

**DEPARTMENT OF BIOTECHNOLOGY**  
**GOVT. DEGREE COLLEGE BARAMULLA**

**SEMESTER 8<sup>th</sup> (NEP)**

**MAJOR COURSE**

SUBJECT: BIOTECHNOLOGY

**TITLE: BIOPROCESS ENGINEERING AND TECHNOLOGY (BTGC2822M)**

**Credit:** (4+2: Theory-04; Practical-02)

**Contact Hours:** 64 (T) + 64 (L)

**Course Learning Objective:** *To develop an understanding of bioprocess technology, key aspects involved and the different steps of downstream technology.*

**Course outcomes:** *A student will be able to*

1. *calculate different parameters of microbial growth and product formation.*
2. *Get an insight about different types of systems used in bioprocess technology.*
3. *identify the different components of a bioreactor.*
4. *employ different techniques for downstream processing.*

**Unit - 1 (16 Hours)**

Introduction to bioprocess technology; Microbial culture and its growth kinetics; Growth rate parameters: specific growth rate, doubling time, growth yield, metabolic quotient, validity of exponential growth law; Measurement of microbial growth.

**Unit - 2 (16 Hours)**

Open and closed system; Batch, Fedbatch and Continuous culture; Chemostat and its elaborations (Turbidostat & pH stat); Product formation in microbial cultures - Growth associated and non-growth associated; Factors affecting product formation.

**Unit - 3 (16 Hours)**

Design of bioreactors/fermenter vessels; Functions of Impeller, Baffles, Sparger; Types of culture/bioreactor – stirred tank, airlift, packed bed, photobioreactor; Upstream processing: Media preparation, Inoculum development and sterilization.

**Unit - 4 (16 Hours)**

Downstream processing: Cell disruption techniques, product recovery and purification; Membrane processes: Basic concept of ultrafiltration, reverse osmosis, liquid membranes; General idea of separation techniques (fractionation, centrifugation, chromatography); Production of amylase and recombinant insulin; Immobilization of enzymes.

**PRACTICALS (2- Credit: 64 hours)**

**Maximum Marks: 50, Minimum Marks: 20**

1. Isolation of microorganisms from natural resources.
2. Study of microbial growth curve.
3. Estimation of growth kinetic parameters in batch fermentation  
(virtual lab: <http://38.100.110.143/model/egk/theory.html>)
4. Demonstration of the different parts of a bioreactor

(virtual lab: <http://38.100.110.143/model/bb/theory.html>)

5. Isolation and assay of amylase.
6. Purification of amylase through fractionation.
7. Industrial visit

#### **BOOKS RECOMMENDED**

1. *Principles of Fermentation Technology*: Stanbury, Whitaker and Hall. Butterworth-Heinemann.
2. *Industrial Microbiology*: Casida. New Age International Private Limited.
3. *Biotechnology - A Textbook of Industrial Microbiology*: Crueger and Crueger. Medtech Publishers.
4. *Industrial Microbiology*: Patel A. H. Laxmi Publications.