THE MAHATMA GANDHI UNIVERSITY

UNDERGRADUATE PROGRAMMES

(HONOURS) SYLLABUS

MGU-UGP (Honours)

(2024 Admission Onwards)

Faculty: Science

Expert Committee: Food Technology and Quality Assurance

Programme: Bachelor of Science (Honours) Food Technology and Quality Assurance

Mahatma Gandhi University
Priyadarshini Hills
Kottayam – 686560, Kerala, India

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PREFACE

In the world, India is the second largest producer of food after China; the country has achieved the potential of being the biggest, with the food and agricultural sector. Indian food industry is considered to supply about two third of total Indian retail market needs. In addition to that, modern skills and equipment have been introduced in food industries such as canning, dairy, cereal processing, specialty processing, packaging, frozen food, refrigeration and thermal processing. India's food processing industry has been growing at the rate of 13% despite the global slowdown. And now the government is aiming to double the turnover in the next five year by setting up mega food parks to attract even global capital. At present the export from agro-sector represents about 16% of total Indian exports. The primary export commodities are cereals, fruits, vegetables and their processed products, and marine products but fast growing specialty products have also penetrated into the foreign markets. Considering the contribution of these products in Indian export, it is necessary to have appropriate technology for handling and processing of agricultural produce. Food technologist develops the manufacturing process and recipes. They work on existing and newly discovered ingredients and technologies to invent new products, recipes and concept. They are involved in conducting experiments and producing sample products as well as designing the processes and machinery for making products with a consistent flavor, color and texture.

- Modifying existing products, processes and new product development (NPD).

- Checking and improving quality control procedures from raw material stage to the finished product incorporating traceability.

- Addressing issues of safety and quality.

- Selecting raw material and other ingredients.

- Maintaining proper hygienic condition of entire food industry.

- Develop steps undertaken to meet the requirements with respect to hygiene, sanitation, good manufacturing practices, HACCP and nutritional quality.

LIST OF EXPERT COMMITTEE MEMBERS
Food Technology and Quality Assurance

Chairperson
Dr. Beena Cherian, Dean & Associate Professor
School of Biosciences,
MACFAST, Tiruvalla
beena.cherian@macfast.org,
beenakunnumadil@gmail.com Mob.No.9744107222

Members

Dr. Sanu Jacob
Director, National Food Laboratory, Chennai
Sanu.jacob@fssai.gov.in
Mob. No :9400540044

Dr.Harikrishnan R
Assistant Professor & HoD
Department of Food Technology and Quality Assurance
CFT-K, Konni
jaidevbiochem@gmail.com
Mob.No:9846585609

Mrs. Mini Michael
Assistant Professor & HoD
St. George's College, Aruvithura
mini@sgcaruvithura.ac.in
Mob. No : 9447147446

Mrs. Mariam Annie Eapen
Assistant Professor & HoD
St. Mary's college for Women, Tiruvalla
mariyamannie@gmail.com
Mob. No: 9961281665

Dr. Tijo Cherian
Assistant Professor
School of Biosciences, MACFAST, Tiruvalla
tijo@macfast.org
Mob. No: 9495976291

Dr. Blessan Santhosh George
Assistant Professor
School of Biosciences
MACFAST, Tiruvalla
blessan@macfast.org
Mob. No: 7025403827

Mrs. Asha Yohannan
Assistant Professor
St. Mary's college for Women, Tiruvalla
ashayohannan20@gmail.com
Mob. No :9946947768

Dr. Shery M Varghese
Assistant Professor
School of Biosciences,
MACFAST, Tiruvalla
shery@macfast.org
Mob. No: 9847432097

Mr. Kuriachen V.P
Senior Quality Assurance Manager
Nestle India Ltd, Village Maulinguem (North)
Bicholim, Goa-403504
kuriachenpathrose@in.nestle.com
Mob. No: 8350801310

ACKNOWLEDGMENTS

The Higher Education Department, Government of Kerala is set to introduce a four-year undergraduate program commencing in the academic year 2024-2025. The four year degree program has been designed keeping in mind the latest technological advances in the food processing industry and the need for complete professionals adopt in all areas of the vast science of food.

The program aims at training students not just academically but also in the areas that develop communication, soft skills and overall ability. The course is also designed to give a further thrust on developing in students a desirable attitude for self- employment.

I express profound gratitude to the Honorable Vice Chancellor, Mahatma Gandhi University, Kottayam, Pro- Vice Chancellor, Registrar, members of the Syndicate and Academic Council for their co-operation and guidance for the completion of the syllabus.

With great pleasure, I express my heartfelt thanks to all the members of the University- academic section as well as the supporting staff members.

With ardent gratitude, I acknowledge all the members of the expert Committee for their untiring effort and support for the framing of the four year undergraduate program in Food Technology and Quality Assurance.

I am indebted to Mrs. Anju Annette Cherian, Mrs. Rittu Susan Babu and Ms. Stefy Sosa Thomas for providing valuable suggestions and all necessary help in drafting the syllabus.

I take this opportunity to thank all the members of faculty from various colleges like MACFAST College, Thiruvalla, CFT-K, Konni, BCM College, Kottayam, St Mary's College for Women, Thiruvalla, Mount Royal College, Munnar, Indira Gandhi College for Arts and Science, Kothamangalam, Musaliar College of Arts and Science, Pathanamthitta and Cochin Arts and Science College, Kakkanad, in the designing and drafting of the syllabus of FYUG –Food Technology and Quality Assurance

Syllabus Index

Name of the Major: Food Technology and Quality Assurance

Semester:1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG1DSCFTQ100	Fundamentals of Food Technology	DSCA	4	5	3		2	
MG1MDCFTQ100	Food Spoilage	MDC	3	4	2		2	

L— Lecture,T—Tutorial,P— Practical/Practicum,O—Others

Semester:2

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG2DSCFTQ100	Basic Biochemistry	DSCA	4	5	3		2	
MG2MDCFTQ100	Food Additives	MDC	3	4	2		2	

Semester:3

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG3DSCFTQ200	Food Preservation	DSCA	4	5	3		2	
MG3DSCFTQ201	Food Analytical Instrumentation	DSCA	4	5	3		2	
MG3DSEFTQ200	Enzymes in Food Industry	DSE	4	4	4			
MG3DSEFTQ201	Food Safety Standards and Certification	DSE	4	4	4			
MG3DSCFTQ202	Unit Operations in Food Industry	DSCB	4	5	3		2	
MG3MDCFTQ200	Food Biotechnology	MDC	3	3	3			
MG3VACFTQ200	Introduction to Good Laboratory Practices	VAC	3	3	3			

Semester:4

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG4DSCFTQ200	Food Chemistry	DSCA	4	5	3		2	
MG4DSCFTQ201	Food Microbiology	DSCA	4	5	3		2	
MG4DSEFTQ200	Food Packaging Technology	DSE	4	4	4			
MG4DSEFTQ201	Food Engineering	DSE	4	4	4			
MG4DSCFTQ202	Novel Technologies in Food	DSCC	4	5	3		2	
MG4SECFTQ200	Baking Technology	SEC	3	3	3			
MG4VACFTQ200	Entrepreneurship Development	VAC	3	3	3			
MG4INTFTQ200	Internship	INT	2					

Semester:5

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG5DSCFTQ300	Food Analysis	DSCA	4	5	3		2	
MG5DSCFTQ301	Technology of Meat, Fish and Poultry Products	DSCA	4	5	3		2	
MG5DSEFTQ300	Cereal Technology	DSE	4	4	4			
MG5DSEFTQ301	Technology of Beverages	DSE	4	4	4			
MG5DSEFTQ302	Sensory Evaluation	DSE	4	4	4			
MG5DSEFTQ303	Technology of Spices	DSE	4	4	4			
MG5DSEFTQ304	Post-HarvestTechnology	DSE	4	4	4			
MG5DSEFTQ305	Food Extrusion Technology	DSE	4	4	4			
MG5SECFTQ300	Food Product Development	SEC	3	3	3			

Semester:6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG6DSCFTQ300	Dairy Technology	DSCA	4	5	3		2	
MG6DSCFTQ301	Fruit and Vegetable Technology	DSCA	4	5	3		2	
MG6DSEFTQ300	Legumes and Oilseeds Technology	DSE	4	4	4			
MG6DSEFTQ301	Snack Food Technology	DSE	4	4	4			
MG6DSEFTQ302	Food Plant Sanitation	DSE	4	4	4			
MG6SECFTQ300	Technology of Chocolate and Confectionery	SEC	3	4	2		2	
MG6VACFTQ300	Environmental Studies	VAC	3	3	3			

Semester:7

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG7DCCFTQ400	Food Quality Assurance and Management	DCC	4	5	3		2	
MG7DCCFTQ401	Food Laws and Regulations	DCC	4	4	4			
MG7DCCFTQ402	Waste Management in Food Industry	DCC	4	4	4			
MG7DCEFTQ400	Nutraceuticals and Functional Foods	DCE	4	4	4			
MG7DCEFTQ401	Nanotechnology inFood applications	DCE	4	4	4			
MG7DCEFTQ402	FoodStorage	DCE	4	4	4			

Semester:8

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MG8DCCFTQ400	Food Plant Organization and Management	DCC	4	5	3		2	
MG8DCCFTQ401	Research Methodology and Biostatistics	DCC	4	5	3		2	
MG8DCEFTQ400	Project Preparation and Management	DCE	4	5	3		2	
MG8DCEFTQ401	Intellectual Property Rights	DCE	4	5	3		2	
MG8DCEFTQ402	Food Supply Chain Management	DCE	4	5	3		2	
MG8DCEFTQ403	Research Ethics and Integrity In Food Technology	DCE	4	5	3		2	
MG8PRJFTQ400	Project		12					

SEMESTER 1

DSC –A

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FUNDAMENTALS OF FOOD TECHNOLOGY**					
Type of Course	**DSC A – MAJOR**					
Course Code	**MG1DSCFTQ100**					
Course Level	**100 – 199**					
Course Summary	This Course provides students with a foundational understanding of the principles and concepts that form the basis of Food Technology					
Semester	**1**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	75
Pre- requisites,if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand food properties, processing and preparationand an appreciation of their interrelationship to produce quality food	**U**	1,2,10
2	To outline nutrition and food consumption andconsequences of food choices on health.	**U**	1,2,10
3	To apply the basic principles of HACCP, ISO and sanitation in general	**A**	1,6,10
4	To analyze the basic concepts of food nutrition	**An**	1,2,10
5	To assess the laws and regulations pertaining to foodquality and safety	**E**	1,2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1 – Introduction	1.1	Scope of food technology Basic 5 food groups, Food guide pyramid	5	1
	1.2	Classification of foods: Health food, Natural food, Organic food, Functional food, Ethnic food, GM food and its safety concerns, Convenience food, Space food and Fabricated food	10	1
	1.3	Food fortification Restoration and Enrichment Nutraceuticals – Prebiotic & Probiotic	5	1,4
2-Food Properties	2.1	Physico-chemical properties of food (Boiling point, melting point, smoke point, surface tension, osmosis, freezing point, humidity and specific gravity)	5	1,2,4
	2.2	Colloidal Systems in food- True solution, suspension, types of colloidal system in food (sol, gel, emulsion, foam)	5	1,2,4
3- Food Adulteration Food Laws, and certifications	3.1	Definition Types of adulterants - Intentional, incidental and other incidental adulterants Detection- DART Methods	7	1,4
	3.2	Voluntary Laws- PFA, AGMARK, BIS Mandatory Laws- Food Safety Standard Act 2006 (FSSAI) International Standards – ISO 22000 FSMS, Codex Alimentarius Commission	8	3,5
4-Practicum	4.1	• Detection of adulterants in food • Determination of pH of different foods. • Industrial Visit	30	1,2,4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1&2- Lecturing, ICT Enabled Learning. Module 3- Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7; 5x4=20 marks) Long Essay (2 out of 4; 2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

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3.

MDC

(MULTI-DISCIPLINARY COURSE)

MAHATMA GANDHI UNIVERSITY

Programme						
Course Name	**FOOD SPOILAGE**					
Type of Course	**MDC**					
Course Code	**MG1MDCFTQ100**					
Course Level	**100-199**					
Course Summary	This course provides an overview of the fundamental principles of food spoilage, covering the factors influencing the deterioration of food products and methods for preservation.					
Semester	**1**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	-	1	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the concept of food spoilage and processes involved in the deterioration of food quality	**U**	1,10
2	To identify the factors influencing microbial, enzymatic, and physical deterioration in different food types.	**U**	1,10
3	To analyze the mechanisms and consequences of microbial, enzymatic, and physical deterioration in food, emphasizing the role of each factor in food spoilage.	**An**	1,2,6,10
4	To analyse the types of spoilage in different food classes, considering variations in microbial activity, enzymatic reactions, and physical changes unique to each type of food.	**An**	1,6

5	To evaluate the presence of foodborne pathogens and their contribution to food spoilage, emphasizing the importance of microbial safety and its relationship to the overall quality of food products.	**E**	1,10
6	To develop practical skills in the detection and visualization of spoilage in raw, cooked, and processed foods, utilizing laboratory techniques	**C**	1,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1- An Introduction to Food spoilage	1.1	Food Spoilage- definition, significance, and economic impact.	**2**	**1**
	1.2	Role of microorganism in Food Spoilage: bacteria, mould and yeast	**3**	**1,2**
	1.3	Classification of foods according to the ease of spoilage - perishable, semi perishable and non-perishable Factors of food spoilage: Intrinsic factors - pH level, water activity, oxidation- reduction potential and nutrient content. Extrinsic factors - temperature, relative humidity, oxygen, light and duration.	**10**	**1,2,3**
2. Spoilage in different Food Categories	2.1	Types of spoilage- microbial spoilage, enzymatic spoilage, spoilage by insects, parasites, and rodents.	**3**	**3,4**
	2.2	Spoilage of meat- Vacuum-packed meats, fresh liver, ham and bacon	**3**	**5**
	2.3	Spoilage of poultry and egg - cause of poultry spoilage and bacterial spoilage in poultry	**3**	**5**
	2.4	Spoilage of fish and shellfish-Different types of fish spoilage. Defects observed on fish by Microbial spoilage. Spoilage of fish products	**3**	**5**
	2.5	Spoilage of Miscellaneous foods- milk and milk products, fruits and vegetables	**3**	**5**

3- Practicum	3.1	Detection and visualization of spoilage in raw foods • Milk • Egg • Meat • Fish • Fruits and Vegetables	**15**	**5,6**
	3.2	Detection and visualization of spoilage in cooked and processed food • Bread • Beverages • Cans • Processed food in flexible films	**15**	**5,6**
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory: 15 marks** Assignments/ Seminars/ Test papers/Book Review **Practical:15 marks** Lab involvement/viva/Attendance
	B. Semester End examination **Theory:35 marks** Short answer (5 out of 7; 5x1=5 marks) Short Essay (4 out of 7; 5x4=20 marks) Long essay (1 out of 3; 1x10-10 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

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3. Frazier William C and Westhoff, Dennis C. (2004) Food Microbiology, TMH, New Delhi.
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SEMESTER 2

DSC –A

MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**BASIC BIOCHEMISTRY**					
Type of Course	**DSC A – MAJOR**					
Course Code	**MG2DSCFTQ100**					
Course Level	**100-199**					
Course Summary	The student will learn about topics such as the structure of major biomolecules in our body and also about their properties and functions					
Semester	**2**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the structure and properties of important sugars	**U**	1,10
2	To explain the classification, properties and organization of proteins and amino acids	**U**	1,10
3	To Identify the different types of enzymes and factors affecting enzyme activity	**A**	1,2,10
4	To assess the major lipids present in our body	**E**	1,6,10
5	To measure both qualitatively and quantitatively sugars, amino acids and lipids present in a given sample	**E**	1,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Carbohydrates	1.1	Structural Configuration of carbohydrates	2	1
	1.2	Stereoisomerism-Enantiomers, Epimers, Anomers, Optical Isomerism-Dextrorotatory and Levorotatory Isomers, Structural configuration of aldoses and Ketoses.	5	1
	1.3	Classification of carbohydrates: Monosaccharides-Glucose,Fructose, Galactose, Mannose Disaccharides-Sucrose, Maltose, Lactose Polysaccharides-Starch, Glycogen and Cellulose	8	1,5
2 – Amino Acids, Proteins and Enzymes	2.1	Classification of amino acids Structural classification-Aliphatic amino acids, hydroxyl group containing amino acids, sulphur containing amino acids, acidic amino acids and their amides, basic amino acids, aromatic amino acids, imino acids Nutritional classification-Essential and Non-Essential amino acids	3	2
	2.2	Properties of amino acids Physical properties-solubility, melting point, taste, optical properties, zwitter ion and isoelectric pH Chemical properties-Decarboxylation, Reaction with ammonia,Ninhydrin reaction, Transamination, Deamination	2	2
	2.3	Protein structure and Organisation: Primary structure-Formation of peptide bond Secondary structure-Alpha Helix and Beta sheets, Tertiary and Quarternary structure	3	2
	2.4	Introduction to enzymes, Classification of enzymes, Holoenzyme, Apoenzyme and Cofactors, Active site, Activation energy	2	3
	2.5	Factors affecting enzyme activity: Concentration of enzyme, Concentration of substrate and Km value, Temperature, pH, Product concentration, Activators, Enzyme Inhibition, Reversible Inhibition, Competitive, Non-Competitive & Un-Competitive Inhibition	5	3

3 –Lipids	3.1	Classification of Lipids-Simple, Complex and Derived lipids	5	4
	3.2	Fatty acids- classification, Essential and non-essential fatty acids, properties of fatty acids	5	4
	3.3	Major Lipids in Metabolism Triacylglycerol, phospholipids and cholesterol and their functions	5	4
4 –Practicals	4.1	Analysis of Carbohydrates Qualitative Analysis of Carbohydrates-Glucose, Fructose, Galactose, Lactose, Maltose, Starch, Dextrin	12	4
	4.2	Quantitative Analysis of carbohydrates by anthrone method	3	4
	4.3	Analysis of Proteins Qualitative Analysis of amino acids-Ninhydrin test, Millon's test, Xanthoproteic Reaction. Quantitative Analysis of proteins by biuret method	8	4
	4.4	Analysis of Lipids Qualitative test for free fatty acid, glycerol and cholesterol	7	3
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicals

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review

Assessment Types	**Practical:15 marks** Lab involvement/viva/Record
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

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MDC

(MULTI-DISCIPLINARY COURSE)

Programme						
Course Name	**FOOD ADDITIVES**					
Type of Course	**MDC**					
Course Code	**MG2MDCFTQ100**					
Course Level	**100-199**					
Course Summary	This subject will cover the chemical classification, structure, properties and reactions of constituents of food.					
Semester	**3**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	-	1	-	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To demonstrate the ability to identify and classify different types of food additives, including preservatives, colorants, flavor enhancers, and emulsifiers	U	1,10

2	To make use of the functionality of antimicrobial agents in food preservation, considering their effectiveness in inhibiting microbial growth and ensuring product safety.	**A**	1,10
3	To analyse the role of nutrient supplements and thickeners in food products, examining their impact on nutritional content and overall quality.	**An**	1,10
4	To estimate the function of antioxidants in preventing oxidative deterioration of food, exploring their mechanisms of action and applications in enhancing shelf life.	**E**	1,10
5	To evaluate the impact of colouring agents and flavouring agents, emulsifiers and sweetners on the visual appeal of food products, improving texture, and enhancing the overall quality of food products.	**E**	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
Food Additives- Classification: Antimicrobials, Antioxidants and Colouring agents	1.1	**Food additives** Definitions, classification and functions and the need of food additives	2	1
	1.2	**Antimicrobial agents** Types, mode of action and their application, safety concerns, regulatory issues in India, international legal issues	3	2
	1.3	**Other Additives** Preservatives, bulking agents, antifoaming agents, synergists, and antagonists. Additives, food uses and functions in formulations; permitted dosage	3	3
	1.4	**Antioxidants** Synthetic and natural, mechanism of oxidation inhibition, chelating agents: types, uses and mode ofaction	2	4
	1.5	**Colouring agents** Colour retention agents, applications and levels of use, natural colourants, sources of natural colour, misbranded colours, colour extraction techniques, colour stabilization	5	5

2- Flavoring Agents, Flour Improvers Sweeteners and Emulsifiers	2.1	**Flavouring agents** Flavours (natural and synthetic flavours), flavour enhancers, flavour stabilization, flavour encapsulation-Micro encapsulation by spray drying.	5	5
	2.2	**Flour improvers**: leavening agents, humectants and sequestrants, hydrocolloids, acidulants, pH control agents buffering salts, anticaking agents.	3	5
	2.3	**Sweeteners** Natural and artificial sweeteners, nutritive and non-nutritive sweeteners, properties and uses of saccharin, acesulfame-K, aspartame, corn sweeteners, invert sugar sucrose and sugar alcohols (polyols) as sweeteners in food products	5	5
	2.4	**Emulsifiers:** Types, selection of emulsifiers, emulsion stability, functions and mechanism of action	2	5
3-Practicals	3.1	1.Analyzing Benzoic Acid in Food by Qualitative Method 2.Detecting Sulphurous Acid in Food by Qualitative Method 3.Assessing the Presence of Nitrates and Nitrites in Food	15	5
	3.2	4.Identifying Non-Nutritive Additives in Food by Qualitative Testing Method 5.Exploring the Impact of Acidulants on Fruit Juice 6.Quality Investigating the Influence of Stabilizing Agents on Food Quality" 7.Understanding the Function of Leavening agents in food	15	5
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 - Lecturing and ICT Enabled Learning Module 2 - Lecturing and ICT Enabled Learning Module 3- practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory: 15 marks** Assignments/ Seminars/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B.Semester End examination **Theory:35 marks** Short answer (5 out of 7; 5x1=5 marks) Short Essay (5 out of 7; 5x4=20 marks) Long essay (1 out of 3; 1x10=10 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. S,N.Mahindru, 2009, Food Additives: Characteristics, Detection and Estimation, A.P.H. Publishing Corporation.
2. Branen A.L., Davidson PM & Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.
3. Gerorge A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
4. Gerorge A.B. 2004. Fenaroli's Handbook of Flavor Ingredients. 5th Ed. CRC Press.
5. Madhavi D.L., Deshpande S.S & Salunkhe D.K. 1996. Food Antioxidants:Technological, toxicological and Health Perspective. Marcel Dekker

SUGGESTED READINGS

1. Morton, I.D. & Macleod, A.J. 1990. Food Flavours. Part A, BC. Elsevier.
2. Nakai S & Modler HW. 2000. Food Proteins. Processing Applications. Wiley VCH

SEMESTER 3

DSC –A

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD PRESERVATION**					
Type of Course	**DSC A- MAJOR**					
Course Code	**MG3DSCFTQ200**					
Course Level	**200-299**					
Course Summary	This course explores advanced techniques and principles in food preservation, building on the foundational knowledge acquired inintroductory courses.					
Semester	**3**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1		**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the importance of food preservation.	**U**	1,2,10
2	To apply the concept of different processing and preservation technologies	**A**	1,10
3	To analyse the importance of application of various preservation methods in food industries.	**An**	1,6,10
4	To examine the importance of food preservation.	**An**	1,6,10
5	To determine the basic process of preserving foods using salt and sugar	**E**	1,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1. Food Preservation	1.1	Introduction, importance and principles of food preservation	2	1
2.High temperature & Low temperature preservation	2.1	Pasteurization -purpose of pasteurization and types of pasteurization-LTLT,HTST,UHT	8	2
	2.2	Sterilization-types of sterilizers	5	2
	2.3	Canning - Principle, Steps Involved in Canning	5	2,4
	2.4	Refrigeration-Principles of refrigeration, mechanism of refrigeration, changes occurs during refrigeration	5	2,3
	2.5	Freezing -Principles of freezing, freezing curve, methodof freezing -direct and indirect contact systems Changes during freezing Thawing- Purpose, method, merits and demerits	5	2,3,4
3-Moisture removal preservation, Irradiation & Hurdle Technology .	3.1	Dehydration-osmotic process, osmotic dehydration,factors affecting dehydration Concentration- principle, methods and changes during concentration	5	2,3,5
	3.2	Drying- Introduction, drying rate curve, factors affecting drying Types of drying- Sun drying, Freeze drying, Accelerated freeze drying (AFD), Drum or roller drying, spray drying, foam mat drying, fluidized bed drying, tunnel drying and oven drying	5	2,3,5
	3.3	Irradiation- Principles, sources, unit, advantages and disadvantages, application in food industry Hurdle Technology-Concept, types of hurdles, hurdle diagrams, mechanism of hurdle technology and its applications in various foods.	5	2
4-Practicals		A. Preservation by using salt and vinegar 1.Preparation of mango pickle 2.Preparation of lime pickle 3.Preparation of garlic pickle 4.Preparation of fish pickle 5.Preparation of ketchup and tomato puree	15	5,6

		B. Preservation by sugar 6. Preparation of jelly 7. Preparation of jam 8. Preparation of squash 9. Preparation of glazed fruits 10.Preparation of cucumber candy	15	5,6
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure** Module 1 & 2 – Lecturing, ICT Enabled Learning Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicals

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End Examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. McWilliams, M and Paine, H (1984). Modern Food preservation. Surjeet Publications, Delhi

2. Potter, N.N. and Hotchkiss J.H (1996). Food Science. CBS publishers and distributors

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3. Dincer, I (1997).Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA.
4. Heldman, D.R. and Lund, D.B (2007). Handbook of Food Engineering 2nd edition. CRC press, Newyork

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD ANALYTICAL INSTRUMENTATION**					
Type of Course	**DSC A**					
Course Code	**MG3DSCFTQ201**					
Course Level	**200-299**					
Course Summary	This course provides students with a comprehensive understanding of analytical instrumentation, focusing on the principles, methods, and application of various analytical techniques.					
Semester	**3**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the basic principles of chromatography	**U**	1,2,10
2	To identify the different types of chromatography used in food industry	**A**	1,2,10
3	To examine the basic principles of spectroscopy	**A**	1,2,10

4	To analyse the instrumentation, working and applications of different types of spectroscopy	**An**	1,2,10
5	To determine the basic principles of electrophoresis and centrifugation	**E**	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1. Chromatography	1.1	Chromatography- introduction, general principle, Classification of chromatography based on physico-chemical properties, stationary phase used	**3**	**1**
	1.2	Paper chromatography-Introduction, Principle, Working and applications	**4**	**2**
	1.3	Thin layer chromatography-Introduction, Principle, working and applications.	**4**	**2**
	1.4	Gas chromatography-Introduction, Principle, working and applications.	**4**	**2**
	1.5	HPLC-Introduction, Principle, working and applications	**4**	**2**
2 Spectrophotometry	2.1	Beer-lambert's law, Instrumentation, working and applications of UV spectrophotometer, atomic absorption and atomic emission spectroscopy, Infrared spectroscopy	**5**	**1,2**
	2.2	Flourimetry and NMR spectroscopy-principle, Instrumentation, working and applications	**4**	**1,2**
3- Electrophoresis & Centrifugation	3.1	Electrophoresis-Introduction, basic principles, types-zone electrophoresis and free solution electrophoresis techniques-procedure and applications; Paper electrophoresis, cellulose acetateelectrophoresis	**5**	**5**
	3.2	Gel electrophoresis- Native – PAGE, SDS-PAGE, agarose gel and starch gel electrophoresis	**4**	**5**
	3.3	Centrifugation-Introduction,Principle,Types of centrifuges, Application in food industry	**4**	**5**
	3.4	Types of rotor heads used in centrifugation Modes of centrifugation-Density gradient centrifugation: Rate zonal, Isopycnic, Differential centrifugation, Ultra centrifugation	**4**	**3,4**

4- Practicals	4.1	1. Separation of amino acids by paper chromatography 2. Separation of chlorophyll by paper chromatography 3. Identification of proteins by thin layer chromatoraphy	10	5,6
	4.2	4. Estimation of ascorbic acid in a given sample by UV spectrophotometer/colourimeter 5. Demonstration of SDS-PAGE 6. Visit to a chemical lab for on training in chromatograhic, electrophoretic and spectrophotometric techniques	20	5,6
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** . Module 1 & 2 – Lecturing, ICT Enabled Learning Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicals

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End examination **Theory: 50 Marks** Short answers (5 out of 7; 5x2=10 marks) Short Essay (5 out of 7; 5x4=20 marks) Long Essay (2 out of 4; 2x10=20 marks) **Practical:35 marks**

	Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. Nielsen, S.S. (2004).Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London.
2. Lawless H.T (2010).Sensory Evaluation of Food, Food Science Text series, Springer Science.

SUGGESTED READINGS

1. Mahindru, S. N (2000). Food additives. Characteristics, detection and estimation.TataMcGraw-Hill Publishing Company Limited, New Delhi.
2. Pearson, D (2002).The Chemical Analysis of Foods, Churchill Livingstone, New York.

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**ENZYMES IN FOOD INDUSTRY**					
Type of Course	**DSE**					
Course Code	**MG3DSEFTQ200**					
Course Level	**200-299**					
Course Summary	This course is employed to enhance various food processes, improve product quality, and increase efficiency.					
Semester	**3**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-		-	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the action and mechanism of enzymes	**U**	1,4,10
2	To identify the important enzymes and their role in food industry	**A**	2,4,10
3	To analyse fermentative production of enzymes followed by isolation and purification.	**An**	1,2,10
4	To examine the role of specific enzymes in the processing of dairy, bakery, brewery, flavours, meat and fish	**An**	1,2,10
5	To evaluate the role of specific enzymes as biosensors, additives, in packaging, and describe the concept of recombinant enzymes and safety of enzymes.	**E**	2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Enzymes in food industry	1.1	Introduction to enzymes used in Food industry, Objectives of using enzymes in food processing and in food product development, Merits and demerits of using enzymes, Sources of enzymes, Microbial enzymes and their advantages/ disadvantages.	**7**	1
	1.2	Commercially important enzymes used in Food industry and their mode of action. Overview of applications of enzymes in the Food industry, Newer enzymes and their actual and potential applications, Production of enzymes used in food industry by SSF or SmF, Recovery and purification of enzymes.	**7**	2,4
2-Fermentative production of enzymes	2.1	Fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing.	**9**	3
	2.2	Enzymes for starch, protein and lipid modification with suitable examples.	**6**	1,2
3-Role of enzymes in food processing	3.1	Role of enzymes in Brewing, Baking (fungal -amylase for bread making maltogenic -amylases for anti-staling xylanses and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers o chemical oxidants; synergistic effect o enzymes);	**7**	1,2,4
		Role of enzymes in Dairy processing (cheese making and whey processing). Role of enzymes in meat processing and fish processing, Role of enzymes in the production of flavours (enzyme-	**7**	

	3.2	aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, MSG; flavours from hydrolyzed vegetable/animal protein)	**7**	1,2,4
4- Other applications of enzymes in food	4.1	Enzymes in biosensors, Enzymes as additives - antioxidant or antimicrobial, Novel food applications of enzymes, Enzymes in active packaging and in edible coatings and films, safety of enzymes used in foods	**5**	1,2,5
	4.2	Food grade enzymes, Immobilization of enzymes for food applications, Recombinant enzymes from GMO.	**5**	5
5		Teacher Specific content		
Teaching And Learning Approach	**Classroom Procedure (Mode Of Transaction)** Module 1 & 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing , ICT Enabled Discussion			

Assessment Types	**MODE OF ASSESSMENT** **A.Continuous Comprehensive Assessment (CCA)** **Theory :30 Marks** MCQ/ Assignments/ Test Papers/Book Review
	B. Semester End examination **Theory:70 Marks** Short answers (10 out of 12; 10x2=20 marks) Short Essay (6 out of 8; 6x5=30 marks) Long Essay (2 out of 4; 2x10=20 marks)

REFERENCES

1. Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH &

Co. KGaA, Wenham Rastall, R.
2. Whitehurst, R.J. & Van-Oort, M., (2010), Enzymes in Food technology, Second edition, Blackwell Publishing Ltd 2.
3. Rastall,R (2007) Novel enzyme technology for food applications
4. Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England
5. Kalaichelvan, P.T., (2002), Bio process technology, MJP publishers, Chennai

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD SAFETY STANDARDS AND CERTIFICATIONS**					
Type of Course	**DSE**					
Course Code	**MG3DSEFTQ201**					
Course Level	**200-299**					
Course Summary	This course is designed to provide a comprehensive understanding of food safety standards and certifications that are crucial in ensuring the safety and quality of food products.					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the fundamental concepts and definitions related to food safety and quality, forming the basis for further exploration of standards and regulations.	**U**	1,10
2	To identify the key features of the 2006 Food Safety and Standards Act, providing insights into the legal framework that governs food safety.	**A**	1,2,10
3	To distinguish voluntary and mandatory food laws and standards, understand the implications for industry compliance and consumer protection	**An**	1,6,10
4	To analyse the role of food safety regulators, commissioners, and designated officers, emphasizing their responsibilities in enforcing food safety laws and standards	**An**	2,6,10

5	To prioritize the uses and guidelines associated with food standards in ensuring the safety and quality of food products.	**E**	2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1. Food Safety and Standards Act (2006)	1.1	Key features of the Food Safety and Standards Act 2006, Administrative structure at the state level, and the FSSAI structure.	5	2
	1.2	Food safety regulators, commissioners, designated officers, officers, adjudicating officers, and their roles and responsibilities.	5	2
	1.3	Authorization and enrolment permit to be issued by the Central Licensing Authority; documentation/format needed for licensing/registration	5	3,5
2.Voluntary and Mandatory Food Laws and Standards	2.1	Food standards - Voluntary and mandatory food laws and Food Safety and Standards Act of India, 2006.	5	2
	2.2	Food Packaging Laws & Specifications.	5	2
	2.3	Principles for hygiene and Food safety System. Risk analysis, risk management, Authenticity and traceability in risk assessment, management, and communication.	5	3,5
	3.1	Introduction to codex standards. Codex India, the primary responsibilities of the National Codex Contact Point, and Codex Alimentarius Commission (CODEX).	5	5,6

3.The Codex Standards of Practice, Guidelines, and Recommendations	3.2	International Organisation of Standardisation (ISO): Overview, structure, interpretation, and case studies of food safety and Quality management, including ISO-22000, ISO-9001:2000, ISO22000:2005, ISO 17025/CODES/GLP	10	6
4. Safety in Food Services	4.1	Food distribution and storage, sanitation, and safety in food services; good manufacturing practices (GMP), good hygienic practices (GHP), goodagricultural practices (GAP), and good Veterinary practices (GVP).	5	7
	4.2	Standard operating procedure: goal; format and use of efficient writing.	3	7
	4.3	Hazard Analysis Critical Control Point (HACCP): Overview, concepts and requirements, applications, history, and structure; HACCP-based Standard Operating Procedures. Vulnerability Assessment and Critical Control Points (VACCP) & Threat Assessment and Critical Control Points (TACCP).	7	5,6,7
5		Teacher Specific Content		

Teaching And Learning Approach	**Classroom Procedure (Mode Of Transaction)** Module 1 & 2-Lecturing, ICT Enabled Learning Module 3&4- Lecturing, ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory :30 Marks** MCQ/ Assignments/ Test Papers/Book Review
	B. Semester End examination **Theory:70 Marks** Short answers (10 out of 12; 10x2=20 marks) Short Essay (6 out of 8; 6x5=30 marks) Long Essay (2 out of 4; 2x10=20 marks)

REFERENCES

1. Andres Vasconcellos J. (2005) Quality Assurance for the Food Industry - A practical approach. CRC press.
2. Inteaz Alli. (2004). Food quality assurance - Principles & practices. CRC Press. New York.
3. Neal D. Fortin. (2009). Food regulation, Wiley Publishers.
4. Naomi Rees. (2000). David Watson. International standards for food safety, An Aspen Publications.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**UNIT OPERATIONS IN FOOD INDUSTRY**					
Type of Course	**DSC B**					
Course Code	**MG3DSCFTQ202**					
Course Level	**200-299**					
Course Summary	This course introduces students to the fundamental unit operations involved in the food industry.					
Semester	**3**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic principles of unit operations in food industry	**U**	1,2,10
2	To illustrate the use of different food equipment's in food industry	**U**	2,3

3	To apply and demonstrate principles of mode of heat transfer.	**A**	1,2,10
4	To evaluate the mechanism of equipment operations.	**E**	1,2,10
5	To formulate the transformation of raw materials to quality food products using different processing technologies in Industries	**C**	2,3,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I)and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Systems for heating and cooling of food products	1.1	Mode of heat transfer: Conduction, Convection and radiation	5	1
	1.2	Heat exchangers: Introduction, types of heat exchangers-Plate heat exchangers, tubular heat exchangers, scraped surface heat exchangers, shell and tube heat exchanger, steam infusion and steam injection	7	1,3
2-Freezing and drying	2.1	Freezing-principles of food freezing, factors affecting freezing, types of freezers Plate freezers, Air blast freezers ,cryogenic freezers and Immersion freezers	6	1,2
	2.2	Drying- Principles of drying, factors affecting drying, type of dryers: spray dryer, fluidised bed dryer and freeze dryer	6	1,2
3-Evaporation, distillation and Mechanical separation	3.1	Evaporation -introduction, types of evaporators-Batch type pan evaporator, natural circulation evaporator, rising, falling, rising and falling film evaporators.	5	3
	3.2	Distillation - principles, types of distillation- water, fractional and steam distillation	6	4
	3.3	Filtration-theory of filtration, Equipment-plate and frame filter press, rotatory filter, centrifugal filters	6	4
	3.4	Membrane filtration techniques- reverse osmosis, ultra filtration, micro filtration and nano filtration	5	4,5
	3.5	Clarification,types, clarifying agent and sedimentation	4	5
	4.1	To evaluate moisture loss during evaporation process in food samples	15	5,6

4-Practicum		To study the dehydration loss and ratio during drying process in foods		
	4.2	To study the effect of osmosis in fruits and vegetable products To visit food processing industry or organization using advanced processing technique	15	5,6
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 ,2 & 3- Lecturing and ICT Enabled Learning. Module 4 - .Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End examination **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

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1 Singh R.P (2004).Introduction to Food Engineering, 3rdedition. AcademicPress, London.

2 George SaraVACos Athanasios E. Kostaropoulos, (2016). “Handbook of Food Processing equipment,” Springer international publications.

3 Kenneth J Valentas and R. Paul Singh, (1997), “Handbook of food engineering practice”, CRC Press.

4 R. Paul Singh and Dennis R Heldman, (2009), “Introduction to Food engineering”, Elsevier Inc.

5 ZekiBerk, (2009), “Food process engineering and technology”, ElvesierInc.
6 P.Fellows, (2000), “Food Processing and Technology-Principles and Practice”, Woodhead Publications.
7 AlbertIbaz, (1997), “Unit operations in Food processing”, CRC Press.

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1. Dincer, I (1997). Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA.
2. Heldman, D.R. and Lund, D.B 2007).Handbook of Food Engineering 2ndedition. CRC press, Newyork.
3. Warren, Julian Smith, Peter Harriott (2004.) Unit Operations of Chemical Engineering 7thEd. McGraw-Hill, Inc., NY, USA.
4. SaraVACos G D and Athanasios E K (2002). Handbook of Food Processing Equipment SpringerScience Business Media, New York, USA.

MDC

(MULTI-DISCIPLINARY COURSE)

MAHATMA GANDHI UNIVERSITY

Programme						
Course Name	**FOOD BIOTECHNOLOGY**					
Type of Course	**MDC**					
Course Code	**MG3MDCFTQ200**					
Course Level	**200-299**					
Course Summary	This course explores the intersection of biology and technology in the context of food production and processing.					
Semester	**3**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	**45**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic principles of biotechnology and its relevance to the food industry	**U**	1,10
2	To outline the basic concepts in rDNA technology	**U**	1,2,10
3	To apply the methods of gene transfer in rDNA technology	**A**	1,6,10
4	To analyse the process of fermentation and to examine the working of a bioreactor	**An**	1,2,10
5	To evaluate how rDNA and fermentation technology areused in development of various food products	**E**	1,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Concept of recombinant DNA Technology-I	1.1	Concept of gene, Central dogma, nucleotides, structure of DNA and RNA.DNA Replication, Transcriptionand Translation rDNA-Definition, steps involved in rDNA technology Types of gene transfer-Transformation, Transfection and Transduction	5	2
	1.2	Enzymes in rDNA technology- Restriction endonucleases-type I II and III, Ligases, DNA Modifying enzymes	4	2
	1.3	Vectors-Characteristics of an ideal vector, cloning and expression vectors, Types of vectors-plasmids, bacteriophage vectors, cosmids, phagemids, BAC and YAC.	5	2
2-Concept of recombinant DNA Technology-II	2.1	Physical methods of gene transfer-Electroporation, Microinjection, Biolistic gun, Sonoporation-principle, procedure, uses, advantages and disadvantages	4	3
	2.2	Chemical methods of gene transfer-calcium phosphate mediated transfer, DEAE Dextran mediated transfer, lipofection-principle, procedure, uses, advantages and disadvantages	4	3
	2.3	Polymerase Chain reaction (PCR)-Principle, procedure and applications	3	3
3-Fermentation, Fermented foods and Applications of rDNA	3.1	Fermentation-Definition, types of fermentation-continuous, batch and fed- batch fermentation; solid state and submerged fermentation	5	4

technology in food	3.2	Bioreactor/Fermenter-Design of a fermenter, parts of a fermenter, types offermenters	5	4
	3.3	Fermented food biotech products- Production of baker's yeast, wine, beer, yoghurt, kefir, kumiss, acidophilous milk, soy sauce, miso, natto, tempeh, vinegar using fermentation technology	5	4
	3.4	rDNA technology in food production- Transgenesis, GMO, Bt Brinjal, Flavr savr tomato, Golden rice, biosafety regulations of GMO	5	1, 4
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning
	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva/Book Review
Assessment Types	**B. Semester End examination** **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks)

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1. Byong H.Lee, (2015), Fundamentals of food biotechnology. Wiley-Blackwell.
2. Anthony Pometto, Kalidas Shetty, Gopinadhan Paliyath, Robert E. Levin, (2005), Food biotechnology. CRC Press.
3. Lee, B. H. (2014), Fundamentals of food biotechnology. John Wiley & Sons.
4. Rai, V. R., (2016), Advances in food biotechnology. John Wiley & Sons Limited.
5. Bhatia, S. C. (2005), Textbook of Biotechnology. Atlantic Publishers & Dist, 2005
6. Mansi Emtel, Bryce CFA. (2004) Fermentation Microbiology and Biotechnology, 2nd Edition,Taylor & Francis Ltd, UK.

VAC

(VALUE-ADDITION COURSE)

MAHATMA GANDHI UNIVERSITY

Programme						
Course Name	**INTRODUCTION TO GOOD LABORATORY PRACTICES**					
Type of Course	**VAC**					
Course Code	**MG3VACFTQ200**					
Course Level	**200-299**					
Course Summary	This course is designed to provide participants with a foundational understanding of the principles and applications of Good Laboratory Practices in various scientific and research settings.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	45
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic calibration and handling of instrumentation in laboratory	**U**	1,10
2	To illustrate how to record, keep and analyse laboratory data with accuracy	**U**	1,10
3	To discover the errors related with handling of laboratory accessories and equipment's	**An**	1,2,10
4	To deduct Standard Operating Procedures (SOPs) for Laboratory equipment	**E**	1,2,10
5	To elaborate on laboratory records, complaints with current industry standards	**C**	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to GLP	1.1	Introduction to GLP (Good Laboratory Practices), History, Scope.	5	1
	1.2	Fundamental points of GLP (Resources Characterization, Rules, Results, Quality assurance)	5	1
2-Laboratory rules, Laboratory hierarchy SOP Record keeping	2.1	General Rules/Protocols for Lab Safety measures, Precaution and Safety in handling of chemicals and solvents.	4	5
	2.2	Laboratory tools, Glassware and instruments. Internal and External Audit	4	5
	2.3	Levels of Laboratories, Log Book Maintenance	3	4
	2.4	Basic SOPs for instrument and acidhandling and Maintenance	4	3,4
	2.5	Keeping data records, its analysis by using statistical and mathematical tools. Result analysis and its interpretation	5	2
3-Practicum	3.1	1. Use of Microsoft word, Excel. (For Data entry, calculation and graphical representation) 2. Use of internet and emails 3. Standard Operating Procedure 4. Calibration of Instruments: pHmeter, colorimeter, spectrophotometer, water bath,Distillation assembly, Burette and Pipette 5. Preparation of Standard Solutionand Buffers 6. Demo and Maintenance of Internal and External Audit	15	5

4		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning, Demonstration

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva/Book Review **B. Semester End examination** **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks)

REFERENCES

1. Handbook: good laboratory practice (GLP): quality practices for regulated non-clinical research and development. World Health Organization.

SUGGESTED READINGS

1.Life science protocol manual (2018)-DBT star college schemeSpecial Programme for Research, Training in Tropical Diseases, & World Health Organization. (2009).

2.. Ezzelle, J., Rodriguez-Chavez, I. R., Darden, J. M., Stirewalt, M., Kunwar, N., Hitchcock, R., & D'souza, M. P. (2008). Guidelines on good clinical laboratory practice: bridging operations between research and clinical research laboratories. Journal of pharmaceutical and biomedical analysis, 46(1), 18-29.

SEMESTER 4

DSC -A

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD CHEMISTRY**					
Type of Course	**DSC A- MAJOR**					
Course Code	**MG4DSCFTQ200**					
Course Level	**200-299**					
Course Summary	This course covers fundamental principles and concepts related to the chemistry of food, focusing on both the chemical composition of food components and the reactions that occur during food processing and storage					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline the basic principles of food chemistry	**U**	1,2,10
2	To illustrate the structures & functions of major food components	**U**	2,4,10
3	To identify the relationship between molecular structure & functional properties in food	**A**	2,3

4	To apply analytical techniques to quantify & characterize food components	**A**	2,3
5	To analyze the functional properties of micro & macro nutrients & linking their role in sensory perception & nutritional quality of food	**An**	1,2
6	To propose experiments to investigate specific food chemistry phenomena	**C**	1,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Carbohydrate	1.1	Carbohydrates- Definition, sources & functions Classification of carbohydrates, Chemical and functional properties of carbohydrates, Changes in carbohydrates during processing	4	2,3,5
	1.2	Starch- composition, structure, starch hydrolysis, Starch modification & types of starch, Properties of starch- Gelatinization, retro-gradation, staling, dextrinization.	5	2,3,5
	1.3	Dietary fiber- Definition, Classification, functions & Health benefits Pectin and its types, cellulose –structure, modification of cellulose	4	2,3,5
2- Proteins and Enzymes	2.1	Proteins-Classification, plant and animal proteins, Denaturation of proteins & denaturing agents	3	2,3,5
	2.2	Changes in proteins during food processing-Effect of moderate heat treatment, Racemisation, protein cross-lining, oxidation of methionine, cysteine, tryptophan and tyrosine	5	2,3,5
	2.3	Functional properties of proteins-Solubility, Gelation, water binding, emulsification, foaming	4	2,3,5
	2.4	Enzymes-Enzymatic browning & Non-enzymatic browning Endogenous Enzymes used in food industry-Oxidoreductases-phenolases, glucose oxidase, catalase, peroxidase, lipoxygenase; Hydrolases-Amylases, pectic enzymes, proteases, lipases	5	1,2

		Immobilisation of enzymes-adsorption, covalent bonding, entrapment, copolymerization, encapsulation		
3-Fats and oils	3.1	Physical properties of fat: melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point, Chemical properties: Reichert meissel value, Polanski value, iodine value, peroxide value, saponification value.	5	1,2
	3.2	Effect of frying on fats, Changes in fats and oils-rancidity, lipolysis, flavor reversion Auto-oxidation and its prevention, Fat Mimetics, Antioxidants: Effectiveness and mechanism of action; Synergism – characteristics of commonly used, antioxidants. Thermal non-oxidable and oxidable Reactions of saturated fats.	5	1,2
	3.3	Processing Technology of fats and oils-Refining of oil-physical and chemical; Degumming, Neutralization, Bleaching, Deodorization, Winterization, Hydrogenation, Interesterification	5	4
4-Practicum	4.1	1. Estimation of glucose by Lane & Eynon's method 2. Estimation of lactose by Willstatter's Iodometric method Estimation of protein by Lowry's method	15	6
	4.2	3. Purity of fats and oils for the presence of sesame oil, argemone oil, linseed oil, mineral oil and hydrocyanic acid 4. Estimation of Iodine value in fats and oils 5. Estimation of Saponification value in fats and oils 6. Estimation of peroxide value in fats and oils Estimation of acid value in fats and oils	15	6
5	5	Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 - Lecturing and ICT Enabled Learning Module 2 - Lecturing and ICT Enabled Learning Module 3 - Lecturing and ICT Enabled Learning Module 4 - Practicals

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva **Practical:15 marks** Lab involvement/viva
	B. Semester End examination **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. Fennema, OwenR, (1996) Food Chemistry, 3rd Ed. Marcell Dekker, New York.
2. DeMan, J.M., (1980). Principles of Food Chemistry, AVI, New York
3. Potter, N.N. and Hotchkiss, J.H (1995). Food Science, 5th Ed, Chapman & Hall.
4. Lillian Hoagland Meyer (1974).Food Chemistry. The AVI Publishing Co Inc., Connecticut, MA,USA.
5. H.D.Belitz, W.Grosch and P.Schieberle (2009).Food Chemistry, 4th Ed.Springer-Verlag Berlin.

SUGGESTED READINGS

1. Aurand, L. W. and Wood, A. E. (1973). Food Chemistry. The AVI Publishing Co. Connecticut, MA.
2. Nielson, S.S. (2002).Introduction to the Chemical Analysis of Foods, CBS Publishers & Distributors,New Delhi.

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD MICROBIOLOGY**					
Type of Course	**DSC A -MAJOR**					
Course Code	**MG4DSCFTQ201**					
Course Level	**200-299**					
Course Summary	This course provides students with a foundational understanding of microbiological principles as they relate to food.					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the fundamental aspects of the microorganisms, including their structure, function, genetics, physiology, ecology, and their roles in various processes.	**U**	1,10
2	To identify the vast diversity of microorganisms and their classification, including their evolutionary relationships and genomic variations.	**A**	1, 4
3	To examine the structure, morphology, physiology, and biochemical processes of microorganisms to understand their functions and adaptations.	**An**	1, 2
4	To appraise the knowledge gained from microbiology to the field of medicine, agriculture, biotechnology, environmental science, food production, and industry.	**E**	2,6

5	To select aseptic techniques in food microbiology in determining microbial contamination in food	**E**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Introduction to Microbiology	1.1	History- Contributions of- Antonie van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner	2	1
	1.2	Principle and applications: Simple, compound microscope, Bright field Microscopy and Dark field Microscopy, Electron microscopy (TEM, SEM), Phase-contrast microscopy and Fluorescent microscopy	5	1
	1.3	Types of media-selective media and differential media Culture techniques-spread plate, streak plate and pour plate	5	1
	1.4	Sterilization principles and techniques	3	1
2- Characteristics of microorganisms	2.1	Description of sizes, shapes and arrangements of bacteria	3	1,2
	2.2	Typical Bacterial cell structure- a) Structure of cell wall (Gram positive & Gram negative bacteria), Cell membrane:-Fluid mosaic model, mesosomes, ribosomes, nucleoid, plasmids, cytoplasmic inclusions, capsules, slime layer, pili, flagella, endospore structure- formation,	5	1,2
	2.3	Fungus-structure and classification Virus-structure and classification	5	1
	2.4	Growth curve-Continuous culture – Chemostat and turbidostat Synchronous growth, Diauxic culture , Factors influencing microbial growth	2	1,2

3-Food borne diseases	3.1	Food intoxication-staphylococcal intoxication, botulism, Bacillus cereus gastroenteritis	7	1
	3.2	Food infection-Salmonellosis, Clostridium perfringens, Shigella dysenteriae, Listeria monocytogens, E. coli infection	8	1,4
4-- Practicum	4.1	Laboratory rules- basic rules of a microbiology lab Basic requirements of a microbiological lab- common glass ware, test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, Bunsen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, Quebec colony counter, centrifuge, microscope	4	1,5
	4.2	Composition, preparation and sterilization of media PDA media Nutrient agar media Mac-conkey agar media Demonstration of techniques for pure culture of microorganisms: Streak plate method, Pour plate method, Serial dilution agar plate method.	6	
	4.3	Methods for detection of specific bacteria: Motile bacteria-hanging drop mount method	4	
	4.4	Methods for staining of micro-organisms: Simple staining (Monochrome staining) Gram staining for differentiation of bacteria Negative staining Endospore staining	10	
	4.5	Antibiotic Sensitivity test MBRT test ImViC test	6	
5		Teacher Specific Content		

Teaching And Learning Approach	**Classroom Procedure (Mode Of Transaction)** Module 1 & 2-Lecturing, ICT Enabled Learning, Experiential Learning, Participatory Learning. Module 3- Lecturing, ICT Enabled Learning, Participatory Learning. Module 4- Practicals.

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva **Practical:15 marks** Lab involvement/viva
	B. Semester End examination **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Kathleen Park Talaro & Arthur Talaro, 2002, Foundations in Microbiology International edition,| McGraw Hill.
3. Michael T. Madigan & J. M. Martin, Brock, 2006, Biology of Microorganisms 12th Ed. International edition Pearson Prentice Hall.
4. Dubey, R.C. and Maheshwari, D.K. 2002. Practical microbiology. S.Chand and Company Limited, Ramnagar. New Delhi

SUGGESTED READINGS

1. Ronald M. Atlas, Microbiology: Fundamentals and Applications, Macmillan Publication New York.
2. Tortora, Funke and Case. 1998. Microbiology an Introduction. 6th Edition. Adisson Wesley Longman Inc.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD PACKAGING TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG4DSEFTQ200**					
Course Level	**200-299**					
Course Summary	This course provides an in-depth exploration of the principles, materials, and technologies involved in food packaging.					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline common materials used in food packaging	**U**	1,10
2	To summarize key regulations and standards related to food packaging	**U**	1, 4
3	To identify the environmental impact of different packaging materials	**A**	2,6
4	To analyse appropriate packaging materials for specific type of food products	**An**	1,2
5	To estimate the effectiveness of various packaging methods in preventing spoilage	**E**	2,6
6	To assess the sustainability of different packaging solutions in the food industry	**E**	2,7

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to food packaging	1.1	Definition, functions & requirements for effective food packaging	3	1
	1.2	Classification of food packaging-primary, secondary and tertiary.	4	1
2- Innovations in sustainable food packaging	2.1	Paper- Types-corrugated fiber board, butter paper, card board, virgin paper, ITC board, SBS board, duplex paper and recycled paper Uses, merits & demerits Plastic Classification-thermoplastics (polypropylene, polyethylene, poly vinyl chloride and polystyrene), thermosets, conductive polymers, biodegradable plastics and bioplastics Uses, merits & demerits	8	1,4
	2.2	Glass – Introduction, types of glass containers-bottles, jars and pots Glass composition-white flint (clear glass),Pale green(half white), dark green, amber (brown in various colour densities) and blue Attributes of food packaged in glass containers-Quality image, transparency, surface texture, colour, decorative possibilities, impermeability, chemical integrity, design potential, tamper evident, ease of opening, UV protection, hygiene, heat processable, microwaveable and strength Uses, merits & demerits	8	1,4

	2.3	Cans Steel can- Tin plate and Tin free steel Tin cans-Two piece tin cans and three piece tin cans Aluminium cans-the standard can, stay-on-tab can and the easy open end can	8	1,4

		Uses, merits & demerits of steel can, tin cans and aluminium cans		
	2.5	Retort pouches- Structure and principle types-three ply laminate of polyester, aluminium foil and polypropylene Merits & demerits, Closures, laminates, edible films	6	1,4
3 Advancements in food packaging technology	3.1	Aseptic Packaging, Active Packaging, Intelligent Packaging, Vacuum Packaging, MAP & CAP, Stretch & Shrink Packaging, Bio-degradable packaging	10	5
4- Testing & Regulatory Dimensions in food packaging	4.1	Testing methods- Thickness, Bursting strength, Tensile strength, WVTR, GTR, Puncture resistance, Tear Strength, Cobb's test, Grease resistance, Drop test, Identification of plastics	10	5
	4.2	Food Packaging Laws & Regulations	3	5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:30 marks** MCQ/ Assignments/ Test Paper/viva/Book Review
	B. Semester End examination **Theory: 70 marks** Short answers (10 out of 12; 10x2=20 marks) Short Essay (6 out of 8; 6x5=30 marks) Long Essay (2 out of 4; 2x10=20 marks)

REFERENCES

1. Gordon L. Robertson. 2014. Food Packaging: Principles and Practice, 3rd Ed. CRC Press, Boca Raton FL, USA.
2. Robertson, (1998), Principles of Food Packaging Press, USA
3. Scharow, S., and Griffin, R.C. (1980). Principles of Food Packaging, 2nd Edition, AVI Publications Co. Westport, Connecticut, USA.
4. Rajia Ahvennainen. 2003. Novel Food Packaging Techniques. CRC-Woodhead Publishing Ltd., Cambridge, England.
5. Richard Coles, Berek McDowell and Mark J. Kirwan. 2003. Food Packaging Technology. Blackwell Publishing Ltd., Oxford, UK

SUGGESTED READINGS

1. Gordon L. Robertson. 2010. Food Packaging and Shelf Life – A Practical Guide. CRC Press, Boca
2. Dong Sun Lee. 2008. Food Packaging Science & Technology. CRC Press, Boca Raton FL, USA.
3. Jung H. Han. 2007. Packaging for Non- thermal Processing of Food. Blackwell Publishing Ltd., Oxford, UK.
4. Jung H. Han. 2005. Innovations in Food Packaging. Elsevier Science & Technology Books, UK

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD ENGINEERING**					
Type of Course	**DSE**					
Course Code	**MG4DSEFTQ201**					
Course Level	**200-299**					
Course Summary	This course provides an in-depth exploration of the principles and applications of food engineering, focusing on the physical, chemical, and biological processes involved in the production, preservation, and distribution of food.					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline the broad scope of food engineering	**U**	1,4
2	To understand the process of heat transfer and mass transfer	**U**	1,10
3	To analyse how material science principles can applied to foods	**An**	1,2,6,10
4	To estimate the importance of key rheological parameters	**E**	1,2,10
5	To compare dehydration system used in food	**E**	2, 4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1 – Food Engineering-Basic Terms and Principles	1.1	Characteristics of temperature and heat: Celsius, fahrenheit and kelvin, boiling point, freezing point	4	1
	1.2	Concept of Unit operation- Units and dimensions, unit conversions, dimensional analysis	3	1
	1.3	Conservation of mass; Steady state and transient state	3	1
2-Thermodynamics	2.1	First Law of Thermodynamics, second law of Thermodynamics.	2	3
	2.2	Entropy, Isothermal process mAdibatic process Thermodynamic principles applied to food system	5	3
	2.3	Phase transitions in food (freezing, melting, crystallization)	3	3
	2.4	Water activity and its impact on food stability	5	3
3- Heat and Mass Transfer	3.1	Systems for heating and cooling food products	4	2
	3.2	Thermal Properties of Food-Thermal conductivity, Thermal diffusivity, Latent heat, Sensible heat. Modes of heat transfer-: Conductive, Convective-forced convection and Natural convection and Radiation.	6	2
	3.3	Steam injection, ohmic heating Microwave heating, dielectric properties. Definition and Applications	5	2
4 –Fluid Mechanics	4.1	Fluid Flow in food Processing. Liquid Transport systems	4	
	4.2	Properties of Liquids		

		Newton's Law of Viscosity Principle of Capillary tube and rotational viscometer	3	4
	4.3	Flow characteristics, Reynolds Number, Bernoulli"s Equation	3	4
	4.4	Concept of flow measurement devices	2	4
	4.5	Rheology- Mechanical and Rheological measurements Stresses, elasticity, plasticity, fluidity Newtonian and Non-Newtonian Foods- Bingam plastic, Plastic, pseudo plastic and dilatant Viscosity in Food and Processing	4	4
	4.6	Basic Drying Process - Moisture content on wet basis and dry Basis Dehydration systems Dehydration system and Drying Evaporators & Types of evaporators, size reduction and its equipment	4	2
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:30 marks** MCQ/ Assignments/ Test Paper/viva/Book Review
	B. Semester End examination **Theory: 70 marks** Short answers (10 out of 12; 10x2=20 marks) Short Essay (6 out of 8; 6x5=30 marks) Long Essay (2 out of 4; 2x10=20 marks)

REFERENCES

1. Dennis R. Heldman and Daryl B. Lund, "Handbook of Food Engineering"
2. Theodoros Varzakas, Athanasios Labropoulos, and Spyridon K. Yanniotis, "Food Engineering Handbook"
3. P.J. Fellow, "Food Processing Technology: Principles and Practice",

SUGGESTED READINGS

1. Gustavo V. Barbosa- Canovas, Daryl B. Lund, and Mark A. Sommers "Food Engineering: Principles and Selected Applications"
2. R. Paul Singh and Dennis R. Heldman, "Introduction to Food Engineering"
3. Zeki Berk, "Food Process Engineering and Technology"
4. George D. SaraVACos and Zacharias B. Maroulis, "Food Engineering: Operations and Product Development".

DSC –C

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**NOVEL TECHNOLOGIES IN FOOD**					
Type of Course	**DSC C**					
Course Code	**MG4DSCFTQ202**					
Course Level	**200-299**					
Course Summary	This course explores emerging technologies in the food industry, focusing on innovations that impact production, processing, safety, and quality.					
Semester	**4**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3		1	-	**75**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the membrane technology: MF, UF, NF & RO and Super critical fluid extraction process in food industry	**U**	1,10
2	To understand the application of microwave and radio frequency wave technology in food processing	**U**	1,2,10
3	To assess different applications of novel food processing techniques.	**E**	1,2,10
4	To explain the working principle of instruments which are used to measure the characteristics of food.	**E**	1,2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit s	Course description	Hrs.	CO No.
1- Advances in Food Packaging Technology	1.1	Active and intelligent packaging systems, Advances in Active packaging techniques and Intelligent packaging techniques. Aseptic packaging technology-advances, systems and its food applications, packaging for high pressure processing	5	3
	1.2	Current use of novel packaging techniques in different food products, consumers acceptance of novel food packaging Oxygen and ethylene, scavenging technology, concept and its food applications Carbon dioxide, Odor and flavour absorber and other scavengers, ethanol emitters and preservative releaser, and their food packaging uses	5	3
	1.3	Non-migratory bioactive polymers (NMBP) in food packaging, Advantages and limitations Inherently bioactive synthetic polymers: types and Applications, Polymers with immobilized bioactive compounds. Packaging-flavour interactions, Factors affecting flavour absorption, Role ofthe food matrix and different Packaging	5	3
		Materials. Case studies: Packaging and lipid oxidation, Modelling lipid oxidation and absorption Shelf-life evaluation of packaged food		

2-Advances in Food Processing Technology	2.1	Emerging technology in food processing- Active and intelligent packaging, membrane technology, HPP, PEF, Ultra sound. Supercritical fluid extraction: Concept, property of near critical fluids NCF and extraction methods. Application of SCFE in food processing	5	2
	2.2	Microwave and radio frequency, IR drying: Definition, Advantages, mechanism of heat generation, inductive heating in food processing and preservation. Application in food processing: microwave blanching, sterilization and finish drying	5	2
	2.3	High intensity light generation system, Application of high intensity light in food processing, Pulse electric field mechanism of inactivation, PEF generation system, PEF treatment chambers, Mechanism of ohmic heating and its application in liquid food processing, Principle of cold plasma technology and its generation systems and its application Nanotechnology: Principles and its applications in foods	5	2
3-Ultrasonic processing and Newer techniques in food processing	3.1	Understanding the concept of ultrasonic processing technology with reference to the mechanism of microbial inactivation. Identification of parameters for designing of ultrasonic process equipment. Application of ultra-sonication in food processing	7	4
	3.2	Understanding the concept of high intensity light, pulse electric field, ohmic heating, IR heating, inductive heating and pulsed. Principles and		

		applications in foods with special reference to nano-composite packaging films and nano-emulsion as carrier of biomolecules while developing functional food products	8	4
4-Practicum	4.1	To identify the packaging material used in food processing companies To study the effect of microwave heating in food products To evaluate the emulsion formation and stability in various food formulation	20	3
	4.2	To visit food processing industries with novel technologies	10	3
5		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva **Practical:15 marks** Lab involvement/viva
	B. Semester End examination **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks

	Record-5 marks

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2. Zadow JG. 1994, Ultrafiltration and Microfiltration Handbook. Technomic Publ. House.
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5. Jacqueline H. Beckley, M. Michele Foley Elizabeth J. Topp &_J. C. Huang Witoon Prinyawiwatkul (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA.
6. Howard R. Moskowitz, I. Sam Saguy & Tim Straus (2009). An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA

SEC

(SKILL- ENHANCEMENT COURSE)

MAHATMA GANDHI UNIVERSITY

Programme						
Course Name	**BAKING TECHNOLOGY**					
Type of Course	**SEC**					
Course Code	**MG4SECFTQ200**					
Course Level	**200-299**					
Course Summary	This course is designed to equip students with the knowledge and skills necessary for the development of VALUE-ADDITION food products					
Semester	**4**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-		-	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the principles and working of equipment's used in baking	**U**	1,4
2	To experiment with the ingredients and unit operations used in baking	**A**	2,4
3	To select the ingredients and steps involved in manufacture of bread	**A**	1,2
4	To evaluate the preparation of biscuits and cookies	**E**	2,4
5	To appraise the methods involved in the manufacture of cakes and pastries	**E**	1,2
6	To develop various recipes in making bread, biscuits, cookies and pastries	**C**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction toBaking technology	1.1	Baking - Definition, Principles of baking, classification of baked foods. Types of equipment's in baking industry, cleaning and sanitizing methods of baking equipment's; Baking temperature of different products, operation techniques of different baking equipment's	5	1
	1.2	Flour-types of flour, Flour Enzymes, Characteristics and pH value, Starch, Flour Testing and Storage Water-Sources, Types, Functions and Usages of Water Salt, sugar and milk Yeast-types, enzymes, functions in dough making Leavening agents-types, properties, Baking soda and Baking powder Flavourings, Nuts and fruits,Food colours,	5	2
	1.3	Unit operations in baking Mixing-Scaling of mixing phase, objectives of mixing phase, mixing time, temperature control Fermentation, proofing, baking	5	2
2–Technology of Bread, Biscuits, Cakesand pastries	2.1	Bread Preparation of bread - ingredients used; methods of dough preparation; steps in bread processing; evaluation of the baked bread; staling of bread; diseases of bread.	3	3,6
	2.2	Biscuits Preparation of biscuits and cookies – types; ingredients; processing and evaluation, Crackers	2	4,6
		Cake Technology		

	2.3	Preparation of cakes - types of cakes; ingredients used; methods of batter preparation; steps in cake making; balancing of cake formula; evaluation of the baked cake; operational faults in cake processing and the remedial measures. Labeling and Packaging,Costing, Cake decoration- different methods of cake decoration	5	5,6
	2.4	Pastry Technology	5	5,6
		Preparation of pastry - types of pastries (short crust, puff/flaky and choux pastry); ingredients; processing and evaluation. Faults and remedies		
3-Practicum	3.1	1.Preparation of bread and assessment of its quality 2. Preparation of butter cake and assessment ofits quality. 3. Preparation of sponge cake with icing and assessment of its quality.	10	6
	3.2	4.Preparation of cookies and assessment ofquality. 5.Preparation of biscuits and assessment ofquality. 6.Visit to a baking industry and preparation of report	5	6
4		Teacher Specific Content		
Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2-Lecturing, ICT Enabled LearningModule 3- Lecturing, ICT Enabled Learning.			

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva/Book Review

Assessment Types	**B. Semester End examination** **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks)

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1. Cornell, Hugh J and Hoveling, Alber W, 1998, Wheat Chemistry and Utilization, CRC Press.
2. Dubey SC. 2007, Basic Baking-Science and Craft. Society of Indian Bakers, Delhi.
3. Edward, W P, 2007, The Science of Bakery Products, RSC Publishing.
4. Encyclopedia of Food Science and Technology, 1993, Academic Press.
5. Kent NL, 2004, Technology of Cereals. Pergamon Press, London.
6. Ketrapaul N, Grewal RB, Jood S, 2005, Bakery Science and Cereal Technology. Daya Publishing House, Delhi.

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1. Khanna K, Gupta S, Seth R, Mahana R, Rekhi T, 2004, The Art and Science of Cooking. Phoenix Publishing House Private Limited, Delhi.
2. Matz A, 1998, Bakery Technology and Engineering. CBS Publishers, Delhi.

VAC

(VALUE-ADDITION COURSE)

MAHATMA GANDHI UNIVERSITY

Programme						
Course Name	**ENTREPRENEURSHIP DEVELOPMENT**					
Type of Course	**VAC**					
Course Code	**MG4VACFTQ200**					
Course Level	**200-299**					
Course Summary	This course is designed to equip students with the knowledge, skills, and mindset necessary to navigate the challenges of entrepreneurship.					
Semester	**4**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		45	-		-	**45**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand entrepreneurial culture and encourage the students to become entrepreneurs	**U**	1,10
2	To make use of various procedures for starting a small-scale mode of production.	**A**	1, 2
3	To analyse how to prepare a project to start a small-scale industry.	**An**	1 ,2
4	To select various agencies that can help with starting a new project.	**E**	2, 9
5	To formulate basic idea to develop a new product.	**C**	2, 6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Entrepreneurship	1.1	Introduction to Entrepreneurship- Meaning, definition and concepts, characteristics, functions, entrepreneurial traits and motivation; Role of entrepreneur development, factors affecting entrepreneurial growth. Types of entrepreneurs	6	1
	1.2	Entrepreneurship Development Program Objectives, Steps, Need for training- target group- Contents of the training program Special Agencies for Entrepreneurial Development and Training-DIC.	5	1
	1.3	Women entrepreneurship, significance, problems, solutions to the problems	4	1
2- Setting up of micro small and medium enterprises	2.1	Setting up of micro small and medium enterprises, location significance Green channel, bridge capital, seed capital assistance, margin money scheme, Sickness, Causes- Remedies.	6	2, 3
	2.2	Role of Government in promoting Entrepreneurship Incentives, subsidies and grants Agencies and their role - DIC, SISI, EDII, 3NIESBUD, NEDB	6	3, 4
3- Project formulation and Product Development	3.1	Project formulation- Various approaches principles of product selection and development ,techno-economic feasibility of the project, structure of project report	8	5
	3.2	Product Development - need for new products, stages in product development, factors to be considered for it, Pricing and distribution of new product -kinds of pricing, sales promotion techniques	10	5
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Paper/viva/Book Review
Assessment Types	**B. Semester End examination** **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Short Essay (5 out of 7;5x4=20 marks) Long Essay (2 out of 4;2x10=20 marks)

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2. Abraham, M.M., 2000, Entrepreneurship Development & Management, Prakash Publications,Changanacherry.

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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**INTERNSHIP**					
Type of Course	**INT**					
Course Code	**MG4INTFTQ200**					
Course Level	**200 – 299**					
Course Summary	This Course provides students with a foundational understanding of the principles and concepts that form the basis of Food Technology					
Semester	**4**	Credits			**2**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
			-		2	30
Pre- requisites,if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the association of students with food industry.	**U**	1,2,10
2	To create and apply team-work and leadership quality among students and knowledge in real world problems	**A**	1, 2, 5,6
3	To percept the role and responsibility of food scientist in the industry.	**A**	5, 6
4	To assess the laws and regulations pertaining to food quality and safety	**An**	1,2,6,10
5	To network and collaborate with industry-professionals and ethical issues in the work environment.	**A**	7, 8, 9

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest(I) and Appreciation (Ap)

Mode of Assessment				
Sl No.	**Points**	**Distribution marks**	**Total Marks**	**Credit**
Internal Evaluation				
1.	Plan and goal of Internship	2	CCA:15	2
2.	Acheivement of goals	3		
3.	Work Report of Internship	5		
4.	Overall Performance	5		
External Evaluation				
1.	Certificate of Internship	5	ESE: 35	
2.	Attendance & Timeliness	5		
3.	Work Report of Internship	15		
4.	Viva Voce	10		

SEMESTER 5

DSC –A

MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD ANALYSIS**					
Type of Course	**DSC A –MAJOR**					
Course Code	**MG5DSCFTQ300**					
Course Level	**300-399**					
Course Summary	This course provides an in-depth exploration of techniques and methodologies used in the analysis of food components.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the steps in food analysis and discover the errors	**U**	1,4
2	To identify the method and types of sampling	**U**	1,4
3	To utilize different aspects of moisture and ash analysis	**A**	1,2
4	To examine the amount of carbohydrates, fiber content and protein in food samples	**An**	1,2

5	To evaluate various methods for crude fat, mineral and vitamin analysis	**E**	1, 2
6	To determine the amount of reducing and non-reducing sugar, vitamin C, pectin content, gluten content titrable acidity and minerals in a given food sample	**E**	2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1- Moisture and Ash Analysis	1.1	Moisture Analysis, Oven Drying Methods- Forced Draft Oven, Vacuum Oven, Microwave Oven, Infrared Drying Distillation Procedures Reflux Distillation with Immiscible Solvent	4	3
	1.2	Physical and Chemical Methods Chemical Method-Karl Fischer Titration Physical Methods- Electrical Methods, Dielectric Method, Conductivity Method Hydrometry- Pycnometer, Hydrometer, Westphal Balance Refractometry, Infrared Analysis, Freezing Point	4	3
	1.3	Dry, Instrumentation, Procedure and applications Wet Ashing-Principle, Procedure and applications Low temperature ashing-Principle, Instrumentation, Procedure and applications Microwave Ashing	4	3
	2.1	Carbohydrate analysis Total Carbohydrate: Phenol-Sulfuric Acid Method Total Reducing Sugars- Somogyi-Nelson Method Determination of total starch and determination of the degree of starch gelatinization	4	4

2- Carbohydrate, Dietary Fiber and Protein analysis	2.2	Fiber Analysis Dietary Fiber-Components, Gravimetric methods-total, Insoluble and soluble fiber Chemical methods-Englyst-Cummings Procedure-Principle, Procedure and applications	4	4
	2.3	Protein Analysis Kjeldahl Method, Biuret Method, Lowry Method, Bicinchoninic Acid (BCA) Method, Ultraviolet (UV) 280 nm Absorption Method, Ninhydrin Method, Dye-Binding Method-Principle, procedure and applications	4	3
3- Lipid, Mineral and Vitamin Analysis	3.1	Crude Fat analysis Solvent extraction methods-Sample preparation, solvent selection Continuous Solvent Extraction Methods-Principle, characteristics and Procedure Semicontinuous Solvent Extraction Methods-Soxhlet method: Principle and Characteristics, Preparation of Sample, Procedure Discontinuous solvent extraction-Modified Mojonnier method for Milk fat-Principle and characteristics, procedure Non-solvent Wet extraction methods Babcock method for milk fat-Principle, procedure and applications Gerber method for milk fat-Principle, procedure and applications	7	5

	3.2	Mineral analysis EDTA Complexometric Titration-Principle, Procedure-Calcium Determination Using EDTA Titration, Applications Redox Reactions-Principle, Procedure-Calcium Determination Using Redox Titration Precipitation Titration-Principle and procedure and applications of 1) Mohr Titration of Salt inButter 2) Volhard Titration of Chloride in Plant Material	7	4

	3.3	Vitamin B1-principle and procedure Vitamin A-Principle and Procedure Vitamin E-Principle and Procedure Vitamin C-2,6-Dichloroindophenol Titrimetric Method, Micro-fluorometric Method-Principle and Procedure Thiamin (Vitamin B,) in Foods Thiochrome Fluorometric Procedure-Principle and Procedure Riboflavin (Vitamin B2) in Foods and Vitamin Preparations. Fluorometric Method-Principle and Procedure Bioassay Method-Microbiological assay of Niacin and Folate	7	4
4-Practicum	4.1	Estimation of hardness of water / chlorine - total, temporary and permanent by EDTA method. 2. Estimation of polyphenols - total anthocyanin / tannins from fruit juices. 3. Estimation of sugars (reducing and non-reducing) in fruit juices. 4. Estimation of Iodine in Iodised salt 5. Estimation of ascorbic acid from lime juice. 6. Estimation of total acidity in various food products 7. Estimation of salt content in butter by Mohr's method 8.Estimation of gluten content in wheat 9. Estimation of pectin content in jams and jellies.	20	5,6
	4.2	Sensory analysis tests: Difference tests, Paired comparison, Duo-Trio test, Difference from control, Ranking tests, Triangle tests, Magnitude estimation, Acceptance test, Hedonic rating and multiple sample ranking for preference	10	5,6
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Practicals

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers Practical:15 Marks Lab Involvement/Lab Test/Viva
	B. Semester End Examination Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

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1. Rovina Kobun, 2015, Advanced Food Analysis Tools .1st Edition, Elsevier publisher.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**TECHNOLOGY OF MEAT, FISH AND POULTRY PRODUCTS**					
Type of Course	**DSC A – MAJOR**					
Course Code	**MG5DSCFTQ301**					
Course Level	**300-399**					
Course Summary	This course is designed for students pursuing in-depth knowledge and skills in the technology and processing of meat, fish, and poultry products.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To Illustrate the structure and composition of meat and the post mortem changes in meat	**U**	1,4
2	To outline the processing and preservation of meat	**U**	1,10
3	To examine the processing of poultry and its products	**A**	1,6
4	To analyse the composition of fish and its byproducts	**An**	1,2
5	To assess the structure of egg and its quality	**E**	1,2
6	To formulate methods for the preparation of various products from meat	**C**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSECONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Basic Meat science	1.1	Classes of meat, structure, composition and nutritive value of meat, meat pigments, Post-mortem changes in muscle, ageing and tenderization.	8	1
	1.2	Ante mortem and post mortem inspection and handling of meat and poultry, Modern abattoirs, typical layout and features, Stunning types Grading of meat- retail and whole sale cuts	7	1,2
2-Processing and preservation of meat	2.1	Chilling, freezing of meat, Canning, cooking, irradiation, drying, pickling, curing-wet and dry curing and smoking-cold smoking, hot smoking and liquid smoking, Preparation of sausage, ham and bacon, PSE and DFD meat	10	3
	2.2	Packaging of meat products-VACuum Skin packaging, thermo-VAC packagingmodified atmosphere packaging and chamber method	5	3
3-Poultry, Fish, and its products	3.1	Classification, composition and nutritive value, processing, preservation and storage of poultry	4	4,6
	3.2	Egg-Formation of egg, structure, composition, quality of egg and preservation of egg	4	4
	3.3	Classification, composition, storage and methods of preservation	3	5
	3.4	Fish by products-Fish oil, fish meal, Fish Manure and Guano, Fish Flour (Hydrolysed Protein), Fish Silage, Fish Sausage and Ham & Isinglass	4	7

4-Practicals	4.1	1. Preparation of fish pickle, fish cutlet, fish nuggets 2. Preparation of meat pickle, meat nuggets, meat cutlet and mayonaisse	15	8
	4.2	Determination of quality parameters-Sensory evaluation and microbial assessment	15	8
5		Teacher Specific Content		
Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Practicals			

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers Practical:15 Marks Lab Involvement/Lab Test/Viva **B. Semester End Examination** Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

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1. Collins, D. S., & Huey, R. (2015). Meat inspection protocols. Gracey's Meat Hygiene; Collins, DS, Huey, RJ, Gracey, JF, Eds.
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2. Kalschne, D. L., Corso, M. P., & Canan, C. 2020, Advances in meat processing technologies: Modern approaches to meet consumer demand. Bentham Science Publishers.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**CEREAL TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ300**					
Course Level	**300-399**					
Course Summary	Composition and nutritive value of certain cereals and different processing techniques of cereals and certain fermented and non-fermented food products					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline the structure composition and nutritive value of cereals, wheat and corn.	**U**	1,4
2	To identify the characteristics of breakfast cereals and properties of fermented and non-fermented products	**A**	1,4
3	To examine the properties of different processed products of cereals	**An**	2,4
4	To evaluate the processing of corn and its byproducts	**E**	1,2
5	To elaborate the process and mechanism of fermentation in the production of cereal based fermented foods	**C**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Rice Chemistry and Technology	1.1	Rice grain structure, composition of rice, Processing of cereals- Milling of rice, parboiling– traditional and modern methods, advantages and disadvantages of each method of parboiling.	7	1,5
	1.2	By-products of cereals – starch, dextrose, dextrin, bran, broken grains, parched rice, puffed rice, flaked rice, popped rice, hulls, rice pollards, bran oil, germ and germ oil, husk, straw.	8	1,3
2-Wheat Chemistry and Technology	2.1	Classification of wheat, structure and composition of wheat, , nutritive value and its relation to processing qualities, wheat milling,	8	1
	2.2	Wheat products: whole wheat flour, maida, semolina. Method of preparation of macaroni, spaghetti and vermicelli.	7	1
3-Corn chemistry and Technology	3.1	Origin, types of corn, structure and composition of corn, nutritive value, processing of corn: dry milling, wet milling and alkali processing,	8	6
	3.2	Products of corn: degerminated flour, corn germ oil, popcorn, corn starch, corn syrup, HFCS.	7	6
	4.1	Definition, Nutritive value of breakfast cereals, classification of breakfast cereals: uncooked breakfast cereals and ready to eat cereals	7	2,4

4-Breakfast Cereals	4.2	processing of ready –to-eat cereals (Batch cooking, continuous cooking and extrusion cookers) and products (flaked cereals, puffed cereals, shredded products, granular products)	8	2,4
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B Semester End Examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

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2. Manay, N.S, Shadaksharaswamy, M., 2004, Foods- Facts and Principles, New Age International Publishers, New Delhi.
3. Potter, N.N. and Hotchkiss J. H. Food Science. 1996, CBS publishers and distributors.
4. Srilakshmi, B. 2003, Food Science. New Age International Publishers, New Delhi.

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1. Subalakshmi, G and Udipi, S.A. 2001, Food processing and preservation. New Age International Publishers, New Delhi.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**TECHNOLOGY OF BEVERAGES**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ301**					
Course Level	**300-399**					
Course Summary	This course explores the scientific, technological, and practical aspects of the beverage industry.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the manufacturing process in the context of beverage technology	**U**	1,10
2	To analyze water sample and explain the techniques of purification of water for preparation of packaged drinking water	**An**	1,2
3	To evaluate processing of non-alcoholic beverages (tea and coffee) as per standards	**E**	1,2
4.	To determine the processing and quality evaluation of different types of beer, wine and other alcoholic beverages.	**E**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill

(S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to Beverages	1.1	Type of beverages and their importance, status of beverage industry in India	3	1
	1.2	Manufacturing technology for juice based beverages, synthetic beverages, technology of still, carbonated, low-calorie and dry beverages, isotonic and sports drink	8	1
	1.3	Role of various ingredients of soft drinks, carbonation of soft drinks.	4	1
2-Manufacturing process of beverages	2.1	Beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy- based beverages	10	1,3
3-Types of coffee and tea	3.1	Chemical composition and processing of tea and coffee and their quality assessment. Types of tea: Black tea, Green tea, Oolong tea. Types of coffee: Vacuum coffee, drip coffee, iced coffee, Espresso coffee, Instant coffee, decaffeination of coffee, types of decaffeination: Roselius method, Swiss water process, Direct and indirect method, Triglyceride method, Carbon dioxide method.	15	1,3
4-Manufacture of Alcoholic beverages and Packaged Drinking Water	4.1	Types, manufacture and quality evaluation: role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipment's used for brewing and distillation, wine and related beverages, distilled spirits	10	1

	4.2	Definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water, mineral water, natural spring water, flavoured water, carbonated water	10	1,2
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Manay, N.S, Shandaksharaawamy, M., (2004), "Foods- Facts and principles", New Age International Publishers, New Delhi.
2. Potter, N.N. Hotchkiss, J.H (2000), "Food Science". CBS Publishers, New Delhi.
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MAHATMA GANDHI UNIVERSITY

Programme	**B.Sc. FOOD TECHNOLOGYAND QUALITY ASSURANCE**					
Course Name	**SENSORY EVALUATION**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ302**					
Course Level	**300-399**					
Course Summary	This course provides a comprehensive exploration of sensory evaluation in the context of food.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic human taste senses	**U**	1,10
2	To utilize the different aspects of sensory evaluation	**A**	4, 6
3	To analyse the product characteristics and perform different type of sensory tests	**An**	2,4
4	To evaluate the awareness about the objective evaluation	**E**	2,4
5	To rate various food products using different sensory evaluation techniques.	**E**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1 – Introduction	1.1	Subjective evaluation Sensory evaluation- Definition and applications	3	1
	1.2	Sensory attributes of food- appearance, color, flavor, taste and texture	2	1
	1.3	Difference between objective and subjective evaluation	3	1
	1.4	Sensory perception of food flavor- mechanism of taste, smell, retro nasal smell, somesthesis, kinesthesis, chemesthesis- pepper heat, carbonation, Metallic taste. Multimodal perception	7	1,2
2- Sensory evaluation requirements	2.1	Requirements of sensory evaluationn Sensory laboratory design, sensory booths, sensory panels- Types of panels, requirements, recruitment criteria and selection, training.	7	1
	2.2	Sample preparation and serving procedures such as sample size, sample serving temperature, palate cleansers, swallowing and expectoration, score card sensory scaling- Line scales, Numeric scales, Hedonic scales;	8	3
3– Sensory measurement	3.1	Kinds of sensory tests Difference,triangle, duo-trio tests, paired comparison test Descriptive tests- Texture profile, flavor profile Affective tests- Preference test, ranking and hedonic test.	7	3
	3.2	Factors affecting sensory measurements- Psychological- expectation error, mutual		

		suggestion effect, distraction error Physiological- adaptation, mixture interactions-enhancement, synergy & suppression, health& environmental factors	8	4,5
4 – Food texture and appearance	4.1	Definition, kinds of texture: Visual texture, auditory texture- crunchiness, crumbliness, oral tactile texture- Size and shape, Mouth feel, Phase changes, Oral crispiness, crumbliness and crunchiness, Hand tactile feel, Texture measurement- Texture Profile	7	4,5
	4.2	Normal human color vision mechanism and color blindness, Measurement of Appearance & Color attributes, Appearance attributes such as turbidity, glossiness, translucency; Visual Color Measurement. Instrumental Color Measurement: Munsell Color Solids, Tricolorimetry, Standard observer.	8	4,5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review

	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Harry T Lawless, Hildegarde Heymann (2010) Sensory evaluation of Food: Principles and Practices, Second Edition, Springer, New York.
2. Sarah Kemp, Tracey Hollywood, Joanne Hort (2011) Sensory evaluation: A Practical Hand- book, Wiley-Blackwell, New York.
3. Nielsen, S.S, 2004 Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London.
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Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**TECHNOLOGY OF SPICES**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ303**					
Course Level	**300-399**					
Course Summary	This course is designed to provide students with a comprehensive understanding of spices technology, covering various aspects of spice production, processing, quality control, and utilization in the food industry.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic concepts of spices, spice oils and oleoresins	**U**	1,10
2	To demonstrate the extraction of flavour components from minor and major spices.	**U**	1,10

3	To examine the functions and application of spices	**An**	1,6,10
4	To analyse the drying and storage of spices.	**An**	1,10
5	To evaluate the basic concepts of post processing treatments in spices.	**E**	1,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Spices, spice oils and oleoresins	1.1	Spices: Definition, classification, chemical composition, functions of spices.	4	1
	1.2	Spice oil and oleoresins: definition, Technology of manufacturing.	5	1
2-Post harvesting technology of spices	2.1	Harvesting, transportation, threshing, drying, cleaning, packaging and storage of spices	6	5
	2.2	Seeds and fruits, leaves and stems, flowers and buds	4	5
	2.3	Roots and rhizomes, bark, wood and resins	4	5
3-Major spices of India and minor spices in India	3.1	Pepper: classification, processing of pepper	4	2,3
	3.2	Cardamom: composition, drying of fruits, grading, processing	4	2,3
	3.3	Chilly: drying of chilly, quality attributes of chilly	5	2,3
	3.4	Ginger: composition, processing, uses	4	2,3
	3.5	Coriander, cumin, cinnamon, fenugreek, garlic, nutmeg, onion - introduction, processing steps, uses	4	2,3
	3.6	Saffron, Tamarind, cloves, mint, vanilla, Asafoetida, Allspice -Introduction, Processing steps, Uses	4	2,3
4-Drying, storage and pest control of spices	4.1	Different methods of drying and storage of spices, Pest control methods in spices, decontamination techniques in spices	6	4
	4.2	Post processing treatments - Ethylene oxide, propylene oxide, irradiation, steam sterilization.	6	4

5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 - Lecturing and ICT Enabled Learning Module 2 - Lecturing and ICT Enabled Learning Module 3 - Lecturing and ICT Enabled Learning Module 4 - Lecturing and ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Pandey, 2002, P. H. Post-Harvest Engineering of Horticultural Crops through objectives. Saroj Prakasam, Allahabad.
2. Shanmugavelu KG, 2018, Kumar N, Production Technology of Spices and Plantation Crops, 1st Edition, Peter KV Publisher, Agrobios (India).
3. ASTA, Official analytical methods of the American Spice Trade Association, 1997, IV Edition.

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1 Pruthi, J.S. Spices and Condiments Chemistry, Microbiology and Technology. 2011, 1stEdition. Academic Press Inc., New York, USA.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**POST HARVEST TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ304**					
Course Level	**300-399**					
Course Summary	This course involves the handling, storage, processing, and transportation of agricultural produce from the point of harvest to the consumer.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the post harvesting processing of the fruits and vegetables.	**U**	1,10
2	To utilize the knowledge of processing and milling technologies of cereals and pulses	**U**	1,6
3	To analyze the processing and quality control aspects of oil and oil products processing industries.	**An**	1,2
4	To evaluate the importance of minimal processing techniques in post-harvest technology.	**E**	1,2
5	To discuss the use of nanomaterials in food processing	**C**	1,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Postharvest Management of fruits and vegetables	1.1	Importance and scope of postharvest management of fruits and vegetables	3	1
	1.2	Post-harvest losses, pathological disorders in fruits and vegetables-types, symptoms and control measures.	4	1
	1.3	General steps in processing of fruits and vegetables	3	1
	1.4	Role of plant growth regulators in postharvest management. Pre-harvest factors influencing postharvest life of crops.	5	1
2-Postharvest Management of Cereals	2.1	Food Processing by Radio Frequency Electric Fields and its applications: Pulse Electric Field (PEF),Moderate Electric Field (MEF)	8	1,2,4
	2.2	Use of Electromagnetic Radiations in Food Processing: Ohmic heating, IR heating, Microwave heating, Inductive heating.	7	1,2,4
3-Postharvest Management of Pulses	3.1	Advances in Membrane Technology and their industrial applications in Food Processing: Microfiltration, ultrafiltration, nano filtration, reverse osmosis. Principle and equipment involved	7	1,2,4
	3.2	Principle, application, advantages and disadvantages of super critical fluid Extraction (SCFE) process. Types of super critical fluids and their properties, methods of extraction. Applications in food processing sector	8	1,2,4

4-Postharvest Management of Oilseeds	4.1	Concept and applications of nanotechnology in food processing, its semblance and contribution in food industry along with advantages and limitations	8	1,3
	4.2	Significance of Nano particles, Nano composites, Nano emulsions, Nano structured materials and Nano sensors and their applications in Food Processing Sector.	7	1,3
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

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1. Girdhari Lal, Siddhapa and Tondon, Preservation of Fruits and Vegetables, ICAR, NewDelhi.
2. S. Ranganna, Hand Book of Analysis and Quality Control of Fruits & Vegetable Products Tata McGraw Hill, New Delhi.

3. Wood Roof & Lue, Commercial Vegetable Processing.
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5. A.Chakraverthy, Post-harvest Technology of cereals, pulses and oil seeds, third edition.
6. B.O. Juliano, Rice Chemistry and Technology.
7. G.Fabriani and C. Lintas, Durum Wheat Chemistry and Technology.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD EXTRUSION TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG5DSEFTQ305**					
Course Level	**300-399**					
Course Summary	This course explores the principles, processes, and applications of food extrusion technology.					
Semester	**5**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand basic fundamentals, design considerations, processing of different extruded products and selection of food extrusion equipments	**U**	1,10
2	To utilize suitability of raw materials, preconditioning, process variables and extruder types for extrusion and its impact on extrusion process, rheological behaviour and product quality	**A**	1, 2
3	To analyse chemical and nutritional changes occurring in extrusion process and packaging requirement of extruded products	**An**	1,2,6,10
4	To assess recent trends and future aspects of food extrusion	**E**	2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction	1.1	Food Extrusion: Definition, Introduction to extruders, principles and types, Uses of extruders in the food industry	7	1
	1.2	Pre-conditioning of raw materials used in extrusion process, extruderselection, design, and operation for different food applications	8	1
2-Twin screw extruder	2.1	Single screw extruder: Principle of working, net flow, operations, manufacturing of pasta and vermicelli	6	2
	2.2	Twin screw extruder: Counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder	6	2
	2.3	Rheological properties of materials during the extrusion process, Advantages of twin screw extruder	6	2
3- Effect of extrusion on food products	3.1	Chemical and textural changes in food during extrusion	4	3
	3.2	Classification of breakfast cereals:Raw materials, process and quality testing for Ready to eat breakfast cereals	8	3
4-Recent Advances in extrusion technology	4.1	Carbon dioxide or nitrogen assisted extrusion technology,	7	4
	4.2	Extrusion in confectionary technology, Non-thermal Extrusion of Protein Products	8	4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. S. Matza, Extruded foods, Springer
2. N.D. Frame, Technology of Extrusion Cooking, Springer
3. Riaz M.N., Extruders in Food Application, CRC Press
4. J.M. Harper, Extrusion of Foods, CRC Press
5. Maskan and Altan, Advances in Food Extrusion Technology, CRC Press

SEC

(SKILL-ENHANCEMENT COURSE)

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD PRODUCT DEVELOPMENT**					
Type of Course	**SEC**					
Course Code	**MG5SECFTQ300**					
Course Level	**300-399**					
Course Summary	This course provides a comprehensive overview of the food product development process, focusing on the key stages involved in bringing new food products to market.					
Semester	**5**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	**45**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To Illustrate the need for food product development and factors affecting food product development	**U**	1,4
2	To identify the marketing characteristics of new product	**A**	2,4
3	To analyse the different stages/phases involved in food product development	**An**	1,2,

4	To judge the recipe development for food processing	**E**	2,4
5	To estimate various marketing strategies for a new product developed.	**E**	1,2
6	To develop a new product and analyse its nutrient composition, sensory properties and shelf life	**C**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to Product Development	1.1	Definition and need for product development, factors affecting food product development – corporate factors, market factors, technological pressures, government issues and legislations. Classes and Characteristics of New Food Products.	6	1
	1.2	Marketing characteristics of new products-product life cycle and profit picture. Corporate avenues for growth and profitability, opportunities in the marketplace for new product development, technological advances driving new product development, government's role in new product development.	9	1
2-New Product development	2.1	Food product development process. Stages/ Phases of new product development – idea generation, screening, feasibility studies, consumer research, financial review, product design and formulation. Process development – recipe development and scale-up, consumer trials and market testing. Quality Assessment of New	7	1,3,4

		Developed Products – sensory evaluation, chemical and microbiological assessment		
	2.2	Recipe development; use of traditional recipe and modification; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.	8	1,3,4
3-Development process, Design and Product Marketing	3.1	Process and equipment design; manufacturing protocol, establishing process parameters for optimum quality; sensory evaluation; food testing lab requirements; different techniques and tests; statistical quality control; comparison of market samples; stages of the integration of market and sensory analysis	4	3,4
	3.2	Product stability, evaluation of shelf life, changes in sensory attributes and effects of environmental conditions, accelerated shelf life determination, developing packaging systems for maximum stability and cost effectiveness, regulatory aspects, approval for proprietary product, food safety management system and quality audits for a food product, regulatory aspects of FSSAI for a food product.	5	3,4
	3.3	Product performance testing, market positioning Marketing: developing test market strategies, various tools and methodologies to evaluate consumer attitudes, preferences and market acceptance factors, case studies - successes and failures, innovation, best	3	2,5

		Practice, technological and marketing approaches to NPD; food choice models and new product trends.		
	3.4	International trade. Salient Features of International Marketing. International Marketing Environment. Export Regulation – direct, indirect licensing and joint ventures. Product Promotion and Pricing, Distribution Channels. World Trade Organization (WTO)	3	2,5
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers
	B. Semester End examination Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

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1. Jacqueline H. Beckley, M. Michele Foley Elizabeth J. Topp & J. C. Huang Witoon Prinyawiwatkul (2007). Accelerating New Food Product Design and Development. Blackwell Publishing Company. IFT Press. USA.

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SEMESTER 6

MGU-UGP (HONOURS)

Syllabus

DSC- A

MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**DAIRY TECHNOLOGY**					
Type of Course	**DSC A - MAJOR**					
Course Code	**MG6DSCFTQ300**					
Course Level	**300-399**					
Course Summary	This course is designed to provide students with an in-depth understanding of the principles, processes, and technologies involved in the production and processing of dairy products.					
Semester	**6**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the composition and physico-chemical of milk	**U**	1,4
2	To identify the steps involved in manufacture of milk and milk products	**A**	1,2
3	To analyse the defects in cream and butter	**Ap**	2,4
4	To assess the manufacture of cheese and ice cream	**A**	2,4
5	To develop different methods for the preparation of various milk products	**U**	4,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S),Interest (I) and Appreciation (Ap)

COURSE CONTENT
Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction and operation of milk processing	1.1	Definition, different sources of milk and their composition, factors affecting composition of milk,nutritive value, Physico-chemical properties of milk constituents.	5	1,2
	1.2	Operation of milk processing- clarification, pasteurization and homogenization	5	3
2-Special Milk and concentrated dairy products	2.1	Sterilized milk, Homogenized milk, Flavored milk, frozen concentrated milk, Reconstituted milk, Recombined milk, Toned milk, double toned milk, Vitaminized/ Irradiated milk.	8	5
	2.2	Condensed and Evaporated Milk - Introduction, definition, composition, nutritive value, method of manufacture, defects and uses of condensed and evaporated milk	7	5
3-Important dairy products	3.1	Butter- definition, classification, composition and nutritive value, method of manufacture, packaging and storage Uses of butter and its defects Cream- definition, classification, composition, manufacture of cream, packaging and storage Uses of cream and its defects.	5	4

	3.2	Ice-cream- Definition, composition and nutritive value, role of constituents, method of manufacture and storage Uses of ice-cream, defects in ice-cream Cheese: Introduction, definition, classification, composition and nutritive value Manufacture of cheddar cheese, cottage cheese defects in cheese, their causes and prevention, uses of cheese.	5	6
	3.3	**Concentrated whole milk products** Kheer/Basundi, khoa/mawa, Rabri and kulfi-Definition, chemical composition, standardized method of preparation and uses **Coagulated milk products** Dahi(curd/yoghurt), srikhand, paneer, chhana-Definition, composition, method of preparation and uses	5	8
	3.4	Dried whole milk-Definition, standards-FSSAI 2006, composition and nutritive value, packaging and storage Dried skim milk- Definition, standards-PFA, composition and nutritive value, packaging and storage	5	7

4-Practicals	4.1	1. Determination of titrable acidity in milk 2. Detection of preservatives and adulterants in milk 3) Phosphatase Test 4) Preparation of peda 5) Preparation of burfi 6) Preparation of paneer 7) Preparation of rasmalai 8) Preparation of khoa 9) Preparation of rasgulla 10) Preparation of Gulabjamun 11) Preparation of Lassi 12) Preparation of flavoured milk 13) Preparation of Whey drink 14) Preparation of Icecream 15) Preparation of kulfi	20	8
	4.2	Determination of quality parameters of selected dairy products-Sensory evaluation, chemical analysis and microbial analysis Visit to dairy plant	10	8
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Practicals
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers/Book Review Practical:15 Marks Lab Involvement/Lab Test/Viva
	B. Semester End examination

	Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

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3. Potter, N. N, Hotchkiss, J. H. 2000, Food Science. CBS Publishers, New Delhi.
4. Spreer E and Mixa, A; 2005, Milk and Dairy Product Technology; Marcel Dekker.
5. Srilakshmi, B. 2003, Food Science (3rd edition), New Age International (P) LimitedPublishers, New Delhi.
6. Sukumar De, 2001, Outlines of dairy technology; Oxford University Press.
7. Walstra A, Geurts T.J and Noomen, A 2005, Dairy Technology – Principles of milk and Properties and Processes; Marcel Dekker.

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1. Hilton Deeth and Phil Kelly.2020, Processing and Technology of Dairy Products. MDPI,ISBN 978-3-03928-689-8.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**TECHNOLOGY OF FRUITS AND VEGETABLES**					
Type of Course	**DSC A**					
Course Code	**MG6DSCFTQ301**					
Course Level	**300-399**					
Course Summary	This course covers various aspects related to the production, processing, preservation, and quality control of fruits and vegetables.					
Semester	**6**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To summarise the production and processing scenario and also the scope of fruits and vegetables in India and world	**U**	4,6
2	To outline the classification, nutritive value, pigments, flavour and bitter components in fruits	**U**	1,4
3	To identify the changes during ripening, maturity indices and its importance	**A**	2,4
4	To examine the post-harvest operations and losses in fruits and vegetables	**An**	1,2
5	To explain the methods of storage in fruits and vegetables	**E**	2,4

6	To build a perspective on the minimal processing technologies in fruits and vegetables	**C**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to fruits	1.1	Production and processing scenario of fruits and vegetables in India and world, Scope of fruit and vegetable processing industry in India Definition, classification of fruits, nutritive value, pigments in fruits, flavour and bitter components in fruits, health benefits in fruits, anti-nutritional factors	7	1,3
	1.2	Stability of nutrients – chemical changes, flavor changes, changes in nutritive value (Physical, chemical and biological changes) Primary and secondary factors, Control of post-harvest losses. Freezing injury, chilling injury and heat injury	8	4,5
2-Maturity, ripening and harvesting of fruits and vegetables	2.1	Ripening – Changes during ripening Maturity indices and its importance, determination of harvest maturity indices – Computational methods, physical methods, chemical methods and physiological methods. Harvesting of fruits and vegetable- manual and mechanical methods and mode of transportation	8	2

	2.2	Post-harvest operations– reception, drenching, washing, cleaning, pre-cooling, trimming, presorting, sorting/ grading, waxing, physical treatments, chemical treatments, packaging and labeling	7	5
3-Storage methods and processing of fruits and vegetables	3.1	Factors affecting storage, methods of storage – Traditional storage (on site storage, pit storage, high altitude storage, clamp storage, under-ground storage and evaporative cool storage) and improved storage methods (MAP, CAP, active packaging, Vacuum packaging and hypobaric storage)	10	6
	3.2	Processing of fruits and vegetables Peeling, slicing/ dicing, blanching and nutritional quality of blanched food, Canning of fruits and vegetables	5	8
4- Practicum	4.1	1. Determination of acidity in juice 2.Determination of TSS by gravimetric and refractometer 3.Preparation of squash, fruit juices, crushes and cordials –standards and processing 4. Preparation of jam, Jellies and maramalades-Different test for judging the end point-TSS by refractometer, sheet test, drop test	15	8
	4.2	5. Preparation of candied, glazed and crystallised fruits-standards and processing 6. Preparation of fruit pickles-standards and processing 7. Preparation of tomato products-juice, purees, ketchup and sauce-standards and processing 8.Osmotic dehydration of fruits and vegetables by using sugar and salt	15	8
5		Teacher Specific Content		
Teaching and Learning	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning			

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers/Book Review Practical:15 Marks Lab Involvement/Lab Test/Viva

Assessment Types	**B. Semester End examination** Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

REFERENCES

1. Sudheer, K. P., & Indira, V. (2007). Post-harvest technology of horticultural crops (Vol. 7). New India Publishing.
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5. Desrosier, N. W., & Desrosier, J. N. (1977). The technology of food preservation (No. Ed. 4). AVI Publishing Company, Inc...

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1. Jongen, W. (Ed.). (2002). Fruit and vegetable processing: improving quality. Elsevier.
2. Sinha, N. K., Sidhu, J., Barta, J., Wu, J., & Cano, M. P. (Eds.). (2012). Handbook of fruits and fruit processing. John Wiley & Sons.
3. Siddiq, M., Ahmed, J., Lobo, M. G., & Ozadali, F. (Eds.). (2012). Tropical and subtropical fruits: postharvest physiology, processing and packaging. John Wiley & Sons.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**LEGUMES AND OILSEEDS TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG6DSEFTQ300**					
Course Level	**300-399**					
Course Summary	This course covers various aspects related to the cultivation, processing, and utilization of legumes and oilseeds.					
Semester	**6**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To Illustrate the structure composition and nutritive value of pulses and oilseeds	**U**	1,10
2	To identify the characteristics of Quick cooking legumes, instant legume powders and legume protein concentrates	**A**	1,4
3	To examine the treatment and processing of the grain from cereal and legume	**An**	1,2
4	To assess different milling process used in the processing of pulses and processing techniques of RTE food	**E**	1,2
5	To explain the processing of edible oil and properties of fats and oils	**E**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Technology of pulses	1.1	Chemical composition and nutritive value of important pulses (ground nut, soya bean, black gram, Bengal gram). Decortications of pulses – soaking, pounding, grinding, roasting, toasting, parching, milling of pulses and puffing	8	1
	1.2	Byproducts of milling - protein isolates Storage and infestation, Role of pulses in cookery.	7	6,7
2-Legumes	2.1	Present status and future prospects of legumes; Morphology of legumes; Classification and types of legumes. Chemical composition and nutritional value; Anti-nutritional compounds in legumes; Methods of removal of anti-nutritional compounds.	9	1
	2.2	Quick cooking legumes, instant legume powders and legume protein concentrates Roasted , germinated, fermented and canned legume products	6	1,2,4
3-Nuts and oilseeds	3.1	Chemical composition and nutritive value of oilseeds, processing of edible oil–rendering, pressing, and solvent extraction.	7	1,6
	3.2	Methods of oil refining – deodorization, hydrogenation, winterization, randomization andinter-esterification. Role of nuts and oilseeds in cookery, Toxins	8	1,3,8
4-Fats and oils	4.1	Composition and nutritive value, Refining and processing of fats,Specific fats and oils, emulsions, rancidity	7	1,5,6
	4.2	Functional properties of fats and oils, Effect of heating, Trans fat, Role of fat or oil in cookery, Unconventional oils, fat substitutes.	8	1,5

5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

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1. Chakraverty A. 1988, Post-harvest technology of cereals: pulses and oilseeds, Oxford & IGBH publishing company.
2. Pandy, P.H, 2000, principles and practices of postharvest technology. kalyani publishers, Madras;
3. Bailey A.E. and Shahidi F. 2005, Bailey's Industrial Oil & Fat Products, Wiley Publication,

SUGGESTED READINGS

1. Basra A., 2006, Handbook of Seed Science and Technology, CRC Press.

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**SNACK FOOD TECHNOLOGY**					
Type of Course	**DSE**					
Course Code	**MG6DSEFTQ301**					
Course Level	**300-399**					
Course Summary	This course in Snack Food Technology provides participants with a comprehensive understanding of the principles and practices involved in the production and development of snack foods					
Semester	**6**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the basic concepts of snack food technology	**U**	1,10
2	To Analyse different types of snacks in food industry	**An**	1,10
3	To examine different equipment's used for preparation of snack food	**An**	1,2,
4	To determine the different processes involved in production of snack food	**E**	1,2,
5	To evaluate the different types of packaging materials used for snack food.	**E**	1,2,

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Snack Foods	1.1	Introduction, the major types of snack foods	5	1
	1.2	Ingredients -Cereal products, fats, oils, emulsifiers, antioxidants, sweeteners, dairy products, salt, water, nuts and fruits, vegetable ingredients, flavors and colours.	6	1,2
2-Products and processes	2.1	Potato chip - potato chips processing, quality factors , storage stability	5	1,2
	2.2	Snacks based on popcorn-popping procedure, caramel corn and other formulated popcorn snacks	5	2
	2.3	Baked snacks; salty -savory baked snacks, sweet baked snacks	5	2
	2.4	Meat based snacks,nut based snacks, puffed snacks	5	2,4
3-Snack food seasonings	3.1	Breakfast cereals, extruded products - macaroni products and malts: Specifications, compositions, ingredients, formulations, processing, equipment, packaging, storage and quality testing.	8	2,3
4-Processing Techniques and packaging of snack food	4.1	Extrusion, Extruders, Functions, Operation	5	3
	4.2	Frying-Fryers, Baking-Principle, Baked Foods, Baking Equipment	5	3
	4.3	Roasting-principles of roasting, roasting equipment, Drying -drying equipment	5	3
	4.4	Packaging materials used for snack foods, packaging equipment's-folding cartons, performed pouches, form- fill-seal equipment	6	3,5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 - Lecturing and ICT Enabled Learning Module 2 - Lecturing and ICT Enabled Learning Module 3 - Lecturing and ICT Enabled Learning Module 4 - Lecturing and ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1 NIIR Board of Consultants & Engineers. 2014. The Complete Technology Book on Bakery Products (Baking Science with Formulation & Production), 3rd Ed. NIIR, New Delhi.

2 Peter P. Grewling. 2013. Chocolates & Confections, 2nd Ed. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.

3 E.J. Pyler and L.A. Gorton. 2009. Baking Science & Technology, Vol. II: Formulation & Production, 4th Ed. Sosland Publishing Company, Kansas City, MO, USA.

4 Samuel.A.Matz, snack food technology 2nd edition, avi publishing company, INC Westport, connecticut.

5 Panda H, Booth RG, 1999, Snack, Food Springer.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD PLANT SANITATION**					
Type of Course	**DSE**					
Course Code	**MG6DSEFTQ302**					
Course Level	**300-399**					
Course Summary	This course is designed to provide students with a comprehensive understanding of the principles and practices related to sanitation in food processing plants.					
Semester	**6**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To Illustrate the importance of sanitation, personal hygiene and requirement of hygiene practices in food industry	**U**	1,4
2	To outline the role of sanitizers and cleaning compounds	**U**	1,4
3	To compare the working of sanitation equipment's in food industry	**An**	2,4
4	To examine various pests involved in food industry and how to manage these pests	**An**	2,6

5	To determine the sanitary design, construction and methods of sanitation involved in various food industry	**E**	1,2
6	To design the sanitary methods and procedures in a particular industrial plant	**C**	2,4

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to sanitation	1.1	Sanitation-Definition, biofilms, transfer of contamination-chain of infection, contamination of foods, other contamination sources, protection against contamination	5	1
	1.2	Personal hygiene-Employee hygiene, different body parts of human as source of contamination, personal contamination of food products, hand washing, methods of disease transmission	5	1
	1.3	Requirement of hygiene practices Sanitary food handling-role of employees, personal hygiene, facilities, employee supervision, employee responsibilities	5	1
2-Cleaning compounds and Sanitizers	2.1	Soil characteristics, effect of surfaces on soil deposition Soil removal-role of cleaning media, cleaning compound characteristics, factors affecting cleaning performance,cleaning terminology, classification of cleaning compounds, cleaningauxilaries- sequestrants, surfactants, scouring compounds, selection of a	5	2

		cleaning compound, handling and storage precautions		
	2.2	Sanitizers Sanitizers and disinfectant, Methods of sanitation-thermal, steam, hot water, radiation, HHP, VACuum, chemical sanitizing- desired sanitizer properties, physio-chemical properties, Types- chlorine compounds, iodine compounds, bromine compounds, quaternary ammonium compounds, acidsanitizers, peroxy acid sanitizers, acid anionic sanitizers, acid quat sanitizer, hydrogen peroxide, ozone, glutaraldehyde	5	2, 3
	2.3	Sanitation Equipment Cleaning equipment, CIP, COP- procedures, advantages and disadvantages	2	2,3
3-Pest Control	3.1	Insect Infestation Cockroaches- species, detection andcontrol Housefly-characteristics, control and prevention Fruit flies-characteristics and control Insect destruction-pesticides-residualand non-residual, Fumigants, Mechanical methods-Insect light traps, sticky traps, pheremone traps, Trap placement and Monitoring	4	4
	3.2	Rodents & Birds Rats and Mice-Characteristics,Determination of infection, control, Prevention of entry, Elimination of rodent shelters and food sources, Eradication methods-Poisoning,	3	4

		Trapping, Tracking powder, Gassing, Ultrasonic devices Birds-characteristics and control		
	3.3	Integrated pest Management (IPM) Inspection, housekeeping, physical and mechanical methods and chemical methods Use of pesticides	3	4
4-Sanitary design and construction for food Processing	4.1	Site selection and preparation, Building construction consideration-Walls,Loading doc, roofs, windows, doors, ceilings, floors, processing and design considerations- Design practices to prevent pest Infestation	4	5
	4.2	Equipment design for ready-to-eat Processing Operations, pest control design, renovation considerations and construction materials	3	5
	4.3	Sanitation in various Food ProcessingPlants- 1. Dairy processing plant Sanitary considerations, soil characteristics, cleaning steps, cleaning equipment- CIP and COP 2. Meat and poultry sanitation Effect of product decolouration, pathogen control, layout and plant design, process control, operation and sanitation practices Sea food plant sanitation Sanitary construction considerations, Contamination sources, sanitation principles, recovery of by-products	8	5

	4.4	Sanitation in various Food Processing Plants-II Fruit and vegetable processing plant sanitation Sanitary construction considerations, contamination sources, sanitation principles, cleaning considerations and procedures Beverage sanitation sanitation principles, cleaning considerations and procedures Non-alcoholic beverage plant sanitation, Brewery sanitation, winery sanitation, Distillery sanitation	8	5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination
	Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Marriott, Norman (2013), “Principles of Food Sanitation”, Springer Science & Business Media Publishing.
2. Roday S, (2011) (2002), “Food Hygiene and Sanitation”, McGraw Hill Publishing Company Limited.
3. H.L.M. Lelieveld, John Holah, David Napper, (2014), “Hygiene in Food Processing: Principles and Practice”, Elsevier Publications.

SEC

(SKILL-ENHANCEMENT COURSE)

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**TECHNOLOGY OF CHOCOLATE AND CONFECTIONARY**					
Type of Course	**SEC**					
Course Code	**MG6SECFTQ300**					
Course Level	**300-399**					
Course Summary	This course covers the fundamental aspects of both plant and animal-based food products, exploring various topics related to production, processing, quality control, nutritional aspects, and market trends.					
Semester	**6**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	-	1	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the knowledge of cocoa processing and chocolate manufacturing Technology.	**U**	1,10
2	To outline the chemistry of flavor development during processing	**U**	1,2,10
3	To assess the preparation of sugar confectionary products.	**E**	1,2,10
4	To formulate methods for production of different types chocolate and confectionery	**C**	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1 – Cocoa Processing and chocolate manufacture	1.1	Cocoa-Introduction, cocoa processing and technology – bean selelction and quality criteria, cleaning, breaking and winnowing, sterilization, alkalization, roasting, nib grinding and liquor treatment, liquor pressing, cake grinding, cocoa powder production.	5	1
	1.2	Chocolate manufacturing processes Mixing, refining, conching – dry conching, pastry phase, liquid conching, tempering, lipid crystallization and continuous phase character during chocolate, particle distribution in chocolate. Chocolate defects – fat bloom, sugar bloom	5	1
	1.3	Chemistry of flavor development during processing Introduction, influence of bean selection on chocolate flavour quality, effect of roasting , flavour development during chocolate manufacture, key flavour compounds in milk chocolate, key flavour compounds in dark chocolate. Sensory perception of quality in chocolates.	5	2
2-Confectionery	2.1	Confectionery- Definition, importance of sugar confectionery. Types of confectioneries, classification; basic technical consideration of confectionery-TSS-pH-Acidity; Raw materials-types of sugar-role of sugar, alternative bulk sweeteners, syrup production, enzymes used, additives used. Quality parameters, faults and corrective measures. Spoilage of confectionery products. Optimization of ingredients for different types of bread, toffees and sugar boiled confectionary	5	3
	2.2	Hard candy Introduction, formulations and ingredients, processing – typical process steps, other hard candy technologies. Product characteristics – chemical changes, microstructure, stability / shelf life.	4	2
	2.3	Fondants and Creams Introduction, formulation and ingredients, manufacturing – fondant, powdered	3	3

		fondant, creams. Product characteristics, potential problems and trouble shooting.		
	2.4	Caramel, Fudge and Toffee Introduction, formulations and ingredients – sweeteners, dairy ingredients, fats, emulsifiers, hydrocolloids, salts, flavors, colors. Processing – Mixing & Emulsification, Cooking and browning, Cooling and forming. Product characteristics, Trouble shooting.	3	3
3– Practicum	3.1	1. Preparation of toffees. 2. Preparation of caramel 3. Preparation of sugar boiled confectionary. 4. Preparation of chocolates (milk and dark), fruit drops. 5. Determination of chocolate melting point	15	4
	3.2	6. Preparation of Chocolate caramel cookies 7. Preparation of Chocolate Desserts 8. Preparation of fruit toffees, candies and preserve Analysis of protein, fat, and calcium in chocolate	15	4
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1-Lecturing, ICT Enabled Learning Module 2- Lecturing, ICT Enabled Learning Module 3- Practicals

	MODE OF ASSESSMENT **A. Continuous Comprehensive Assessment (CCA)** Theory:15 Marks MCQ/Assignments/Seminars/Test Papers Practical:15 Marks

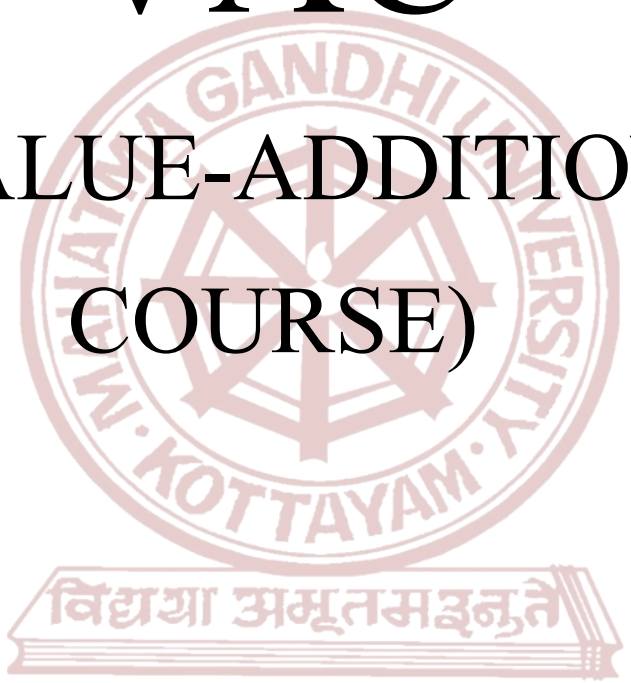
Assessment Types	Lab Involvement/Lab Test/Viva/Book Review
	B. Semester End examination Theory: 35 Marks Short Answers (5 out of 7; 5x1=5 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (1 out of 3; 1x10=10 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

REFERENCES

1. Emmanuel., Chocolate science and technology, Wiley, 2010
2. Shanmugavelu KG, Kumar N, 2018, Production Technology of Spices and Plantation Crops, 1st Edition, Peter KV Publisher: Agrobios India.
3. Jackson E.B., 1992, Sugar confectionery and chocolate manufacture, Blackie Academic & Professional.
4. Hartel.W. 2018, Confectionery science and technology, Springer.

VAC

(VALUE-ADDITION COURSE)



MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**ENVIRONMENTAL STUDIES**					
Type of Course	**VAC**					
Course Code	**MG6VACFTQ300**					
Course Level	**300-399**					
Course Summary	The Environmental Studies course is designed to provide students with a comprehensive understanding of the interrelationships between humans and the environment.					
Semester	**6**	Credits			**3**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	-	**45**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the importance of biosphere and life sustaining process on earth	U	1,10
2	To identify the differences in the structure and functions of different types of ecosystem.	A	1,2,
3	To analyse the important land, water and energy resources in nature	An	1,2
4	To assess the major concepts and terminology in the field of environmental pollutants, its interconnections and direct damage to the wildlife, in addition to human communities and ecosystem.	E	1,4
5	To evaluate the consequences of human actions on the web life, global economy and quality of human life.	E	2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill

(S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to Environmental Studies	1.1	Multidisciplinary nature of environmental studies; components of environment: Atmosphere, hydrosphere, lithosphere and biosphere.	3	1
	1.2	Scope and importance; Concept of sustainability and sustainable development; Brief history of environmentalism.	2	1
2-Ecosystems and Natural Resources	2.1	Definition and concept of ecosystem Structure of ecosystem (biotic and abiotic components Functions of ecosystem :Physical (energy flow) Biological (food chains, food web, ecological succession), and Biogeochemical (nutrient cycling) processes Concepts of productivity, ecological pyramids and homeostasis	5	1,2
	2.2	Types of ecosystems: Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries); importance and threats with relevant examples from India.	5	1,2
	2.3	Land resources: Minerals, soil, agricultural crops, natural forest products, medicinal plants and forest based industries and livelihoods; land degradation, soil erosion and desertification; causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal communities.	5	3
		Water resources: Natural and man-made sources, use of water, over		

	2.4	exploitation of surface and ground water resources: floods, droughts and international and interstate conflicts over water.	3	3
	2.5	Energy resources: Renewable and non-renewable energy sources; use of alternate energy sources; Energy contents of coal, petroleum, natural gas and biogas, Agro – residues as a biomass energy source	3	3
	2.6	Case studies: Contemporary Indian issues related to mining, dams, forests, energy (National Solar Mission, Cauvery river water conflict, Sardar sarovar dam Chipko movement, Appiko movement)	4	3
3-Environmental Pollution	3.1	Environmental pollution: Air, water, soil, thermal and noise): causes, effects and controls: primary and secondary air pollutants: Air and water quality Standards	5	4
	3.2	Nuclear hazards and human health risks.	2	4
	3.3	Solid waste management: Control measures for various types of urban, industrial waste, hazardous waste, E-waste etc.: waste segregation and disposal.	5	4
	3.4	Pollution case studies: Ganga Action Plan (GAP), Delhi air pollution and public health issues, plastic waste management rules, Bhopal gas tragedy etc.	3	4
4		Teacher Specific Content		
Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1-Lecturing, ICT Enabled Learning Module 2- Lecturing, ICT Enabled Learning			

	Module 3- Lecturing, ICT Enabled Learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers
	B. Semester End examination Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y., and Berg, L.R. (2015). Environment, 8th Edition. Wiley Publishing, USA.
2. Singh, J.S., Singh, S.P., and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
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5. McCully, P. (1996). Rivers no more: the environmental effects of dams, In: Silenced Rivers: The Ecology and Politics of Large Dams, Zed Books, New York, USA.
6. Brusseau, M.L., Pepper, I.L. and Gerba, C.P. (2019). Environmental and Pollution Science, 3rd Edition. Academic Press, USA.
7. Carson, R. (2002). Silent Spring. Houghton Mifflin Harcourt, USA. 12. Raven, P.H, Hassenzahl, D.M., Hager, M.C, Gift, N.Y. and Berg, L.R. (2015). Environment, 9th Edition. Wiley Publishing, USA.

SUGGESTED READING

1. E-Book for environmental studies

SEMESTER 7

DCC

MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD QUALITY ASSURANCE & MANAGEMENT**					
Type of Course	**DCC**					
Course Code	**MG7DCCFTQ400**					
Course Level	**400-499**					
Course Summary	This course is designed to provide students with a comprehensive understanding of food quality assurance and management principles.					
Semester	**7**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To compare quality control and quality assurance	**U**	1,4
2	To identify the hazards and risk analysis in food industry	**A**	1,2
3	To analyse the tools of total quality management and its application in food industry	**An**	1,2,
4	To examine the critical control points in food processing industry	**An**	1.6,
5	To assess food quality management system to be adopted in food industry	**E**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit s	Course description	Hrs.	CO No.
1-Concepts of Quality control, Quality Assurance and Total Quality Management	1.1	Introduction to food safety, quality Control and quality assurance Comparison between quality control and assurance, Current challenges to food safety. Risk Analysis-Risk assessment, Risk management and communication Hazards: definition, classification: physical, chemical & biological, Biological- Pathogenic bacteria, Viruses, protozoa; Chemical: Naturally occurring toxins and added chemical hazards; Physical hazards: Glass,wood, stones, metal fragments etc. their tolerance & control.	7	1,2
	1.2	Total Quality management: Principles Leadership, Customer satisfaction, Employee Involvement, Continuous Process Improvement, Supplier Partnership, Performance Measures. Total Quality management:Practices5S Principles, Kaizen, PDSA cycle	3	3
		Strategic Tools for TQM		

	1.3	Benchmarking, Six sigma Statistical Quality Control: Definition, Seven tools for SQC- Flow chart, Check sheet, Fishbone diagram, Pareto charts, Histogram, Runcharts &Control chart – definition, use, Quality by Design, Failure Mode & Effect Analysis	3	3
	1.4	The new seven tools of TQM Affinity Diagram [KJ method] Interrelationship diagram, Tree diagram, Prioritization matrix, Matrix diagram or quality table, Process decision program chart, Activity network diagram	2	3
2-Food safety Practices	2.1	Pre-requisite Programs Establishment-Design and facilities, Control of operation, Maintenance and sanitation, Personal hygiene, product information and consumer awareness, Training and management, Audit, Documentation and Record keeping	6	4
	2.2	HACCP History, Background and Structure of HACCP HACCP Prerequisites and Good Hygienic Practices Principles and Implementation of HACCP Case Studies on HACCP	6	4

	2.3	Other Food Safety Practices Good Agriculture Practices, Good Animal Husbandry Practices and Good Manufacturing Practices Good retail practices, good transport practices and nutrition labeling traceability studies	3	4
3-Food and Quality Management Systems	3.1	Management systems, auditing and accreditation Introduction to Management Systems Auditing Standardization and Accreditation	2	4
	3.2	**Quality Management Systems** ISO-9001:2015 - An Overview ISO-9001:2015 – Structure Clause wise Interpretation of ISO 9001:2015 ISO 9001:2015- Case Studies	3	4
	3.3	Food Safety Management Systems ISO 22000:2018 - An overview Clause Wise Interpretation of ISO 22000 ISO 22000:2018 - Food Safety Plan ISO 22000:2018 - Case Studies Laboratory Quality Management System An Overview and Requirements of ISO 17025 Requirements Specific to Food Testing Laboratories - Physical and Chemical Parameters	5	4

	3.4	Requirements Specific to Food Testing Laboratories - Biological Parameters Retailer Standards BRC Food and BRC/IOP Standards - An Overview International Food Standard (IFS) SQF 1000 and SQF 2000 Global GAP and India GAP	5	4
4-Practicum	4.1	1. Developing GHP and GMP in a Food Factory A. Identifying Key focus areas for GHP and GMP B. Identifying Gaps and closure plans for identified Gaps	10	5,6
	4.2	2. Development of ISO 22000 for a Food establishment. 3. Developing FSMS in a Food establishment A. Data collection and Hazard Identification B. Hazard Analysis C. Development of HACCP plan D. Monitoring and Corrective measures E. Verification and validation	10	5,6
	4.3	4. Application of ISO 9001 Model in any food industry A. Understanding process approach B. Defining quality policy and objectives C. Correction, Corrective action and Preventive action D. Continual Improvement	10	5,6
5		Teacher Specific Content		
Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1-Lecturing, ICT Enabled Learning Module 2- Lecturing, ICT Enabled Learning			

	Module 3- Lecturing, ICT Enabled Learning Module 4- Practicals
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:25 Marks MCQ/Assignments/Seminars/Test Papers Practical:15 Marks Lab Involvement/Lab Test/Viva
	B. Semester End examination Theory: 50 Marks Short Answers (5 out of 7; 5x2=10 Marks) Short Essay (5 out of 7; 5x4=20 Marks) Long Essay (2 out of 4; 2x10=20 Marks) Practical: 35 Marks Lab Examination-25 Marks Viva Voce-5 Marks Record-5 Marks

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1. Wilbur A. Gould, Ronald W. Gould (2001) Total quality assurance for the food industries. 3rd Edition, CTI Publication Inc, Maryland, USA
2. Besterfield DH, C Besterfield-Michna, Besterfield GH, M Besterfield-Sacre (2007) Total Quality Management, 3rd Edition, Pearson Education Inc.
3. Rekha S. Singhal, Pushpa R. Kulkarni, Dinanath V. Rege (1997) Handbook of Indices of Food Quality and Authenticity, 2nd Edition, Woodhead Publishing Ltd, England.
4. Clive De W. Blackburn and Peter J. Mcclury (2002) Foodborne pathogens-Hazards, Risk analysis and control, Woodhead publishing, Ltd, England.
5. James M. Jay, Martin J. Loessner, David A. Golden (2005) Modern Food microbiology, 7th Edition, Springer.
6. J Andres Vasconcellos (2004) Quality Assurance for the Food Industry: A Practical Approach, CRC Press.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD LAWS AND REGULATION**					
Type of Course	**DCC**					
Course Code	**MG7DCCFTQ401**					
Course Level	**400-499**					
Course Summary	This course provides a comprehensive examination of the legal frameworks and regulations governing the food industry.					
Semester	**7**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the legal frameworks and historical evolution of food regulations.	U	1,10
2	To outline the impact of major foodborne illness outbreaks on the development of food safety laws.	U	1,6
3	To apply the knowledge of food labeling and packaging regulations to select and develop labels of various food products.	A	1,6

4	To analyze the role of international organizations in setting global food standards and examine their impact on national regulations.	An	1,2
5	To evaluate information on environmental considerations and propose strategies for sustainable and ethical food production practices.	E	2,7

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit s	Course description	Hrs.	CO No.
1- Food Laws and Regulations	1.1	Overview of legal frameworks governing the food industry.	3	1
	1.2	Historical evolution of food regulations	2	1
	1.3	Global perspectives on food legislation	5	1
	1.4	Examination of laws and regulations focused on ensuring the safety of food products. Case studies on major foodborne illness outbreaks and regulatory response	5	2
2- Labelling and Packaging Regulations	2.1	Study of laws governing food labeling and packaging.	2	3
	2.2	Analysis of requirements for nutritional labeling and allergen disclosure	3	3
3-Quality Standards and International Trade Regulation	3.1	Understanding laws related to the quality standards and grading of food product.	5	4
	3.2	Evaluation of the impact of quality regulations on consumer choices. International Trade and Food Regulations	5	4
	3.3	Exploration of laws governing the international trade of food products	5	4
	3.4	Analysis of the role of international organizations in setting food standards	5	4

	4.1	Analysis of laws addressing the environmental impact of food production.	5	5
4- Environmental, Enforcement and Ethical Considerations	4.2	Examination of ethical considerations in food regulations.	5	5
	4.3	Enforcement and Compliance- Understanding the mechanisms of enforcement in food regulations.	5	5
	4.4	Case studies on compliance challenges and enforcement actions.	5	5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1-Lecturing, ICT Enabled Learning Module 2- Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Sanchez, M. (2016). Food law and regulation for non-lawyers. Springer International Pu.
2. Fortin, N.D. (2022). Food regulation: law, science, policy, and practice. John Wiley & Sons.
3. Fortin, N. D. (2017). Food regulation: law, science, policy, and practice.
4. Steier, G., & Patel, K. K. (Eds.). (2016). International food law and policy. Springer.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**WASTE MANAGEMENT IN FOOD INDUSTRY**					
Type of Course	**DCC**					
Course Code	**MG7DCCFTQ402**					
Course Level	**400-499**					
Course Summary	This course focuses on understanding and managing waste generated in the food industry and explores strategies for utilizing byproducts to minimize environmental impact.					
Semester	**7**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-		**60**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline the classification and characterization of food industrial waste	**U**	1, 4
2	To apply treatment methods for solid waste and liquid waste in food industry.	**A**	1,2
3	To examine environmental pollution by proper treatment of food waste.	**An**	1,2
4	To evaluate Industrial waste disposal methods and economical aspect.	**E**	1,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S),Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit s	Course description	Hrs.	CO No.
1-Waste utilization from rice mill industry	1.1	Waste from rice mill industry – waste based furnace-types, design Utilization of rice husk- cement preparation, ceramic materials	5	1,3,4
	1.2	Utilization of rice bran -problems in processing of rice bran stabilization-methods of utilization.	5	1,3,4
	1.3	rice bran stabilizers-extraction of rice bran-refining-uses of bran, bran oil and defatted bran	5	1,3,4
2-Fish and poultry waste utilization	2.1	Fish industry by products- methods and production of fish leather, fish skin and fish bone	9	1,3,4
	2.2	Fish protein concentrate-fish and body oils- poultry waste recycling.	6	1,3,4
3-Coconut and tuber crops waste utilization	3.1	Waste from Coconuts – uses of coir pith-biogas production-particle board utilization of husk-coir fiber- shell-methods for production of shell charcoal- fuel briquette-machineries used	10	1,3,4
	3.2	Tapioca waste utilization- furfural production methods-paper making from cellulosic waste	5	1,3,4
4- Waste Treatment and Byproduct Utilization	4.1	Waste Treatment Technologies- Biological treatment (composting, anaerobic digestion) Thermal treatment (incineration, pyrolysis) Chemical treatment methods	5	1,2,4
	4.2	Byproduct Utilization Strategies- Introduction to byproducts in the food industry Innovative approaches for byproduct utilization	5	1,2,4

	4.3	Case studies of successful byproduct utilization projects	5	1,2,4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, , ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Cheremisinoff, P. N., & Morresi, A. C. (1976). Energy from solid wastes. NASA STI/Recon Technical Report A, 77, 10698.
2. Nagar, R. V. M.Sc Food Science and Technology.
3. Beagle, E. C. (1978). Rice-husk conversion to energy.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**NUTRACEUTICALS AND FUNCTIONAL FOODS**					
Type of Course	**DCE**					
Course Code	**MG7DCEFTQ400**					
Course Level	**400-499**					
Course Summary	This course provides an introduction to the field of nutraceuticals and functional foods,exploring the relationship between food components and their potential health benefits.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	60
Pre- requisites,if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	To understand the basic concepts of neutraceuticals and functional food.	**U**	1,2,10
2	To illustrate the role of various nutraceuticals and functional foods towards managing chronic diseases	**U**	1,2,10
3	To identify the source of various neutraceuticals and functional foods	**A**	1,2,10
4	To analyse the importance of functional foods in promoting health and immunity	**An**	1,2,10
5	To determine the market trends, regulations and consumer preferences of functional foods and nutraceuticals	**E**	1,2,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1 – Nutraceuticals and Functional foods	1.1	Defining nutraceuticals and functional foods, Nature, type and scope	3	1
	1.2	Nutraceuticals and functional foods applications and their health benefits	3	1
	1.3	Classification based on chemical and biochemical nature with suitable and relevant descriptions	3	1
	1.4	Marketing and regulatory issues for functional foods and nutraceuticals Recent developments and advances in the area of nutraceuticals and functional foods Nutrigenomics- concepts and benefits Understand consumer preferences and attitudes towards these products.	6	1,2,3
2–Nutraceuticals in disease condition	2.1	Nutraceuticals for specific situation such as cancer, heart diseases, stress, osteoarthritis and hypertension	5	2
	2.2	Antioxidants and other phytochemicals, isoflavones, lycopenes, their role in nutraceuticals	5	2
	2.3	Dietary fibers and complex carbohydrates as functional food ingredients.	5	2
3- Role of functional foods	3.1	Protein as functional food ingredients Herbs as functional foods	2	3
	3.2	Functional role of Prebiotics, probiotics and symbiotic	5	3
	3.3	Health promoting activity of common herbs	3	3
	3.4	Cereal products as functional foods and its health concern- Oats, wheat bran, rice bran	5	3
4- Functional foods	4.1	Functional vegetable products, oil seeds and sea foods	5	3
	4.2	Coffee, tea and other beverages as functional foods/ drinks and their protective effects	5	3
	4.3	Effects of processing and storage and interaction of various environmental factors on the potential of such foods	5	1,2,3
5		Teacher Specific content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4 - Lecturing, ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1.Wildman, R. E., Wildman, R., & Wallace, T. C. (2016). Handbook of nutraceuticals and functional foods. CRC press.

2. Wildman, R. E., & Medeiros, D. M. (2000). Advanced human nutrition (p. 37). Boca Raton, FL: CRC press.

3.Shubhangini A. 2010, Joshi Nutrition and Dietetics, Tata McGraw – Hill Education.

4. Manay, N. S. O. (2001). Food: facts and principles. New Age International.

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**NANOTECHNOLOGY IN FOOD APPLICATION**					
Type ofCourse	**DCE**					
Course Code	**MG7DCEFTQ401**					
CourseLevel	**400-499**					
Course Summary	This course provides an in-depth exploration of the application of nanotechnology in the food industry.					
Semester	**7**	Credits			**4**	Total Hours
CourseDetails	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre-requisites, ifany						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the fundamental principles of nanotechnology	**U**	1, 10
2	To understand the synthetic principles of nanoparticles via biological methods	**U**	1, 10
3	To apply nanotechnological principles to design, formulate and appropriate prospective models in food industry	**A**	2,3
4	To analyse the impact of different nanotechnology based techniques on nutritional content, flavor, texture of food products	**An**	3,4
5	To evaluate the impact of different nanotechnology based packaging methods and products on sensory parameters of food products	**E**	2,4
6	To develop innovative nanotechnology based strategies considering sustainability, cost effectiveness and consumer preferences	**C**	2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create

(C), Skill (S),Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course Description	Hrs.	CO No.
1-Introduction to Nanotechnology	1.1	Introduction to Nanotechnology: Characteristic scale for quantum phenomena, nanoparticles, nano clusters, nanotubes, nanowires and nanodots.	5	1
	1.2	Nanobiotechnology: Nanoparticles conjugated nucleic acid and protein based recognition groups – application in optical detection methods.	5	1
	1.3	Nanoparticles as carrier for genetic material - nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.	5	1,3,8
2- Synthesis of nanoparticles	2.1	Biological synthesis of nanoparticles: Biosynthesis of Nanoparticles: Biomineralization -Microbial Nanoparticle production. Biofunctionalization of gold nanoparticles – phospholipids polymer nanoparticles – magnetic nanoparticles–metallic nanoparticle.	5	2
	2.2	Application of nanotechnology in food Science in brief: Nanosensors for microbial, chemical contaminants;		

		Foods incorporated with nanoscale antimicrobial compounds, antioxidants and flavors which would improve shelf-life or sensory characteristics such as flavor, odour.	5	3,4,8
3-Nano Ingredients, additives Nano-encapsulation and nano food processing	3.1	Nano materials for food applications-metal oxides, functionalized nanomaterials, nano additives.	5	8
	3.2	Importance of nanotechnology in food processing in terms of food texture, appearance and taste, nutritional value and shelf-life	5	8
	3.3	Nanoparticles as ingredients and additives in nutrients and food supplements.	5	8
	3.4	Encapsulation, Nano-encapsulation and release efficiency of nanoparticles, applications of nano-encapsulation in food industry.	5	5
4-Potential benefits, hazards, risks associated and regulations	4.1	Industrial benefits, consumer benefits, Detection and characterization of nanoparticles in food, potential hazards.	7	6,7
	4.2	ENP, health risks- toxins, metabolism action etc. Risk governance – principle. General regulations, safety aspects in different regions, Regulation aspects of nano scale food ingredients, additives, FCMS	8	6
5		Teacher Specific Content		

Teaching And Learning Approach	**Classroom Procedure (Mode Of Transaction)** Module 1 & 2-Lecturing, ICT Enabled Learning, Experiential Learning, Participatory Learning. Module 3- Lecturing, ICT Enabled Learning, Participatory Learning. Module 4- Lecturing, Participatory Learning.

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

REFERENCES

1. Shanmugham S., 2011, Nanotechnology, MJP publishers.
2. Charles P. Poole and Frank J. Owens, 2008, Introduction to Nanotechnolog, Wiley.
3. Qasim Chaudhary, Laurence Castle and Richard Watkins, 2010, Nanotechnologies in Food, RSCPublishing Data Book.

SUGGESTED READINGS

1. Q. Huang., 2010, Nanotechnology in the Food, Beverage and Nutraceutical Industries Woodhead Publishing Limited.
2. Lestie prey, 2010, Nanotech in food products, Wiley publications.
3. Pandua W., 2012, Nanotech research methods for foods and bioproducts, Wiley publications.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD STORAGE**					
Type of Course	**DCE**					
Course Code	**MG7DCEFTQ402**					
Course Level	**400-499**					
Course Summary	This advanced-level course explores the principles and practices of food storage and preservation.					
Semester	**7**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	-	-	-	**60**
Pre- requisites, if Any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To illustrate the principles of classifying food based on perishability, distinguishing between perishable, semi perishable, and non-perishable foods.	**U**	1,10
2	To outline food storage and convey its importance in preserving the quality and safety of food products over time	**U**	1,6

3	To compare and categorise between various types of storage, including short-term, long-term, refrigerated, frozen, and ambient storage methods.	**An**	1,2
4	To examine the techniques involved in the storage of different food items, with a particular emphasis on traditional and modern storage systems.	**An**	1,6,
5	To evaluate traditional food storage methods employed by different cultures, understanding the historical context, principles, and limitations associated with these traditional approaches.	**E**	1,2
6	To build a perspective on developing strategies for sustainable food storage practices, considering environmental impact, energy efficiency, and the reduction of food waste in storage processes.	**C**	2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Unit s	Course description	Hrs.	CO No.
1-Introduction	1.1	Classification of food based on perishability. Definition of food storage	5	1
	1.2	Types of storage Essential features of food Storage Areas Basic guidelines for food storage Care & Maintenance of Storage Equipment	6	1
2-Food and Grain storage	2.1	Introduction, scope, importance, basic requirements, safe and scientific storage	5	2
	2.2	Selection of site for storage Pre and post-storage operations cleaning, drying and inspection Spoilage, control measures	6	2
3-Traditional, Modern and large	3.1	Traditional storage methods, mud bins, drums, gunny bags	5	3,4,5
	3.2	Small scale storage structures, brick, concrete types, local storage, morai, bhukari, kothar, kuthla structures	6	3,4,5

	3.3	Improved storage; bunker, cover, and plinth, Factors affecting storage	5	3,4,5
scale storage	3.4	Bulk storage Warehouses: considerations, types. Silos: types- deep, shallow, Airys, numerical	5	4
	3.5	Refrigerated storage: Cold storage, refrigeration load calculations, cold storage components, vapour barriers	5	4
4-Storage of Food and Supporting structure	4.1	Storage of food frozen storage, CAS, MAS, hermetic storage, storage conditions for raw and processed fruits, vegetables, meat, dairy, etc. Storage requirements	6	6,7
	4.2	Supporting equipment, drying before storing,dryers,humidifiers, dehumidifiers, freezers, conveyors for Solid and liquid food storage. Aeration, ventilation,economic aspects of storage	6	6,7
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1& 2-Lecturing, ICT Enabled Learning Module 3- Lecturing, ICT Enabled Learning Module 4- Lecturing, ICT Enabled Learning

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** Theory:30 Marks MCQ/Assignments/Seminars/Test Papers/Book Review
	B. Semester End examination Theory: 70 Marks Short Answers (10 out of 12; 10x2=20 Marks) Short Essay (6 out of 8; 6x5=30 Marks) Long Essay (2 out of 4; 2x10=20 Marks)

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2. G. Boumans, Grain Handling and Storage, 1985, Volume 5 1st Edition, Elsevier Science.
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4. James G Brennan, 2006, Food processing Handbook, Wiley-VCH, 2e.

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2. Zeki Berk, 2013, Food process engineering and technology, Elsevier.
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SEMESTER 8

MGU-UGP (HONOURS)

Syllabus

DCC

MGU-UGP (HONOURS)

Syllabus

MAHATMA GANDHI UNIVERSITY

Programme	**B.Sc. FOOD TECHNOLOGY AND QUALITY ASSURANCE**					
Course Name	**FOOD PLANT ORGANIZATION AND MANAGEMENT**					
Type of Course	**DCC**					
Course Code	**MG8DCCFTQ400**					
Course Level	**400-499**					
Course Summary	This course aims to provide students with a comprehensive understanding the principles and practices involved in efficiently running and managing food processing plants					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline the overall structure of an enterprise.	**U**	1,10
2	To identify the steps involved in preparation of a plant layout.	**A**	1,2
3	To analyse the skills in layout presentation and to study the quantitative analysis for the plant layout	**An**	1,2
4	To evaluate the concept of practical layouts	**E**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Overall Design of An Enterprise	1.1	Plant design, sales planning for plant design, plant Location, levels of plant location, location of layout	6	1
	1.2	Location factors, plant site selection, location theory and models, industrial buildings and grounds	5	1
	1.3	Classification of dairy and food plants, farm level collection and chilling center, space requirement.	6	1
2-Preparation of a plant layout	2.1	Plant layout problem, importance, objectives and classical types of layouts, evaluation of plant layout.	5	2
	2.2	Advantages of good layout. Organizing for plant layout, data forms.	5	2
3-Development and presentation of layout and its analysis	3.1	Development of the pilot layout, constructing the detailed layout: Functional design: Sitting of different sections in a plant, layout installations.	6	3
	3.2	Engineering economy, linear programming, Queing theoryCommon Problems in plant layout and process scheduling.	6	3
	3.3	Siting of process sections, equipment selection and capacity determination, arrangement of process	6	3
4-Practicum	4.1	To prepare a plant location report To prepare and evaluate a feasibility report on plant location and layout To prepare general laws and regulation for establishing a food plant To prepare a waste management system	10	4

	4.2	Design and layout of milk, meat and egg processing plant Design and layout of fruit and vegetable processing plant Design and layout of beverage plant Design and layout of bread, cake, biscuits and confectionery plant Design and layout of cereals and pulses processing plant	10	5
	4.3	Risk assessment and control measures – case study on any four food processing industries such as milk, meat, fruit, vegetables, oil products, cereals, pulses and convenience foods, canned products	10	
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks

	Record-5 marks

REFERENCES

1. M Moore, Mac Millan, 1971, “Plant Layout & Design”. Lames, New York.
2. H.S. Hall & Y.S. Rosen, 1963“Milk Plant Layout”. FAO Publication, Rome.
3. Theunis C. Robberts, II Edition, 2013. “Food plant engineering system” CRC Press, Washington.
4. John Holah, HuubLelieveld, 2011. “Hygienic Design of Food Factories”, Wood head publishing,
5. Slade, S. 1990. “Food Processing Plant” Vol. 1, Leonard Hill Books.

MAHATMA GANDHI UNIVERSITY

Programme	**B.Sc. FOOD TECHNOLOGY AND QUALITY ASSURANCE**					
Course Name	**RESEARCH METHODOLOGY AND BIOSTATISTICS**					
Type of Course	**DCC**					
Course Code	**MG8DCCFTQ401**					
Course Level	**400-499**					
Course Summary	This course covers the fundamental principles and techniques essential forconducting research in the field of biology and related disciplines.					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites,if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To outline various kinds of research questions and research design	**U**	1,6
2	To identify qualitative, quantitative and mixed methods research.	**A**	1,4
3	To compare a good quantitative purpose statement and hypotheses.	**An**	1,2
4	To estimate the various types of quantitative sampling techniques and conditions use.	**E**	1,2
5	To modify the various statistical tools to test the hypothesis, drawing inferences and obtain knowledge on writing different types of report	**C**	2,6

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Research methodology	1.1	Meaning, objectives and types of research, research approaches, significance of research, research and scientific methods, research process and criteria of good research.	5	1,2
	1.2	Definition and identification of a research problem – selection of research problem, justification, theory, hypothesis, basic assumptions, limitations and delimitations of the problem.	5	1,2
2-Research design, measurement and writing	2.1	The various types of quantitative sampling techniques and conditions use The various steps involved in coding qualitative data	5	1
	2.2	Apply the various statistical tools to test the hypothesis & drawing inferences, obtain knowledge on writing different types of report. Develop independent thinking for critically analyzing research reports	5	1
	2.3	Introduction-Research Report-Research Proposal –Different types –Contents of report– Important Parts – Title, Table of contents – synopsis, bibliography-introductory section –research design Result– sampling techniques– probability and non-probability sampling methods	5	1,2
3-Sampling and data collection, Data preparation, analysis and statistics	3.1	Sampling Techniques– probability and non– probability sampling methods- Data collection, types of data–primary and secondary data–methods of	5	4

		primary data collection		
	3.2	Observation, interview, questionnaire and schedule– construction of questionnaire– pilot study–case study, literature survey.	5	4
	3.3	Data Preparation – editing – Coding – Data entry-test of significance – assumptions about parametric and non-parametric tests	5	3
	3.4	Multiple comparison tests Introduction ANOVA application of statistical software for data analysis. Introduction to descriptive statistics–hypothesis testing–T test–analysis of variance–linear regression.	5	3
4- Practicum	4.1	Literature Review Process and Formulation of Research Questions, Writing of the research proposal or report, Alternative Ways of research presentation	8	1,2
	4.2	Interpretation of Data and Paper Writing – Layout of a Research Paper and Research review, Quoting, Paraphrasing, Journal metrics, Impact factor of Journals, When and where to publish?	8	1,4
	4.3	Use of tools / techniques for Research: methods to search required information effectively, Referencing formats and styles (APA, Chicago, Harvard, MLA, Vancouver, ASA), Reference Management Software like Zotero/Mendeley, EndNote Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism	10	3,4
	4.4	Use of SPSS for data analysis and interpretation, Tabulation and graphical representation of data, Report writing in SPSS	4	1,4,6
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

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5. Mukherjee, S. P. (2019). A guide to research methodology: An overview of research problems, tasks and methods. CRC Press.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**PROJECT PREPARATION AND MANAGEMENT**					
Type of Course	**DCE**					
Course Code	**MG8DCEFTQ400**					
Course Level	**400-499**					
Course Summary	This course builds upon the foundational concepts of project management and delves into advanced techniques for project planning and execution.					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the key project management terms and definitions from the course.	U	1,10
2	To outline the fundamental principles of project preparation and management.	U	1,6,
3	To utilize project management tools and software to plan and organize project tasks.	A	1,5
4	To examine potential risks and challenges in a given project scenario.	An	1,2
5	To assess the effectiveness of project management methodologies in different contexts.	E	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Project Planning Initiation, Execution and Control	1.1	Introduction to Project Management, overview of project management principles, Importance of effective project planning Project Initiation- Developing project, identifying project, stakeholders, conducting feasibility studies charters and goals	4	1
	1.2	Scope –definition, defining project scope and objectives, work breakdown structure (WBS) and scope change management	4	1
	1.3	Project Execution Resource allocation and management, team building and leadership in project environments	3	1
	1.4	Project monitoring and control- tracking project progress, controlling project costs, quality, and risks Change control and configuration management	4	2
2–Project Risk Management, Project Communication and Stakeholder Management	2.1	Risk identification and assessment-Identifying project risks qualitative and quantitative risk assessment techniques	4	4
	2.2	Risk mitigation and response, planning-developing risk mitigation strategies and creating risk response plans	4	4
	2.3	Project Communication- effective communication in project management Stakeholder communication strategies	4	5
	2.4	Stakeholder Management- Identifying and analyzing project stakeholders Managing stakeholder expectations	3	5
3- Advanced Topics in Project Management	3.1	Project closure and evaluation-closing out a project Post-implementation reviews	5	3,5
		Agile Project Management-Introduction to Agile methodologies		

	3.2	Scrum, Kanban and other Agile frameworks	5	3,5

	3.3	Project management software tools- overview of popular project management tools Practical application and use of project management software	5	3,5
4-Practicum	4.1	To Develop a Project planning on startup To Prepare a survey for the project initiation To estimate the Guidelines for Time, Costs and resources for project development	10	1,3
	4.2	To establish a project Appraisal Arrangement of funds To find out the types of Costs, Refining estimates and contingency funds for the preparation of project	10	2
	4.3	To prepare a project management using any software or tool for the project development	10	3
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks

	Record-5 marks

REFERENCES

1. Kerzner, H. (2017). Project management: a systems approach to planning, scheduling, and controlling. John Wiley & Sons.
2. Sutherland, J. Scrum: The Art of Doing Twice the Work in Half the Time by Sutherland, Jeff (2014) Hardcover.
3. Cohn-background, M. (2007). Agile Estimating and Planning.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**INTELLECTUAL PROPERTY RIGHTS**					
Type of Course	**DCE**					
Course Code	**MG8DCEFTQ401**					
Course Level	**400-499**					
Course Summary	This course introduces students to the fundamentals of Intellectual Property Rights (IPR) with a focus on patents, trademarks, copyrights, and trade secrets.					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	1	-	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the key terms related to intellectual property rights.	U	1,10
2	To understand the procedures for patent, trademark, and copyright registration.	U	1,10
3	To apply patent examination criteria to evaluate patentability.	A	1,2

4	To analyze the economic and ethical implications of intellectual property protection and copy rights Issues.	An	1,2
5	To evaluate the effectiveness of intellectual property protection in the context of emerging technologies.	E	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill(S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction to Intellectual Property	1.1	Definition and types of intellectual property	3	1
	1.2	Historical evolution of intellectual property rights Analyzing the importance of IP in innovation and economic growth Evaluating the ethical considerations of IP protection	7	1
	1.3	International treaties and conventions	3	1
2-Patent Law, Practice, Trademark Design Protection	2.1	Understanding patentable subject matter, Patent application process and Examination	5	2,3
	2.2	Patent infringement and litigation	5	2,3
	2.3	Basics of trademark law and Registration, Design protection and industrialdesigns and Trademark infringement andenforcement	4	2
3–, Copyrights, Trade Secrets and Emerging Trends	3.1	Copyright principles and protection Fair use and exceptions Digital copyright issues	4	2
	3.2	Definition and protection of trade secrets Trade secret litigation and remedies Comparative analysis with other forms of IP	4	2
	3.3	Digital Intellectual Property - Analyzing IP challenges in the digital era Studying issues related to software patents and digital copyrights	5	4

		Exploring the role of block chain in IP protection		
	3.4	Ethical and Social Implications of IP - Examining the ethical dilemmas in IP protection Analyzing the social impact of IP on access to knowledge Discussing open-source movements and IP ethics	5	5
4- Practicum	**4.1**	Group discussion on User experience design, innovation management and strategic management, Case Studies on Assignment /Licensing, Group discussion on Technology Transfer issues, Assignment on Strategy on Technology Transfer- Case basis	6	1,3
	4.2	Hands-on Training on Patentability Assessment, Group Discussion on IP valuation of Patent, Video Modules: Technology Scan and implementation in business; IPR and Biodiversity and Biotechnology and Pharmaceutical (plant/ animal/ microbial varieties, biological products and processes, diagnostic, therapeutically and surgical methods, drugs	6	3
	4.3	Group Discussion and Video Module on Introduction to Trademark and global significance, Techno-legal strategy to protect Intellectual Property to avoid Intellectual Crimes and Plagiarism, Hands-on workshop on Design Registration, Group Discussion on Technology Designing, Soft Skill Development and Pitching idea /invention-Case studies.	6	3
	4.4	Group Discussion on Competition and Confidentiality issues; Antitrust Laws; Group Discussion on Employee Confidentiality; Care & Maintenance of Confidential Information; Assignment of Intellectual Property Rights Group Discussions and Video Modules on Copyright management and strategic management, Case Studies on Assignment /Licensing, Group discussion on Technology Transfer issues Assignment on	7	3,4

		Strategy on Technology Transfer-Case basis		
	4.5	Patentability Assessment, IP valuation of Patent, Technology Scan and implementation in business, Trademark Search, Pitching idea /invention, Licensing and IP marketing strategy, Technology Transfer handling	5	3,4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1.Vaidhyanathan, S. (2017). Intellectual Property: A very short introduction. Oxford University Press.
2. Bently, L., Sherman, B., Gangjee, D., & Johnson, P. (2022). Intellectual property law. Oxford university press.
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1. Keller, B. P., & Cunard, J. P. (2012). Copyright law: A practitioner's guide. (No Title).
2. Drahos, P., & Braithwaite, J. (2017). Information feudalism: Who owns the knowledge economy. Routledge.
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MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**FOOD SUPPLY CHAIN MANAGEMENT**					
Type of Course	**DCE**					
Course Code	**MG8DCEFTQ402**					
Course Level	**400-499**					
Course Summary	This course delves into the intricacies of managing the supply chain in the food industry, emphasizing advanced concepts, analytical skills, and strategic decision-making.					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	-	-	1	**75**
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understand the strategic role of logistic and supply management in the cost reduction and offering best service to the customer.	**U**	1,10
2	To understand advantages of SCM in business	**U**	2,10
3	To apply the knowledge of supply chain analysis	**A**	1,6
4	To analyze reengineered business processes for successful SCM implementation	**An**	1,2
5	To evaluate recent trends in supply chain management	**E**	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill(S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1-Introduction	1.1	Logistics and supply chain management- scope, significance	3	1,2
	1.2	Drivers, basic model- primary and secondary activities	4	1,2
	1.3	Role and challenges of logistics and supply chain management in food industry	3	1,2
2-Demand Forecasting and Warehousing	2.1	Demand and supply chain management	2	2
	2.2	Forecasting techniques, strategic planning for material sourcing, Outsourcing strategies, Warehouse strategies	4	2
	2.3	Inventory models and control techniques	3	2
3- Distribution and Transportation Packaging, Information Technology, LCSM and performance analysis	3.1	Various sources of distribution channels; Distribution models, 3PL and 4PL, Distribution network planning	5	3
	3.2	Modes of transportation, design of transportation, shipment, containerization.	5	3
	3.3	Types of packaging and packaging materials Applications of packaging in logistics	6	3
	3.4	Export and import packaging labeling details Reverse supply chain, information technology and the supply chain (ERP, Bar – coding, RFID, GPS, E-Procurement), Export and import procedure and Documentation. Customer relationship management in LSCM, Performance metrics in supply chain,challenges in LSCM	10	4
4 - Practicum	4.1	Plan and co-ordinate the movement of food products from farms to processing plants. Identifying and mitigating risks that could disrupt the food supply chain.	10	5

	4.2	Adopting best practices and innovations to enhance the efficiency and effectiveness of the food supply chain. Identification of plastics by simple test i)Burning Test ii)Bending Test iii)Film tear test iv)Solublity test	10	5
	4.3	3)Industrial Training 4)Industrial visit.	10	5
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. Bowersox, D. J., Closs, D. J., Cooper, M. B., & Bowersox, J. C. (2020). Supply chain logistics management. Mcgraw-hill.

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SUGGESTED READINGS

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2. Rogers, H., Srivastava, M., Pawar, K. S., & Shah, J. (2016). Supply chain risk management in India–practical insights. International Journal of Logistics Research and Applications, 19(4), 278-299.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**RESEARCH ETHICS AND INTEGRITY IN FOOD TECHNOLOGY**					
Type of Course	**DCE**					
Course Code	**MG8DCEFTQ403**					
Course Level	**400-499**					
Course Summary	This course is designed to provide a comprehensive understanding of research ethics and integrity within the context of food technology.					
Semester	**8**	Credits			**4**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	**75**
		3	-	1	-	
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To understanding of the ethical principles and regulatory frameworks governing research in food technology	**U**	1,10
2	To understand and explain the ethical considerations associated with various stages of food technology research, including data collection, analysis, and reporting.	**U**	1,2
3	To apply ethical principles to real-world scenarios, demonstrating their ability to make informed decisions regarding ethical dilemmas in food technology research.	**A**	1,6

4	To evaluate case studies, identify ethical issues, and analyze the implications of ethical decisions in the context of food technology research.	E	1,2
5	To create a research proposal that incorporates ethical considerations, demonstrating the ability to synthesize ethical principles in designing and conducting research projects in food technology.	C	1,2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E),Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs.	CO No.
1 – Introduction to Research Ethics and Regulatory Framework	1.1	Definition and importance of research ethics in food technology.	2	1
	1.2	Historical context and landmark cases in research ethics.	1	1
	1.3	Ethical principles and Guidelines in research	2	1
	1.4	Regulatory Framework: Overview of international, national, and institutional regulations governing research in food technology	3	1
	1.5	Ethical review boards and their role in ensuring compliance	2	1
2-Informed Consent and Participant Protection	2.1	Principles and components of informed consent	3	3,4
	2.2	Challenges and considerations in obtaining informed consent in food technology studies.	3	3,4
	2.3	Protection of Human and Animal Subjects	3	3,4
	2.4	Ethical considerations in research involving human subjects	3	3,4
	2.5	Ethical treatment of animals in food technology research	3	3,4
	3.1	Guidelines for collecting and handling data in food technology research. Ethical considerations in data analysis and reporting	4	2

3–Data Management and Integrity in Food Technology Research, Publication Ethics -and Professional Responsibility	3.2	Addressing data fabrication, falsification and plagiarism, Types of research misconduct, Strategies for preventing and addressing data integrity issues	4	2
	3.3	Authorship and contributor ship Avoiding plagiarism and duplicate publication. Building a culture of integrity in research. The role of researchers in promoting ethical practices in the field.	4	2
	3.4	Ethical considerations in emerging technologies (e.g., GMOs, Nano technology). Environmental and social implications in food technology research. Case studies and ethical dilemmas	4	2
	3.5	Analyzing real-world cases and ethical dilemmas in food technology research Discussing potential solutions and decision-making processes	4	
4- Practicum	4.1	Open access publishing: Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies, SPPU developed software tool to identify predatory publications, Journal finder/ journal suggestion tools (JANE, Elsevier Journal Finder, Springer Journal Suggester, etc)	15	1,3,4
	4.2	Subject specific ethical issues, FFP, authorship, Conflict of interests, Complaints and appeals: examples and fraud from India and abroad	3	1,2
	4.3	Use of plagiarism software like Turnitin, Urkund and other open-source software tools	3	3,4
	4.4	Indexing databases, citation databases: Web of Science, Scopus, etc	4	1,4
	4.5	Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics	5	1,4
5		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Module 1 & 2 – Lecturing, ICT Enabled Learning. Module 3 – Lecturing, ICT Enabled Learning. Module 4-Practicum

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **Theory:25 marks** MCQ/ Assignments/ Test Papers/Book Review **Practical:15 marks** Lab involvement/viva
	B. Semester End examination: **Theory: 50 marks** Short answers (5 out of 7;5x2=10 marks) Essay type(short) 5 out of 7;5x4=20 marks Long Essay (2 out of 4;2x10=20 marks) **Practical:35 marks** Lab examination -25 marks Viva Voce-5 marks Record-5 marks

REFERENCES

1. Elliott, D., & Stern, J. E. (Eds.). (1997). Research ethics: A reader. Upne.

2. Shamoo, A. E., & Resnik, D. B. (2009). Responsible conduct of research. Oxford University Press.

3. Pfeiffer, T., Rand, D. G., & Dreber, A. (2009). Decision-making in research tasks with sequential testing. PLoS One, 4(2), e4607.

4. Mepham, T. B. (2000). The role of food ethics in food policy. Proceedings of the Nutrition Society, 59(4), 609-618.

MAHATMA GANDHI UNIVERSITY

Programme	**BSc (Hons) Food Technology and Quality Assurance**					
Course Name	**PROJECT**					
Type of Course	**PRJ**					
Course Code	**MG8PRJFTQ400**					
Course Level	**400 – 499**					
Course Summary	This Course provides students with a foundational understanding of the principles and concepts that form the basis of Food Technology					
Semester	**8**	Credits			**12**	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
			-		12	
Pre- requisites,if Any						

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	To develop ideas on projects associated with Food Product development and Food Processing Technology.	U	1,2,10
2	To create an interest in working with different fields related to food processing.	C	1,2,10
3	To analyze and solve the complex problems arised in processing sector	A	1,6,10
4	To gain knowledge about research, data interpretation and data presentation of research work in future.	S	1,2,6,10

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest(I) and Appreciation (Ap)

Mode of Assessment for 12 Credits				
Sl No.	**Points**	**Distribution marks**	**Total Marks**	**Credit**
Internal Evaluation				
1.	Preparation & Submission of Thesis	20	CCA Marks - 60	12
2.	Weekly Work Report & Communication	15		
3.	Internal Presentation of Project Work	15		
4.	Timeliness & Attendance	10		
External Evaluation				
1.	Dissertation- (Certificates, Abstract, Introduction, Review, Material and Methods, Results and Discussion, Conclusion, Bibliography, Tables, and Figures)	70	ESE Marks: 140	
2.	Attendance	5		
3.	Relevance of area or topic selected	5		
4.	Presentation –Timing, Display of slides, preparation of results	40		
5.	Viva (reponse of questions, concept of objective and knowledge of methodology and justification of results	15		
6.	Completion certificate	5		