

<b>Programme</b>	BS-Biochemistry	<b>Course Code</b>	BC. 306	<b>Credit Hours</b>	2+1
<b>Course Title</b>	<b>Industrial Biochemistry</b>				
<b>Course Introduction</b>					
<p>This course provides an introduction to the field of Industrial Biochemistry, designed for undergraduate students majoring in Biochemistry. The curriculum covers the application of various biochemical principles in industrial settings. Students will learn about the production and optimization of biochemical, such as enzymes, biofuels and pharmaceuticals, through various fermentation and extraction techniques.</p>					
<b>Learning Outcomes</b>					
<p>On the completion of the course, the students will:</p> <ul style="list-style-type: none"> <li>• Understand metabolites with respect to their industrial importance.</li> <li>• Evaluate bioprocesses to manipulate for large scale production of a chosen material/metabolite.</li> <li>• Analyze limitations of industrial biological processes.</li> </ul>					
<b>Course Content</b>					
<b>Theory Unit-I</b>					
<ul style="list-style-type: none"> <li>• Introduction, overview, importance and applications of Industrial Biochemistry</li> <li>• Biological molecule: Importance and Applications</li> <li>• Types of industries: Goods producing industries, Application in different fields</li> <li>• Service industries: Application in different fields</li> <li>• Introduction to fermentation, Types of fermentation</li> <li>• Alcoholic and Lactic acid fermentation: Mechanism and Applications</li> <li>• Biological processes</li> <li>• Microbial selection for key industries, Screening, Isolation and Cultivation, Activity assays and Enrichment methods, Genetic and genomic analysis, Sequencing, Genetic engineering</li> <li>• Introduction to microbial metabolites, Overview of microbial metabolites, Types and Metabolic pathways</li> <li>• Microbial metabolites: Biochemical characterization, Metabolite profiling, enzyme characterization</li> <li>• Introduction to microbial production, Significance in Industrial Biochemistry</li> <li>• Microbial production of enzymes, antibiotics, acids, Industrial and Pharmaceutical products</li> <li>• Microbial fermentation: Optimization, Manipulation techniques, Metabolic pathway engineering</li> <li>• Sustainability and Environmental impacts, Applications</li> <li>• Biochemical engineering, Enzymatic processes, Innovations and trends</li> <li>• Extraction of different components, Plants extraction, Various extracts from plants</li> <li>• Methods of Extraction, Soxhlet methods, Process and Advantages, Purification of extracted compounds, Distillation and crystallization, Filtration and precipitation</li> <li>• Purification of extracted compounds, Chromatographic techniques, TLC and HPLC</li> <li>• Glucose extraction, Manufacturing techniques, Process and applications</li> <li>• Glucose extraction from major crops</li> <li>• Industrial glucose production from rice, wheat, corn, and potato: Advantages and disadvantages</li> </ul>					

- Future Directions in Industrial Biochemistry, Emerging Technologies, Innovations and Trends
- Quality control Techniques: Quality assurance and value addition, SOPs and regulations
- Role 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 Biochemistry in textile industry
- Biopolymers and fibers
- Denim- distressing and softening
- Role of Biochemistry in cosmetic industry, Cosmetics and personal health care products, Advancements and Challenges
- Recent researches in Industrial Biochemistry, Emerging Technologies, Innovations and Trends
- Industrial examples, Case studies, Real world cases and success stories, Future Prospects, Challenges and Opportunities, Innovations in Industrial Biochemistry
- Applications of fermentation: Industrial applications, Food, Environmental, Agriculture, Biofuels Biotechnological applications, Pharmaceuticals and Medical applications

#### **Practical Unit-**

- Measure and understand the impact of pH on biochemical reactions
- Investigate enzyme activity and its dependence on various factors
- Estimation of total protein in given sample
- 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 ethanol percentage in fermentation broth
- Extraction of plant seeds oil by using Soxhlet apparatus
- Determination of acid value of oil extracted from plant seeds
- 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.**

- Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr (2022) *Biochemistry 5<sup>th</sup> Edition* Press
- George W. A. Milne, Albert A.P. Williams, Barbara R. Conner. (2022) *Carbohydrates Chemistry and Biochemistry: Sources, Methods and Applications 2<sup>nd</sup> Edition*, Springer Nature.
- Donald Voet, Judith G. Voet, Charlotte W. Pratt (2021) *Fundamentals of Biochemistry: life at the Molecular Level 5<sup>th</sup> Edition* Journal Press
- Linda E. Smith and Robert K. Adams ( 2021) *Industrial Biotechnology: A Laboratory Manual 2<sup>nd</sup> Edition*

### **Teaching Learning Strategies**

- Active Learning; Promoting student participation

- Experimental learning
- Formative assessment
- Inquiry based instructions
- Growth mindset

### Assignments: Types and Number with Calendar

- 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

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.