

BACHELOR OF SCIENCE

5th SEMESTER

DISCIPLINE SPECIFIC ELECTIVES (DSEs)

BT520DA: BIO-TECHNOLOGY: BIOTECHNIQUES

CREDITS: THEORY - 4, PRACTICAL - 2(4+2)

OPTION-I

THEORY (4 CREDITS: 60 HOURS)

MAXIMUM MARKS: 60, MINIMUM MARKS: 24

Objective: This course is designed to give students exposure to various techniques and instruments used in biotechnology.

Unit - 1 (15 Hours)

Microscopy: Principle, working and applications of light microscopy - bright-field, dark-field, phase-contrast, fluorescence & confocal microscopy, electron microscopy - TEM and SEM;

Staining - principle and procedure of simple staining, negative staining & differential staining; **Spectroscopy:** principle, working and applications of ultraviolet / visible light spectroscopy (UV/Vis spectroscopy).

Unit - 2 (15 Hours)

Centrifugation- Basic principles and applications of preparative and analytical centrifugation (differential centrifugation & density-gradient centrifugation), ultracentrifugation and its applications; **Chromatography -** Principle, working and applications of thin-layer chromatography, ion-exchange chromatography, gel filtration and affinity chromatography.

Unit - 3 (15 Hours)

Electrophoresis: General principle and types; Principle, procedure and applications of native polyacrylamide gel electrophoresis, sodium dodecyl sulphate-polyacrylamide gel electrophoresis, isoelectric focusing, two-dimensional gel electrophoresis and agarose gel electrophoresis; **Blotting techniques:** Southern, northern & western blotting; **PCR -** principle, types and application.

Unit - 4 (15 Hours)

Immunological techniques: Principle, procedure and application of immunodiffusion, immuno-electrophoresis, enzyme linked immunosorbent assay (ELISA) and radioimmunoassay (RIA); **Radioisotope techniques:** Concept of radioisotopes, types and properties of radioactive decay, units of radioactivity, characteristics of radioisotopes commonly used in biology, measurement of radioactivity.

PRACTICALS (2 CREDITS: 60 HOURS) MAXIMUM MARKS: 30, MINIMUM MARKS: 12

1. Paper chromatography.
2. SDS-PAGE.
3. Agarose gel electrophoresis.
4. Demonstration of Western blotting.
5. Demonstration of ELISA/RIA
6. Demonstration of PCR.

BOOKS RECOMMENDED

1. *Principles and Techniques of Biochemistry and Molecular Biology:* Wilson, K. and Walker, J. - Cambridge University Press.
2. *Physical Biochemistry - Applications to Biochemistry and Molecular Biology:* Freifelder, D. - W. H. Freeman and Company.
3. *Molecular Cloning - A Laboratory Manual:* Sambrook, J. and Russell, D. W. - Cold Spring Harbor Laboratory Press.

Expected Learning Outcomes:

1. *Understanding of biophysical and molecular biology techniques and their applications.*

BACHELOR OF SCIENCE
5th SEMESTER
DISCIPLINE SPECIFIC ELECTIVES (DSEs)
BT520DB: BIO-TECHNOLOGY: BIOPROCESS ENGINEERING
CREDITS: THEORY - 4, PRACTICAL - 2(4+2)

OPTION-II

THEORY (4 CREDITS: 60 HOURS) MAXIMUM MARKS: 60, MINIMUM MARKS: 24

Objective: This course aims at training the students for application of biotechnology principles for production of bio-based products.

Unit-1 (15 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(15 HOURS)

Open and closed system; Batch, fedbatch and continuous culture; Chemostat and its elaborations; Product formation in microbial cultures - growth associated and non-growth associated; Factors affecting product formation.

Unit- 3(15 HOURS)

Design of bioreactors/fermenters - functions of Impeller, Baffles, Sparger; Types of bioreactors - stirred tank, airlift, packed bed, photo-bioreactor; Media preparation, Inocula development and sterilization.

Unit- 4(15 HOURS)

Downstream processing - cell disruption techniques, product recovery and purification; Membrane processes - basic concept of ultrafiltration, reverse osmosis, liquid membranes; Separation techniques - fractionation, centrifugation, chromatography; lyophilization.

PRACTICALS (2 CREDITS: 60 HOURS) MAXIMUM MARKS: 30, MINIMUM MARKS: 12

1. Isolation of microorganism from natural resource.
2. Study of microbial growth characteristics.
3. Isolation and assay of amylase.
4. Purification of amylase through fractionation.

BOOKS RECOMMENDED

1. *Industrial Microbiology*, Casida - New Age International Private Limited
2. *Biotechnology: A textbook of Industrial Microbiology*, Crueger and Crueger, -Panima Publishing Co. New Delhi.
3. *Industrial Microbiology*, Patel AH, - Laxmi Publications, New Delhi
4. *Principles of Fermentation Technology*, Stanbury, Whitaker and Hall, Elsevier Science Ltd.

Expected Learning Outcomes:

1. *Understanding of microbial growth, kinetics and measurement.*
2. *Idea of bioreactors along with the complementary components and processes.*
3. *Understanding of various methods and techniques involved in downstream processing of products.*