OPTIONAL COURSES

Programme: M.Sc. Marine Biotechnology
Course Code: MBO 183
Title of the course: LAB IV - BIOPROCESS TECHNOLOGY
Number of Credits: 2
Effective from 2019-2020

Course Objectives	The objectives of this laboratory course are to provide hands-on training to students in upstream and downstream unit operations.	
Learning Outcomes	Students should: • Gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply laboratory skills to solve complete bioprocess technology problems. • Use acquired skills and knowledge in solving problems typical of bio-industry and research.	
Contents	1. Microbial production of ethanol using yeast sp. 2. Estimating ethanol concentration by Cerric Ammonium nitrate method. 3. Microbial production and estimation of organic acids: Citric acid using *Aspergillus* sp. 4. Microbial production of antibiotics. 5. Immobilization of microbial cells: use of alginate. 6.Fermentation: Batch,Fed-Batch and Continuous 7. Use of fermenter with special reference to scale-up operations. 8. Microfiltrations: separation of cells from broth 9. Bioseperations: Chromatography and extractions (organic acid & antibiotics) 10. Manufacture of ginger ale and estimating the alcohol content. 11. Solid State Fermentation: Mushroom cultivation. 12. Food Microbiology: Preparation of an edible fermented product	48 hours
References/ Reading	1.Khramtsov, N., McDade, L., Amerik, A., Yu, E., Divatia, K., Tikhonov,A., ... & Henck, S. (2011). Industrial yeast strain engineered to fermentethanol from lignocellulosic biomass. Bioresource technology, 102(17), 8310-8313. 2.Moser, A. (2012). Bioprocess technology: kinetics and reactors. Springer Science & Business Media. 3.Tamang, J. P. (Ed.). (2015). Health benefits of fermented foods and beverages. CRC Press. 4.Ray, B., & Bhunia, A. (2013). Fundamental food microbiology. CRC press. 5.Korzybski, T., Kowszyk-Gindifer, Z., & Kurylowicz, W. (2013). Antibiotics: origin, nature and properties. Elsevier. 6.Ngo, T. T. (Ed.). (2013). Molecular interactions in bioseparations. Springer Science & Business Media.	