

	H.K. Das Wiley Publisher 20. Gene Cloning and DNA Analysis: An Introduction 2016 T. A. Brown Wiley-Blackwell; 7th edition 21. Applied Molecular Biotechnology: The Next Generation of Genetic Engineering (2016) Muhammad Sarwar Khan, Iqar Ahmad Khan, Debmalya Barh. CRC press 1st Edition	
<u>Learning Outcomes</u>	Given the impact of genetic engineering in modern society, students should be endowed with strong theoretical knowledge of this technology. In conjunction with the practicals in molecular biology & genetic engineering, the students should be able to take up biological research as well as placement in the relevant biotech industry.	

Programme: M. Sc. Biotechnology

Course Code: GBC-281 **Title of the Course:** Bioprocess Technology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Microbiology and Biochemistry	
<u>Objective:</u>	The objective of this course are to educate students about fundamental concepts of bioprocess technology and its related applications, thus, preparing them to meet challenges of new and emerging areas of biotechnology industry.	
<u>Content:</u>	MODULE I Basic Principles of Biochemical Engineering and Fermentation Processes: • Isolation, screening, and preservation of industrially important microbes • Bioreactor designs • Types of fermenters • Concepts of basic modes of fermentation: batch, fed-batch and continuous • Scale up fermentation processes • Media formulation	12 hours

	• Air and media sterilization. • Aeration & agitation in bioprocess. • Measurement and control of bioprocess parameters. MODULE II Industrial production of chemicals: • Strain improvement for increased yield & other desirable characteristics • alcohol (beer) • organic acids (citric acid) • antibiotics (Penicillin) • amino acids (lysine) • Application of microbes in food processing: manufacture of cheese and monosodium glutamate MODULE III Downstream Processing: • introduction, removal of microbial cells & solids • bioseparation, filtration, centrifugation sedimentation. • flocculation, cell disruption, liquid-liquid extraction, • Purification by chromatographic techniques • Drying, crystallization. • Storage & Packaging • Effluent treatment & disposal. • Immobilization of microbial cells & their applications • Bioprocess for the production of biomass: yeast and mushrooms	12 hours 12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	1. Encyclopedia of bioprocess technology. Vol 1-5. (1999). Flickinger, M.C. & Drew, S.W.(Ed). 2. Fermentation technology. (1994). Cassida. 3. Bioprocess engineering: Down stream processing & recovery of bioproducts, safety in biotechnology and regulations. (1990). Behrens, D. & Kramer, P.(Ed). 4. Fundamentals of biotechnology. (1987). Prave, P., Fanst, V., Sitting, W. & Sukatesh, D.A. (Ed.)	

	5. Comprehensive biotechnology. Vol 2-4. (1985). &Young, M. (Ed) 6. Chemical engineering. (1984). Coulson, J.M. & Richardson, J.F. 7. Principles of fermentation technology. (1984). Stanbury, F. & Whitaker, A. 8. Immobilized enzymes: An introduction & application in biotechnology. (1980). Trevan, M.D. 9. Topics in enzyme & fermentation technology. (1984). Wiseman, A. (Ed). 10. Kuila, A., & Sharma, V. (Eds.). (2018). Principles and Applications of Fermentation Technology. John Wiley & Sons. 11. Dordick, J. S. (Ed.). (2013). Biocatalysts for industry. Science & Business Media. 12. Najafpour, G. (2015). Biochemical engineering and biotechnology. Elsevier. 13. Prasad, K. K., & Prasad, N. K. (2010). Downstream process technology: a new horizon in biotechnology. PHI Learning Pvt. Ltd. 14. Fomina, M., & Gadd, G. M. (2014). Biosorption: current perspectives on concept, definition and application. Bioresource technology, 160, 3-14.	
<u>Learning Outcomes</u>	On completing of this course, students should be able to: • appreciate relevance of microorganisms from industrial context; • carry out stoichiometric calculations and specify models of their growth; • give an account of design and operations of various fermenters; • present unit operations together with fundamental principles for basic methods in production techniques for bio-based products; • calculate yield and production rates in biological production process, and also interpret data; • give an account of important microbial/enzymatic industrial processes in the industry.	