

Programme	BS-Biotechnology	Course Code	BT. 206	Credit Hours	2+1
Course Title	Industrial Biotechnology				
Course Introduction					
This course provides an introduction to the field of Industrial Biotechnology, designed for undergraduate students majoring in Biotechnology. The curriculum covers the application of various biotechnological principles and methods to industrial processes. Students will learn about the production and optimization of biochemical, such as enzymes, biofuels and pharmaceuticals, through various fermentation and extraction techniques.					
Learning Outcomes					
On the completion of the course, the students will:					
<ul style="list-style-type: none">Understand industrial-scale bioprocesses.Evaluate the use of various biocatalysts and fermentation techniques in industrial processes.Understand the optimization and scaling up of biotechnological processes in industry.					
Course Content					
Theory Unit-I					
<ul style="list-style-type: none">Introduction, overview, importance and applications of Industrial BiotechnologyBasics of BiotechnologyBiological molecule: Importance and ApplicationsTypes of industries, Application in different fieldsIntroduction to fermentation, overview, Biological processes and Types of fermentationAlcoholic and Lactic acid fermentation: Mechanism and ApplicationsApplications of fermentation, Industrial applications, Food, Environmental, Agriculture, and Biofuels, Biotechnological applications, Pharmaceuticals and Medical applicationsMicrobial selection for key industries, Screening, Isolation and Cultivation, Activity assays and Enrichment methods, Genetic and genomic analysis, Sequencing, Genetic engineeringIntroduction to microbial metabolites, Overview of microbial metabolites, Significance in Industrial BiochemistryMicrobial production of enzymes, antibiotics, acids, Industrial and Pharmaceutical productsMicrobial fermentation: Optimization, Manipulation techniques, Metabolic pathway engineeringFermentation Optimization, Sustainability and Environmental impacts and ApplicationsBiochemical engineering, Enzymatic processes, Innovations and trendsExtraction of different components, Plants extraction, Various extracts from plantsMethods of Extraction, Soxhlet methods, Process and Advantages, Purification of extracted compounds, Distillation and crystallization, Filtration and precipitationPurification of extracted compounds, Chromatographic techniques, TLC and HPLCGlucose extraction, Manufacturing techniques, Process and applicationsGlucose extraction from major cropsIndustrial glucose production from rice, wheat, corn, and potato: Advantages and disadvantagesFuture Directions in Industrial Biotechnology, Emerging Technologies, Innovations and TrendsQuality control Techniques: Quality assurance and value addition, SOPs and regulationsRole of Industrial products in food sciences					

- Food production and packaging, Advancements and Challenges
- Role of Industrial products in medical sciences
- Biopharmaceuticals,
- Production of biologics,
- Role of Biotechnology in textile industry,
- Biopolymers and fibers,
- Denim- distressing and softening
- Role of Biotechnology in cosmetic industry, Cosmetics and personal health care products
- Advancements and Challenges,
- Recent researches in Industrial Biotechnology, Emerging Technologies, Innovations and Trends
- Industrial examples, Case studies, Real world cases and success stories, Future Prospects
- Challenges and Opportunities, Innovations in Industrial Biotechnology

Practical Unit

- Measure and understand the impact of pH on biochemical reactions
- Estimation of total protein in given sample
- Investigate enzyme activity and its dependence on various factors
- Determination of citric acid by titration method in the fermentation medium
- Understand and optimize conditions for microbial fermentation
- Preservation of food by UV-radiation /chemical method
- Determination of Iodine value of Fat/oil
- Determination of ethanol percentage in fermentation broth
- Determination of acid value of oil extracted from plant seeds
- Extraction of plant seeds oil by using Soxhlet apparatus
- Purification of protein by column chromatography
- Separation of phospholipids by Thin Layer Chromatography
- Estimation of glucose in the given sample
- Production soap from fats and oils
- Perform quality control tests on biochemical products
- Formulate and test the stability of industrial product

Textbooks and Reading Material

- **Textbooks.**
- David P. Clark and Nanette J. Pazdernik (2022) *Biotechnology: Principles and Applications 2nd Edition*.
- Sandy B. Primrose and Richard Twyman (2022) *Principles of Gene Manipulations and Genomics 8th Edition*.
- Paul Robinson and David L. Platt (2022) *Fundamentals of Biotechnology 2nd Edition*.
- Linda E. Smith and Robert K. Adams (2021) *Industrial Biotechnology 2nd Edition*.

Teaching Learning Strategies			
<ul style="list-style-type: none"> • Active Learning; Promoting student participation and interaction blended learning • Experimental learning • Formative assessment • Inquiry based instructions • Growth mindset 			
Assignments: Types and Number with Calendar			
<ul style="list-style-type: none"> • Short assignment; Before mid term exam • Long assignment; Before final term exam • Class room participations; before and after midterm exam • Quizzes; before and after midterm exam • Poster presentations 			
Assessment			
Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.