Programme outcome:

The programme outcome of M.Sc. (Home Science) is to instill professional, practical and entrepreneurship skills for improvement in the quality of life of family and community.

Course specific outcomes (Food Biotechnology):

- To familiarize the students with the fundamentals of Biotechnology, Industrial Microbiology, Food Biosciences and Nutritional Biotechnology.
- To impart knowledge related to Food and Nutritional Security using the biotechnological approach.
- To impart theoretical and practical knowledge related to food quality assurance.
- To acquire skills to undertake systematic and independent research in the area of Food Biotechnology.

SARDAR PATEL UNIVERSITY
Programme – M.Sc.
(Under Choice Based Credit Scheme)
Semester – III
Syllabus with effect from: 2021-22
M. Sc. H.Sc. Food Biotechnology

Sr. No.	C/E	Course No	Title	T/P	Credits	Contact hrs/ week	Exam Duration in hrs	Marks		
								Internal	External	Total
Core Course										
1	C	PH03C FBT51	Research Methodology and scientific writing	T	2	2	2	15/5	35/14	50/20
2	C	PH03C FBT52	Practical –Scientific Writing	P	1	2	-	25	-	25
3	C	PH03C FBT53	Fundamentals of Industrial Microbiology	T	4	4	3	30/10	70/28	100/40
4	C	PH03C FBT54	Practical based on PH03C FBT53 (Fundamentals of Industrial Microbiology)	P	2	4	4	15/5	35/14	50/20
5	C	PH03C FBT55	Advanced Nutrition	T	4	4	3	30/10	70/28	100/40
6	C	PH03C FBT56	Practical based on PH03C FBT55 (Advanced Nutrition)	P	2	4	4	15/5	35/14	50/20
7	C	PH03C FBT57	Dissertation*	-	4	4	-	100	-	100
Elective Course (8 & 9 OR 10 & 11)										
8	E	PH03E FBT51	Human Genetics	T	4	4	3	30/10	70/28	100/40
9	E	PH03E FBT52	Practical based on PH03E FBT51 (Human Genetics)	P	2	4	4	15/5	35/14	50/20
10	E	PH03E FBT53	Food Product Development and Quality Assurance	T	4	4	3	30/10	70/28	100/40
11	E	PH03E FBT54	Practical based on PH03E FBT53 (Food Product Development and Quality Assurance)	P	2	4	4	15/5	35/14	50/20
			Total		**25**	**32**	**--**	**275**	**350**	**625**

Note: 1) C- Core course , E- Elective course
2) Student will select any one elective from theory and the related practical.
*One contact hour per week per student

SARDAR PATEL UNIVERSITY
Programme – MSC
(Under Choice Based Credit Scheme) Semester – IV
Syllabus with effect from: 2021-22
M. Sc. H.Sc. Food Biotechnology

Sr. No.	C*	Course No	Title	T/P	Credit	Contact hrs/ week	Exam Duration in hrs	Marks		
								Internal	External	Total
Core Course										
1	C	PH04CFBT51	Nutritional Biotechnology	T	4	4	3	30/10	70/28	100/40
2	C	PH04CFBT52	Food Bioscience	T	4	4	3	30/10	70/28	100/40
3	C	PH04CFBT53	Dissertation & Viva Voce*	--	14	21	-	100	250 (150** +100***)	350
4	C	PH04CFBT54	Seminar	--	2	4	-	50	-	50
Viva Group										
5	C	PH04CFBT55	Comprehensive Viva Voce	--	1	2	-	25	-	25
			Total		**25**	**35**	**-**	**235**	**390**	**625**

*One contact hour per week per student
**150 – Dissertation Evaluation
***100 – Viva Voce

(Master of Science-Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT51	Title of the Course	Research Methodology and Scientific Writing
Total Credits of the Course	02	Hours per Week	02

Course Objectives:	1. To understand significance of research in Home Science 2. To understand sampling methods and techniques 3. To understand types of researches and develop the ability to construct data gathering tools appropriate to research design 4. To gain knowledge regarding scientific writing in research report presentations

Course Content		
Unit	Description	Weightage (%)
1.	Basic concepts of research: Introduction, Meaning, Objectives, Characteristics, Requirements for a Scientific Research, Types of Researches: Exploratory and Descriptive	15
2.	Research Problem: Introduction, Selecting the Problem, Defining the Problem, Sources of Problem, Criteria for Selection of the Problem, Delimiting a Problem, Process of Formation of a Research Problem	20
3.	Research design and Hypothesis Formulation: (a) Meaning of Research Design, Types of Research Designs (exploratory, descriptive, diagnostic, experimental) (b) Hypothesis, Sources of Hypothesis, Forms of Hypothesis	15
4.	Sampling methods and techniques: Meaning and Definition of Population and Sampling, Techniques of Sampling (probability and non-probability)	15
5.	Data collection and Measurement: (a) Types of data: Secondary and Primary (b) Methods of Primary data collection: Observation, Personal Interview, Questionnaire, Schedule, Case Study, Social Survey, Field study, Field experiment, Scaling measurement: types of measurement scales	20
6.	Organization of data and presentation: (a) Coding, Tabulation and Charts (b) Purpose of Report, Essentials of a Good Report, Types of Report Presentations (written, oral, poster), Format of a Report	15

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with examples	

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Become better researchers.
2.	Know how to present research report in a systematic manner.

Suggested References:	
Sr. No.	References
1.	Kothari, C.K. (1990). *Research Methodology: Methods and Techniques*. New Delhi: Wiley Eastern Ltd.
2.	Sarangi, P.(2010). *Taxman's Research Methodology*. New Delhi: Taxman Publications (P) Ltd.
3	Oliver, P. (2008). *Writing your Thesis*. Delhi: Sage Publication.

4.	Hart, C. (2005). *Doing your Master's Dissertation*. New Delhi: Vistaar Publications.
5.	Chawla. D and Sondhi. N. (2011), *Research Methodology Concepts and Cases.* Noida: Vikas Publishing House.
6.	William, N. *Your Research Project.* New Delhi: Vistaar Publications.

On-line resources to be used if available as reference material
On-line Resources
https://www.open.edu/openlearn/money-management/understanding-different-research-perspectives/
www.guide2research.com
https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=827

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(Master of Science-Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT52	Title of the Course	Practical- Scientific Writing
Total Credits of the Course	01	Hours per Week	02

Course Objective:	1. To understand the nuances of scientific writing and develop skills in presentation of scientific information

Course Content		
Unit	Description	Weightage (%)
1.	Scientific writing as a means of communication (grammar, punctuation and conventions of scientific writing)	15
2.	(a) Sections of a report: Research Paper, Thesis/Dissertation, Poster (b) Steps in writing a report	10
3.	Tables: Drafting titles, subtitles, construction details	15
4.	Graphs- Types, Title, Elements (scales, title, scale captions and key)	15
5.	Citing the references	15
6.	Appendices: Content, Need, Rules for Presentation	10
7.	Writing of proposal (for grants)	20

Teaching-Learning Methodology	Classroom lecture (Black board/ Power Point Presentation), Practice exercises in class, discussions

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Practical Examination (As per CBCS R.6.8.3)	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Demonstrate knowledge of scientific writing method and style.
2.	Develop research proposal on a topic relevant to their field of study.

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(Master of Science - Home Science) (Food Biotechmology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT53	Title of the Course	Fundamentals of Industrial Microbiology
Total Credits of the Course	04	Hours per Week	04

Course Objective:	1. To introduce and appreciate the scope and future of bioprocess technology 2. To learn how microorganisms can be screened for the production of metabolites and activities 3. To understand the cultivation methods for a bioprocess. 4. To know the types of bioreactor configurations available and the principles of their design 5. To understand the role of mass and heat transfer, aeration and mixing in bioprocesses 6. To know how bioprocesses can be controlled 7. To elaborate the various methods available for the recovery and purification of biotechnological products

Course Content

Unit	Description	Weightage (%)
1.	Introduction to fermentation technology (a) Concept of fermentation technology (b) Range of processes and products (c) Industrially fermentation important microorganisms and their screening- Primary screening (antibiotic, organic acid, amylase and growth factor) and significance of secondary screening (d) Improvement of industrially important microorganisms	25
2.	Up stream processing-1 (a) Inoculum development criteria for an ideal inoculum. Inoculum development for bacteria, yeast and molds (b) Media for industrial fermentation (ideal characteristics) (c) Substrates for industrial fermentations (carbon and nitrogen Source) (d) Role of precursors, inhibitors and inducers in fermentation medium (e) Sterilization of air and media	25
3.	Fermenter design, type & control (a) Methods of fermentation: Batch, Fed batch and Continuous, solid state fermentation including tray fermenters (b) Industrial fermenter design (Criteria for the design, design of typical fermenter)	25

	(c) Types of fermenters – Air lift fermentor, plug flow reactor, packed bed reactor and UASB (d) Components of fermenter and their uses (e) Introduction to mass transfer of oxygen, factors affecting Kla and methods for its determination	
4.	Extraction and purification processes (a) Criteria for the selection of recovery process. (b) Separation of cells by filtration and centrifugation (c) Techniques for the disruption of microbial cells (d) Liquid: Liquid extraction of fermentation products (e) Product purification by chromatographic techniques (f) Product concentration by precipitation, reverse osmosis and ultrafiltration	25

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with related examples.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcome: Having completed this course, the learner will be able to	
1.	Recognize the potential of microorganisms which can produce a variety of economically viable products.
2.	Learn how microorganisms can be screened for the production of various metabolites.
3.	Understand how inoculums for industrial fermentations can be prepared and maintained.
4.	Appreciate the requirement of aseptic conditions and the control of contamination during the bioprocess.
5.	Identify and select appropriate media constituents required to produce the desired product.
6.	Understand on what basis cultivation methods are decided for a particular bioprocess.

7.	Know the types of bioreactor configurations available for bioprocesses and will also be able to learn the importance of various important components which constitute various parts of a bioreactor.
8.	Understand the need for monitoring and the control of various essential bioprocess parameters.
9.	Learn the various methods available for recovery and purification of fermentation products from the complex fermentation broth.

Suggested References:

Sr. No.	References
1.	Stanbury, P.F., Whitaker, A. and Hall, S.J. (1995). *Principles of Fermentation Technology.* (2nd edition). Pergamon.
2.	Modi, H.A. (2011). *Fermentation Technology* - VoI & Vol II. Pointer Publishers.
3.	Patel, A.H. (2011). *Industrial Microbiology*. (2nd edition). Laxmi Publications.
4.	Crueger, W. and Crueger, A. (1990). *Biotechnology: A textbook of Industrial Microbiology.* (2nd edition). Sinauer Associates Inc.

On-line resources to be used if available as reference material
https://epgp.inflibnet.ac.in/
Industrial Microbiology - an overview, Science Direct
Industrial Microbiology, Wiley
Industrial Microbiology, FEMS Microbiology Letters

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(M.Sc. - HomeScience) (Food Biotechnology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT54	Title of the Course	Practical based on PH03CFBT53 (Fundamentals of Industrial Microbiology)
Total Credits of the Course	02	Hours per Week	04

Course Objective:	1. The techniques of screening microorganisms for enzyme production (eg. amylase, lypase, etc.) 2. The production of industrially important products and components using fermentation such as wine, cheese, yogurt, citric acid, etc 3. The technique of cell immobilisation

Course Content		
Unit	Description	Weightage (%)
1.	Screening of amylase producing microorganisms	20
2.	Microbial production of amylase and starch hydrolysis	8
3.	Enzymatic digestion of protein into amino acids	8
4.	Enzymes in laundry detergents	8
5.	Microbial production of cellulose and cellulose degradation	8
6.	Production of wine	8
7.	Microbial production of citric acid	8
8.	Yoghurt / cheese production from milk	8
9.	Purification of enzymes by • salt • acetone • iso-electric pH	8
10.	Enzyme immobilization	8
11.	Cell immobilization & bio-reactor design	8

Teaching-Learning Methodology	Classroom lectures (Blackboard), demonstration and then actual performance by students, discussion of results.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Screen microorganisms for various industrially important enzymes.
2.	Master the production of industrially important fermented products such as wine, cheese, yogurt, etc.
3.	Master the technique of cell immobilisation.

Suggested References:	
Sr. No.	References
1.	

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(Master of Science-HomeScience) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT55	Title of the Course	Advance Nutrition
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. Learn the nutritional aspects of carbohydrates, proteins, fats, vitamins and minerals for various age groups. 2. Learn the role of nutrients in health and diseases. 3. Gain knowledge about the physiological and metabolic role of carbohydrates, proteins, fats, vitamins and minerals in human body.

Course Content		
Unit	Description	Weightage* (%)
1.	(a) Energy balance, regulation of food intake and body composition (b) Carbohydrate: food sources, functions, excess and deficiency states	20
2.	(a) Protein: food sources, functions, excess and deficiency states (b) Lipids: food sources, functions, excess and deficiency states	20
3.	Fat soluble vitamins: Sources, functions, effect of excess and deficiency	15
4.	Water soluble vitamins: Sources, functions, effect of excess and deficiency	15
5.	(a) Major Minerals: Sources, functions, effect of excess and deficiency (b) Trace Minerals: Sources, functions, effect of excess and deficiency	20
6.	Animal Experiment	10

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with related examples.

Evaluation Pattern		
Sr.	Details of the Evaluation	Weightage

No.		
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	--
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Describe about the B.M.R and factors affecting it.
2.	Discuss about the metabolic functions of various nutrients.
3.	Discuss about the signs and symptoms of various deficiency diseases.
4.	Understand how to conduct animal experiment

Suggested References:	
Sr. No.	References
1.	Burk, R.F., Levander, O.A. Selenium. In: Shils, M.E., Shike, M., Ross, A.C., Caballero, B., Cousins, R.J., 2006. *Modern Nutrition in health and Disease 10th edition*. Philadelphia, PA: Lippincott Williams & Wilkins.
2.	Medeiros, denis M., 2015, *Advanced Human Nutrition*. Jones & Bartlett learning.
3.	Berdanier C.D. and Berdanier L.A., 2015 *Advanced Nutrition Boca* Raton: CRC Press Taylor and Francis Group.

On-line resources to be used if available as reference material
On-line Resources
www.annualreviews.org/journal/Nutrition
Nutrition Research, Elsevier
Nutrition Reviews, Oxford University Press

British journal of Nutrition, Cambridge University
The *American Journal of Clinical Nutrition,* American Society for Nutrition
Annual review of Nutrition, Annual Reviews
Foods and Function, Royal Society of Chemistry
Nutrition and reviews, Wiley Blackwell
Nutrition Research Reviews, Cambridge University Press
Nutrition and Metabolism, Springer

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(Master of Science-HomeScience) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT56	Title of the Course	Practical based on PH03CFBT55 (Advanced Nutrition)
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	1. Learn the laboratory analysis of various clinical parameters. 2. Update the skill to interpret the results of blood parameters, liver and kidney functions tests. 3. Learn the laboratory analysis of various vitamins and antioxidant to assess the nutritional status.

Course Content		
Unit	Description	Weightage (%)
1.	Blood /Serum analysis using auto-kits: Hemoglobin, Lipid profile- (Total lipid, Total cholesterol, Triglyceride, HDL-C), Liver Function Test (AST, ALT), Total protein, A/G ratio.	30
2.	Urine Analysis: (Manually and by auto-kit): Nitrogen, urea,creatinine and uric acid.	20
3.	Analysis of Vitamin A, E and C	25
4.	Analysis of FRAP and Glutathione	25

Teaching-Learning Methodology	Classroom lectures (Blackboard), demonstration and followed by actual performance by students and discussion of results.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	30%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Attendance (As per CBCS R.6.8.3)	--
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Analyse the serum lipid profile, liver and kidney functional tests and able to interpret the diagnosis.
2.	Analyse the urinary products and diagnosis.
3.	Measure physiological antioxidant status

Suggested References:	
Sr. No.	References
1.	Raghuramula, N., Nair, K. M., & Kalyansundaram, S. (2003). *A manual of Laboratory Techniques*. (2nd Edition)National Institute of Nutrition (ICMR).
2.	Varley, H. (2005). *Practical Clinical Biochemistry*.(4th Edition) CBS publication.

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(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03CFBT57	Title of the Course	Dissertation
Total Credits of the Course	04	Hours per Week	04

Course Objective:	To develop research skills in the student.

Course Content		
Unit	Description	Weightage (%)
	Identification of a research problem based on the latest developments in the field of food biotechnology, review the related literature, plan the research work using appropriate research tools.	100

Teaching-Learning Methodology	Literature search, demonstration and then actual performance by students, discussion of results.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Continuous Assessment in the form of Practical, Attendance (As per CBCS R.6.8.3)	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Identify research areas of his or her own interest pertaining to the latest developments in the field of food biotechnology.
2.	Explore the research area in depth.
3.	Conduct the research project after identifying the appropriate research tool.

Suggested References:

Sr. No.	References
1.	Kothari, C.K. (1990). *Research Methodology: Methods and Techniques*. New Delhi: Wiley Eastern Ltd.
2.	Sarangi, P.(2010). *Taxman's Research Methodology*. New Delhi: Taxman Publications (P) Ltd.
3.	Hart, C. (2005). *Doing your Master's Dissertation*. New Delhi: Vistaar Publications.
On-line resources to be used if available as reference material	
On-line Resources	
Journal of Biosciences, Indian Academy of Sciences	
Journal of Biosciences, Springer	
Food Biotechnology, Springer	
Food Science and Biotechnology, Home - Springer	
Food Biotechnology, Taylor & Francis Online	

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(Master of Science - Home Science) (Food Biotechnology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03EFBT51	Title of the Course	Human Genetics
Total Credits of the Course	04	Hours per Week	04

Course Objective:	1. To understand the basic concepts of genetics and inheritance, chromosomal aberrations, associated genetic disorders, mutations and the related human diseases

Course Content		
Unit	Description	Weightage (%)
1.	Transmission of Genes – Segregation and Independent Assortment Mendel's laws of inheritance, homozygous, heterozygous, dominant and recessive genes, basic principles of inheritance (segregation and independent assortment), the probability of inheritance of particular genes or traits, "independent" and "dependent" events Modes of inheritance and pedigrees: To construct a pedigree from the given information, to calculate the likelihood of a genetic event based on a pedigree to determine which mode of inheritance is most likely based on the information in a pedigree	23
2.	Variations and Extensions of Mendel's laws: How multiple alleles for a single gene results in multiple distinguishable traits (rather than two for two alleles), alleles with different relationships besides simple recessiveness or dominance, why a given genotype does not always result in the same phenotype, comparison of inheritance of the mitochondrial genome with the nuclear genome, contrasting the inheritance of linked genes with unlinked genes Linkage, crossing over and chromosome mapping linkage, sex determination and sex linkage Sexual development and dosage compensation, How "phenotypic" sex is different from "gonadal" sex, outward sexual characteristics can be mismatched with genetic sex (the sex chromosomes), dosage compensation and the basic mechanism of how it works in humans, to compare the impact of dosage compensation on individuals with sex chromosomal abnormalities	22
3.	Molecular Genetics: The "central dogma" of genetic information transfer, the relationship between chromosomes, genes and DNA to distinguish between the theories for how DNA replication might work, and explain	23

	how it works, process of transcription and its utility, processing of mRNA transcripts before translation, to demonstrate how we know the "code" is non-overlapping and redundant, to interpret how mutations might affect protein structure	
4.	Mutations: Recognize different kinds of mutations (frameshift, insertions, deletions, point mutations), and predict their effect on amino acid sequence and protein structure, to predict the likelihood of a region of DNA incurring a mutation, examples of how DNA can be mutated, why are most of us relatively normal despite the fact that mutations occur in our DNA	16
5.	Applications of DNA technology: Basic idea of PCR, and how/why it is used, working of gel electrophoresis and interpretation data from a gel. Palindromic restriction enzyme sites, why restriction enzymes are used, significance of variable regions in DNA, STR, how STRs can be used in DNA fingerprint analysis Biochemical Genetics**:** Inborn errors of metabolism: (Molecular and biochemical pathways in phenyl ketonuria, alkaptonuria, Maple syrup urine disease, albinism, mucopolysaccharidosis, lipidosis and glycogen storage disorders), human mitochondrial syndromes Pharmacogenetics: Definition, drug metabolism, genetic variation	16

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with related examples

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Obtain an in-depth understanding of the concepts and scientific methods of modern genetics as it applies to humans.

2.	Understand the genetics of human biology and disease.
3.	Develop conceptual skills to address questions in genetics research and clinical practice.

Suggested References:	
Sr. No.	References
1.	Singh, B.D. (2004). *Fundamentals of Genetics*. (3rd Edition). Kalyani Publishers.
2.	Gupta, P.K. *Genetics*. Rastogi Publications, Meerut, India. ISBN: 81-7133-842-9.
3.	Gardener, E. J., Simmons, M. J. & Snustad, D. P. *Principles of Genetics*. (8th Edition). John Wiley & Sons, New York. ISBN: 9971-51-346-3.
4.	Bhatnagar, S.M. (1999). *Essentials of Human Genetics*. (4th Edition). Orient Longman. ISBN: 81-250-1426-8.

On-line resources to be used if available as reference material
https://epgp.inflibnet.ac.in/
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3602567/
https://www.tandfonline.com/doi/full/10.1080/07315724.2019.1582980
https://www.karger.com/Article/Fulltext/327772
https://www.intechopen.com/online-first/nutrigenomics-an-interface-of-gene-diet-disease-interaction

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(M.Sc. - HomeScience) (Food Biotechnology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03EFBT52	Title of the Course	Practical based on PH03EFBT51 (Human Genetics)
Total Credits of the Course	02	Hours per Week	04

Course Objective:	1. The objective of the course is to acquaint the students with the basic techniques of DNA and RNA isolation from various sources

Course Content		
Unit	Description	Weightage (%)
1.	Isolation of DNA from blood , E –Coli, Yeast	50
2.	Yeast response to UV radiation	25
3.	RNA isolation from yeast	25

Teaching-Learning Methodology	Classroom lectures (Blackboard), demonstration and then actual performance by students, discussion of results

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Master the technique of DNA and RNA isolation from different sources.

On-line resources to be used if available as reference material
https://www.web-books.com/MoBio/
Replication Clamps and Clamp Loaders
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3683903/
https://pubmed.ncbi.nlm.nih.gov/11959500/

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(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.- H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03EFBT53	Title of the Course	Food Product Development and Quality Assurance
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	1. To gain an understanding of the processes involved in the invention process, formulation, and development of new food products. 2. To develop an appreciation of the food industry and how innovation is critical to the industry. 3. To cultivate basic food science principles to problem solve during product development. 4. To develop and enhance team cooperation and communication skills.

Course Content		
Unit	Description	Weightage (%)
1.	(a) Concept of new food product development: Categories, reasons (b) Nutritional concept in food designing (c) Factors affecting food product development: External factors (macro-environment) and internal factors (micro-environment)	20
2.	(a) Food formulations for various health claims such as diabetes, heart diseases, hypertension, menopausal women etc. and for various age groups such as infant, children, geriatrics, (b) Speciality food: defense services, space foods, sports person, natural calamities, etc. (c)Convenience foods, modification of existing commercial/convenience food products (d) Analysis of food products: Sensory analysis, nutrient analysis, storage stability (e) Packaging, labelling and marketing (f) IPR and Patent	30
3.	(a) Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; types of hazards (physical, chemical, biological), exposure, estimation, toxicological requirements and risk assessment. (b) Quality assessment: Sampling procedure and plans, Sensory vis-à- vis instrumental methods for testing quality, Laboratory quality procedures and assessment of laboratory performance (c) Concepts of quality management: Objectives, importance and	25

	functions of quality control; quality assurance, total quality management; GMP/GHP; GLP, GAP; HACCP, Quality manuals, documentation and audits (d) Sanitary and hygienic practices in food business organization	
4.	Indian and International quality systems and standards: (a) ISO series, Codex, GFSI, Agmark, BIS, etc. (b) Food safety and standard act and regulations (c) Export import policy	25

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Group discussion, Discussion with suitable examples.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Successfully produce food prototypes or food concepts.
2.	Develop formulations to meet cost targets, ingredient statement, nutrition profile and sensory attributes of desired product.
3.	Determine label and nutrition fact specifications according to regulations for nutrition, product naming, and claims.
4.	Design effective food safety plans (HACCP)

Suggested References:

Sr. No.	References
1.	Heijden, K.V., Younes, M., FIshbein, L. & Miller, S. (2017). International food safety handbook: Science, international regulation, and control. CRC Press
2.	Rao, E. (2013). Food quality evaluation. (1st ed.). Variety Books Publishers Distributors
3.	Watson, D. (Ed.). (2014). *Food chemical safety: Volume 2: Additives*. Elsevier.
4.	Watson, D. (Ed.). (2014). *Food chemical safety: Volume 1: Contaminants* (Vol. 1). Woodhead Publishing.
5.	Roday, S. (1998). *Food hygiene and sanitation*. Tata McGraw-Hill Education.
6.	Frazier, W. C. (2013). *Food microbiology*. Tata McGraw-Hill Education
7.	Hough, T. (2008). *Elements of hygiene and sanitation*. BiblioBazaar, LLC.
8.	Ganguli, P.(2008), Intellectual Property Rights: Unleashing Knowledge Economy, McGraw Hill, New Delhi
On-line resources to be used if available as reference material	
On-line Resources	
https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=444	
https://www.fssai.gov.in/	
https://old.fssai.gov.in/Codexindia/index.htm	
https://www.iso.org/home.html	
https://agmarknet.gov.in/	
https://dmi.gov.in/GradesStandard.aspx	

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(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.- H.Sc.) (Food Biotechnology) Semester (III)

Course Code	PH03EFBT54	Title of the Course	Practical based on PH03EFBT53 (Food Product Development and Quality Assurance)
Total Credits of the Course	02	Hours per Week	04

Course Objectives:	5. To detect common adulterants in foods 6. To enable students to plan, optimize and develop food products

Course Content		
Unit	Description	Weightage (%)
1.	Detection of food adulteration	15
2.	Planning of food product	10
3.	Optimization of the formula (using RSM)	15
4.	Food product preparation	15
5.	Sensory evaluation and analysis of prepared food product for verification of various health claims	15
6.	Report writing	15

Teaching-Learning Methodology	Classroom explanation (Blackboard), actual performance by students, discussion

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Attendance (As per CBCS R.6.8.3)	15%

3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Successfully produce food prototypes or food concepts.
2.	Analyse developed food product for nutrients, sensory attributes and storage stability.

Suggested References:	
Sr. No.	References
1.	Rao, E. (2013). Food quality evaluation. (1st ed.). Variety Books Publishers Distributors

On-line resources to be used if available as reference material
On-line Resources
Detect adulteration with rapid test available at https://fssai.gov.in/dart/
https://www.fssai.gov.in/

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(Master of Science - Home Science) (Food Biotechnology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (IV)

Course Code	PH04CFBT51	Title of the Course	Nutritional Biotechnology
Total Credits of the Course	04	Hours per Week	04

Course Objective:	1. To understand how biotechnology can be utilized for improving the nutrient content of foods

Course Content		
Unit	Description	Weightage (%)
1.	Principles and methods of plant tissue culture, development of transgenic plants	25
2.	Enhancing the nutritional quality of foods- manipulation of sucrose and starch content: manipulation of fatty acid composition of oils, enriching with protein content, increasing the content of methionine and lysine in feed storage proteins, increasing the levels of vitamins and minerals	25
3.	Removal or minimization of the antinutritional factors and toxic molecules from foods - phytate, oxalic acid, neurotoxins etc., decreasing the contents of pesticides, herbicides	25
4.	(a) Increasing the shelf life of fruits (b) Development of food value metabolites-food colors, food flavours, food additives, sweeteners etc (c) Animal biotechnology for increasing meat quality and meat production	25

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with related examples.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Viva-voce, Quizzes, Seminars,	15%

	Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	70%

Course Outcome: Having completed this course, the learner will be able to:
Apply biotechnological techniques for improving the nutritional quality of different plant-based and animal-based food sources.

Suggested References:	
Sr. No.	References
1.	Ruth, S.K. (2009). *Food and Nutritional Biotechnology*. Navyug Publishers & Distributors.
2.	Rai, R.V. (2015). *Advances in Food Biotechnology*. (1st Edition). Wiley-Blackwell.
3.	Bills, D. D. and Kung, S. (1992). *Biotechnology and Nutrition: Proceedings of the Third International Symposium*. Butterworth-Heinemann.

On-line resources to be used if available as reference material
On-line resources
https://epgp.inflibnet.ac.in/
Animal Biotechnology, Taylor & Francis Online
Plant Biotechnology Journal - Wiley Online Library
Food Science and Biotechnology, Home - Springer
Food Biotechnology, Taylor & Francis Online

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(Master of Science - Home Science) (Food Biotechnology)
(M.Sc. - H.Sc.) (Food Biotechnology) Semester (IV)

Course Code	PH04CFBT52	Title of the Course	Food Biosciences
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	• To understand the various bio-processes taking place in foods • To get sensitized and motivated towards the application of biology and related sciences to food-based issues

Course Content		
Unit	Description	Weightage (%)
1.	Bioprocesses (a) Significance of microorganisms in foods – Nutrient requirements and physiology of microorganisms (b) Factors influencing microbial growth, survival, and destruction of pathogenic and beneficial microorganisms (c) Spoilage organisms in milk, fruits, vegetables, grains, cereals, oilseeds, meat and poultry (d) Physical and chemical methods of controlling microbes	25
2.	Immobilization (a) Immobilization- basics, applications, methods (b) Immobilized reactors (c) Immobilization in food processing (d) Microencapsulation - basics and applications in food processing	25
3.	(a) Enzymes in food processing: fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing (b) Enzymes for the production of protein hydrolysates and bioactive peptides, maltodextrins and corn syrup solids (liquefaction, saccharification, dextrinization, isomerization for the production of high-fructose-corn- syrup), fructose and fructooligosaccharides (c) Bacitracin - a probiaotic trait (d) Enzymes as processing aids: Role of enzymes in cheese making and whey processing; fruit juices (cell wall degrading enzymes for liquefaction, clarification, peeling, debittering, decolourization of very dark coloured juices such as anthocyanases); baking (fungal α-amylases for bread making; maltogenic α-amylases for anti-staling; xylanses and pentosanases as dough conditioners; lipases for dough conditioning	25

4.	(a) Bioinformatics: Basics and application in food science. (b) Molecular techniques in the detection of food pathogens and GM foods (c) Biosensors in foods (d) Manufacture of beer, wine, vinegar, cheese, and mold-modified foods	25

Teaching-Learning Methodology	Classroom lectures (Blackboard/Power Point Presentations), Discussion on recent updates with related examples.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcome: Having completed this course, the learner will be able to:	
1.	Use bioprocesses for increasing the functionality and nutraceutical properties of foods.
2.	Use immobilization techniques and encapsulation methods for the processing of foods.
3.	Use microbial enzymes for the processing of foods.

Suggested References:	
Sr. No.	References
1.	*Enzymes in Food Processing: Fundamentals and Potential applications*. (2010). (Editors – P. S. Panesar, S.S. Marwaha, H.K. Chopra). I K International Publishing House Pvt. Ltd.
2.	*Food Biotechnology Principle and Practices.* (2013). (Editors - V. K. Joshi and R. S. Singh). I K International Publishing House Pvt. Ltd.
On-line resources to be used if available as reference material	
Journal of Biosciences, Indian Academy of Sciences	
Journal of Biosciences, Springer	
https://www.researchgate.net/publication/286327834_BIOINFORMATICS_APPROACHES_IN_FOOD_INDUSTRY_AN_OVERVIEW	

Food Biotechnology, Springer

(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (IV)

Course Code	PH04CFBT53	Title of the Course	Dissertation & Viva Voce
Total Credits of the Course	14	Hours per Week	21

Course Objective:	To develop research skills in the student.

Course Content		
	Description	Weightage (%)
	Review the related literature, carryout the laboratory work to fulfill the objectives of the research plan, apply the relevant statistical tools, write a detailed thesis and finally to defend the research work in a viva voce examination.	100

Teaching-Learning Methodology	Literature search, demonstration and then actual performance by students, discussion on recent update with related examples, discussion of results.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Continuous Assessment in the form of Practical, Attendance (As per CBCS R.6.8.3)	30%
2.	University Examination in the form of thesis of appraisal and viva voce	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Identify research areas of his or her own interest pertaining to the latest developments in the field food biotechnology.

2.	Explore the research area in depth.
3.	Conduct the research project after identifying the appropriate research tool.
4.	Apply appropriate statistical analysis to the data collected.
5.	Write a scientific report (dissertation) after the completion of the work.
6.	Face an examination in the form of a viva-voce and defend the research work conducted.

Suggested References:

Sr. No.	References
1.	Kothari, C.K. (1990). *Research Methodology: Methods and Techniques*. New Delhi: Wiley Eastern Ltd.
2.	Sarangi, P.(2010). *Taxman's Research Methodology*. New Delhi: Taxman Publications (P) Ltd.
3.	Oliver, P. (2008). *Writing your Thesis*. Delhi: Sage Publication.
4.	Hart, C. (2005). *Doing your Master's Dissertation*. New Delhi: Vistaar Publications.

On-line resources to be used if available as reference material

On-line Resources

Journal of Biosciences, Indian Academy of Sciences

Journal of Biosciences, Springer

Food Biotechnology, Springer

Food Science and Biotechnology, Home - Springer

Food Biotechnology, Taylor & Francis Online

SPSS:20

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(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (IV)

Course Code	PH04CFBT54	Title of the Course	Seminar
Total Credits of the Course	02	Hours per Week	04

Course Objective:	To expose students to the scientific literature available through online and offline resources in order to appreciate the current research going on in the field of food biotechnology.

Course Content		
	Description	Weightage (%)
1.	Student will select a current research topic related to food biotechnology	25
2.	Student will review research papers related to the selected topic and make a presentation	75

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal continuous Assessment in the form of seminar presentation and attendance (As per CBCS R.6.8.3)	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Improve his/her ability in the critical assessment of the available scientific literature.
2.	Use various resources to locate and extract information using offline and online tools.
3.	Obtain experience in the preparation and presentation of scientific papers.

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(Master of Science –Home Science) (Food Biotechnology)
(M.Sc.-H.Sc.) (Food Biotechnology) Semester (IV)

Course Code	PH04CFBT55	Title of the Course	Comprehensive viva-voce
Total Credits of the Course	01	Hours per Week	02

Course Objectives:	7. To assess the student's ability to communicate the knowledge he has gained. 8. To assess the student's understanding of the concepts and the depth of knowledge of the various courses he/she has studied.

Course Content		
	Description	Weightage (%)
	At the end of the semester the student will appear for a viva voce based on the course content covered in all the theory and practicals of all the four semesters.	100

Teaching-Learning Methodology	Literature search, lectures, practicals

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal viva voce (As per CBCS R.6.8.3)	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain confidence in communicating the knowledge he/she has learnt.
2.	Strengthen the understanding of the concepts he/she has studied.

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UGC-MOOC COURSES IN THE SUBJECT OF HOME SCIENCE FOOD BIOTECHNOLOGY

Sr. No.	Title of MOOC
1	Food Microbiology and Food Safety
2	Research Methodology
3	Biostatistics
4	Analytical techniques
5	Communication research
6	Functional Foods and Nutraceuticals
7	Academic Writing
8	Biomolecules: Structure, Function in Health and Disease