Course Syllabus
Gyanmanjari Science College
Semester- 3(M.Sc.)

Subject: Food Biotechnology and Fermentation -MSCFT13516

Type of course: Major

Prerequisite: Student must have comprehensive understanding of Food Processing and Preservation Technology

Rationale: This course empowers students with essential knowledge and practical skills for effective processing and preservation of fruits and vegetables, addressing industry needs and emerging technologies.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No	Course content	Hrs	% Weightage
1	**Introduction to Food Biotechnology and Genetic Applications in Food Production:** History and development of biotechnology, Applications of genetics to food production: Genetic modification in food crops, Methods of molecular cloning, immobilization, and cultured plant cells, Role of biotechnology in enhancing food production, quality, and nutrition.	10	15%

2	**Downstream Processing and Industrial Applications**: Principles of downstream processing, small, medium and large scale processing, bacterial starter culture, Methods of inoculums and medium preparation, slurry processing and product isolation. Technological aspects of industrial production of beer, wine, enzymes-amylase, pectinase, protease, organic acids, amino acids, vitamins, antibiotics, baker's yeast, single cell protein.	20	35%
3	**Regulatory and social aspects of biotechnology** of foods, Plant tissue culture, genetically modified foods (GMF), applications of enzymes in food industry. Biotechnology of food borne disease outbreaks, disease investigation, materials and equipment, laboratory testing, field analysis, interpretation of data and preventive measures.	20	35%
4	**Fermentation**: Fermentation as a method of food preparation and preservation, Role of microorganisms in pickling, alcoholic beverages, and other food products, Mechanisms of enzyme functions in food processes: Starch and sugar conversion (e.g., amylase in baking), de-oxygenation and desugaring (glucose oxidase), and cheese making (proteases). Bioconversion of food waste: Whey, molasses, starch substrates, and other food wastes into useful products.	10	15%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Case Study on Food Spoilage and Preservation Techniques:** Students select a food item prone to spoilage (e.g., dairy, meat, or fruits) and design a preservation method combining physical, biological, and chemical techniques. They also analyze real-world examples of food borne illness outbreaks (e.g., *Salmonella* or *Clostridium*) and propose rapid identification methods for pathogens and submit it on GMIU web portal.	10
2	**Research and Presentation on GM Foods and Single-Cell Protein:** Students research specific examples of genetically modified (GM) foods and single-cell proteins (SCP), highlighting their production, advantages, and ethical considerations. They prepare a brief presentation with supporting data and submit it on GMIU web portal.	10
3	**HACCP Plan for a Food Processing Scenario:** Students develop a HACCP (Hazard Analysis and Critical Control Points) plan for a selected food processing scenario (e.g., dairy production, meat packaging). They identify critical control points, potential hazards, and prevention methods to ensure food safety and submit it on GMIU web portal.	10

4	**Bioreactor Design:** Prepare a 3D Design of bioreactor for producing a specified product and make video of it and submit it on GMIU web portal.	10
5	**Industry Application Research Project:** Research the application of bioprocess engineering in a specific industry (e.g., pharmaceuticals or food production). Write a report highlighting current trends and future challenges and submit it on GMIU web portal.	10
Total		**50**

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks **(Revised Bloom's Taxonomy)**						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	30%	10%	-	10%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Understand the basics of food biotechnology and genetic applications in food production.
CO2	Apply downstream processing techniques in industrial food biotechnology.
CO3	Analyze regulatory, ethical, and safety aspects of food biotechnology.
CO4	Explain the role of fermentation and microbial enzymes in food processing and waste utilization.

Instructional Method: The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1]. Bains. W, 1993, Biotechnology from A to Z, Oxford Univ, Press, Oxford.
[2]. Crueger. W and Crueger. A, 1984. Biotechnology: A Textbook of Industrial Microbiology. Science Tech. Madison, USA.
[3]. Joshi, V.K and Pandey, A. Ed, 1999. Biotechnology. Food Fermentation, (2 Vol.set). Education Publ. New Delhi.
[4]. Knorr, D.1982. Food Biotechnology. Marcel Dekker, New York.