Syllabus of 4 + 1 Year Integrated UG and PG Programme

w. e. f 2024-25 Academic Year

GRADUATE SCHOOL

Mahatma Gandhi University

P. D. Hills P O

Kottayam, Kerala

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Schools offering Majors

SL.No	School/Centre
1	School of Bio Sciences
2	School of Chemical Sciences
3	School of Computer Sciences
4	School of Environmental Sciences
5	School of Gandhian Thought and Development Studies
6	School of International Relations and Politics
7	School of Pure and Applied Physics
8	School of Social Sciences

Sl. No.	Major	Intake
SCIENCE		
1	Bio Sciences	6**
2	Chemistry	6
3	Computer Science	6
4	Environmental Science	6
5	Physics	6
SOCIAL SCIENCES		
1	Development Studies	5
2	Gandhian Studies	5
3	History	10
4	International Relations and Politics	10

Majors offered and Intake *1 seat shall be sanctioned over and above the intake in each major in the 3rd semester for students who opt for a change of major after two semesters.

**Progression to PG Shall be based on the specialization selected by students as Biochemistry (2 seats) Biotechnology (2 seats) and Microbiology (2 seats) based on merit.

Schools offering Minors/MDCs/AECs/VACs/SECs

SL.No	School/Centre
1	School of Artificial Intelligence And Robotics
2	School of Behavioural Sciences
3	School of Biosciences
4	School of Chemical Sciences
5	School of Computer Sciences
6	School of Data Analytics
7	School of Energy Materials
8	School of Environmental Sciences
9	School of Food Science And Technology
10	School of Gandhian Thought And Development Studies
11	School of Gender Studies
12	School of Indian Legal Thought
13	School of International Relations And Politics
14	School of Letters
15	School of Mathematics And Statistics
16	School of Nanoscience And Nano Technology
17	School of Pedagogical Sciences
18	School of Polymer Science And Technology
19	School of Pure And Applied Physics
20	School of Social Sciences
21	School of Tourism Studies
22	International and Inter University Centre for Nanoscience and Nanotechnology
23	K N Raj School of Economics

Scheme for 4 + 1 Integrated UG and PG Programme
Graduate School
Mahatma Gandhi University
School of Food Science & Technology

Course Code	Title	Credits	Hours per Week		Level	Type
			Theory	Practicals		
SEMESTER I						
MG1DSCUFT121	Principles of food chemistry	4	4	0	Foundation (100-199)	Minor A
MG1DSCUFT141	Fundamentals of food & nutrition	4	4	0	"	Minor B
MG1MDCUFT101	Basic principles of food technology	3	3	0	"	MDC
SEMESTER II						
MG2DSCUFT121	Principles of food preservation technology	4	4	0	"	Minor A
MG2DSCUFT141	Dairy Microbiology	4	4	0	"	Minor B
MG2MDCUFT101	Post-harvest technology of fruits & vegetables	3	3	0	"	MDC
SEMESTER III						
MG3DSCUFT221	Food Anthropology	4	4	0	Intermediate (200-299)	Minor A
MG3MDCUFT20	Food safety &	3	3	0	"	MDC

1	quality assurance					
MG3VACUFT201	Novel approach to food packaging	3	3	0	“	VAC
SEMESTER IV						
MG4DSCUFT241	Instrumental techniques in food industry	4	4	0	“	Minor B
MG4SECUFT201	Food product development & Sensory evaluation	3	3	0	“	SEC
MG4VACUFT201	Waste management in food processing `	3	3	0	“	VAC
SEMESTER V						
MG5SECUFT301	Fssai guide for Food entrepreneurs	3	3	0	Higher (300-399)	SEC
MG5VACUFT301	HACCP in food industry	3	3	0	“	VAC
SEMESTER VI						
MG6SECUFT301	Chocolate & Confectionary technology	3	3	0	“	SEC

SEMESTER VII						
MG7DSCUFT421	Novel techniques in food processing	4	4	0	Advanced (400-499)	Minor A

*Only for 4-Years Honours Students

**Only for students who opt for theory courses instead of Research Project

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Level	Foundation (100-199	Intermediate (200-299)	Higher (300-399)	Advanced (400-499)	PG Level (500-599)

Type	Major	Minor	MDC	SEC	VAC	AEC

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4 + 1 Integrated UG and PG Program		
Course Title	**Principles of Food Chemistry**		
Course Type	Minor		
Course Level	100-199		
Course Code	MG1DSCUFT121		
Course Overview	The course is framed to get a basic idea on the chemistry of food. It explores the basic constituents of food and their role in various chemical reactions during food processing and spoilage in a basic level. This course developed as a strong foundation in the field of food technology		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	11^{th} & 12^{th} level physics, chemistry and biology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the chemistry and properties of water, ice	U	
2	To identify the different types of biomolecules such as carbohydrates, proteins, lipids, vitamins and minerals in various kind of food.	U/An	
3	To learn the structures of biomolecules (such as carbohydrates, proteins etc) and the way in which they contribute various reactions in foods during processing	A	
4	To create a basic knowledge about enzymes and their importance in foods	U/R	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Water Water as a nutrient, function, sources, requirement, structure, effect of deficiency. Introduction to chemistry of water and ice. Moisture in food: Hydrogen bonding, Bound water, Free water, Water activity and Food stability.	12	1
Module 2	**Hours**	
Carbohydrates & Lipids	15	2, 3, 5

Carbohydrates- composition, classification, sources, functions, structure, physical & chemical properties, browning reactions Lipids – composition, nomenclature, saturated, unsaturated fatty acids, classification, sources & functions of fats. Role of lipids in food flavor		
Module 3	**Hours**	
Proteins & Enzymes Enzymes-Nomenclature, specificity, kinetics factors influencing enzyme activity. Enzymes added to food during processing. Amino acids & Proteins- Basics of amino acids, sources, classification, functions and denaturation of proteins	15	2, 3, 4, 5
Module 4	**Hours**	
Vitamins & Minerals Vitamins & Minerals- Classification, sources and functions	10	2

Mode of Transaction	**Classroom activities:** Direct instruction: Brain storming lecture, Explicit teaching, E-learning. Interactive instruction: Active co-operative learning, Seminars, Single/Group assignments Authentic learning: Library work and Group discussion, Presentations by individual student/Group representative

Mode of Assessment	**A. Continuous Internal Assessment (CIA)** **Internal test (20 marks)** **Assignment: Every student needs to write an assignment on a given topic based on the available published literature- 10 marks** **Seminar Presentation: A topic needs to be presented and discussed with the class- 10 marks** **B. Semester end examination- 60 Marks**

Learning Resources

1 Beltz, H.D. 2005. Food Chemistry. Springer Verl

2 Fennema, O.R, 2006, Food Chemistry, Academic Press.

3 Manay, N.S, 2004, Shadaksharaswamy, M., Foods- Facts and Principles, New Age Intemational Publishers, New Delhi.

Relevance of Learning the Course/ Employability of the Course
Understanding Food Chemistry is one of the major basic requirements to build a career in Food Technology as an academician, researcher, industrial expert or any other since it gives an idea about the basic chemistry of the constituents of foods.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	Food Science and Technology		
Programme	**4+1 Integrated UG and PG Programme**		
Course Title	**Fundamentals of Food &Nutrition**		
Course Type	Minor		
Course Level	100-199		
Course Code	MG1DSCUFT141		
Course Overview	This course provides an introduction to the fundamental principles of food and nutrition. It covers the essential nutrients, their roles in the body, dietary requirements, food sources, and the relationship between diet, health, and disease. To enable students to obtain in-depth knowledge of both macro and micronutrients. Then, understand the role of each nutrient in various stages of life and diseases due to their deficiencies and excessive intake.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/fieldwork**	
	60 (h)		
Pre-requisite	Basics of Human Nutrition		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the basic concepts of nutrition and the role of nutrients in the body.	U	2
2	Identify the sources and functions of major nutrients.	U	4
3	Assess dietary needs and develop balanced meal plans	A/E	1
4	Understand the relationship between nutrition and health	U	1

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Introduction to Food &Nutrition Definition and Importance of Food, Different Food Groups. Definition and Importance of Nutrition, Overview of Nutrients: Macronutrients and Micronutrients, RDA, EAR, Factors affecting RDA, Indian reference man and women Definition of Energy, Energy content of Food, Energy measurement, Basal Metabolism,	**16**	**1**
Module 2	**Hours**	
Macronutrients Nutritional importance of macro nutrients Carbohydrates, Protein, Fats, sources, significances.	**12**	**2**
Module 3	**Hours**	
Micronutrients , Water & Dietary Fiber Vitamins –Classification of vitamins Water-Soluble/ Fat-Soluble Vitamins: Functions and Sources of Key Vitamins (A, C, D, E, K, B-complex,C) Major Minerals and Trace Elements: Functions and Sources of Essential Minerals (Calcium, Iron, Potassium, Magnesium, Zinc) Water - Functions, Distribution, Factors affecting water	**18**	**2**

distribution, Regulation of water balance in the human body. Dietary Fiber – Types of Dietary fibre, physiological and metabolic effects of dietary fibre and potential health benefits.		
Module 4	**Hours**	
NUTRITION THROUGH LIFE CYCLE Nutritional Needs During Different Life Stages (Infancy, Childhood, Adolescence, Adulthood, Elderly) Special Nutritional Considerations During Pregnancy and Lactation. Nutritive calculation using Ready Reckoner Introduction to Therapeutic Nutrition, Nutrition for the prevention of lifestyle Diseases	**14**	**3,4**

Mode of Transaction	Classroom activities: Plan a balanced diet for individuals (through the life cycle) using Ready Reckoner/ Field activities: Visit nearest Anganwadi
Mode of Assessment	1. Internal Tests of Maximum 20 Marks 2. Seminar Presentation –a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings Semester End examination-60 marks

Learning Resources

1. Dr. Swaminathan. (2018). *Handbook of Food and Nutrition*. The Bangalore Printing and Publishing Co., Ltd., No. 88, Mysore Road, Bangalore 560018.
2. Indian Council of Medical Research. (2020). *Recommended Dietary Allowances and Nutrient Requirements for Indians*. Retrieved from https://www.nin.res.in/RDAshortreport2020.html
3. Joshi, S. A. (2015). *Nutrition and Dietetics*. McGraw Hill Education (India) Private Limited.
4. Christian Medical College, Vellore, Department of Endocrinology, Diabetes & Metabolism. *Ready Reckoner*.

Relevance of Learning the Course/ Employability of the Course
• This course provides essential knowledge for careers in nutrition, dietetics, public health, food science, and wellness industries. Understanding the fundamentals of food and nutrition is crucial for roles in healthcare, research, education, and the food industry.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4+1 integrated UG and PG programme		
Course Title	**Basic Principles of Food Technology**		
Course Type	MDC		
Course Level	100-199		
Course Code	MG1MDCUFT101		
Course Overview	This course explores the fundamental principles of food technology, covering essential concepts in food science, processing, preservation, and safety. This course provides students insights into the intricacies of food production and its impact on nutrition, health, and sustainability.		
Semester	1	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	11th and 12th level physics, chemistry and biology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	To create an insight to food processing sector in India	An/ E	
2	To understand various physical and functional properties of food and effect of processing on these properties	U/R/ An	
3	To create insights to the principles regarding preservation by various thermal, non-thermal and chemical techniques and novel techniques in food processing	U/R	
4	Create an insight to concept of food quality, food safety, food quality assurance and food quality management, national agencies in the field of food safety	U/ An	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1 Introduction to Food Technology	**Hours**	**CO No**
Definition and scope of food technology, Food processing industries/institutions/food scientists of importance in India, Status of the Indian food industry, Socioeconomic implications of food technology, Ethical considerations in food production Food attributes viz. colour, texture, flavour, rheology, nutritive value and consumer preferences, Functional properties of food- gelatinisation, dextrinization, foaming capacity, water absorption capacity, oil absorption capacity, bulk density, swelling capacity, emulsion capacity, solubility, gelation, aeration	**15**	**1, 2**
Module 2 Food Preservation Methods	**Hours**	
Classification of food on the basis of spoilage, Causes of food spoilage, sources of microbial contamination of foods, Principles and methods of food preservation- preservation by salt and sugar, preservation by drying and dehydration, blanching, pasteurization, canning, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives, Importance of packaging in food preservation Novel processing techniques- high pressure processing, pulsed electric field, ultrasound, cold plasma, ohmic heating, ozone treatment, Functional foods, Probiotics and prebiotics, Robotics in food processing	**20**	**2, 3**
Module 3 Principles of Food Safety and Quality Management	**Hours**	
Introduction to Food Safety, Food Safety System, Food quality assurance and food quality management, National standards- FSSAI, BIS, AGMARK, Food Labelling	**10**	**4**

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative
Mode of Assessment	A. Continuous Internal Assessment (CIA) Internal Test -20 marks Assignment/Seminar – Every student needs to write an assignment on a given topic based on the available published literature – 20 marks B. Semester End examination – 60 marks

Learning Resources

1. Frederick, J.F, 2000, Encyclopedia of Food Science and Technology. Second edition vol l-4, awidely inter science publication.
2. Food science :Norman.N.Potter,Joseph. H. Hotchkis
3. Manany S, N S. Swamy Food Facts and Principles. New Age International Publishers
4. Sivasankar B. (2002): Food Processing And Preservation, Prentice Hall of India Pvt Ltd., New delhi
5. Rao M.A. and Rizvi S.S. and Datta A. K. (2005) .Engineering properties of foods: CRC Press

Relevance of Learning the Course/ Employability of the Course
Studying food technology offers a gateway to a dynamic and growing industry, presenting diverse career paths across sectors such as food processing, research, regulatory compliance, and product development.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science & Technology		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Principles of Food Preservation technology**		
Course Type	Minor		
Course Level	100-199		
Course Code	MG2DSCUFT121		
Course Overview	• This course is designed to impart a fundamental grasp on food preservation. • The course material aims to provide students with a basic understanding on various techniques used in the preservation of food.		
Semester	2	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	Basics of food science		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand various type of food spoilage & principles of food preservation	U/R	
2	Create a deep insight to different types of high & low temperature method for preserving food.	U/R	
3	Understanding the principles regarding preservation by irradiation of food	U/R	
4	Understand the role of temperature & moisture in food preservation	U/An	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
Food spoilage & Introduction to preservation: Definition, types of spoilage - physical, enzymatic, chemical, biological & miscellaneous. Factors affecting food spoilage. Classification of food based on perishability. Scope & significance of food preservation. Principles of food preservation. Historical developments in food preservation. Traditional preservation techniques.	**15 Hours**	1
Module 2	**Hours**	
Preservation by use of High Temperature: Role of temperature in food preservation. Basic principle and equipments: Cooking, Canning, blanching, pasteurization, sterilization. Spoilage of canned foods. **Chemical preservation**: Class I & Class II preservatives, House hold preservation methods	**15 Hours**	2,4,5
Module 3	**Hours**	
Preservation by low temperature: Basic principle and equipments: Chilling, cold storage, freezing (Advantages & disadvantages). Slow & quick freezing, common spoilages occurring during freezing, freezing curve.	**15 Hours**	2,5
Module 4	**Hours**	
Preservation by Removal of Moisture: Water activity: Role of water activity in food preservation. Dehydration: drying,	**15 Hours**	

dehydration and concentration. Factors affecting drying. **Preservation by Irradiation:** Food Irradiation: history and mechanism. Principles of using electromagnetic radiations in food preservation, Advantages & disadvantages.		3,4

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:** **Lab based activities:**
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings **Semester End examination – 60 marks**

Learning Resources

1. Sivasankar B. (2002): Food Processing And Preservation, Prentice Hall of India Pvt Ltd., New delhi.
2. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
3. Desrosier N W & James N. (2007). Technology of food preservation. AVI. Publishers

Relevance of Learning the Course/ Employability of the Course
The course will help the students comprehend how food spoils and different methods of preserving it to enhance its shelf life.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4+1 integr ated UG and PG programme		
Course Title	**Dairy Microbiology**		
Course Type	Minor		
Course Level	100-199		
Course Code	MG2DSCUFT141		
Course Overview	This course helps to explore the basics of dairy microbiology and covers important topics in microbiology of production and preservation of dairy products. Course also prov des a detailed outline on microbial spoilage of dairy products. This course provides students detailed outline of microbial aspects of dairy products.		
Semester	2	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	11th and 12th level chemistry and biology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	To create an insight to microbiology of milk	U	
2	To create an insight to various microbial species associated with dairy products	An/ An	
3	To understand the sources of contaminations, methods of preservation and microbial spoilage of milk and milk products	U/R	
4	To understand the methods of analysis of milk and milk products	U/S	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An),Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1:Introduction to Dairy Microbiology	**Hours**	**CO No**
Introduction and significance of dairy microbiology, Scope and application of microbiology in field of dairy technology. Normal flora of milk, Factors affecting growth of microorganisms in milk- intrinsic and extrinsic factors, Hygienic milk production. Milk borne food infection, intoxication, Milk borne diseases	**15**	**1**
Module 2:Microorganisms associated with milk	**Hours**	
Common microbial species associated with milk and their significance, Role of psychrotrophs in milk, Effect of processing on microorganisms in milk	**15**	**2**
Module 3:Microbiological methods of milk testing	**Hours**	
Qualitative and quantitative methods of milk testing Microscopic methods, Dye reduction assay, Standard plate count (SPC), Coliform counts in Milk, Methods of Enumeration of other groups of bacteria, fungi and yeast in Milk	**15**	**4**

Module 4:Microbiology of milk and milk products	Hours	
Sources of contamination, preservation techniques and microbial spoilage of milk, cream, butter, cheese, and yoghurt. Milk fermentation, Abnormal milk fermentations.	**15**	**3**

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative
Mode of Assessment	A. Continuous Internal Assessment (CIA) Internal Test -20 marks Assignment and seminar- 10 marks Industrial Visit/field visit and report submission –10 marks B. Semester End examination – 60 marks

Learning Resources

1. Britz, T.J. and Robinson, R.K. 2008. Advanced Dairy Science and Technology. 1st ed. Blackwell Publ. Ltd., UK.
2. Fernandes, R. 2009. Microbiology Handbook: Dairy Products. Royal Society of Chemistry, Revised ed., London.
3. Marth, E.H. and Steele, J. 2001. Applied Dairy Microbiology. 2nd ed. CRC Press, Boca Raton, USA.
4. Robinson, R.K. 2002. Dairy Microbiology Handbook - The Microbiology of Milk and Milk Products. 3rd ed. Wiley-Interscience, New York.

5. Walstra, P., Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.

Relevance of Learning the Course/ Employability of the Course
Studying food technology offers a detailed outline of microbiology of milk and milk products. This will provide a clear idea of spoilage and microbial diseases of dairy products which will help to improve eating habits of everyone.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4+1 integrated UG and PG programme		
Course Title	**Post Harvest Technology of Fruits and Vegetables**		
Course Type	MDC		
Course Level	100-199		
Course Code	MG2MDCUFT101		
Course Overview	This course explores the principles and practices of post-harvest handling, processing, and preservation of fruits and vegetables to ensure quality, safety, and marketability. Topics include harvesting methods, storage techniques, packaging, processing technologies, and quality control measures.		
Semester	2	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	11th and 12th level chemistry and biology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the physiological changes occurring in fruits and vegetables after harvest	U/R	
2	Understand various post-harvest handling techniques to minimize losses and maintain quality and to create insight to various storage techniques of fruits and vegetables	U/An/A	
3	Understand processing technologies for value addition and extending shelf life	U/S/C	
4	To create insight to quality control measures and food safety regulations in post-harvest operations	U/An	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1 Introduction to post harvest system	**Hours**	**CO No**
Importance of post harvest technology, Post harvest handling (harvesting, precooling, sorting, grading and packaging) of perishables, Ripening and senescence, Maturity indices, ripening process – factors affecting ripening- chemicals used for hastening and delaying ripening, Respiration	**10**	**1,2**
Module 2 Storage systems and operations	**Hours**	

Introduction, Principles of storage, Objectives of storage, storage considerations- temperature, relative humidity and atmospheric composition, Concept of cool chain, Precooling, Pre Storage Treatments, Low Temperature Storage, Controlled Atmosphere Storage, Modified Atmosphere Storage Hypobaric Storage, Irradiation And Low Cost Storage Structures, ZECC	**15**	**2**
Module 3 Value addition of fruits and vegetables	**Hours**	
Processing of fruit pulp/puree, Processing of sauce, Processing of ketchup, Processing of sauce, Processing of pickles, Processing of chutneys, Processing of fruit juices, Fermented and non-fermented beverages, Intermediate moisture food- concept of water activity, Jam, jelly, marmalade, preserve, candy, honey, FSSAI regulation and standards in maintaining food safety and quality, packaging, labelling, registration and licensing, GMP, GHP, GLP, HACCP	**20**	**3, 4**

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative

Mode of Assessment	B. Continuous Internal Assessment (CIA) Internal Test -20 marks Assignment/Seminar – Every student needs to write an assignment on a given topic based on the available published literature – 20 marks B. Semester End examination – 60 marks

Learning Resources

1 Hui, Y.H. (2008). Handbook of fruit and vegetable processing. Wiley India Pvt. Ltd., New Delhi

2 E-Course of ICAR, New Delhi

3 Sharma, S.K. (2010). Postharvest management and processing of fruits and vegetables. New India Publishing Agency, New Delhi

Relevance of Learning the Course/ Employability of the Course
Studying food technology offers a gateway to a dynamic and growing industry, presenting diverse career paths across sectors such as food processing, research, regulatory compliance, and product development.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	Food Science and Technology		
Programme	**4+1 Integrated UG and PG Programme**		
Course Title	Food Anthropology		
Course Type	Minor		
Course Level	200-299		
Course Code	MG3DSCUFT221		
Course Overview	This course provides an introduction to the fundamentals of food and culture identity. It covers the food culture and its impact on nutrition and health of the people To enable students to obtain in depth knowledge of food anthropology and globalization of food		
Semester	3	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/fieldwork**	
	60 (h)	0	
Pre-requisite	Basic Human Biology, Nutrition, Culture and History		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.

	Upon completion of this course, students will be able to;		
1	Understand the fundamental concepts of anthropology.	U	1
2	Analyze the historical context of foods and food habits,	An	3
3	Evaluate the role of food in different religious practices, food taboos, and rituals, and analyze the relationship between food and the environment.	E/U/An	4
4	Apply anthropological concepts to understand the globalization of food, food identity, social status, and predict future trends in the food industry.	A/U	5

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
Introduction to anthropology, different sociological dimension of food by looking theoretical insights, academically and research. Eminent scientists in Food anthropology	**15**	**1**
Module 2	**Hours**	
History of Indian foods, Regional food habit and ethnography. Food culture, Food as craft ,anthropology of food and eating	**15**	**2**
Module 3	**Hours**	
Food taboos and religion ,Food rituals and rituals in foods, Food and environment	**15**	**3**
Module 4	**Hours**	
Globalisation of food ,Food identity and social states,future of food, Food anthropology and impact on Food industry	**15**	**4**

Mode of Transaction	Classroom activities:, Group Discussion, Seminar, E-learning, Brain storming Lecture, interactions Group Assignments

Mode of Assessment	**Continuous Internal Assessment (CIA)** 1. Internal Tests of Maximum 20 Marks 2. Seminar Presentation –a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings Semester End examination-60 marks

Learning Resources

- Nanbiar, V. (2021). *Indian Food Anthropology and the Eat Right Movement: Vol. 1*. Forensic Book store

- Nanbiar, V. (2021). *Indian Food Anthropology and the Eat Right Movement: Vol. 2*. Forensic Book store

Additional Resources

1.e-PGPathshala – Food Anthropology

Relevance of Learning the Course/ Employability of the Course
Understanding the food anthropology is one of the major basic requirement to teaching ,work with non-profit organization, Heritage management work, Campanies ,including societies ,historians,journalism and media worker

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	Food Science and Technology		
Programme	**4+1 Integrated UG and PG Programme**		
Course Title	Food Safety and Quality Assurance		
Course Type	MDC		
Course Level	200-299		
Course Code	MG3MDCUFT201		
Course Overview	• The course is designed to provide fundamental knowledge of food safety and food quality assurance. It offers an introduction to HACCP and other techniques in food quality assurance, aiming to equip students with a basic understanding of various international and national food laws and regulations.		
Semester	3	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/fieldwork**	
	45	0	
Pre-requisite	Basics of Food Science and quality control		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1.	Students will be able to understand the concept of Food Safety, Food Quality and Food Hazards and other basic quality concepts.	U/An/E	3
2.	Create an basic idea of HACCP and working of Food quality management systems	U/An/S	2
3.	Students will understand Techniques in Food Quality Assurance	U/AN/E	3
4.	Students will acquire the different International and National Food laws and Regulations	U/R	5

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Introduction to Food Safety and Quality Introduction to concepts of Food Safety, Food quality, Food Hazards, Types of Food Hazards, Food quality management systems, Current challenges to Food Safety.	**15**	**1**
Module 2	**Hours**	
Techniques in Food Quality Assurance HACCP ,Principles and pre-requisites of HACCP, Good Manufacturing Practices (GMP) ,Good Hygienic Practice (GHP),Good Agricultural Practice (GAP) , Total Quality Management (TQM),Sanitation and safety in Food services	**15**	**2,3**
Module 3	**Hours**	
FOOD LAWS AND REGULATIONS Food Safety and Standard Authority of India (FSSAI) Act, Regulations ,The Prevention of Food Adulteration Act(PFA), The Bureau of Indian Standards (BIS), Agricultural Marketing Quality Certification Standard (AGMARK) ,Indian Standard Institute, International Organization for Standardisation (ISO-9000,22000), FDA.	**15**	**4**

Mode of Transaction	Classroom activities:, Group Discussion, Seminar, E-learning, Brain storming Lecture, interactions Group Assignments
Mode of Assessment	**Continuous Internal Assessment (CIA)** 1. Internal Tests of Maximum 20 Marks 2. Seminar Presentation –a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings Semester End examination-60 marks

Learning Resources

1. Marriott, N.G., & Gravani, R.B. (2006). Principles of Food Sanitation. Springer.
2. Frazier ,W.C. (2008) Food Microbiology ,2nd Ed, McGraw Hill Inc.,New York.
3. Forsythe, S.J. (2010). The Microbiology of Safe Food. Wiley-Blackwell.
4. Lawley, R., Curtis, L., & Davis, J. (2008). The Food Safety Hazard Guidebook. Royal.
5. Mortimore, S., & Wallace, C. (2013). HACCP: A Practical Approach. Springer.
6. De Vries, J. (1997). Food Safety and Toxicity. CRC Press.

Additional Resources

- **Websites:**
  - Food Safety and Standards Authority of India (FSSAI): www.fssai.gov.in
  - World Health Organization (WHO): www.who.int
  - Food and Agriculture Organization (FAO): www.fao.org

Relevance of Learning the Course/ Employability of the Course
This course provides essential knowledge and skills relevant to careers in food safety and quality assurance, food inspection, regulatory affairs, and related fields. It is critical for students aspiring to work in food manufacturing, processing industries, and regulatory

bodies, both nationally and internationally.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science & Technology		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	Novel approach to food packaging		
Course Type	VAC		
Course Level	200-299		
Course Code	MG3VACUFT201		
Course Overview	• This course is designed to impart knowledge about specific trends and advancements in food packaging materials and technologies with the goal of guaranteeing the safety and quality of food items in order to create an optimal package that meets all functional, marketing, and legal requirements.		
Semester	3	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	Basics of food packaging		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the basic concept of packaging and various types packaging materials	U/R	1
2	Create a deep insight to active and intelligent packaging	U/R	1,2
3	Understanding oxygen scavenging technology, TTIs, antimicrobial packaging and developments in MAP.	A	2,4
4	Provide a basic knowledge on edible films and coatings	U	1,4

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
Introduction to Food Packaging: Basic concept of packaging, definition, importance and scope of packaging foods, criteria for packing foods, functions of food packaging. Primary, secondary and tertiary packaging of foods. Packaging materials and containers: Origin of packaging materials; different types; properties, advantages and disadvantages of each material	**15 Hours**	1
Module 2	**Hours**	
Active and Intelligent Packaging techniques: Active Packaging Techniques and intelligent Packaging Techniques, current use of novel Packaging Techniques, consumers and novel Packaging. Oxygen scavenging technology, selecting right types of oxygen scavenger, ethylene scavenging technology, carbon dioxide and other scavengers. Time-temperature indicators (TTIs), Definition and classification of TTIs, Requirement, development and current TTI systems, Use of freshness indicators in packaging. Legislative issues relating to active and intelligent packaging. Active packaging of particular products	**15 Hours**	2,3
Module 3	**Hours**	

Edible films and MAP: Edible films and coating – use of edible active layers to control water vapor transfer, gas exchange, modification of surface conditions with edible active layers. Antimicrobial food packaging, Factors affecting the effectiveness of antimicrobial packaging. Developments in MAP: Novel MAP applications for fresh prepared-produce, Reducing pathogen risk in MAP prepared produce. Integrating MAP with new germicidal techniques. Biodegradable packaging.	**15 Hours**	3,4

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:** **Lab based activities:**
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings **Semester End examination – 60 marks**

Learning Resources

1. Ahvenainen R. 2001. Novel Food Packaging Techniques. CRC.
2. Richard Coles, Derek Mcdowell, Mark J. Kirwan, Food Packaging Technology, BlackwellPublishing, CRC Press LLC, 2003
3. Food packaging, principles and practice, Gordon L Robertson, CRC press, 2013

Relevance of Learning the Course/ Employability of the Course
The course will impart the knowledge about the various novel techniques for packaging the food products.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4+1 integrated UG and PG programme		
Course Title	**Instrumental Techniques in food industry**		
Course Type	Minor		
Course Level	200-299		
Course Code	MG4DSCUFT241		
Course Overview	The course aims to introduce the basic instrumental techniques followed in food industry. The students are expected to have a deep knowledge on basic and emerging instruments applicable in food analysis.		
Semester	4	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	11th and 12th level physics, chemistry and biology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	To create an insight to Instruments and measurement system in food industry	U	
2	To create an insight to various Process instrumentation analysis for food	An/ A	
3	To understand the Techniques of food analysis and to create an idea on theoretical and practical aspects of basic instrumentation methods followed in food industries	U/R/E/S	
4	To understand the role of sensors in food analysis	U/S	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1: Introduction to instrumental food analysis	**Hours**	**CO No**
Concepts of food analysis: Principles and methodology involved in analysis of foods: Rheological analysis, textural profile analysis of foods;	**15**	**1**
Module 2: Analytical techniques	**Hours**	
Principles and methodology involved in analytical techniques: spectroscopy, ultraviolet, visible, fluorescence, infrared, atomic absorption and emission	**15**	**2**
Module 3 Techniques of food analysis	**Hours**	
Chromatography: Adsorption, column, partition, affinity, ion-exchange, size-exclusion method, gas-liquid, high performance liquid chromatography; Separation techniques: Dialysis, electrophoresis, sedimentation, ultra-filtration, ultracentrifugation	**15**	**3**
Module 4 Sensors in food industry	**Hours**	

Chemosensors, biosensors, immunosensors; Electronic noses and tongues: Sensors for food flavour and freshness, electronic noses, tongues and testers; Introduction to flavour assessment, modelling the human nose, electronic nose, electronic tongue	**15**	**4**

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative
Mode of Assessment	A. Continuous Internal Assessment (CIA) Internal Test -20 marks Assignment and seminar- 10 marks Industrial Visit and report submission –10 marks B. Semester End examination – 60 marks

Learning Resources

1. S. Suzanne Nieisen. 2010. Food Analysis Laboratory Manual, 2nd Ed. Springer, NY, USA.
2. Semih Ötles. 2009. Handbook of Food Analysis Instruments. CRC Press, Boca Raton, FL, USA.
3. Da-Wen Sun. 2008. Modern Techniques for Food Authentication. Elsevier Inc., Burlington, MA, USA.
4. S. Suzanne Nieisen. 2003. Food Analysis, 3rd Ed. Kluwer Academic, New York, USA

Relevance of Learning the Course/ Employability of the Course

Studying instrumental techniques in food industry offers a detailed outline of instruments applicable in food industries. It gives an idea on emerging sensory evaluation techniques in food industry.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4 + 1 Integrated UG and PG Program		
Course Title	**Food Product Development & Sensory Evaluation**		
Course Type	SEC		
Course Level	200-299		
Course Code	MG4SECUFT201		
Course Overview	The course is framed to get a very good understanding regarding the stages and techniques of new food product development process and equips students with a basic knowledge of different techniques of sensory evaluation, which is needed for food quality evaluation in food industries		
Semester	4	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	Basics of plus two-level science or commerce		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome *Upon completion of this course, students will be able to;*	Learning Domains	PSO No.
1	Students will be able to understand the need, stages and techniques in new food product development	U/An/E	1
2	Students will be able to develop a real new food product prototype and prepare a scientifically comprehensive description of this prototype.	S	2, 3
3	To understand the importance of plant layout of food industry	U/E	2, 3
4	Students will equip with the basic knowledge in different type of quality evaluation of food and to learn the categories and techniques in sensory evaluation of food products	U/An/S	1,2,4

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
New Product Development New Product Development-importance, definition, objectives and need Main reasons for the success and failure factors of new products The concept of food innovation New product development process-laboratory scale, pilot scale and large scale Stage-Gate process, product lifecycle management Plant location and layout	15	1, 2 & 3
Module 2	**Hours**	

Basics of Sensory Evaluation Sensory evaluation: Definition, difference between objective and subjective evaluation, sensory characteristics of food: Appearance, texture and flavor. Intelligent analysis equipment (e-nose, e-tongue etc) Sensory evaluation requirements: Requirements of sensory evaluation: Sensory laboratory design, sensory booths, sensory panels- types of panels, requirements, recruitment criteria & selection, training. Sample preparation and serving procedures (sample size, sample serving temperature palate cleansers, score card etc)	15	4
Module 3	**Hours**	
Sensory Evaluation Techniques Factors affecting sensory evaluation Kinds of sensory tests-Threshold tests, difference tests, ranking tests, scoring tests (composite & numerical), hedonic scale, acceptance test, preference tests and descriptive tests	15	4

Mode of Transaction	**Classroom activities:** Direct instruction: Brain storming lecture, Explicit teaching, E-learning. Interactive instruction: Active co-operative learning, Seminars, Single/Group assignments Authentic learning: Library work and Group discussion,
	Presentations by individual student/Group representative

Mode of Assessment	**A. Continuous Internal Assessment (CIA)** Internal test (20 marks) Assignment: Every student needs to write an assignment on a given topic based on the available published literature- 10 marks Seminar Presentation: A topic needs to be presented and discussed with the class- 10 marks **B. Semester end examination**- 60 Marks

Learning Resources

1 Srilakshmi, B 2005. Food Science. New Age lnternational (P) Limited, New Delhi.

2 Lawless, H.T. and Klein B.P. (2001): Sensory Science Theory and Application in Foods. Marcel Dekker Inc. New York.

3 Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.

Relevance of Learning the Course/ Employability of the Course
This course provides students with an in-depth understanding of innovation, new product development and sensory evaluation. New product development and sensory evaluation are two very essential parts of research and development sector of a food industry. This will help to build a career in Food Technology as an researcher, industrial expert etc.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Food Science and Technology		
Programme	4+1 integrated UG and PG programme		
Course Title	Waste management in Food Processing		
Course Type	VAC		
Course Level	200-299		
Course Code	MG4VACUFT201		
Course Overview	• The objective of this course is to develop a very good understanding about characteristics of waste generated in the food industry, its safe and hygienic disposal. • This course also gives an overview regarding different methods of utilizing wastes from food industry to make value added products.		
Semester	4	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	Basic knowledge in food processing and food industry waste		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome *Upon completion of this course, students will be able to;*	Learning Domains	PSO No.
1	To understand the basic principles of Waste Characteristics pertaining to Food Processing Industry	Un/An	1
2	To classify and characterize waste from various food processing industries.	Un/An/E	1
3	To understand the safe and hygienic disposal methods for different classes of wastes from food industrie	Un/An/A	3,4
4	To evaluate the efficiency of various waste treatment processes and technologies used in the food industry and to understand the byproducts associated with various types of food processing industries and its utilization	Un/An/E/A	4,5

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1 ***Classification & characterization of food industry waste***	**Hours**	**CO No**

Food waste- definition, causes of food waste in processing, global and local perspective, environmental, economic, and social impacts of food waste Classification and characterization of food industrial wastes from fruit and vegetable processing industry, fish, meat and poultry industry and sugar industry Waste characterization- Temperature, pH, Oxygen demands (BOD, COD, TOD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste	**12**	**1,2**
Module 2 ***Treatment Methods of Food Wastes***	**15**	**3,4**
Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation Secondary treatments: Biological oxidation, trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons Tertiary treatments: Advanced waste water treatment process- sand filtration, activated carbon filters, ion exchange, membrane filtration and UV treatment.		
Module 3 ***Value from food waste***	**18**	**3,4**
By-product utilisation: fruit and vegetable processing industry: bioactive compounds, pectin, organic acids, protein/enzymes and dietary fibre Fish processing: fish ising glass, gelatin, chitin, chitosan, fish albumin, shark fin rays, squalene and collagen Meat and poultry industry: utilisation of feather, blood, offal, hatchery waste and poultry manure Sugar industry: utilisation of bagasses, molasses and filter mud		

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning: Library work and Group discussion, Presentation by individual student/ Group representative
Mode of Assessment	A. Continuous Internal Assessment (CIA) Internal Test -20 marks Assignment/Seminar – Every student needs to write an assignment on a given topic based on the available published literature – 20 marks B. Semester End examination – 60 marks

Learning Resources

1. Robert R. Zall (2004), Managing Food Industry Waste: Common sense methods for Fod Processors, Blackwell Publishing.
2. Loannis S. and Arvanitoyannis (2008). Waste Management in Food Industry, Academic Press
3. VassoOreopoulou and Winfried Russ (2007). Utilization of byproducts and treatments of waste in Food Industry, Springer publication.
4. Lawrence K. Wang (2006). Waste Treatments in Food Industry, Taylor and Francis

Relevance **of Learning** the Course/ Employability of the Course
This course gives helps the students in understanding and applying effective waste management practices and thereby can contribute to reducing these environmental burdens. Economically, efficient food waste management can lead to cost savings for food processing industries through reduced waste disposal expenses and the recovery of valuable byproducts that can be reused or sold. This knowledge also enhances food security by ensuring that more food reaches consumers, thereby addressing issues of food scarcity.