MICROBIAL BIOTECHNOLOGY</b>				
<b>COURSE INTRODUCTION</b>					
<p>The course Microbial Biotechnology covers detailed information on the industrial-scale production of various biobased products involving microbial fermentation. The course has been designed to give an in-depth understanding to students of the commercial production processes, purification, standardization, and packaging strategies employed for various biotechnology products. The course also offers in its practical syllabus the various analytical laboratory techniques used in the quality testing, in-process control, and quality assurance of various biotechnology products and the laboratory scale fermentation processes for various microbial products</p>					
<b>LEARNING OUTCOMES</b>					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> <li>1. Be able to understand the overall fermentation process involved in the commercial scale production, purification and standardization of various biotechnology products including health care products, alcoholic beverages, organic acids and fuels, microbial enzymes and baking yeast</li> <li>2. Be able to apply various analytical microbiology techniques used in the quality testing and quality control of biotechnology products, and to perform laboratory scale fermentations for various products</li> </ol>					
<b>COURSE CONTENT</b>					
<p>Health Care Products; antibiotics penicillin/<math>\beta</math>-lactams industrial scale production by fermentation, bacterial and viral vaccines production, vitamins production by microbial fermentation, insulin, Human Growth Hormone (hGH) and interferons production by the fermentation of genetically modified organisms and purification strategies, Beverage fermentation; alcoholic beverages including wines, beers, distilled beverages, Organic acids and fuels; commercial production of citric acid, acetic acid, ethanol and biogas <i>etc.</i> Microbial Enzymes; enzyme applications, enzyme immobilization technologies, commercial production of amylases (<math>\alpha</math> and <math>\beta</math> amylases), proteases (alkaline and acidic proteases), lipases, etc, by microbial fermentation, commercial production of baking yeast</p>					
<b>PRACTICALS</b>					
<p>Bioassays of antibiotics and vitamins, Lab scale fermentation for the production of Sauerkraut, lab-scale fermentation for the production of white wine, Lab scale fermentation for the production of Citric Acid by <i>Aspergillus</i> strains, Isolation and screening of microbial strains with extracellular</p>					

enzyme activity (Proteolytic Activity), Lab scale fermentation for the production of ethanol, Basic concepts in quality management (Quality Definitions, Quality Gurus, Principles and ISO model of quality management), Introduction and application of Hazard Analysis and Critical Control Points (HACCP) in industry

### TEXTBOOKS AND READING MATERIAL

1. Crueger, W & Crueger, A. (2004). *Biotechnology: A Textbook Of Industrial Microbiology*, 2<sup>nd</sup> Edition, Verlag GmbH, Munchen.
2. Waites, M. J., Morgan, N. L., Rockey, J. S. & Higton, G. (2001). *Industrial Microbiology: An Introduction*. John Wiley & Sons.
3. Strohl, W. R. (1997). *Biotechnology of Antibiotics*. 2<sup>nd</sup> Edition, M. Dekker, New York.
4. Barrett, A. J., Woessner, J. F. & Rawlings, N. D. (2012). *Handbook of Proteolytic Enzymes*. 3<sup>rd</sup> Edition, Elsevier.
5. Baltz, R. H., Demain, A. L. & Davies, J. E. (2010). *Manual of Industrial Microbiology and Biotechnology*. 3<sup>rd</sup> Edition, American Society for Microbiology Press.
6. Todaro, C. M. & Vogel, H. C. (2014). *Fermentation and Biochemical Engineering Handbook*. 3<sup>rd</sup> Edition, William Andrew.
7. Wood B.J.B. (1997). *Microbiology of Fermented Foods*. Springer, Boston, MA
8. Stanbury, P. F., Whitaker, A. & Hall, S. J. (2013). *Principles of Fermentation Technology*. 3<sup>rd</sup> Edition, Elsevier.
9. Fix, G. J. & Fix, L. A. (1997). *An analysis of Brewing Techniques*. Brewers Publications.
10. Glazer, A. N. & Nikaido, H. (2007). *Microbial Biotechnology: Fundamentals of Applied Microbiology*. Cambridge University Press.

### 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, practicals, 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, fieldwork , report writing etc.