



JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF BIOTECHNOLOGY
B.Sc. VI SEMESTER BIOTECHNOLOGY PAPER VIII SYLLABUS (2021 NEP
BATCH)
BIOPROCESS AND ENVIRONMENTAL BIOTECHNOLOGY

COURSE TITLE	Bioprocess and Environmental Biotechnology
COURSE CODE	21VIBT8(T)
COURSE CREDITS	04
TOTAL CONTACT HOURS	60
DURATION OF ESE	3 Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	40 Marks
END SEMESTER EXAMINATION (ESE)	60 Marks

COURSE OBJECTIVES:

Through this course, the student is imparted with

1. Understanding about the importance of fermentation, types of fermentation, the methods of production of various industrially important products through fermentation technology.
2. Compare and contrast on the role of biotechnology in addressing various environmental issues, like pollution by implementing sustainable approaches.
3. To facilitate candidates to comprehend on the applications in the field of bioentrepreneurship.

LEARNING OUTCOMES:

After successful completion of the course the students will be able to:

1. Explore the basics of Bioprocess technology concepts, which includes strain improvement and fermentation technology.
2. Recognize the importance of downstream processing and microbial production of various products.
3. Understand and apply project management and product development strategies in the field of Bio-Business.
4. Critically evaluate the various Environmental Biotechnological concepts to solve various environmental problems.

CO NO.	Course outcomes statement	Knowledge level
1	Explore the basics of Bioprocess technology concepts , which includes strain improvement and fermentation technology.	K1, K3, K4
2	Recognize the importance of down stream processing and microbial production of various products.	K1
3	Understand and Apply project management and product development strategies in the field of Bio-Business.	K2, K3
4	Critically evaluate the various Environmental Biotechnological concepts to solve various environmental problems.	K2, K5

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	✓	✓	✓	✓	✓		✓			✓
CO2	✓	✓		✓			✓			✓
CO3	✓	✓	✓	✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓		✓	✓	✓		✓

Programme Objectives aligned with Graduate attributes

PO1- Knowledge

PO2- Scientific thinking

PO3- Entrepreneurial skills

PO4- Analytical skills

PO5- Communication skills

PO6- Social commitment

PO7- Research and Inquiry

PO8- Conservation of Environment

PO9- Digital awareness and literacy

PO10- Academic orientation

UNIT 1

15 Hrs.

Introduction to Bioprocess technology

- a) Introduction to Industrial Biotechnology** - Basic principles of fermentation technology.
- b) Principles of upstream processing** – Media preparation, Inocula development, and sterilization.
- c) Types of Fermentation:** (Batch, Continuous, submerged and solid-state fermentation).
- d) Strain improvement-** Screening and isolation of microorganisms, maintenance of strains, Improvement (Mutant selection, recombinant DNA methods, metabolic engineering, and bioprospecting).

UNIT 2

15 Hrs.

Bioreactors and downstream processing **a) Design of fermenter, Types of Fermenters** - Design and their functions: Airlift bioreactors, tubular bioreactors, membrane bioreactors, tower bioreactors, fluidized bed reactor, packed bed reactors, fermentation media.

b) Factors affecting fermentation - Aeration, Agitation, temperature regulation, Mass transfer, oxygen transfer, and filtration method, Foams and antifoams.

c) Downstream processing (DSP) – Disruption of cells (Physical, chemical and enzymatic methods) separation (Filtration, sedimentation, flocculation and centrifugation), Concentration (Evaporation, precipitation and liquid - liquid extraction), Purification – Crystallization, chromatography, adsorption, Formulation of products (drying devices biosensors-construction and applications, Microbial production of ethanol, amylase and Single Cell Proteins. optimization of additives), storage and packaging.

d) GLP

e) **Biosensors-construction and applications-** Microbial production of ethanol, amylase and Single Cell Proteins.

UNIT 3

15 Hrs.

Bioentrepreneurship

a) **Introduction to bio entrepreneurship and bio business** – Introduction, Fundamental of Biotechnology for bio business and wealth creation. Fermentation industry – Market analysis , Human resource and skills required (Leadership, Managerial, communication, Scientific skills and team work)

b) **Business planning and Management** – Business development, new product development, Development of products in biomedical industry, Business plan and financial projection.

c) **Modern Bio-business technology** A brief introduction to concepts related to industry 4.0 including the use of smart manufacturing in bioprocessing, project management and operations roles in the field of health care.

c) **Importance of bioremediation in environmental cleanup.** Types of contaminants suitable for bioremediation. Microorganisms used in bioremediation. In-situ Bioremediation Methods. Bioaugmentation. Biostimulation. Bioventing. Phytoremediation. Ex-situ Bioremediation Methods – Composting, Land farming, Biopile and bioslurry systems. Xenobiotics. Bio metallurgy and biomining

UNIT 4

15 Hrs.

Fundamentals of Environmental Biotechnology

a) Introduction to Environmental Biotechnology-

Principles of Environmental Science. Role of Biotechnology in Environmental Conservation. Microbial Processes in Environmental Biotechnology

b) **Pollution and Biotechnology** – Major issues in environmental pollution and the role of biotechnology in addressing them. Biotechnological Methods of Pollution Detection-General bioassay methods for pollution detection. Cell biological methods for assessing pollution levels. Use of biosensors in pollution monitoring. Biotechnological Methods in Pollution Abatement-Reduction of CO₂ emission using biotechnological approaches.

Brief note on biofuels, bioplastics and lignocellulosic biomass as an alternative environmental sustainable substrate.

References

1. Stanbury PF, Whitaker A and Hall SJ. (2016). Principles of Fermentation Technology. 3rd edition, Butterworth-Heinemann.
2. Crueger W and Crueger A. (2017). Biotechnology: A textbook of Industrial Microbiology. 3rd edition. Panima Publishing Co. New Delhi.

3. Paul S Teng , (2008) Bioscience Entrepreneurship in Asia : Creating value with Biology , World Scientific Publishing Company.
4. Shuler ML and Kargi F. (2015) Bioprocess Engineering: Basic concepts, 2nd Edition, Pearson Education India.
5. Prescott, Sc and Dunn, C. (2004) Industrial Microbiology, 4th edition, CBS.
6. Gurinder Shahi (editor), (2008). BioBusiness Perspectives, GBI books

COURSE TITLE	Bioprocess and Environmental Biotechnology
COURSE CODE	21VIBT8(P)
COURSE CREDITS	02
TOTAL CONTACT HOURS	4 Hours/week
DURATION OF ESE	3 Hours
CONTINUOUS INTERNAL ASSESSMENT (CIA)	25 Marks
END SEMESTER EXAMINATION (ESE)	25 Marks

Biotechnology Practical Paper VIII

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| 1. Bacterial growth curve. | 1 unit |
| 2. Determination of thermal death point (TDP) of a bacterial sample. | 1 unit |
| 3. Study of fermenter – Demonstration | 1 unit |
| 4. Production of wine | 1 unit |
| 5. Estimation of the percentage of alcohol by specific gravity method. | 1 unit |
| 6. Estimation of citric acid by titration method | 1 unit |
| 7. Experimental Analysis BOD, COD, TDS. | 1 unit |
| 8. Solid state fermentation for the production of amylase enzyme . | 1 unit |
| 9. Review report on relevant biotechnological problems | 12 unit |

