**Course contents for Fermentation Technology**

1. **Faculty:** FLSB
2. **Course Code:** LSB509
3. **Course Title:** Fermentation Technology
4. **Number of Credits:** 5 (2L, 1T, 2P)
5. **Course objectives:**
   This course introduces various aspects of applied and industrial microbiology. The course helps the students to learn every important upstream, middle and downstream components of fermentation process including strain selection, development, media design, formulation and recovery of products. Additionally, the course can educate the students about fermenter design, different modes of bioprocess operation and the current trend of fermentation process in biotech-industry. Overall, the course helps in the student's exposure on industrial applications of bioprocesses.

**6. Minimum prerequisites for taking this course, if any:**

Basic knowledge of Microbiology and Molecular biology would be expected.

**7. Course structure with units, if applicable:**

a. **Introduction to fermentation process:** microbial biomass, enzymes, metabolites and biotransformation.
b. **Microbes for fermentation:** Isolation, preservation and improvement of industrially important microorganisms.
c. **Preparation of Media**: design, formulation, energy, carbon, nitrogen sources and micro nutrients, media sterilization-batch and continuous process
d. **Preparation of inocula:** for processes involving bacteria, fungi, yeast, animal cells and 33aspetic inoculation of plant fermentation.
e. **Submerged fermentation:** design of fermenters and process engineering for batch, continuous and fed-batch mode of operation
f. **Solid-state fermentation:** selection of biomass, pre-treatment of biomass, process design, design of fermenters and current practice in industry
g. **Downstream processing**: Introduction, recovery and purification of products; and effluent treatment

**8. Practicals:**

a. Immobilization of amylase by calcium alginate entrapment method
   # Bead Formation with entrapped enzyme and Bead Size determination
   # Starch Hydrolysis by entrapped enzyme (alpha Amylase) and reducing sugar estimation
b. Baker's Yeast Fermentation of Sugars for Ethanol Production
   # Gas Chromatography
   # Sugar estimation and Standard for Xylose estimation
c. Enzyme purification by ammonium sulphate salt precipitation method
   # Salting-out and Fractionation
   # Desalting using PD 10 column
   # Protein estimation (by Bradford method)

**9. Suggested Readings:**


a. Principles of Fermentation Technology, Third Edition, PF Stanbery, A. Whitaker and Steve Hall,Elesvier (2016).
b. Bioprocess Engineering Basic Concepts, by M Shuler and F. Kargi, Prentice Hall Press (2015)
c. Fermentation and Biochemical Engineering Handbook, 2nd Edition., H C. Vogel and C M. Todaro, Elesvier (2014)


**10. Evaluation:**

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| Theory: Mid-semester Written Examination | : 40% Marks |
| End-semester Written Examination | : 40% Marks |
| Quiz / Assignment/Presentation (oral / poster)/other | : 20% Marks |