PAAVAI ENGINEERING COLLEGE, NAMAKKAL – 637 018
(AUTONOMOUS)
REGULATIONS – 2023
CHOICE BASED CREDIT SYSTEM
B. Tech - FOOD TECHNOLOGY
CURRICULUM
(Applicable to the candidates admitted during the academic year 2023-2024 onwards)

SEMESTER III							
S.No	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Theory							
1	BS	MA23301	Transform Techniques and Partial Differential Equations	3	1	0	4
2	PC	FT23301	Stoichiometry and Food Process Calculations	3	0	0	3
3	PC	FT23302	Food Microbiology	3	0	0	3
4	PC	FT23303	Fundamentals of Food Technology	3	0	0	3
5	MC	MC23301	Environmental Sciences and Sustainability	2	0	0	0
Theory Cum Practical							
6	ES	FT23304	Process Fluid Mechanics	3	0	2	4
Practical							
7	PC	FT23305	Fundamentals of Food Technology Laboratory	0	0	2	1
8	PC	FT23306	Food Microbiology Laboratory	0	0	4	2
9	EE	GE23301	Professional Development I	0	0	2	1
			TOTAL	**17**	**1**	**10**	**21**
SEMESTER IV							
S.No	**Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
Theory							
1	BS	MA23403	Probability and Statistics	3	1	0	4
2	PC	FT23401	Heat and Mass Transfer in Food Processes	3	0	0	3
3	PC	FT23402	Engineering Properties of Food	3	0	0	3
4	PC	FT23403	Post Harvest Engineering	3	0	0	3
5	MC	MC23402	Human Values and Gender Equality	2	0	0	0
Theory Cum Practical							
6	PC	FT23404	Food Analysis	3	0	2	4
Practical							
7	PC	FT23405	Heat and Mass Transfer Laboratory	0	0	4	2
8	PC	FT23406	New Product Development Laboratory	0	0	2	1
9	EE	GE23401	Professional Development II	0	0	2	1
			TOTAL	**17**	**1**	**10**	**21**

PAAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Food Technology
8/5/24
AUTONOMOUS

MA23301	TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4

(Common to Aero, Agri, BME, Biotech, Civil, Chemical, EEE, Food, Pharma, Mech, MCT, R&A)

COURSE OBJECTIVES

To enable the students to

1.	develop the knowledge of periodic and non-periodic functions and their representations using Fourier series.
2.	acquaint the student with Fourier transform techniques used in wide variety of situations.
3.	introduce the basic concepts of PDE for solving standard partial differential equations.
4.	acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
5.	develop Z transform techniques for discrete time systems.

UNIT I	FOURIER SERIES	12

Dirichlet's conditions; General Fourier series; Odd and even functions; Half range series; Statement of Complex form of Fourier series; Parseval's identity; Harmonic analysis.

UNIT II	FOURIER TRANSFORMS	12

Fourier integral theorem (without proof); Fourier transform pair; Sine and cosine transform - Properties; Transforms of elementary functions; Convolution theorem; Parseval's identity.

UNIT III	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations; Lagrange's linear equation; Solutions of four standard types of first order partial differential equations; Linear partial differential equations of second order with constant coefficients.

UNIT IV	FOURIER SERIES SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS	12

Solutions of One-dimensional wave and heat equation; Steady state two-dimensional heat equation.

UNIT V	Z -TRANSFORMS AND DIFFERENCE EQUATIONS	12

Z-transforms - Elementary properties; Inverse Z-transform; Method of partial fraction ; Residue method; Convolution theorem; Solution of difference equations by Z-transform.

	TOTAL PERIODS	60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	classify the properties of periodic and non-periodic vibrations with the help of Fourier series.	Applying (K3)
CO2	apply the Fourier transform to convert the function from frequency domain to time domain.	Applying (K3)
CO3	demonstrate partial differential equations that occur in many engineering applications.	Applying (K3)
CO4	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.	Applying (K3)
CO5	apply knowledge of Z transform to analyse linear time invariant systems.	Applying (K3)

TEXT BOOKS

1. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second Edition, Reprint, 2012.
2. Grewal. B.S, "Higher Engineering Mathematics", Forty fourth Edition, Khanna Publications, New Delhi, 2018.

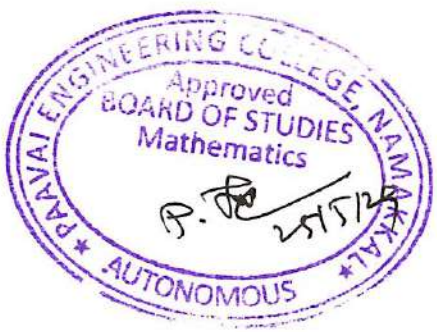
REFERENCES

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", Tenth Edition, Wiley Publications, New Delhi, India, 2016.
2. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company limited, New Delhi 2010.
3. Glyn James, "Advanced Modern Engineering Mathematics", Third Edition, Pearson Education 2007.
4. Wylie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics", Tata Mc-Graw Hill Publishing Company limited, Sixth Edition, New Delhi, 2012.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	1	3
CO2	2	3	3	2	-	-	-	-	-	-	-	3	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO5	2	3	2	2	-	-	-	-	-	-	-	2	2	3



FT23301	STOICHIOMETRY AND FOOD PROCESS CALCULATIONS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic principles involved in Food Process Calculations
2	solve the problems in energy balance and law of conservation of energy
3	get knowledge about the calculation of pressure, volume and temperature using ideal gas law
4	learn mass and energy balance in unit operation and process involved in food industries
5	know about the composition of mixture and solutions

UNIT I	UNITS, DIMENSIONS AND FUNDAMENTAL CALCULATIONS	9

Basic and derived units, unit conversions, use of model units in calculations, methods of expression, compositions of mixture and solutions, ideal and real gas laws – gas constant - calculations of pressure, volume and temperature using ideal and van der Waals equation, use of partial pressure and pure component volume in gas mixture calculations.

UNIT II	MATERIAL BALANCE WITHOUT CHEMICAL REACTION	9

Stoichiometric principles, material balance without chemical reaction - application of material balance to unit operations: distillation, evaporation, absorption, extraction, drying, filtration, and crystallization.

UNIT III	MATERIAL BALANCE WITH CHEMICAL REACTION	9

Stoichiometric equation, coefficient, ratio, and propagation. Limiting reactant, excess reactant and percent excess. conversion, yield and selectivity- composition of product and reactant with chemical reaction.

UNIT IV	RECYCLE OPERATION AND HUMIDITY CALCULATIONS	9

Recycle operations, recycle stream, purge operation, purge stream, Recycle ratio, Combined ratio, and purge ratio. Humidity and Saturation: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity, wet and dry bulb temperature, dew point - Humidity chart usage

UNIT V	ENERGY BALANCE	9

Energy Balance Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats for food products.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	express the different system of units and dimension, estimate composition of mixture solutions.	Understanding (K2)
CO2	apply the material balance without chemical reaction for different unit operations.	Applying (K3)

CO3	make use of the material balance with chemical reaction for different unit operations	Applying (K3)
CO4	employ recycling operation and humidity calculation.	Applying (K3)
CO5	analyze the energy balance involved in food processing operations	Analyzing(K4)

TEXT BOOKS

1. Gavhane, K.A —Introduction to Process Calculations (Stoichiometry) Nirali Prakashan Publications, Pune, 2006.
2. Narayanan K.V. and Lakshmikutty B., "Stoichiometry and Process Calculations", 5th Edition, Prentice Hall of India, New Delhi, 2013

REFERENCES

1. Bhatt, B.L and Vora, S.M., —Stoichiometry, 4th Edition, Tata McGraw-Hill, Publishing Company, New Delhi, 2004.
2. Himmelblau D.M., "Basic Principles and calculation in Chemical Engineering", 6th Edition, Prentice Hall of India, New Delhi, 2003.
3. Zeki Berk "Food Process Engineering and Technology", 2nd Edition, Amsterdam, Netherlands, 2010
4. Venkataramani V and Anantharaman., "Process Calculations", Prentice Hall of India, New Delhi, 2003.

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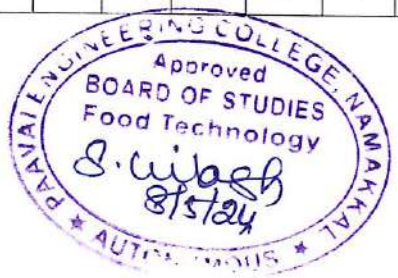
CO1	3	3	1	1	1	-	-	-	-	-	-	1	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	3
CO3	3	3	2	2	1	1	-	-	-	-	-	1	3	3
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	3
CO5	3	3	2	2	2	1	1	1	1	1	1	1	3	3



FT23302	FOOD MICROBIOLOGY	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	know about the principles of microbiology to emphasize structure and biochemical aspects of various microbes
2	know the importance of genera of microorganisms associated with food and their characteristics
3	understand the role of microbes in fermentation
4	understand the role of microbes in food spoilage
5	solve the problems in microbial growth in food and diseases caused

UNIT I	INTRODUCTION	9

History and development of Microbiology - Importance and significance of microorganisms in food science; Microscopy -light and electron microscopy; Principles of different staining techniques - monochrome staining, gram staining, acid fast staining, capsular staining, flagellar staining.

UNIT II	MICROBES - STRUCTURE AND MULTIPLICATION	9

Structural Organization and multiplication of - bacteria, viruses, algae and fungi; Bacterial Growth curve; Factors affecting growth of microorganisms – pH, water activity, oxidation – reduction potential, nutrient content; Life history of actinomycetes, yeast and bacteriophage; Calculation of doubling time of bacteria.

UNIT III	ISOLATION AND IDENTIFICATION OF MICROORGANISMS IN FOOD	9

Culture media- types of media; Pure culture techniques- Cultivation, maintenance, and preservation of media; Culture dependent methods - Direct microscopic observation, enumeration (Standard Plate Count, Most probable number, Dye reduction technique, Direct microscopic count) and identification by chemical and physical methods; Culture independent methods - PCR, DGGE.

UNIT IV	MICROBIAL SPOILAGE AND CONTROL	9

Food spoilage definition, types of spoilage – physical, enzymatic, chemical and biological spoilage; Mechanism of spoilage and its product of different types of foods– fruits and vegetables, meat and meat products, bakery products, dairy products, fermented foods, and canned foods; Control of microorganisms: Physical agents, Chemical agents, and their mode of action. Indicators of water quality.

UNIT V	FOOD BORNE DISEASES	9

Gastroenteritis, Listeriosis, Salmonellosis, Shigellosis, Vibriosis, Campylobacteriosis. Food toxins – Aflatoxin, Ochratoxin, Patulin, Botulin. Indicators of food product quality- Coliform bacteria- Indicators of food safety. Microbiological criteria for foods - HACCP and ISO system.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	understand the historical development of microbiology and staining methods	Understanding (K2)
CO2	classify different microorganism and the factors affecting their growth.	Analyzing(K4)
CO3	identify the different microorganism in food	Analyzing(K4)
CO4	apply the knowledge of spoilage in fermented and canned foods.	Applying (K3)
CO5	infer food born disease	Applying (K3)

TEXT BOOKS

1. James M. Jay, Martin J. Loessner, David A. Golden, "Modern Food Microbiology", 4th Edition, Springer Netherlands, 2012.
2. Frazier W.C., Westhoff D.C. and Vanitha N.M., "Food Microbiology", 5th Edition, Tata McGraw Hill, New Delhi, 2014.

REFERENCES

1. Prescott Harley, Klein" Microbiology ": Authored by Wiley, Sherwood, Woolverton, 10th edition (2017) McGraw-Hill Higher Education.
2. Jay, J.M. "Modern Food Microbiology". 4th Edition. CBS Publishers, 2003
3. Adams, M.R and M.O. Moss. "Food Microbiology". New Age International, 2002
4. Michael P. Doyle, Robert L. Buchana "Food Microbiology: Fundamentals and Frontiers" 5th Edition, Washington, USA, 2013.

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CO's	PO's												PSO's	
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CO1	3	1	1	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	2	-	2	2	-	-	-	1	-	-	3	3
CO3	3	2	3	-	2	1	-	-	-	1	-	1	3	3
CO4	3	3	3	-	1	2	-	1	-	1	-	1	3	3
CO5	3	2	2	-	-	2	1	1	-	1	-	1	3	3

FT23303	FUNDAMENTALS OF FOOD TECHNOLOGY	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	get an outline of food science
2	understand the basics of food engineering.
3	study the processing flow of various food products.
4	have an overview on food spoilage and preservation.
5	study various food conversion and preservation techniques

UNIT I	INTRODUCTION TO FOOD SCIENCE	9

Introduction - Career Preparation in Food Science, Activities of Food scientists; Characteristics of the food industry; Food groups – Classification and importance; Basics of pasteurization, blanching, canning; Food nutrient leeching; Food enrichment technology - Fortification, Bio fortification, valorization.

UNIT II	FOOD ENGINEERING OPERATIONS	9

Properties of food, Characteristics of food raw materials, Cleaning of food raw materials, Sorting of foods, Grading of foods. Equipment used- cutting equipment, Heating Utensils, Types of heat and heat sources.

UNIT III	PROCESSING OF FOOD PRODUCTS	9

Dairy products- flavored ice cream, Vegetable/Fruits products- Dehydrated, Canned, pickled; Cooking of meat; Processing of carbonated nonalcoholic beverage, stimulating beverage (coffee), alcoholic beverages (beer, wine, distilled liquors); RTS Products.

UNIT IV	TECHNIQUES IN FOOD TECHNOLOGY	9

Food Conversion Techniques- Size reduction, Mixing, Emulsification, Filtration, Centrifugation, Extraction, Crystallization; Preservation Objectives and Importance of preservation – traditional and modern methods of food preservation – Class I and Class II preservatives; Scope of Preservation industry in India Preservation Techniques- Preservation of Food by Chemicals, Drying, Irradiation, Freezing (Principle, methods, effect on quality of food).

UNIT V	INTRODUCTION TO NEW PRODUCT DEVELOPMENT AND FOOD QUALITY	9

Definition to Creativity, innovation, New Product Development, entrepreneurship; Introduction to food adulteration and adulterants; Sensory Evaluation of Food Quality; Quality factor for consumer safety; HACCP.

	TOTAL PERIODS	45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the concepts of need of food science and food enrichment technology	Understanding (K2)
CO2	characterize the food engineering operations	Applying (K3)
CO3	analyze the various process involved in food products	Analyzing(K4)
CO4	express the various food conversion and preservation techniques	Understanding (K2)
CO5	demonstrate new product development, food quality and entrepreneurship	Applying (K3)

TEXT BOOKS

1. N.Shakunthala Many, M.Shadaksharaswamy,"Food Facts and Principles" New Age International (P) Limited, Publishers, 2013.
2. Sumati R Mudambi, Shalini M. Rao, M.V. Rajagopal,"Food Science", Revised second edition, New Age International (P) Limited, Publishers, 2006

REFERENCES

1. BSivasankar,"Food Processing and Preservation", PHI Learning Private Limited, Delhi, 2019.
2. R.Paul Singh and Dennis R. Heldman, " Introduction to Food Engineering", fifth edition, San Diego, CA, 2013.
3. Romeo T. Toledo," Fundamentals of Food Process Engineering", third edition, Springe, New York, 2007.
4. Lorenzo V.Greco, Marco N.Bruno,"Food Science and Technology: New Research",Nova Science Publishers,Inc. NewYork,2008.

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CO's	PO's												PSO's	
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CO1	3	2	1	-	-	3	-	1	-	-	-	2	3	3
CO2	2	2	2	-	2	2	-	2	-	2	3	2	3	3
CO3	2	2	-	-	-	2	-	2	-	2	-	2	3	3
CO4	2	1	-	2	2	3	-	3	-	2	-	2	3	3
CO5	2	2	2	3	3	3	-	3	-	3	-	2	3	3

PAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
Food Technology
8/5/24
AUTONOMOUS

MC23301	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1.	establish the knowledge of precious resources of the environment and their various impacts.
2.	create awareness on ecosystem and biodiversity preserve.
3.	learn scientific and technological solutions to current day pollution issues.
4.	analyze climate changes, concept of carbon credit and the challenges of environmental management.
5.	understand green materials, energy cycles and the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND NATURAL RESOURCES	6

Definition, scope and importance of Environment. Forest resources: Use and over-exploitation, deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and over- utilization of surface and ground water, dams-benefits and problems. Food resources: effects of modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural resources.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	6

Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems. Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity - Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

UNIT III	ENVIRONMENTAL POLLUTION	6

Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Electronic waste – Sources - Causes and its effects - Pollution case studies - Field study of local polluted site – Industrial/Agricultural.

UNIT IV	SUSTAINABILITY AND ENVIRONMENT	6

Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change - acid rain - ozone layer depletion. Regional and local environmental issues and possible solutions - case studies. Concept of carbon credit, carbon footprint. Environmental management in industry - A case study.

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment - Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

	TOTAL PERIODS	30

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	find the method of conservation of natural resources.	Understanding (K2)
CO2	understand ecosystem and the conservation of biodiversity.	Understanding (K2)
CO3	aware of environmental pollution and interpret its effects.	Understanding (K2)
CO4	apply sustainable development for technological advancement and societal development.	Applying (K3)
CO5	measure the sustainability practices for green energy cycles.	Analyzing (K4)

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
2. Gilbert M. Masters, Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

REFERENCES

1. William P.Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern",McGraw Hill, 16th edition, 2023.
2. C.S.Rao,, "Environmental Pollution and Control Engineering", New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., Hyderabad, 3rd edition, 2020.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 4th Edition, 2015.

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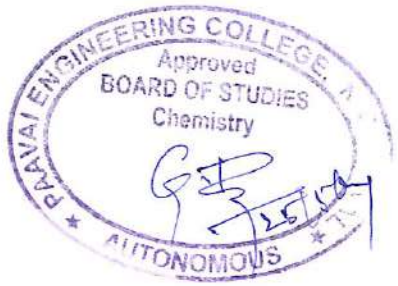
	Programme Outcomes PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	1	-	-	-	2	-	-	1	1	-	-	1	1
CO2	-	2	-	-	1	1	-	1	-	-	-	-	1	2
CO3	2	-	1	1	-	-	-	2	-	-	-	2	1	1
CO4	-	2	-	-	1	-	3	1	1	-	1	1	2	1
CO5	2	2	-	1	-	-	2	2	-	-	-	1	1	2



FT23304	PROCESS FLUID MECHANICS	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	understand the basic concepts of fluid statics and dimensional analysis
2	learn the fluid flow operations in pipes and basic equations associated with flow through pipes
3	execute the packed and fluidized beds used in process industries
4	preparing the types of flow measuring devices and to determine coefficient of discharge
5	acquire knowledge over classification of fluid moving machinery and their performance analysis

UNIT I FLUID PROPERTIES AND STATICS 9

Physical properties of fluids -Classification of fluids; Pressure measurement – Manometers – Simple and Differential; Dimensional Analysis-Dimensionless Group-The Rayleigh Method -Application of Dimensional Analysis to Fluid Flow -Buckingham's π Theorem - Use of Buckingham's π Theorem for Dimensional Analysis; Different dimensionless numbers-Reynolds number, Grashof number, Prandtl number and Nusselt number.

UNIT II FLOW THROUGH CONDUITS 9

Types of flow– Shear stress distribution-Laminar and turbulent flow in pipes; Equation of Continuity; Bernoulli Equation- Pump Work in Bernoulli Equation; Reynold's Experiment; Flow of Incompressible Fluids in Pipes-The Fanning Friction Factor (f)-Laminar Flow in Circular Pipe-Hagen-Poiseuille equation.

UNIT III FLOW AROUND SOLIDS 9

Drag and its types-Drag coefficient; Pressure drop across packed bed- Ergun's equation; Fluidization and its classification- Pressure drop across the fluidized bed – Minimum fluidization velocity- Motion of particles through fluids–Terminal settling velocity; motion of spherical particle -stokes law.

UNIT IV FLOW METERING 9

Classification and Selection of flow meters; Principle, working and applications of Venturimeter, Orifice meter, Rotameter and Pitot tube; Determination of discharge coefficient; Other meters: Magnetic Flow Meter; Measurement of Flow in Open Channels - Rectangular Notch and Triangular notch.

UNIT V FLUID MOVING MACHINERY 9

Classification and selection of fluid moving machinery; Principle, working and applications of Centrifugal pump and Reciprocating Pump-Characteristics curves of centrifugal pump; Elementary principles of gear, air lift, diaphragm and submersible pumps.

TOTAL PERIODS 45

LIST OF EXPERIMENTS

1. Calibration of rotameter
2. Determination of Coefficient of discharge in orifice meter
3. Determine the friction factor for flow of fluid
4. Determination of Coefficient of discharge in Venturi meter

5. Draw the Characteristic curves for Centrifugal pump.	
6. Draw the Characteristic curves for Reciprocating pump	
7. Pressure drop studies in packed column	
8. Pressure drop studies in Fluidized bed	
9. Viscosity measurement	
10. Determination of Coefficient of discharge in Triangular notches	
	TOTAL PERIODS 75

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	examine the properties of fluids and pressure measurements	Applying (K3)
CO2	apply the various type of flow through conduits	Applying (K3)
CO3	compute the terminal settling velocity for the motion of spherical particle	Analyzing(K4)
CO4	determine the coefficient of discharges for various flow meters	Analyzing(K4)
CO5	characterize the working principles of different pump	Analyzing(K4)

TEXT BOOKS

1. R.K. Bansal, "Fluid Mechanics and Hydraulic Machines", Revised Ninth Edition, Laxmi Publications(p) limited, (2014).
2. Yunus A. Cengel and John M. Cimbala, "Fluid mechanics: Fundamentals and application", 4th Edition, New York, (2018).

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1. McCabe W.L, Smith, J C and Harriot. P "Unit operations in Chemical Engineering", McGraw Hill, VII Edition, (2006).
2. J.M.Coulson and J.F.Richardson, "Chemical Engineering Vol - I &II", 6th Edition Butterworth – New Delhi, (2000).
3. Pijush K. Kundu, Ira M. Cohen, and David R. Dowling, " Fluid Mechanics", 6th Edition, San Diego, CA, 2015.
4. Frank M. White, " Fluid Mechanics", 8th Edition, McGraw - Hill Education, New York, 2015.

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CO1	3	2	2	2	2	2	-	-	3	2	2	2	3	3
CO2	3	2	2	2	3	2	-	-	3	2	2	2	3	3
CO3	3	3	2	2	2	2	-	-	3	2	2	2	3	3
CO4	3	3	3	2	2	2	-	-	3	2	2	2	3	3
CO5	3	3	2	2	2	2	2	2	3	2	2	2	3	3

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FT23305	FUNDAMENTALS OF FOOD TECHNOLOGY LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	know about the basics of laboratory practices
2	learn the proximate analysis of food samples
3	know about adulterations.
4	learn about different preservation techniques.

LIST OF EXPERIMENTS

1. Introduction to Good Laboratory Practices
2. Introduction to Food Laboratory Equipments
3. Concepts of molarity, molality, normality
4. Determination of moisture content of a food sample
5. Determination of ash content in food samples
6. Estimation of total titratable acidity
7. Detection of adulteration in food products
   - A. Milk
   - B. Ghee
   - C. Honey
8. Cutout analysis of canned food
9. Effect of blanching on Food Quality
10. Preparation and Evaluation of,
    - A. Pickle
    - B. Any Milk based product

TOTAL PERIODS 30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the good Laboratory Practices	Applying (K3)
CO2	practice perform basic proximate analysis	Applying (K3)
CO3	detect adulteration in food samples	Applying (K3)
CO4	relate their knowledge on preservation in food samples	Applying (K3)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	2	1	-	1	2	-	-	3	3	3
CO2	2	2	3	-	2	1	-	1	2	-	-	3	3	3
CO3	2	2	2	1	2	1	-	1	2	-	-	3	3	3
CO4	2	2	2	1	2	1	-	-	-	2	2	2	3	3

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FT23306	FOOD MICROBIOLOGY LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	understand various aspects of food
2	impart knowledge on identification of microbes using different techniques and its enumeration methods
3	recognize the role of microbes in food spoilage and preservation
4	acquire knowledge in various food-based materials

LIST OF EXPERIMENTS

1. Introduction to Microbiology and Laboratory safety
2. Microscopy: working, principle and care of microscope
3. Sterilization and Disinfection techniques
4. Preparation of culture media
5. Staining techniques - Monochrome staining
6. Staining techniques - Gram staining
7. Bacteriological testing of milk (MBRT Test)
8. Detection of coliforms from milk by MPN method
9. Isolation of bacteria from eggs, milk, and fermented foods
10. Microbiological Examination of Fruits and vegetables
11. Preparation of Fermented Food using Microorganism

TOTAL PERIODS	**60**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	infer the source of microorganism and its spoilage in food	Applying (K3)
CO2	select the appropriate equipment for microbiological work	Analyzing(K4)
CO3	practice the different sterilization methods	Applying (K3)
CO4	inoculate, isolate and identify the microorganisms from both liquid and solid sample	Analyzing(K4)

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
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CO2	3	3	2	2	2	2	-	-	3	2	-	2	3	3
CO3	3	3	2	2	2	2	-	2	3	2	2	2	3	3
CO4	3	3	2	2	2	2	2	2	3				3	3

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GE23301	PROFESSIONAL DEVELOPMENT I	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1. enhance and evaluate the student's professional skills and introduce the function of corporate world.
2. enhance and develop the students behavioral, speaking and listening skills to face the interview.
3. solve advance level verbal aptitude tests to get placed in Tier I companies.
4. improve their reasoning skills to get placed in reputed companies.

UNIT I	SELF - UNDERSTANDING AND PERSONALITY ENHANCEMENT SKILLS	7

Introduction self-exploration; SWOT analysis - Types and barriers; Effective communication in workplace; Leadership skills; Decision making - Problem solving; Goal setting - Critical, strategic and lateral thinking; JAM level- I; Basic resume building level- I.

UNIT II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SKILLS	7

Behavioral skills; Time management; Emotional intelligence; Analytical thinking- Listening; Listening and hearing; Self-introduction; Group discussion - Types and importance, evaluation criteria, do's and don'ts of GD; GD Level-1.

UNIT III	QUANTITATIVE APTITUDE	8

Number System; LCM and HCF; Simple interest and compound interest; Average; Pipes and cisterns; Area; Profit and loss.

UNIT IV	LOGICAL REASONING	8

Logical sequence; Analogy; Classification; Causes and effect; Making judgment; Directions.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	define and analyze soft skills to improve the leadership skills.	Analyzing (K4)
CO2	demonstrate the behavioral skills through various activities.	Applying (K3)
CO3	develop the problem-solving skills through quantitative aptitude.	Applying (K3)
CO4	illustrate the logical reasoning Skills to solve real world problems.	Analyzing (K4)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill, 2023.
2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												PSO's	
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	1
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	1
CO3	3	2	2	2	-	1	-	-	-	-	2	-	2	2
CO4	2	1	3	2	-	3	3	1	-	1	2	-	2	2

MA23403	PROBABILITY AND STATISTICS	3	1	0	4

(Common to Agri, Biotech, Cyber, CSE, CSE(IOT), CSE(AI&ML), AI&DS, IT, Food, Pharma)

COURSE OBJECTIVES

To enable the students to

1.	analyse the concept of random variables and probability distribution in designing processes.
2.	differentiate the discrete and continuous two dimensional random variables.
3.	determine the concepts of hypotheses testing, its need and applications.
4.	equip with statistical techniques for designing experiments, analyzing, interpreting and presenting research data.
5.	emphasize the aspects of control charts in quality control.

UNIT I	RANDOM VARIABLES	12

Discrete and continuous random variables – Moments, Moment generating functions; Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions; Functions of random variables.

UNIT II	TWO - DIMENSIONAL RANDOM VARIABLES	12

Joint distributions; Marginal and conditional distributions; Covariance, Correlation and Linear regression; Transformation of random variables; Applications of Central limit theorem (for independent and identically distributed random variables).

UNIT III	TESTING OF HYPOTHESIS	12

Sampling distributions - Estimation of parameters; Statistical hypothesis; Large sample test for single mean and difference of means; Small samples - Tests based on t, Chi-square and F distributions for mean, variance and proportion; Contingency table (test for independent), Goodness of fit.

UNIT IV	DESIGN OF EXPERIMENTS	12

Completely randomized design; Randomized block design; One way and two way classifications- Latin square design - 2^2 factorial design.

UNIT V	STATISTICAL QUALITY CONTROL	12

Control charts for measurements (X and R charts) - Control charts for attributes (P, C and NP charts), Tolerance limits, Acceptance sampling - U-test and Sign test.

	TOTAL PERIODS	60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	assign suitable probability distributions in engineering problems.	Applying (K3)
CO2	apply the concept of discrete and continuous two dimensional random variables.	Applying (K3)
CO3	apply the concept of testing of hypothesis for small and large samples in real life problems	Applying (K3)
CO4	analyse the principles to be adopted for designing the experiments.	Analysing (K4)
CO5	examine statistical data using control chart in quality control	Applying (K3)

TEXT BOOKS

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2. Johnson. R.A. and Gupta. C.B., Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.

REFERENCES

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												PSO's	
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CO1	3	3	3	3	-	-	-	-	-	-	-	3	1	3
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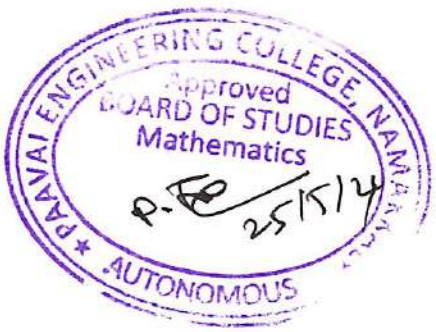
CO3	3	3	3	2	-	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO5	3	3	2	3	-	-	-	-	-	-	-	2	2	3



FT23401	HEAT AND MASS TRANSFER IN FOOD PROCESSES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	learn the principles and applications of heat and mass transfer operations in industries.
2	understand the mechanisms and concept of heat transfer effectively.
3	acquire the knowledge radiation heat transfer operation in industries.
4	discuss the principles of mass transfer operations in industries.
5	investigate the mass transfer operational approaches.

UNIT I	HEAT TRANSFER – CONDUCTION	9

Basic heat transfer processes - conductors and insulators - conduction – Fourier's law of heat conduction – thermal conductivity and thermal resistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere – solving problems in heat transfer by conduction.

UNIT II	HEAT TRANSFER - CONVECTION	9

Heat transfer - convection – free and forced convection - factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems heat transfer by convection.

UNIT III	HEAT TRANSFER – RADIATION AND HEAT EXCHANGER	9

Radiation heat transfer – concept of black and grey body - monochromatic Total emissive power– Kirchhoff's law – Planck's law - Stefan-Boltzmann's law –Heat exchangers – parallel, counter and cross flow- Logarithmic Mean Temperature Difference – overall coefficient of heat transfer in shell and tube heat exchanger.

UNIT IV	MASS TRANSFER -DIFFUSION	9

Mass transfer in foods – introduction – Fick's law for molecular diffusion - molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of A through non diffusing B, diffusion coefficients for gases - molecular diffusion in liquids, solids, biological solutions and gels.

UNIT V	MASS TRANSFER – DISTILLATION	9

Vapour liquid equilibria - Raoult's law- Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method.

	TOTAL PERIODS	45

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	describe the concepts of conduction and apply them in different approaches	Understanding (K2)

CO2	make use of equations for interpreting convective heat transfer coefficients.	Applying(K3)
CO3	apply the concepts of radiation and heat exchanger to derive the heat transfer problems.	Applying (K3)
CO4	explain the diffusion in different medium	Understanding (K2)
CO5	identify various distillation process.	Analyzing (K4)

TEXT BOOKS

1. Yunus A. Cengel and Afshin J. Ghajar. "Heat and Mass Transfer: Fundamentals & Applications". McGraw-Hill Education ,6th edition (2020)
2. McCabe. W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering",6th Edition, McGraw Hill, 2003.

REFERENCES

1. Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, and David P. DeWitt "Fundamentals of Heat and MassTransfer". John Wiley & Sons, 7th edition (2010).
2. Holman, J.P. "Heat Transfer". Tata McGraw-Hill Publishing Newyork, 2017
3. Incropera.F.P "Incoroperas Principles of Heat and Mass Transfer", 1st Edition, Wiley India Edition, 2018.
4. R.K.Rajput, " ATextbook of Heat and Mass Transfer" S Chand publishing, 7th edition, 2019.

CO-PO MAPPING :

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	1	1	1	-	-	-	-	1	-	1	3	3
CO2	3	3	1	2	2	-	-	-	-	1	-	1	3	3
CO3	3	3	1	2	1	-	3	2	-	1	-	1	3	3
CO4	3	3	2	2	1	-	-	-	-	1	-	1	3	3
CO5	3	3	3	3	3	-	3	2	3	1	-	1	3	3

FT23402	ENGINEERING PROPERTIES OF FOOD	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic physical properties of food.
2	learn the thermal properties of food.
3	acquire knowledge over optical properties of food material
4	understand the rheological properties of food.
5	acquire knowledge over textural and colour measurement techniques.

UNIT I PHYSICAL PROPERTIES 9

Importance of engineering properties, Physical properties of food materials- size, shape, volume, density, porosity and surface area – definitions and measurements, Frictional properties –coefficient of friction, angle of repose – types and its determination, rolling resistance and angle of internal friction – definition, Aerodynamic properties – Drag coefficient, Terminal Velocity and its application.

UNIT II THERMAL PROPERTIES 9

Definition of specific heat, enthalpy, thermal conductivity, thermal diffusivity, surface heat transfer coefficient. Measurement of specific heat, thermal conductivity – steady state and unsteady state methods, thermal diffusivity – Dickerson's method, Calorific value of food, Bomb calorimeter, Boiling point elevation and freezing point depression - definition, Applications of thermal properties.

UNIT III OPTICAL AND ELECTROMAGNETIC PROPERTIES 9

Refractive index of food items, Abbe's refractometer, Optical activity, Polarimeter, Gloss and glossmeter, color, translucency– Definitions and applications. Electromagnetic Properties: Electrical properties- electrical conductivity and its measurement, dielectric properties - measurement methods, effect on moisture, temperature and composition, microwave heating and other Applications.

UNIT IV RHEOLOGICAL PROPERTIES 9

Classification of rheology, Stress Strain behavior of Newtonian and Non- Newtonian fluids- Bingham and Non-Bingham. Stress strain relationships in solids, liquids and visco elastic behavior- stress relaxation test, creep test and dynamic test,stress-strain diagrams, Rheological models – Kelvin and Maxwell model. Viscosity – Types and its definitions, measurement methods - Capillary, Orifice, Falling and Rotational viscometers.

UNIT V TEXTURAL PROPERTIES 9

Types of food textures, Texture measuring instruments- Compression, Snap Bending, Cutting Shear, Puncture, Penetration and TPA, Properties of food powders. Color: Interaction of object with light, Measurement methods -Spectrophotometer and Colorimeter, Color order systems- Munsel color system, CIE color system, Hunter lab color space, Lovibond system.

TOTAL PERIODS 45

COURSE OUTCOMES		
At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	apply the various physical properties in food process design	Applying (K3)
CO2	outline the thermal properties of foods and its measurement methods	Understanding (K2)
CO3	make use of optical and electromagnetic properties of food materials in food processes	Applying (K3)
CO4	explain various rheological behavior of solid, liquid and viscoelastic food materials	Understanding (K2)
CO5	choose suitable textural and color measurement techniques for food materials.	Applying (K3)

TEXT BOOKS

1. Rao M.A. and Rizvi S.S.H., "Engineering Properties of Foods", 4th Edition, CRC Press, New York, 2014.
2. Serpil Sahin and Servet Gulum Sumnu,"Physical Properties of Foods", 1st Edition, Springer, New York, 2006.

REFERENCES

1. Sahay K.M. and Singh K.K., "Unit Operations of Agricultural Processing", 2nd Edition, Vikas Publishing, New Delhi, 2004
2. Nuri N. Mohsenin. Thermal Properties of Food & Agricultural materials", Gordon and Reach sciencepublishers, 1990
3. Shafiur Rehman. Food Properties Hand book. CRC press inc. New York, 2nd Edition, 2009.
4. Sakamon Devahastin aand Osvaldo H. Campanella, "Engineering aspects of Thermal Food Processing", CRC Press inc. New York, 1st Edition, 2009

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Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's

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CO's	PO's												PSO's	
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CO1	3	3	2	1	1	-	-	-	-	1	-	1	3	3
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CO4	3	3	2	1	1	-	-	-	-	2	-	2	3	3
CO5	3	3	2	1	1	3	3	2	3	2	-	2	3	3

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FT23403	POST HARVEST ENGINEERING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	understand the basic post-harvesting and post-harvest losses.
2	know about different types of storage, cleaners and screens.
3	get knowledge about harvesting, handling techniques and quality control measures.
4	learn post-harvest treatment to increase the shelf life.
5	know about the agents and causes of spoilage in storage.

UNIT I **INTRODUCTION TO POST HARVESTING** **9**

Basic post harvest technology - Definition, concept and science. Post harvest losses - Transpiration and water stress. Respiration, maturation, ripening, senescence and biochemical changes affecting quality. Temperature, Moisture content and RH measurement. Ethylene biosynthesis and action.

UNIT II **STORAGE, CLEANING AND GRADING** **9**

Changes during ripening - Change in colour, texture, flavour during storage. Role of Vitamins and Carbohydrates. Types of storage, Bioregulators, Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens - rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance. Peeling Sorting, grading, methods of grading; Grading- Size grading, color grading, specific gravity grading; screening, equipment for grading of fruits and vegetables.

UNIT III **SEPARATION AND QUALITY IMPROVEMENT TECHNIQUES** **9**

Separation - Magnetic separator, de-stoners, electrostatic separators, pneumatic separator. Harvesting and handling techniques, Coatings and treatments, quality control measures, GAP, GMP, HACCP. Water binding and its effect on enzymatic and non-enzymatic reactions and food texture, control of water activity and moisture.

UNIT IV **MATERIALS HANDLING** **9**

Milling, polishing, grinding, milling equipment, de huskers, polishers (abrasion, friction, water jet), flour milling machines, pulse milling machines, grinders, cutting machines, oil expellers, machine efficiency and power requirement Introduction to different conveying equipment used for handling of grains, fruits and vegetables; Post harvest treatment to increase shelf life i.e. freezing, chilling, dehydration, canning, thermal processing. Scope and importance of material handling devices.

UNIT V **FOOD SPOILAGE AND PEST CONTROL** **9**

Direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and Control. Integrated pest management, fumigation and rodent control.

TOTAL PERIODS **45**

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	describe the basics of post harvesting.	Understanding (K2)
CO2	explain the different storage, cleaning and grading operations involved in food industry.	Understanding (K2
CO3	apply various separation technique to improve quality.	Applying (K3)
CO4	apply the concepts of handling different milling equipments	Applying (K3)
CO5	identify the suitable pest control and management method for agricultural produce.	Applying (K3)

TEXT BOOKS

1. Post harvest physiology and pathology of vegetables, by Jerry A Bartz, Jeffrey K Brecht, 2nd edition, Marcel Dekker Inc. NY
2. Amalendu Chakraverty and R. Paul Singh. 2014. Post- Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.

REFERENCES

1. Don W. Green and Robert H. Perry. 2008. Perry's Chemical Engineers' Handbook. McGraw-Hill Co., Inc., NY, USA.
2. James G. Brennan. 2006. Food Processing Handbook. Wiley -VCH Verlag GmbH & Co. KGaA, Weinheim, Germany.
3. K.M. Sahay and K.K. Singh. 2001. Unit Operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd., Noida, UP.
4. R.H.H. Wills *et al.*, An introduction to the post-harvest physiology and handling of fruits and vegetables.

CO-PO MAPPING :

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(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
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CO3	3	3	2	2	1	1	-	-	-	-	-	1	3	3
CO4	3	3	2	2	1	-	-	-	-	-	-	1	3	3
CO5	3	3	2	2	2	1	2	1	1	1	1	1	3	3

MC23402	HUMAN VALUES AND GENDER EQUALITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1.	define different types of human values and their impact on individual behaviour and societal norms.
2.	apply principles of personal development such as self-confidence, self-discipline, and resilience to navigate modern challenges effectively.
3.	evaluate the role of values in shaping professional ethics, civic sense and global citizenship.
4.	examine the socio-economic factors influencing gender inequality and explore avenues for empowerment and advocacy.
5.	critically analyze prevalent issues and challenges faced by women, including gender-based violence, discrimination, and cultural biases, and propose measures for their eradication.

UNIT I	HUMAN VALUES	6

Value Education - Definition, Types of values; Human values - Acceptance, Consideration. Appreciation, Listening. Empathy, Sympathy, Honesty, Integrity, Wisdom, Decision making, Self-actualization, Character formation towards positive personality, Contentment; - Religious Values - Humility, Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II	PERSONALITY DEVELOPMENT	6

Personal Development - Introspection, Self-confidence, Self-discipline; Flexibility -Peer pressure - Sensitization towards Gender Equality; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition, Positive and Negative attitudes; Family values; Self-improvement - Physical exercises, Meditation ,Yoga.

UNIT III	VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT	6

Professional Values -. Integrity, Responsibility, Punctuality, Dedication - Perseverance - Competence; Civic sense and Responsibility; Global Values - Computer Ethics, Moral Leadership, Code of Conduct; Corporate Social Responsibility; Aesthetic values; National Integration and International understanding of Religious Values – Spirituality, thought process.

UNIT IV	GENDER EQUALITY	6

Gender Equality - Definition, Empowerment, Economic Equality; Condition of Women in India-Education, Healthcare, Political Representation, Gender-based Violence; Challenging Stereotypes: Parental and Caregiving Responsibilities; Legal and Policy Reform; Cultural Shifts; Global Perspective; Male Chauvinism; Sustainable Development..

UNIT V	WOMEN ISSUES AND CHALLENGES	6

Women Issues and Challenges - female feticide, violence against women; Domestic violence- dowry related abuse and deaths, Physical violence, Emotional abuse; Sexual assault; Honour killing; Eve-teasing- Stalking, e-stalking (cyber-crime).

	TOTAL PERIODS	30

COURSE OUTCOMES		
At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
CO2	demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
CO3	recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
CO4	cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing (K4)
CO5	analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing (K4)

TEXT BOOKS

1. A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
2. Aurther, John. Personality Development. Lotus Press, 2018.

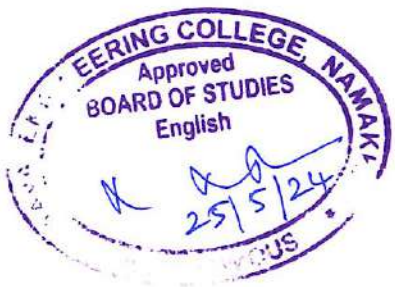
REFERENCES

1. Joshi, Dhananjay. Value Education in Global Perspective. Lotus Press, 2014.
2. Mahrotra, Mamta. Gender Inequality in India: Challenging Social Norms. Prabhat Books, 2015.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	PO's												PSO's	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	1	-	1	1	1	2	3	2	1	1	3	1	1
CO2	-	1	-	1	1	1	3	3	2	2	1	1	1	1
CO3	-	1	-	1	1	1	2	3	1	1	1	3	1	1
CO4	-	1	-	1	1	1	2	3	2	2	1	2	1	1
CO5	-	1	-	1	1	1	1	3	2	2	1	3	1	1



FT23404	FOOD ANALYSIS	3	0	2	4

COURSE OBJECTIVES

To enable the students to

1	understand the basic food testing.
2	understand the techniques for analysis of lipids, protein & carbohydrates.
3	gain knowledge on spectroscopic techniques.
4	know about electrophoresis, polarimetry, refractometry.
5	gain knowledge on chromatographic techniques.

UNIT I INTRODUCTION 9

Introduction, Food Regulations and Standards - Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods; titratable Acidity in foods, determination of dietary fiber and crude fiber.

UNIT II LIPIDS, PROTEIN AND CARBOHYDRATE ANALYSIS 9

Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods.

UNIT III SPECTROSCOPIC TECHNIQUES 9

Basic Principles- Spectrophotometric analysis of food additives and food Components – IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; use of fluorimeter in vitamin assay- specific use of Tintometer in vanaspathi analysis.

UNIT IV ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY 9

Basic Principles, application of electrophoresis in food analysis, refractive indices of oils and fats, total soluble solids in fruit juice and honey, specific rotation of sugars, estimation of simple sugars and disaccharides by polarimeter; Immunoassay techniques and its applications in foods.

UNIT V CHROMATOGRAPHIC TECHNIQUES 9

Basic Principles, detection of adulterants in foods by paper chromatography and thin layer chromatography, column chromatography for purification analysis, analysis of food additives, sugars, phytochemicals and aflaotoxins, contaminants and other food components by HPLC, GC analysis of fatty acids, cis, trans Isomers - volatile oils, flavours and pesticides contaminants and other volatile derivatives of food components; Significance MS detector in HPLC and GC.

TOTAL PERIODS 45

LIST OF EXPERIMENTS

1. Estimation of iodine value and saponification value in lipids.
2. Thin Layer Chromatography.
3. Estimation of reducing sugars by Lane and Eynon's method

4.	Estimation of Iodine content in iodized salt
5.	Estimation of total extractives in tea
6.	Determine the swelling ratio and extract release
7.	Estimation of fat in milk by Gerber's method.
8.	Extraction of curcumin in turmeric
9.	Rapid detection of food adulterants
10.	Estimation of gingerol in ginger
11.	Determination of specific rotation of sugar using polarimeter

TOTAL PERIODS	**75**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	demonstrate the various basic food testing methods.	Applying (K3)
CO2	incorporate various lipid, protein, carbohydrates testing methods.	Applying (K3)
CO3	make use of spectroscopic techniques to analysis food.	Applying (K3)
CO4	characterize the food samples.	Applying (K3)
CO5	choose suitable chromatographic techniques for separation process.	Applying (K3)

TEXT BOOKS

1. S.S.Nielsen. Food Analysis: Principles and Techniques. Springer, 2nd Edition, 2023.
2. Pomeranz, Yeshajahu,Clifton E.Meloan "Food Analysis: Theory and Practice", 3rd Edition CBS Publishers, 2004.

REFERENCES

1. J.C Miller and L.W King, "Modern Methods of Food Analysis". Academic Press,2022.
2. M N R Ramesh "Handbook of Food Analysis Techniques" 5TH Edition Academic Press, 2022.
3. Otles, Semih, "Methods of Analysis of Food Components and Additives". CRC Press,2005.
4. S.Suzanne Nielson, "Food Analyis Laboratory Manual", Springer 3rd Edition, 2010.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

	Programme Outcomes PO's												**PSO's**	
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	3	3	3	-	3	2	3	3	3	3
CO2	3	3	3	3	3	3	3	-	3	-	3	3	3	3
CO3	3	3	3	3	3	3	3	-	3	-	3	3	3	3
CO4	3	3	2	3	3	3	3	-	3	-	3	3	3	3
CO5	3	3	2	3	3	3	3	-	3	-	3	3	3	3

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FT23405	HEAT AND MASS TRANSFER LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1	enable the student to basic study of the phenomena of heat and mass transfer, to develop methodologies for solving food engineering problems.
2	understand the information concerning the performance and design of Heat exchangers.
3	develop processes with better heat efficiency and economics.
4	provide knowledge on various flows measuring equipment's involved in food industries.

LIST OF EXPERIMENTS

1. Natural convection.
2. Thermal Conductivity -Lagged Pipe
3. Thermal Conductivity -metal rod.
4. Stefan Boltzmann constant for radiation heat.
5. Forced convection.
6. Double pipe heat exchanger -cocurrent flow.
7. Double pipe heat exchanger -counter current flow.
8. Separation of binary mixture using Steam distillation.
9. Drying characteristics of Rotary dryer.
10. Separation of binary mixture using Simple distillation.

TOTAL PERIODS 60

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	infer the basic laws of heat transfer and account for the consequence of heat transfer in thermal analyses of engineering systems.	Analysing (K4)
CO2	interpret the importance of distillation and dryer in industrial applications	Analysing (K4)
CO3	optimize the heat exchanger devices and demonstrate the loss of energy due to friction in pipes.	Analysing (K4)
CO4	calculate the losses of energy due to fittings in pipe flow systems.	Analysing (K4)

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Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes PSO's
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CO's	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	2	-	-	-	3	2	2	-	3	3
CO2	3	3	3	3	2	-	-	-	3	2	2	-	3	3
CO3	3	3	3	3	2	-	-	-	3	2	2	-	3	3
CO4	3	3	3	3	2	-	-	-	3	2	2	-	3	3

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FT23406	NEW PRODUCT DEVELOPMENT LABORATORY	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1	have an idea on different projects and its methods.
2	acquire knowledge on entrepreneurship and business models.
3	develop effective technical presentation.
4	improve body language and posture for effective public speaking.

In this laboratory session, students were organized into teams comprising 4-5 members, with each group tasked with conducting one experiment from the range of 2-8. Teams has the autonomy to select a faculty member to provide guidance during the laboratory activities, all group were obligated to undertake the final four experiments and subsequently produce a comprehensive report accompanied by a power point presentation, the report should encompass aim, objectives, literature review, methodology and formulation of their protocol canvas. While the methodology section is not obligatory, attention must be given to canvas preparation. Validation of the report will be conducted by an external examiner.

LIST OF EXPERIMENTS

1. Introduction to innovation, entrepreneurship and new product development.
2. Develop an innovative dairy product.
3. Develop a valorized bakery product.
4. Develop a new packaging material.
5. Develop a new beverage product.
6. Develop an innovative RTS product.
7. Develop an idea on waste management.
8. Develop an innovation meat product.
9. Preparation and presentation of Business model canvas.
10. Preparation and presentation of problem statement canvas.
11. Preparation and presentation of empathy map canvas.
12. Present a PPT on your innovation and business opportunity plan.

TOTAL PERIODS	**30**

COURSE OUTCOMES

At the end of this course, students will be able to		**BT Mapped (Highest Level)**
CO1	figure out the recent problems on the domain and to develop solution for that problem.	Analysing (K4)
CO2	articulate the various research papers.	Understanding (K2)
CO3	analyse his/her public speaking, entrepreneurship skill.	Analysing (K4)
CO4	explore knowledge on that domain.	Analysing (K4)

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CO4	3	2	2	3	3	1	3	3	3	3	3	3	3	3

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GE23401	PROFESSIONAL DEVELOPMENT II	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1. enhance their own behavioural skills to survive in corporate world.
2. evaluate their listening and speaking skills to face the interviews in a successful way.
3. solve advance level verbal aptitude tests to get placed in Tier I companies.
4. improve their reasoning skills to get placed in reputed companies.

UNIT I	WRITING SKILLS	7

Email writing; Fixing and cancelling appointments; Paper submission for seminars and conferences; Business communication; Stress management; Body language; Dress code; Self-introduction II; Update resume building II; JAM level -3.

UNIT II	PRESENTATION SKILLS	7

Presentation skills - Types and methods of delivering presentation, ways and methods to improve presentation skills; Mini presentation in smaller groups; Situational role play; Face to face interview; Group discussion level IL; JAM Level-4.

UNIT III	QUANTITATIVE APTITUDE - I	8

Simplification; Time, speed and distance; Trains; Boats and streams; Ratio and proportion; Partnership; Percentage.

UNIT IV	LOGICAL REASONING	8

Seating arrangement; Arithmetic reasoning; Character puzzle; Syllogisms; Matching definitions; Statements and arguments.

	TOTAL PERIODS	30

COURSE OUTCOMES

At the end of this course, students will be able to		BT Mapped (Highest Level)
CO1	interpret the personality development through various activities.	Understanding (K2)
CO2	examine speaking and listening skills to excel in their jobs	Analyzing (K4)
CO3	develop the quantitative skills and analytical skills to face the interview.	Applying (K3)
CO4	extend the reasoning abilities by scoring exceeded percentage to get placed in reputed companies.	Understanding (K2)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co.2021

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill. 2023.
2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

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CO3	3	2	2	-	-	1	-	-	-	-	2	-	2	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	2	2

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