SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2H01NCFBT01	Principles and Applications of Instruments and Techniques	4-0-1	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1. Analyze and evaluate the underlying principles of spectroscopic techniques including colorimetry, photometry, fluorimetry, atomic absorption and IR spectroscopy used in food and nutrition analysis.

CLO2. Explain the principles and applications of chromatographic techniques such as paper chromatography, TLC, HPTLC, GC and HPLC.

CLO3. Apply electrophoretic and separation techniques (PAGE, SDS-PAGE, agarose gel electrophoresis) in biochemical and food analysis.

CLO4. Analyse the working, principles and applications of modern analytical instruments including ELISA, PCR, RT-PCR, centrifuge, texture analyzer and electron microscope.

CLO5. Evaluate the role of analytical instruments in qualitative and quantitative assessment of food components and research applications.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Spectroscopy: Colorimetry, photometry, fluorimetry, atomic absorption spectroscopy, spectrophotometry, infrared spectroscopy and applications	Classroom lecture, ICT- enabled learning	CLO1
II	Chromatography: Principles, Paper chromatography, TLC, HPTLC, Column chromatography, Gas chromatography (GC), High Performance Liquid Chromatography (HPLC)	Classroom lecture, Problem-based learning	CLO2
III	Electrophoresis & Instruments: PAGE, SDS-PAGE, 2D electrophoresis, agarose gel electrophoresis; Instruments – texture analyzer, food color measurement, isotope techniques, microtome, centrifuge	Classroom lecture, Seminar	CLO3, CLO4
IV	Advanced Techniques: ELISA, PCR, RT-PCR, gel documentation system, pH meter, titration, electron microscope, computer applications in analysis	Classroom lecture, ICT-enabled learning,Seminar	CLO4, CLO5

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Assignment, Self-learning and Terms work
(b) Seminar/Presentation
(c) Quiz

b. Internal Summative Assessment

(a) Mid-term tests

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1	30	1	1	11	13
II	CLO2	32	1	1	10	12
III	CLO3, CLO4	28	1	1	10	12
IV	CLO4, CLO5	30	1	1	11	13
		120	**04**	**04**	**42**	**50**

- **Assessment and Evaluation**

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quiz, Class Regularity, Internal exam	50%
2	End-Semester Examination	Written Exam	50%

(C) CLOs – PLOs Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	3	2	-	-	-	-	-	-	-	-	-
CLO2	3	3	3	-	-	-	-	-	-	-	-	-
CLO3	2	3	3	2	-	2	-	-	1	-	-	-
CLO4	2	2	3	3	2	3	1	1	2	1	-	-
CLO5	2	2	3	3	3	3	2	2	2	1	1	1

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

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M.Sc. (Home Science) Food Biotechnology Semester-I

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Food Analysis	Suzanne S. Nielsen	5th Edition, 2017	Springer
2	Principles of Instrumental Analysis	Douglas A. Skoog, F. James Holler, Stanley R. Crouch	6th Edition, 2007	Brooks/Cole (Cengage Learning)
3	Handbook of Analysis of Active Compounds in Functional Foods	Leo M.L. Nollet, Fidel Toldrá	1st Edition, 2012	CRC Press (Taylor & Francis)
4	Thin Layer Chromatography: A Laboratory Handbook	Egon Stahl, M.R.F. Ashworth	2nd Edition, 1990	Springer
5	Non-destructive Evaluation of Food Quality	K. Irudayaraj, C. Joseph	1st Edition, 2013	Wiley-Blackwell
6	Handbook of Dairy Foods Analysis	Leo M.L. Nollet	1st Edition, 2014	CRC Press (Taylor & Francis)

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	e-PG Pathshala modules on Food Analysis and Instrumentation	https://epgp.inflibnet.ac.in
2	Spectrophotometry and analytical techniques (ScienceDirect resources)	https://www.sciencedirect.com
3	Journal of Chromatography B (Research articles on separation techniques)	https://www.sciencedirect.com/journal/journal-of-chromatography-b
4	FAO guidelines on food analysis and quality control methods	https://www.fao.org

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M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2H01NCFBT02	Basic Biochemistry	4-0-1	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1. Analyze and compare the structure and functions of prokaryotic and eukaryotic cells, including their cellular organelles and division process.

CLO2. Explain the chemistry and metabolic pathways of carbohydrates and their role in energy metabolism.

CLO3. Discuss the chemistry, classification, and metabolism of lipids in relation to physiological functions.

CLO4. Analyse the structure, function, and metabolism of proteins along with enzyme classification, kinetics, and regulation.

CLO5. Evaluate the integration of metabolic pathways and their relevance to nutritional disorders and physiological regulation.

Unit	Course Content	Learning Pedagogies	CLO(s)
I	Cell Biology: Prokaryotic vs eukaryotic cells, cell membrane, structure and functions of organelles, cell division (mitosis, meiosis), differentiation, proliferation, cell fractionation	Classroom lecture, ICT enabled learning	CLO1
II	Carbohydrates: Structure, classification, digestion, absorption, metabolism (glycolysis, TCA cycle, glycogenesis, glycogenolysis)	Classroom lecture, ICT enabled learning, Case based learning	CLO2
III	Lipids: Classification, structure, digestion, absorption, β-oxidation, lipid metabolism, physiological roles	Classroom lecture, ICT enabled learning, Case based learning	CLO3
IV	Proteins & Enzymes: Amino acids, protein structure, metabolism; enzymes – classification, properties, kinetics, inhibitors, coenzymes, isoenzymes	Classroom lecture, ICT enabled learning, Research-oriented learning	CLO4, CLO5

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Assignment, Self-learning and Terms work
(b) Seminar/Presentation
(c) Quizzes

b. Internal Summative Assessment

(a) Mid-term tests

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1	30	1	1	11	13
II	CLO2	32	1	1	10	12
III	CLO3	28	1	1	10	12
IV	CLO4, CLO5	30	1	1	11	13
		120	**04**	**04**	**42**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quiz, Class Regularity, Internal exam	50%
2	End-Semester Examination	Written Exam	50%

(C) **CLOs – PLOs Matrix**

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	3	2	-	-	-	-	-	-	-	-	-
CLO2	3	3	3	-	-	-	-	-	-	-	-	-
CLO3	3	3	3	-	-	-	-	-	-	-	-	-
CLO4	2	3	3	2	2	2	1	-	1	-	-	-
CLO5	2	2	3	3	2	3	2	1	1	1	1	1

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Lippincott's Illustrated Reviews: Biochemistry	Richard A. Harvey, Pamela C. Champe, Denise R. Ferrier	7th Edition, 2019	Wolters Kluwer
2	Textbook of Biochemistry for Medical Students	D. M. Vasudevan, S. Sreekumari, Kannan Vaidyanathan	8th Edition, 2016	Jaypee Brothers
3	Lehninger Principles of Biochemistry	David L. Nelson, Michael M. Cox	6th Edition, 2017	W.H. Freeman
4	Essentials of Biochemistry	Pankaja Naik	2nd Edition, 2017	Jaypee Brothers
5	Biochemistry	Jeremy M. Berg, John L. Tymoczko, Gregory J. Gatto Jr., Lubert Stryer	8th Edition, 2015	W.H. Freeman

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	e-PG Pathshala – Biochemistry Modules	https://epgp.inflibnet.ac.in
2	NPTEL Biochemistry Courses	https://nptel.ac.in
3	Khan Academy – Biochemistry	https://www.khanacademy.org
4	PubMed – Biochemistry Research Articles	https://pubmed.ncbi.nlm.nih.gov

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M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
DSC	P2H01NCFBT03	Cell and Molecular Biology	4-0-1	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Explain the structure and chemical properties of nucleic acids and justify DNA as the hereditary material.

CLO2: Analyze genomic organization in eukaryotes including chromatin, chromosomes, and repetitive DNA.

CLO3: Illustrate the mechanism of DNA replication in prokaryotes and eukaryotes and evaluate the role of DNA polymerases and telomerase.

CLO4: Analyze gene expression processes including transcription, translation, and regulation in prokaryotes and eukaryotes.

CLO5: Evaluate mutation mechanisms, DNA repair systems, transposition, and genetic recombination in prokaryotes and eukaryotes.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	(a) Chemistry of nucleic acids, DNA as hereditary molecule (b) Genomic organization: genomic organization in eukaryotes, chromatin and chromosome structure, repetitive DNA	Classroom lectures, ICT enabled learning, Seminar, Reflective practice	CLO1 CLO2
II	DNA replication: Mechanism of DNA polymerase catalyzed synthesis of DNA in prokaryotes and eukaryotes, Types of DNA polymerases and their role, role of telomerases in Replication of eukaryotic chromosomes	Classroom lectures, ICT enabled learning, Seminar, Problem based learning, Case based learning	CLO3
III	(a) Gene transcription, translation of m-RNA into protein in prokaryotes and eukaryotes (b) Gene regulation with specific examples lac, trp, ara etc. (c) Gene expression in eukaryotes with different control	Classroom lectures, ICT enabled learning, Seminar, Problem based learning, Case based learning	CLO4
IV	(a) Molecular basis of mutation and DNA repair (b) Transportable genetic elements in prokaryotes and eukaryotes, mechanism of transposition (c) Bacterial recombination-transduction, transformation and conjugation	Classroom lectures, ICT enabled learning, Seminar, Problem based learning, Case based learning	CLO5

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Assignment, Self-learning and Terms work
(b) Seminar/Presentation
(c) Quiz

b. Internal Summative Assessment

(a) Mid-term tests

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1 CLO2	30	1	1	10	12
II	CLO3	32	1	1	10	12
III	CLO4	28	1	1	10	12
IV	CLO5	30	1	1	12	14
		120	**04**	**04**	**42**	**50**

- **Assessment and Evaluation**

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quiz, Class Regularity, Internal exam	50%
2	End-Semester Examination	Written Exam	50%

(C) CLOs – PLOs Matrix

CLO	PLO											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO 10	PLO11	PLO 12
CLO1	3	2	1	-	-	-	-	1	-	-		1
CLO2	3	2	1	-	-	-	-	1	-	-		1
CLO3	3	3	2	1	1	-	1	2	-	-		1
CLO4	3	3	3	1	2	1	2	2	1	-	1	1
CLO5	3	3	3	2	2	2	2	2	1	1	1	2

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Essentials of Cell and Molecular Biology	De Robertis, E.D.P. & De Robertis, E.M.F.	8th Edition, 2010	Lippincott Williams & Wilkins
2	Essentials of Molecular Biology	Malacinski G.M.	4th Edition, 2003	Jones & Bartlett Publishers
3	Molecular biology of the Cell	Bruce Alberts, Alexander Johnson, Julian Lewis, et al.	7th Edition, 2014	Garland Science
4	Molecular Biology of the Gene.	James D. Watson, Tania A. Baker, Stephen P. Bell, et al.Watson J.D. et. al.	7th Edition, 2013	Pearson

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Free molecular biology tutorials, animations (DNA replication, transcription, translation)	https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation
2	NCBI Bookshelf – Free textbooks and research material on molecular biology	https://www.ncbi.nlm.nih.gov/books
3	Online lectures and courses on molecular biology and genetics	https://www.coursera.org (Search: Molecular Biology)
4	Open-access educational videos on cell and molecular biology	https://www.youtube.com (Channels: MIT OpenCourseWare, CrashCourse Biology)

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M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
DSC	P2H01NCFBT04	Practical based on Principles & Applications of Instruments & Techniques and Basic Bio-Chemistry	0-8-1	**120**	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1. Apply spectroscopic techniques such as spectrophotometry and fluorometry for qualitative and quantitative analysis.

CLO2. Perform and demonstrate chromatographic and electrophoretic techniques for separation of biomolecules, and evaluate food quality using analytical instruments..

CLO3. Determine physicochemical properties of lipids including saponification value, iodine value, peroxide value and acid value. Analyse proteins using biochemical methods such as serum protein estimation and Lowry method.

CLO4. Determine optimum pH and temperature for enzyme activity through experiments and evaluate and interpret biochemical parameters in relation to nutritional status.

Unit	Course Content	Learning Pedagogies	CLO(s)
I	Determination of λ max of a compound; Verification of Beer-Lambert's law; Acid-base titration using pH meter. Use of fluorometer for fluorescent compounds (riboflavin); Spectrophotometric analysis	Laboratory Practicals, Problem-Based Learning	CLO1
II	Separation techniques: Paper chromatography (amino acids), adsorption chromatography (β-carotene), Thin Layer Chromatography (lipids). Electrophoresis (serum proteins); Measurement of color and texture of food; Visit to advanced research laboratory	Laboratory Practicals, Problem-Based Learning	CLO2
III	Qualitative and quantitative analysis of carbohydrates; Estimation of starch, Determination of lipid constants: saponification value, iodine value, peroxide value, acid value, Reichert-Meissl (R.M.) value.	Laboratory Practicals, Problem-Based Learning	CLO3
IV	Protein analysis: Total serum protein, albumin, globulin, A/G ratio; Estimation of cellular protein by Lowry method, Enzyme kinetics (optimum pH and temperature); Quantitative estimation of cholesterol	Laboratory Practicals, Problem-Based Learning	CLO4

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Class Regularity

(b) Laboratory performance

b. Internal Summative Assessment

(a) Internal practical exam

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1	30	1	1	11	13
II	CLO2	32	1	1	10	12
III	CLO3	28	1	1	10	12
IV	CLO4	30	1	1	11	13
		120	**04**	**04**	**42**	**50**

- **Assessment and Evaluation**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Food Analysis	Suzanne Nielsen	3rd Edition, 2010	Springer, New York
2	Official Methods of Analysis of AOAC International	Sidney Williams (Editor)	17th Edition, 2000	AOAC International
3	A Manual of Laboratory Techniques	Narasinga Rao Raghuramulu, Kalyanasundaram Nair, Shanta Kalyanasundaram	2nd Edition, 2003	National Institute of Nutrition, Hyderabad
4	Biochemical Methods	S. Sadasivam, A. Manickam	3rd Edition, 2008	New Age International
5	Official Methods of Analysis of AOAC International	William Horwitz (Editor)	18th Edition, 2005	AOAC International
6	A Manual of Laboratory Techniques	Narasinga Rao Raghuramulu, Kalyanasundaram Madhavan Nair, Shanta Kalyanasundaram	2nd Edition, 2003	National Institute of Nutrition, Hyderabad

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(C) CLOs – PLOs Matrix

CLO \ PLO	PLO1	PLO 2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	3	3	2	-	2	-	-	2	1	-	-
CLO2	3	3	3	2	-	2	-	-	3	1	-	-
CLO3	2	3	3	2	1	3	-	-	3	1	-	-
CLO4	2	2	3	3	2	3	1	1	3	2	1	1

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Class Regularity, Active participation in executing practicals, Internal practical exam	50%
2	End-Semester Examination	Written and Practical Exam	50%

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M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course credits
DSC	P2H01NCFBT05	Practical based on Cell & Molecular Biology and Food Microbiology	0-8-1	**120**	04

- **Course Learning Outcomes (CLOs)**

CLO1. Apply laboratory techniques for isolation, estimation, and analysis of nucleic acids**,** including DNA and RNA extraction and agarose gel electrophoresis.

CLO2. Demonstrate and analyze microbial genetic techniques, including isolation of mutants, antibiotic resistance, bacterial transformation, and conjugation.

CLO3. Apply and evaluate fundamental microbiological techniques, including staining, aseptic handling, sterilization, microbial isolation, and enumeration methods.

CLO4. Analyze and interpret the microbiological quality of water, milk, and food samples using standard microbiological methods (SPC, MBRT, selective media) to assess contamination and food safety

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	a) Estimation of DNA b) Estimation of RNA c) Total chromosomal DNA isolation (Genomic DNA Extraction) d) RNA isolation from yeast, Agarose Gel Electrophoresis of DNA	Laboratory practical, demonstration	CLO 1
II	a) Isolation of auxotrophic mutants b) Isolation of antibiotic resistant strain c) Bacterial transformation, Bacterial conjugation	Laboratory practical, demonstration	CLO 2
III	a) Staining techniques – Gram staining, methylene blue staining, spore staining, capsule staining b) Streaking- simple streaking and four flame Streaking c) Preparation for enumerating microorganism: Autoclaving, Serial dilution technique, Pour plate and spread plate methods, total viable count (TVC), Calculation of CFU	Laboratory Practicals	CLO3, CLO4
IV	a) Bacteriological examination of water, SPC of different sources of water - on nutrient agar, Hichrome agar for E. Coli, etc. b) Bacteriological examination of milk and curd – MBRT test to assess the quality of milk, SPC using nutrient agar, lactobacillus count on MRS agar, yeast and mold count on PDA agar, etc	Laboratory practicals, Case based learning, Problem based learning	CLO3, CLO4

	c) Microbial count of different foodstuff – SPC on nutrient agar, yeast and mould count on PDA from different food stuff, e.g. sweet preparations such as ice-creams, street foods such as panipuri, etc		

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Class Regularity

(b) Laboratory performance

b. Internal Summative Assessment

(a) Internal practical exam

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1	30	1	1	11	13
II	CLO2	30	1	1	10	12
III	CLO3	30	1	1	10	12
IV	CLO4	30	1	1	11	13
		120	**04**	**04**	**42**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Class Regularity, Active participation in executing practicals, Internal practical exam	50%
2	End-Semester Examination	Written and Practical Exam	50%

(C) CLOs – PLOs Matrix

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	3	3	-	2	2	-	-	2	-	-	2
CLO2	3	3	3	2	2	2	2	-	2	2	-	2
CLO3	3	3	3	2	-	2	-	-	3	1	-	-
CLO4	2	3	3	3	1	3	2	1	3	2	1	1

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

M.Sc. (Home Science) Food Biotechnology Semester-I

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Molecular Biology of the Gene	James D. Watson et al.	7th Edition, 2014	Pearson
2	Experimental Microbiology (Vol. I)	Patel Rakesh, J. & Patel Kiran, R.	8th Edition, 2015	Aditya Publication, Ahmedabad.
3	Manual of Microbiology, Tools & Techniques.	Sharma, K.	2nd Edition	Ane Books Pvt. Ltd.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	NPTEL courses on microbiology, biotechnology, and molecular biology	https://nptel.ac.in
2	Protocols and experimental methods in microbiology and molecular biology	https://www.protocols.io
3	Virtual microbiology labs and simulations (covers staining, plating, CFU, etc.)	https://vlab.amrita.edu
4	Food safety and microbiological standards (India)	https://fssai.gov.in

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M.Sc. (Home Science) Food Biotechnology Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2H01NCFBT06	Food Microbiology	2-0-1	**60**	02

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1. Explain and classify microorganisms relevant to food microbiology, and analyze factors influencing microbial growth and survival in food systems.

CLO 2. Evaluate the mechanisms of food spoilage, contamination, and food-borne hazards, and propose appropriate prevention and control measures.

CLO3. Apply and evaluate microbial applications in fermented foods and appropriate culture media and inoculation techniques, and correlate them with traditional Indian fermentation practices.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	a) Classification of bacteria relevant to food microbiology (eight group classification) b) Microbial growth – growth curve, factors affecting the growth and survival of microorganisms in foods – intrinsic factors for growth such as moisture, pH and acidity, nutrient content, biological structure, redox potential, naturally occurring antimicrobial in foods etc. Extrinsic factors for growth – types of packaging/atmospheres, temperatures and humidity conditions of microbial growth c) Types of culture media with examples and inoculation techniques.	Classroom lecture, ICT-enabled learning, Collaborative learning, Self-directed learning	CLO1, CLO3
II	a) General principles underlying food spoilage, chemical changes caused by microorganisms – changes in nitrogenous organic compounds, non-nitrogenous organic compounds, organic acids, other compounds, lipids, pectic substances b) Contamination, food spoilage and prevention in different kinds of foods – cereals, pulses, vegetables, and fruits, milk and milk products, sugar and sugar products, salt, spices and canned foods c) Food Hazards: Food borne infections, food intoxications (poisoning), symptoms, toxicity, foods involved, methods of prevention and control –Bacillus, Campylobacter, Staphylococcus, Clostridium, E. Coli, Vibrio Cholerae, Salmonella, Shigella.	Classroom lectures, ICT-enabled learning, Self-directed learning, Seminar	CLO2, CLO3

	d) Microbes in fermented foods – in alcoholic beverages, in indigenous food products such as idli, khaman, in bread, in milk and milk products – Yogurt, butter, cheese, fermented milks, in soybean based fermented foods - soya sauce, tempeh miso, in other oriental fermented foods – sauerkraut, kimchi, poi, etc.; Probiotic fermented foods e) Traditional Indian fermentation practices (*Sandhana Kalpana*) in Ayurveda f) Role of naturally fermented foods in gut health (Agni) and immunity (Vyadhikshamatva)		

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Assignment, Self-learning and Terms work
(b) Seminar/Presentation
(c) Quiz

b. Internal Summative Assessment

(a) Mid-term tests

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	CLO1, CLO3	25	2	2	7	11
II	CLO2, CLO3	35	2	2	10	14
		60	**04**	**04**	**17**	**25**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	Seminars, Assignments, Quiz, Class Regularity, Internal exam	50%
2	End-Semester Examination	Written Exam/Practical Exam Project Evaluation (Report, Presentation, Viva)	50%

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

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(C) CLOs – PLOs Matrix

CLO			PLO									
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	3	2	2	1	-	-	1	1	-	-	-	-
CLO2	2	3	3	2	1	1	2	2	1	2	1	–
CLO3	2	2	3	2	1	–	1	2	2	1	2	1

Values to **CLO-PLO** matrix are assigned **by judging the importance of the particular CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Basic Food Microbiology	Banwart, G.J.	Edition 1989	AVI Publishers
2	Food Microbiology	Frazier, J; Westhoff, DC.	Edition 2017	McGraw Hill Pvt. Ltd..
3	Modern Food Microbiology	Jay, J.M.; Loessner, M.J. Golden D.A.	Edition 2005	Springer
4.	Handbook of Indigenous Fermented Foods	Steinkraus, KS	1996	Marcel Dekker

- **Online Resources (Open Source)**

Sr.No.	Description of Resource(s)	Weblink
1.	Food Microbiology	https://epgp.inflibnet.ac.in/
2.	International Journal of Food Microbiology. Elsevier	https://www.sciencedirect.com/journal/interna tional-journal-of-food-microbiology
3.	Indian Journal of Microbiology, Springer	https://link.springer.com/journal/12088
4.	Journal of Applied Microbiology, Wiley Blackwell	https://enviromicro-journals.onlinelibrary.wiley.com/journal/1365 2672
5.	Probiotics and Antimicrobial Proteins, Springer	https://link.springer.com/journal/12602
6.	Fermented Foods	https://www.sciencedirect.com/journal/fermen ted-foods

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- **Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Handbook of Ayurveda and Nutrition	Priti Rishi Lal		Elite Publishing
2	Diet and Nutrition: An Ayurvedic Approach	Monika Luharia, Suraj Saries, Rashmi Barsagade, Anurag, Luharia		IP Innovative Publication Ltd., New Delhi
3	Handloom and Handicrafts of India	Jasleen Dhamija	2004	Abhinav Publications
4	Textiles of India	Herbert Ponder	1990	Taraporevala
5	Household Management	B. S. Khatkar	Latest edition	Daya Publishing

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Traditional Folk Media	https://www.igntu.ac.in/eContent/MJMC-4sem-Dr. Manisha%20Sharma.pdf
2	Traditional and Folk Media for Development	https://ebooks.inflibnet.ac.in/hsp13/chapter/traditional-and-folk-media-for-development/
3	Folk And Traditional Media	https://egyankosh.ac.in/bitstream/123456789/78600/1/Unit-10.pdf
4	Ayurveda and food	https://ayush.gov.in/