

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



| Programme | BS | Course Code | MMG309 | Credit Hours | 3(2+1) |
|---|--------------------------------|--------------------|--------|---------------------|--------|
| Course Title | INDUSTRIAL MICROBIOLOGY | | | | |
| COURSE INTRODUCTION | | | | | |
| <p>The course has been designed to give a thorough understanding of fermentation technology, outline the process, types of fermentations, design, and handling of industrial fermenters, and the processes and techniques used in product recovery and purification. Also, the course focuses on various aspects of new product development, regulatory mechanisms, and biosafety implications on the industrial scale. The laboratory syllabus is focused on various analytical microbiology techniques used in the quality control and quality assurance of various industrial and pharmaceutical products.</p> | | | | | |
| LEARNING OUTCOMES | | | | | |
| <p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. Be able to understand the historical prospects in the development of various industrial products, outline of the fermentation process, stages in upstream and downstream processing of fermentation 2. Be able to understand the process and regulatory requirements to develop and introduce a new product into the market, intellectual property (IP) rights, and related biosafety requirements on an industrial scale 3. Be able to apply various analytical microbiology techniques used in the quality testing and quality control of industrial and pharmaceutical products, in-process control and quality assurance | | | | | |
| COURSE CONTENT | | | | | |
| <p>The introduction; historical perspectives and brief overview of the fermentation technology and industrial products obtained by microbial fermentation, secondary metabolism/metabolites, Industrial Microorganisms; major industrial strains, world's major strain collections, industrial strains development, Fermentation Raw Materials; major carbon and nitrogen sources, cost and availability, Fermentation Systems; types and modes of fermentation, fermenter design and construction, control of chemical and physical parameters, stages in submerged fermentation process, solid substrate fermentation, Downstream Processing; cell separation, cell disruption, product recovery, purification, and finishing steps, Product development, regulation and safety; development of new industrial products, regulatory bodies, biosafety on industrial scale</p> | | | | | |
| PRACTICALS | | | | | |
| <p>Introduction and overall land scape of the pharmaceutical and fermentation industry, introduction to clean rooms and clean room classes, Area monitoring/Environmental monitoring techniques</p> | | | | | |

used in pharmaceutical industry, Design of sterile labs and sterility testing of pharmaceutical products, Endotoxin testing (LAL test, gel clot method, High performance liquid chromatography (HPLC), Gas chromatography (GC) and their applications in quality testing, methods of preservation of industrially important microbial strains (lyophilization/freeze drying process)

TEXTBOOKS AND READING MATERIAL

1. Waites, M. J., Morgan, N. L., Rockey, J. S. & Highton, G. (2001). *Industrial Microbiology: an Introduction*. John Wiley & Sons.
2. Crueger, W., & Crueger, A. (2004). *Biotechnology: A Textbook of Industrial Microbiology*, 2nd Edition, Verlag GmbH, Munchen.
3. Stanbury, P. F., Whitaker, A. & Hall, S. J. (2013). *Principles of Fermentation Technology*. 3rd Edition, Elsevier.
4. Baltz, R. H., Demain, A. L. & Davies, J. E. (2010). *Manual of Industrial Microbiology and Biotechnology*. 3rd Edition, American Society for Microbiology Press.
5. Todaro, C. M. & Vogel, H. C. (2014). *Fermentation And Biochemical Engineering Handbook*. 3rd Edition, William Andrew.
6. Glazer, A. N. & Nikaido, H. (2007). *Microbial Biotechnology: Fundamentals of Applied Microbiology*. Cambridge University Press.
7. Strohl, W. R. (1997). *Biotechnology of Antibiotics*. 2nd Edition, M. Dekker, New York.
8. Fix, G. J. and Fix, L. A. (1997). *An Analysis of Brewing Techniques*. Brewers Publications.

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. |