**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**
**M.Sc. MICROBIOLOGY SEM III**

**MB 3001: FERMENTATION TECHNOLOGY**

**1. Course Code & Title**

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|---|---|
| Course code: | Core course 1 (MB 3001) |
| Course title: | Fermentation technology |
| Course type: | Core |
| Course credits: | 04 |

**2. Course overview and Course Objectives**

The objective of this paper is to introduce students to fermentation process and impart knowledge required for fermentation. The paper also provides the information about the industrial applications and recent technological advances in fermentation technology.

**Course Objectives**

- To study the methods of screening and isolation of industrially important microorganisms and also the techniques of strain improvement and its preservation.
- To learn the constituents of media, available sources, media optimization and sterilization for industrial production.
- To gain an insight of the components of a bioreactor and its design as well as to learn types of fermentation process
- To prepare the students for downstream processing and effluent treatment essentials for fermentation process.

**3. Course Content**

| UNIT 1 | ISOLATION, SCREENING AND IMPROVEMENT OF INDUSTRIALLY IMPORTANT MICROORGANISMS |
|---|---|
| | **Teaching Duration: Lectures 15** |
| 1.1 | Isolation of industrially important microorganisms |
| 1.2 | Screening methods and high throughput screening:<br>Enzymes from Extreme Environments, Cell-Based Screening Methods, Metabolomics for the Discovery of Novel Compounds, Methods to access Silent Biosynthetic Pathways |
| 1.3 | New approaches to microbial isolations and actinomycetes |
| 1.4 | Stain Improvement: Selection and Improvement of Industrial Organisms for Biotechnological Applications |
| 1.5 | Over production: Processes for Overproduction of Microbial Metabolites for Industrial Applications |
| 1.6 | Culture preservation: storage at reduced temperature, storage in a dehydrated form, quality control of preserved stock |
| 1.7 | Inoculum development: criteria for the transfer of inoculum, Development of inoculum for yeast and bacterial processes |

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| UNIT 2 | MEDIA FOR INDUSTRIAL FERMENTATIONS |
|---|---|
| | **Teaching Duration: Lectures 15** |
| 2.1 | Introduction |
| 2.2 | Typical media |
| 2.3 | Medium formulation |
| 2.4 | Media components for cultivation of industrial microorganisms |
| 2.5 | Oxygen requirement and antifoams |
| 2.6 | Biosynthetic Pathways for Metabolic Products of Microorganisms |
| 2.7 | Media sterilization |
| 2.8 | Statistical optimization of media |

| UNIT 3 | FERMENTORS: DESIGN, OPERATION, AND APPLICATIONS |
|---|---|
| | **Teaching Duration: Lectures 15** |
| 3.1 | Bioreactors & its components parts |
| 3.2 | Peripheral parts and accessories |
| 3.3 | Alternative vessel designs: The Aerated Stirred-Tank Batch fermenter and anaerobic batch fermenter |
| 3.4 | Design of New fermenters based on the Physiology of the Organisms: Air Lift fermenters |
| 3.5 | Methods of measuring process variables, On-line analysis of other chemical factors, Control systems |
| 3.6 | Fermenter configurations: Fed-batch cultivation, surface or solid state(substrate) |
| 3.7 | Microbial Experimentation in the Fermentation Industry The Place of the Pilot Plant |
| 3.8 | Current trends and future prospects in fermenter design and applications |

| UNIT 4 | DOWNSTREAM PROCESSING AND EFFLUENT TREATMENT |
|---|---|
| | **Teaching Duration: Lectures 15** |
| 4.1 | Removal of microbial cells and other solid matters |
| 4.2 | Foam separation (floatation) |
| 4.3 | Filtration, centrifugation, cell disruption, chromatography, Membrane processes, liquid-liquid extraction, Drying, Crystallization and Whole broth processing |
| 4.4 | Solvent recovery |
| 4.5 | Effluent treatment: various disposal methods and treatment process: Aerobic processes and Anaerobic processes |
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## 4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: Students shall develop insights for the isolation, screening, cultivation, gain knowledge of strain improvements methods as well as preservation techniques.

Unit 2: Students shall gain in-depth knowledge of media components, its optimization and sterilization.

Unit3: Students shall learn scientific design of fermentor vessel, its operation and fermentation processes.

Unit 4: Students shall get acquainted with the understanding of the downstream processing and effluent treatment process.

**Recommended learning resources**


- Creuger W, Crueger A. and Aneja K. R., (2000) Biotechnology: A textbook of industrial microbiology, 3rd Edition, Panima, New Delhi, (ISBN: 978-93-85998-63-8)
- E.M.T. El-Mansi, Bryce C.F.A., Demain A. L. and Allman A. R., (2012) Fermentation Microbiology and Biotechnology, 3rd Edition, Taylor & Francis, (ISBN: 978-1-4398-5581-2)
- Okafor N., (2017), Modern industrial microbiology and biotechnology, 2nd edition, Science publishers, USA., (ISBN: 978-1-1385-5018-6)
- Stanbury P. F., Whitaker A. and Hall S. J., (2016), Principles of Fermentation Technology, 3rd Edition, Elsevier, (ISBN: 978-0-08-099953-1)
- Waites, M.J., (2001) Industrial microbiology: An Introduction, 1st Edition, Blackwell publishing, (ISBN: 0-632-05307-0)


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