



**Avinashilingam Institute for Home Science and Higher Education for Women**  
 (Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD)  
 Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC  
 Coimbatore - 641 043, Tamil Nadu, India

**Department of Food Processing and Preservation Technology**  
**M.E. Food Technology**

**Programme Outcomes:**

1. Graduates will demonstrate good knowledge of Statistics, Science and Technology to solve engineering, technology and research problem
2. Graduates will be able to Identify, formulate and solve problems in areas of food storage, food processing & preservation, analytical and sensory techniques, food packaging and food engineering
3. Design new processes/modifying the existing system to improve the performance and to satisfy the constraints
4. Graduates will be able to perform list of experiments, analyse and interpret the data.
5. Apply various food analytical tools and techniques to improve the efficiency of the process and product.
6. Students conduct themselves to uphold the professional and social obligations.

**Programme Specific Outcomes:**

- 1: Demonstrate their knowledge in food processing and preservation.
- 2: Develop innovative processes, products and design equipment using novel technologies.

**Scheme of Instruction & Examination**

(For students admitted during 2023 - 2024 and onwards)

Part	Course Code	Name of Course /Component	Hours of Instruction/week		Scheme of Examination						
			T	P	Duration of exam	CIA		CE		Total	Credit
						T	P	T	P		
<b>First Semester</b>											
<b>I</b>	<b>Core Courses (CC)</b>										
	23MEFC01	Operations Research	4	-	3	40	-	60	-	100	4
	23MEFC02	Unit Operations for Food Industries	3	-	3	40	-	60	-	100	3
	23MEFC03	Food Engineering Practicals	-	3	3	-	40	-	60	100	1.5
	23MEFC04	Food Packaging Practicals	-	3	3	-	40	-	60	100	1.5
	23MEFC05	Research Methodology and IPR	3	-	3	40	-	60	-	100	3
	<b>Program Electives (PE)</b>										
	23MEFE11/ 23MEFE12/ 23MEFE13	Program Elective-I	3	-	3	40	-	60	-	100	3
	23MEFE21/ 23MEFE22/ 23MEFE23	Program Elective-II	3	-	3	40	-	60	-	100	3

II	<b>Non-Credit Mandatory Courses (NMC)</b>										
	<b>Audit Course (AC)</b>										
	23MEMA11/ 23MEMA12/ 23MEMA13	Audit Course-I	3	-	2	100	-	-	-	100	Remark
	<b>Extracurricular Course (ECC)</b>										
	CSS/ Adult Education/ Community Engagement and Social Responsibility	2	-	-	-	-	-	-	-	-	
<b>Program Elective I:</b> 23MEFE11 Food Preservation Technology / 23MEFE12 Storage Engineering / 23MEFE13 Advances in Meat, Fish and Poultry Technology											
<b>Program Elective II:</b> 23MEFE21 Advances in Food Packaging / 23MEFE22 Non-Thermal Processing Techniques in Foods/ 23MEFE23 Advanced Food Chemistry and Microbiology											
<b>Second Semester</b>											
Part	Course Code	Name of Course /Component	Hours of Instruction/week		Scheme of Examination						
			T	P	Duration of exam	CIA		CE		Total	Credit
						T	P	T	P		
I	<b>Core Courses (CC)</b>										
	23MEFC06	Fruits and Vegetables Processing Technology	3	-	3	40	-	60	-	100	3
	23MEFC07	Milling, Baking and Confectionery Technology	3	-	3	40	-	60	-	100	3
	23MEFC08	Food Processing and Preservation Practicals	-	3	3	-	40	-	60	100	1.5
	23MEFC09	Food Analysis Practicals	-	3	3	-	40	-	60	100	1.5
	23MEFC10	Mini Project with Seminar	-	2	-	-	100	-	-	100	1
<b>Program Electives (PE)</b>											
	23MEFE31/ 23MEFE32/ 23MEFE33	Program Elective-III	3	-	3	40	-	60	-	100	3
	23MEFE41/ 23MEFE42/ 23MEFE43	Program Elective-IV	3	-	3	40	-	60	-	100	3
II	<b>Non-Credit Mandatory Courses (NMC)</b>										
	<b>Audit Course (AC)</b>										
	23MEMA21/ 23MEMA22	Audit Course-II	3	-	2	100	-	-	-	100	Remark
	<b>Extracurricular Course (ECC)</b>										
	23MXCSS1/ 23MXAED1/ 23MXCSR1	CSS / Adult Education /Community Engagement and Social Responsibility	2	-	-	-	-	-	-	100	2
	<b>Professional Certification Course (PCC)</b>										
23MEFPC1/ 23MEFPC2	Professional Certification Course	-	-	-	100	-	-	-	100	2	
<b>Internship during Summer Vacation (1 month)</b>											

<b>Program Elective III:</b> 23MEFE31 Milk and Milk Products Technology/ 23MEFE32 Technology of Frozen Foods / 23MEFE33 Instrumental Techniques in Food Analysis											
<b>Program Elective IV:</b> 23MEFE41 Food Waste Management and By-Products Utilization / 23MEFE42 IoT and Sensors for Food Technology / 23MEFE43 Safety Standards and Quality Auditing											
<b>Third Semester</b>											
Part	Course Code	Name of Course /Component	Hours of Instruction/week		Scheme of Examination						
			T	P	Duration of exam	CIA		CE		Total	Credit
						T	P	T	P		
I	<b>Core Courses (CC)</b>										
	23MEFC11	Research Project – I	-	20	-	-	100	-	-	100	10
	<b>Program Electives (PE)</b>										
	23MEFE51	Program Elective-V Title of MOOC (SWAYAM-NPTEL)*	3	-	-	-	-	100	-	100	3
	<b>Open Electives (OE)</b>										
	23MEBO01/ 23MEEO01/ 23MEDO01	Open Elective	3	-	3	40	-	60	-	100	3
II	23MEFC12	Internship/Training	-	-	-	-	100	-	-	100	2
*One MOOC (12 weeks duration) through SWAYAM - NPTEL with credit transfer of 3 credits as an alternative to one Program Elective Course, Program Elective - V in III Semester should be completed between 1 <sup>st</sup> and 3 <sup>rd</sup> semester. Title of the MOOC to be specified after enrolment.											
<b>Open Electives:</b> 23MEBO01 Quality Assurance and Safety in Hospitals/23MEEO01 Waste to Energy / 23MEDO01 Principles and Techniques of Data Science											
<b>Fourth Semester</b>											
Part	Course Code	Name of Course /Component	Hours of Instruction/week		Scheme of Examination						
			T	P	Duration of exam	CIA		CE		Total	Credit
						T	P	T	P		
I	<b>Core Courses (CC)</b>										
	23MEFC13	Research Project – II	-	32	-	-	200	-	200	400	16
	Total										<b>73</b>
	23MEFMC1	<b>MOOC (Core/ Non-core)</b>	-	-	-	-	-	-	-	-	2
<b>One MOOC (8 weeks duration) with 2 credits from core / non-core to be completed between 1<sup>st</sup> and 3<sup>rd</sup> semester from SWAYAM – NPTEL (without credit transfer).</b>											

**Requirements to earn the M.E. degree:**

1. Total credits required to be earned in Part I & II components: 73.
2. Minimum of 3 credits to be earned in MOOC (12 weeks duration) with credit transfer, as an alternative to one Program Elective in 3<sup>rd</sup> semester to be completed between 1<sup>st</sup> and 3<sup>rd</sup> semester from SWAYAM- NPTEL.
3. Additionally, one MOOC (8 weeks duration) with 2 credits from core /non-core to be completed between 1<sup>st</sup> and 3<sup>rd</sup> semester from SWAYAM – NPTEL (without credit transfer).
4. Successful completion of Part II Non-Credit Mandatory Courses (NCCM).

**List of Program Electives (PE)**

<b>S.No</b>	<b>Course Code</b>	<b>Course Title</b>
1.	23MEFE11	Food Preservation Technology
2.	23MEFE12	Storage Engineering
3.	23MEFE13	Advances in Meat, Fish and Poultry Technology
4.	23MEFE21	Advances in Food Packaging
5.	23MEFE22	Non-Thermal Processing Techniques in Foods
6.	23MEFE23	Advanced Food Chemistry and Microbiology
7.	23MEFE31	Milk and Milk Products Technology
8.	23MEFE32	Technology of Frozen Foods
9.	23MEFE33	Instrumental Techniques in Food Analysis
10.	23MEFE41	Food Waste Management and By-Products Utilization
11.	23MEFE42	IoT and Sensors for Food Technology
12.	23MEFE43	Safety Standards and Quality Auditing
13.	23MEFE51	<b>MOOC (12 Weeks Course in SWAYAM- NPTEL)</b>

**List of Audit Courses (Non-Credit Mandatory Course)**

<b>S. No</b>	<b>Course Code</b>	<b>Audit Course – I</b>
1.	23MEMA11	English for Research Paper Writing
2.	23MEMA12	Disaster Management
3.	23MEMA13	Research and Publication Ethics

<b>S. No</b>	<b>Course Code</b>	<b>Audit Course – II</b>
1.	23MEMA21	Pedagogy Studies
2.	23MEMA22	Value Education

**Open Electives (OE) offered by FPPT Department**

<b>S.No</b>	<b>Course Code</b>	<b>Course Title</b>
1.	23MEFO01	Industrial Safety and GMP in Food Industries

**Professional Certification Course**

<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>
1.	23MEFPC1	HACCP ISO 22000
2.	23MEFPC2	FoSTAC Training / Hygiene Rating and Third-Party Auditing

Other courses to be undergone by the student: MOOC courses 2 to 4 credits

Minimum 73+2 credits to earn the degree



## Operations Research

Semester I  
23MEFC01

Hours of Instruction/week: 4T  
No. of credits: 4

### Objectives:

**CLO1:** To study the mathematical modelling of real life situations in transportation and assignment problems and getting their solutions

**CLO2:** To apply mathematical techniques constructively to make effective decisions in sequencing problems, replacement models and simulation techniques

### Unit I- Linear Programming Problem (LPP)

12

Formulation – graphical solution – simplex Method – duality – Big – M method - two – phase simplex method – transportation problem – North – west corner rule – least cost method – Vogel’s approximation method – MODI method – Assignment problem – Hungarian method.

### Unit II- Sequencing problems

12

Problem of two jobs and n machines- problem of three jobs and n machines- problem of n jobs and m machines-graphical solution.

### Unit III- Inventory control

12

Economic lot size problems - problem of EOQ with shortage - selective control techniques-inventory control with price breaks.

### Unit IV- Replacement problems

12

Introduction-replacement of items that deteriorate with time- replacement of items that completely fails- other replacement problems.

### Unit V- Simulation

12

Introduction – Advantages of simulation techniques – Limitations of simulation techniques –Monte-Carlo simulation – General problems – Applications – Queuing problems – Maintenance problems – Inventory problems.

**Total: 60 Hours**

### Reference Books

1. Handy A.Taha, Operations Research (Seventh edition) Prentice Hall of India (P) Ltd., New Delhi,2005.
2. KantiSwarup, P.K.Gupta, Man Mohan, Operations Research, Sultan Chand and sons Educational Publishers, New Delhi,2005.
3. Larson, R. C., &Odoni, A. R. Urban operations research (No. Monograph),1981.
4. Hillier, F. S. Introduction to operations research. Tata McGraw-Hill Education,2012.

### Course Outcomes:

Upon completion of the course, the student will be able to

**CO1:** Formulate and solve linear programming problems, transportation and assignment problems using various optimization techniques

**CO2:** Expose to sequencing problems

**CO3:** Solve inventory problems in decision making

**CO4:** Explore replacement problems

**CO5:** Apply simulation technique to real world problems

## Unit Operations for Food Industries

Semester I  
23MEFC02

Hours of Instruction/week: 3T  
No. of credits: 3

### Objectives:

**CLO1** : To understand the working principle and applications of various food processing equipment

**CLO2** : To gain knowledge in various unit operations and machineries involved in the food processing industry

### Unit I-Evaporation and Concentration

9

Unit operations in food processing –conservation of mass and energy –overall view of an engineering process-dimensions and units –dimensional and unit consistency –dimensionless ratios- evaporation –definition –liquid characteristics –single and multiple effect evaporation-performance of evaporators and boiling point elevation –capacity –economy and heat balance-types of evaporators – once through and circulation evaporators –short tube evaporators and long tube evaporators –agitated film evaporator.

### Unit II- Mechanical Separation

9

Filtration –definition –filter media–types and requirements-constant rate filtration –constant pressure filtration –filter cake resistance-filtration equipment –rotary vacuum filter –filter press-sedimentation – gravitational sedimentation of particles in a fluid –Stoke’s law, sedimentation of particles in gas-cyclones –settling under sedimentation and gravitational sedimentation-centrifugal separations –rate of separations –liquid –liquid separation –centrifuge Equipment.

### Unit III- Contact Equilibrium Separation

9

Contact equilibrium separation processes –concentrations –gas-liquid and solid -liquid equilibrium – equilibrium concentration relationships –operating conditions-calculation of separation in contact – equilibrium processes-gas absorption –rate of gas absorption –stage –equilibrium gas –absorption equipment-properties of tower packing –types –construction –flow through packed towers-extraction – rate of extraction –stage equilibrium extraction - equipment for leaching coarse solids –intermediate solids –basket extractor -extraction of fine material –Dorr agitator –continuous leaching –decantation systems –extraction towers-washing –equipment’s.

### Unit IV-Crystallization and Distillation

9

Crystallization –equilibrium -solubility and equilibrium diagram –rate of crystal growth –equilibrium crystallization-crystallization equipment –classification –construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers-distillation –binary mixtures –flash and differential distillation steam distillation –theory –consumption –continuous distillation with rectification –vacuum distillation - batch distillation –operation and process –advantages and limitations-distillation equipment’s – construction and operation –factors influencing the operation.

### Unit V- Mixing

9

Definitions and principles– Basic equations standards. Evaluation of constants – work, energy and Power – Agitation and Mixing – Purpose of agitation – Agitated vessels – impellers – propellers – turbine –High efficiency impellers – Impellers for high viscosity liquids. Draft tubes – Power number – mixing and blending of miscible liquids, mixing index.

**Total: 45 Hours**

### Reference Books

1. Earle, R.L, “Unit Operations in Food Processing”. Pergamon Press .2<sup>nd</sup> editionUK,2009.
2. McCabe W.L., Smith J.C. “Unit Operations in Chemical Engineering”, 7<sup>th</sup> Edition, McGraw–Hill Int., 2001.
3. C.J. “Transport Processes and Separation Process Principles”, 4<sup>th</sup> Edition, Prentice Hall, 2003.
4. Geankoplis, C. J. Transport processes and separation process principles:(includes unit operations). Prentice Hall Professional Technical Reference,2003.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Understand the types of evaporators and concentration processes involved in food processing.

**CO2:** Demonstrate the various types of mechanical separation methods in food industries.

**CO3:** Summarize the procedures adopted in equilibrium separation process.

**CO4:** Assess the unit operations in Crystallization and Distillation processes.

**CO5:** Select suitable mixing equipment for food product development.



## **Food Engineering Practicals**

**Semester I**  
**23MEFC03**

**Hours of Instruction/Week: 3P**  
**No. of credits: 1.5**

**Objectives:**

**CLO1:** To understand the working principles of machineries involved in processing of food products

**CLO2 :** To acquaint with the engineering properties of food materials.

1. Thermal processing of liquid foods.
2. Determination of physical properties of Foods.
3. Experiments on drying of fruits and Vegetables
4. Experiments on viscosity of the food materials
5. Experiments on milling and particle size analysis.
6. Experiments on ghee boiling for milk cream
7. Determination of Textural properties of foods
8. Experiments on Rheological property of foods
9. Experiment of food freezing time using Planks equation
10. Experiment on osmotic dehydration of food material
11. Performance evaluation of power operated cleaners.
12. Comparative studies of different types of driers.

**Total: 30 Hours**

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Demonstrate various experiments involved in foods and food products development.

**CO2:** Apply the working principles of machinery used in food processing.

**CO3:** Analyse the engineering properties of foods and food products.

**CO4:** Evaluate the performance of various food processing machinery.

**CO5:** Examine the various parameters involved in food product testing.

## **Food Packaging Practicals**

**Semester I**  
**23MEFC04**

**Hours of Instruction/Week: 3P**  
**No. of credits: 1.5**

**Objectives:**

**CLO1:** To impart knowledge about the properties of packaging materials used for foods.

**CLO2:** To determine the properties of packaging materials and products.

1. Determination of tensile strength of given packaging material.
2. Perform bursting strength for packaging material
3. Determination of leakage in food packaging using leakage
4. Determination of GSM for different packaging materials.
5. Measurement of water absorption capacity of packaging material using COBB
6. Identification of packaging flims
7. Pre-packaging of fruit and vegetables
8. Determination of water vapour permeability (WVTR)
9. Determination of sealing strength of packaging material
10. Experiment on vaccum and modified atmosphere packaging
11. Designing of food packaging for various food products

**Total: 45 Hours**

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Identify the suitable packaging material for desired food products.

**CO2:** Recognize the type of flexible and non-flexible food packaging materials and their applications.

**CO3:** Demonstrate various testing involved in packaging materials

**CO4:** Evaluate the properties of food packaging materials.

**CO5:** Explore new packaging materials with quality standards for food products.

## Research Methodology and IPR

Semester I  
23MEFC05

Hours of Instruction/week: 3T  
No. of Credits: 3

### Objectives:

**CLO1:** Problem formulation, analysis and solutions.

**CLO2:** Technical paper writing / presentation, Patent drafting and filing patents.

### Unit I Research Problem Formulation

9

Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

### Unit II Literature Review

9

Effective literature studies approaches, analysis, plagiarism, and research ethics.

### Unit III Technical Writing/Presentation

9

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

### Unit IV Introduction to Intellectual Property Rights (IPR)

9

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

### Unit V Intellectual Property Rights (IPR)

9

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Total Hours: 45**

### Reference Books:

1. Asimov, "Introduction to Design", Prentice Hall, 1962
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for Beginners" 2010

**Course Outcomes:**

Upon completion of this course, the students will be able to:

- CO1:** Formulate research problem.
- CO2:** Carry out research analysis.
- CO3:** Follow research ethics.
- CO4:** Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- CO5:** Understand procedures of IPR and filing patents in R&D.

## Fruits and Vegetables Processing Technology

Semester II

23MEFC06

Hours of Instruction/week: 3T

No. of credits: 3

### Objectives:

**CLO1:** To demonstrate the manifold processing techniques in fruits and vegetables.

**CLO2:** To Develop a new products from fruits and vegetables using novel techniques.

### UNIT I Post Harvest Technology

9

Physiology of development, ripening and senescence of fruits and vegetables, Harvesting and harvesting indices of fruits and vegetables, post-harvest changes of fruits and vegetables, Technological advances in processing of fruit and vegetables

### UNIT II Minimal process Technology

9

Minimal process Technology- Fresh-cut Produce - Quality Parameters of Fresh-cut Fruit and Vegetable Products- Safety Aspects of Fresh-cut Fruits and Vegetables. Enzymatic Effects on Flavor and Texture of Fresh-cut Fruits and Vegetables- Preservative Treatments for Fresh-cut Fruits and Vegetables- Application of Packaging and Modified Atmosphere to Fresh-cut Fruits and Vegetables, Storage and handling of fresh produce.

### UNIT III Edible coatings for fruits

9

Edible coatings for fruits-Types of edible coatings- Gas permeation properties of edible coatings- Determining diffusivities of fruits- Measuring internal gas composition of fruits-Shelf-life characteristics.

### UNIT IV Novel techniques in processing of fruits and vegetables

9

Novel techniques in processing of fruits and vegetables: Microwave and radio frequency processing, ohmic and inductive heating, high pressure processing , pulsed electric field, high voltage arc discharge, pulsed light technology, oscillating magnetic fields and ultrasonics.

### UNIT V Quality attributes of fresh fruits, vegetables and products

9

Quality attributes of fresh fruits and vegetables- Quality indices of fruit and vegetable juices- Maturity and ripeness indices of fruits and vegetables Microbiology of fresh and processed fruits and vegetable products- Advances in byproduct utilization.

**Total: 45 Hours**

### Reference Books

1. Hui Y. H.,Hand book of fruits and fruit processing. Blackwell publishing,2006.
2. Jongen W. M. F. 2002. Fruits and vegetable processing improving quality. Wood head Publishing Limited, CRC Press LLC,2002.
3. Bayindirli, A.Enzymes in fruit and vegetable processing: chemistry and engineering applications. CRC Press,2010.
4. Sinha, N., Hui, Y. H., Evranuz, E. Ö., Siddiq, M., & Ahmed, J. Handbook of vegetables and vegetable processing. John Wiley & Sons,2010.

### Course Outcomes:

Upon completion of the course, the student will be able to

**CO1:** Analyze the Post-harvest changes in fruits and vegetables.

**CO2:** Demonstrate the various processing techniques of fruits and vegetables.

**CO3:** Apply knowledge in selection of edible coatings for different fruits and vegetables.

**CO4:** Develop new products from fruits and vegetables using novel processing techniques.

**CO5:** Prioritize the quality attributes of fresh fruits, vegetables and products.

## **Milling, Baking and Confectionery Technology**

**Semester II**  
**23MEFC07**

**Hours of Instruction/week: 3T**  
**No. of credits: 3**

**Objectives:**

**CLO1:** This aims to provide knowledge on cereal milling techniques, modern baking and confectionery technology.

**CLO2:** To gain knowledge for the production and quality of Baking and Confectionery products.

**UNIT I - Introduction to Cereals and Milling Techniques** **9**

Importance of Cereals; Nutrient composition of cereal grains; Structure of Cereal Grains; Cereals of the World- origin, classification, types. Storage and pre-processing; Dry Milling technology (rice and wheat.) Wet Milling (maize) - flour quality; Types and grades of flour.

**UNIT II- Raw Materials & Equipment For Baking** **9**

Functions of various raw materials used in baking industries. Essential ingredients, other ingredients. Leaveners and yeast foods, shortenings, emulsifiers, antioxidants, sweeteners, water and salt, Ingredients from milk and eggs.

Introduction to equipment used in bakery unit - bulk handling of ingredients, dough mixers, dividing, rounding, sheeting and laminating. Ovens and slicers, packaging material and equipment, Dough Rheology.

**UNIT III- Bread Manufacturing** **9**

Dough mixing methods for bread making- Straight dough fermentation, sponge and dough, Accelerated processing. Chorley wood bread process, dough retarding and freezing. Processing of bread - characteristic of good bread: Internal characters, external characters. Bread defects and spoilage of bread causes, detection and prevention. .

**UNIT IV- Biscuits, Cookies and Cakes** **9**

Production of cakes and cookies/ biscuits. Types of biscuits dough- Developed dough, short dough's, semi-sweet, enzyme modified dough's and batters. Cake making: Ingredients and their function - different types of cake, cake defects and remedies.

**UNIT V- Confectionery Products** **9**

Quality characteristics of confectionery ingredients; Technology for manufacture of chocolate and hard boiled candy; caramel, toffee, fudge, marshmallow and fondants. Good Manufacturing Practices (GMP) in baking and confectionery industries.

**Total: 45 Hours**

**Reference Books**

1. Hui, Y. H., Corke, H., De Leyn, I., Nip, W. K., & Cross, N. A. (Eds.). Bakery products: science and technology. John Wiley & Sons, 2008.
2. Stanley P Cauvain, Linda S Young, "Technology of Bread Making", Aspen Publication, 2<sup>nd</sup> Edition, 2007.
3. Yogambal Ashok. "Textbook of Bakery and Confectionary". PHI Learning Pvt. Ltd, 2012
4. Matz, Samuel A. "Bakery Technology and Engineering", 3rd Edition. CBS Publishers, 2008.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Adapt the processing and milling techniques of cereals.

**CO2:** Interpret various bakery and confectionery ingredients and their role in products.

**CO3:** Outline the bread manufacturing processes and characteristic analysis.

**CO4:** Evaluate the production and quality of baked products.

**CO5:** Interpret the production and quality of confectionary products.

## **Food Processing and Preservation Practicals**

**Semester II**

**23MEFC08**

**Objectives:**

**Hours of Instruction/Week: 3P**

**No. of credits: 1.5**

**CLO1:** To demonstrate various food processing and preservation techniques.

**CLO2:** To gain the knowledge in instant food products using various food processing techniques.

1. Experiment on Preservation of vegetables using hurdle technology.
2. Experiment on effect of blanching to prevent browning in vegetables.
3. Experiment on preservation of food products using heat treatment.
4. Experiment on dehydration of food products using tray drier.
5. Experiment on osmotic dehydration of food products.
6. Experiment on edible coating of fruits and vegetables.
7. Extraction of essential oils using solvent extraction method.
8. Experiment on fermentation of food products and its analysis.
9. Experiment on different peeling methods.
10. Experiment on pulverisation and sieve analysis.
11. Experiment on development of instant food mixes.
12. Experiment on fluidized bed drier

**Total: 45 Hours**

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Interpret the processing techniques involved in food preservation.

**CO2:** Acquire practical knowledge on handling different driers.

**CO3:** Develop food products by applying different drying techniques.

**CO4:** Recall the size reduction techniques and sieve analysis of foods.

**CO5:** Formulate instant food products using various food processing techniques.



## Food Analysis Practicals

**Semester II**

**23MEFC09**

**Objectives:**

**Hours of Instruction/Week: 3P**

**No. of credits: 1.5**

**CLO1:**To analyze the biochemical properties of foods.

**CLO2:**To analyze the quality analysis of Food products.

1. Determination of Moisture content using IR moisture meter
2. Determination of color using colorimeter
3. Qualitative test for proteins
4. Quality analysis for packaging material
5. Spectrophotometric instrumentation technique
6. Methods to detect adulteration in foods
7. Estimation of free fatty acid value of fat and oil
8. Shelf life studies for various food product
9. Sensory Evaluation of food
10. Determination of quality analysis of milk and milk products

**Total: 45 Hours**

### **Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Demonstrate the various analytical techniques used to determine the quality of food materials.

**CO2:** Analyse the basic constituents present in foods.

**CO3:** Evaluate the biochemical changes involved in formulation of innovative products.

**CO4:** Identification and determination of Microbial analysis in foods

**CO5:** Interpret the Separation Techniques in food analysis

### **Mini Project with Seminar**

**Semester II**  
**23MEFC10**

**Hours of Instruction/week: 2P**  
**No. of Credits: 1**

**Objectives:**

**CLO1:** To make the students to understand about innovative food products development

**CLO2:** To create the innovative design to process food products .

### **Research Project -I**

**Semester III**  
**23MEFC11**

**Hours of Instruction/week:20**  
**No. of Credits: 10**

**Objectives:**

**CLO1:** To make the students identify the area of research in order to satisfy the needs of food Industries and society / In-House as Research Project Phase-I.

**CLO2:** To gain practical knowledge in the area of research in order to satisfy the needs of food Industries and society / In-House as Research Project Phase-I.

### **Internship/Training**

**Semester III**  
**23MEFC12**

**Hours of Instruction/week:-**  
**No. of Credits:2**

**Objectives:**

**CLO1:**To provide students a real time experiential learning environment in food industries for enhancing their skill and knowledge.

**CLO2:** To learn new skills related to their field of study, including technical skills, communication skills, and interpersonal skills.

### **Research Project -II**

**Semester IV**  
**23MEFC13**

**Hours of Instruction/week:32**  
**No. of Credits: 16**

**Objectives:**

**CLO1:**To make the students continue their Research/ Project work done in Project Phase- I.

**CLO2:** To implement new ideas to satisfy the needs of Food Industries and society as Research Project Phase – II

**Program Elective-I**  
**Food Preservation Technology**

**Semester I**  
**23MEFE11**

**Hours of Instruction/week: 3T**  
**No. of credits: 3**

**Objectives:**

**CLO1:** To understand the Principles and different methods of Food Preservation

**CLO2:** To describe the concepts underlying various food preservation methods.

**UNIT I - Food and its Preservation** **9**

General principles of preservation, classification of methods used for preservation, need and importance of preservation at domestic and large scale, Causes of food spoilage; Nature of harvested crop, plant and animal – moisture, pH and water activity of foods.

**UNIT II- Low Temperature Methods** **9**

Principles of storage using low temperature; Product storage; Effect of cold storage on quality, storage of grains; Principles of refrigerated gas storage of foods, Gas packed refrigerated dough, Sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers. Principles of food freezing: Freezing of raw and processed foods, freeze concentration, freeze drying, IQF.

**UNIT III- Canning and chemical preservation** **9**

Principles of canning and bottling of foods; Types and classification of foods used for canning; spoilage of canned and bottled foods, storage of canned foods; Influence of canning on the quality of food; retort pouch processing. Chemical Preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking.

**UNIT IV- Membrane Processing** **9**

Membrane Processing: General principles and advantages, dead end and cross flow, Classification of membrane system: Reverse Osmosis, Nano Filtration, Ultra Filtration, Micro Filtration, Electrodialysis and Pervaporation; Membrane technology comparison chart, Membrane application in the food industries; Membrane performance, and Limitation of membrane processes.

**UNIT V- Food Concentration** **9**

Food Concentration: Evaporation- Definition, types of evaporator (single effect, double effect and multiple effect evaporator); Freeze concentration- General principles and applications, basic elements, ice crystal nucleation, growth and crystallization, separation techniques (filtration and wash column).

**Total: 45 Hours**

**Reference Books**

1. Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge,2003.
2. Gould, G.W. “New Methods in Food Preservation”.Springer, 1995.
3. Hui, Y.H. “Handbook of Vegetable Preservation and Processing”. Marcel Dekker,2003.
4. Subbulakshmi, G., and Shobha A. Udipi “Food Processing and Preservation”.New Age Publications, 2006.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Understand the basic principles of food preservation techniques.

**CO2:** Describe the general principles of refrigerated storage and freezing of foods.

**CO3:** Interpret the functions of canning and chemical preservation of foods.

**CO4:** Analyse the effect of enzymes on spoilage reactions of foods during storage and preservation.

**CO5:** Demonstrate various functions involved in food concentration processes.

## Storage Engineering

Semester I  
23MEFE12

Hours of Instruction/week: 3T  
No. of credits: 3

### Objectives:

**CLO1:** To review about different grain storage structures and its theory.

**CLO2:** To describe about basic principles, different methods, storage structures and design considerations of grain.

### Unit I - Physico - Chemical and Thermal Properties of Grains 9

Grain dimensions, bulk density, true density, and porosity, and coefficient of friction, angle of repose, thermal conductivity and aerodynamic properties. Psychrometry: humidity, % relative humidity, humid heat, deterioration index, wet bulb temperature, use of psychrometric charts.

### Unit II – Insects and Pests 9

Types, extent of losses during storage, causes and control measures, Insecticides- principles, scope of application in warehouses; requirements, group of active ingredients, choice, toxicity, resistance, application techniques, Fumigants - chemicals, areas of application, choice, toxicity, application rates, exposure time and resistance. Rodenticides - Types and effectiveness and limitations, important moulds and bacteria involved in spoilage of grains; effect on physico-chemical and sensory quality of grains; mycotoxins

### Unit III– Grain Storage Theory 9

Principles, moisture movement during bulk storage of grains, methods of aeration, various theories, Physical, chemical, microbiological and sensory changes occurring during storage.

### Unit IV – Grain Storage Structures 9

Grain storage structures - location and material selection for storage building, Types - traditional, modern; temporary and permanent storage structures; design considerations – pressure distribution in storage bins.

### Unit V – Controlled and modified atmosphere Storage 9

Air tight, controlled atmosphere and modified atmospheric storage; differences, principles, optimization of storage gas composition, rate of supply, control systems for oxygen and carbon dioxide- their effect on microbes and limitations.

**Total: 45 Hours**

### Reference Books

1. Shejbal, J. (ed), Controlled atmosphere storage of grains. Elsevier Scientific Publishing Co. London, 1980.
2. Ripp, B. E., ed. Controlled atmosphere and fumigation in grain storages. Elsevier, 2012.
3. Wang, S. X., & Taratorin, A. M. Magnetic Information Storage Technology: A Volume in the Electromagnetism Series. Elsevier, 1999.
4. Bala, B. K., & Bala, B. K. Drying and storage of cereal grains. Enfield (NH): Science Publishers, 1997.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Interpret the physico-chemical and thermal properties of grains.

**CO2:** Visualize the spoilage of grains by Insects and Pests during storage.

**CO3:** Explain the basic principles and methods of grain storage.

**CO4:** Describe about design considerations in grain storage structures.

**CO5:** Demonstrate the concepts of controlled and modified atmospheric storage for grains .

## Advances in Meat, Fish and Poultry Technology

Semester I

Hours of Instruction/week: 3T

23MEFE13

No. of credits: 3

### Objectives:

**CLO1:** To Recognize the various processes included in Meat, Fish and Poultry production.

**CLO2:** To comprehend the knowledge in advanced methods involved in processing of meat, fish and poultry.

### UNIT I- Introduction 9

Sources of meat and meat products in India, its importance in national economy; Industrial profile of meat and poultry industry -Meat production and trade practices.

### UNIT II- Slaughtering of Animals and Poultry 9

Common and commercially important meats; pre and post slaughter handling, meat inspection and grading; animal welfare and safety in slaughter plant; Structure and composition of meat, carcass chilling, ageing; storage of fresh meat. Mechanical deboning, meat tenderization. Factors affecting post-mortem changes, properties and shelf-life of meat- meat quality evaluation.

### UNIT III- Meat Products and Standards 9

Modified atmosphere packaging, packaging of retail cuts; Processing and preservation artificial tenderizing, chilling, freezing, curing, smoking, sausage manufacture, ready-to-eat meats and meat products; Aging, pickling and smoking of meat; Meat plant sanitation and safety, By-product utilization; Recent trends in meat processing; MMPO, MFPO, radiation processing; meat safety. Kosher and Halal certification, safety issues, regulation and quality assurance.

### UNIT IV- Poultry, Egg and Egg Products 9

Poultry industry in India- quality characteristics of poultry products, microbiology of poultry meat, spoilage factors; Lay-out and design of poultry processing plants, Plant sanitation. Poultry meat processing operations, equipment, Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Factor affecting egg quality and measures of egg quality; egg products- egg powder and frozen liquid eggs.

### UNIT V- Fish and Marine Products 9

Types of fish, composition, post-harvest quality changes, post-harvest losses, methods for assessing and preventing losses; structure, post-mortem changes in fish. Processing of fish, crab, prawns, seaweeds, canning, smoking, freezing and dehydration of fish; Freezing techniques and irradiation process, value addition, preparation of fish products (Fish sausage, fermented fish, fish products, fish soups, fish powder, prawn powder and cutlets), seaweed products like pickles, hydrocolloids and fish oil.

**Total: 45 Hours**

### Reference Books

1. Sofos, J.N. "Improving the Safety of Fresh Meat" Wood Head Publishing / CRC, 2005.
2. Toldra, F. "Handbook of Meat Processing", Wiley Blackwell, 2010
3. Kerry, J.P. "Improving the Sensory and Nutritional Quality of Fresh Meat", CRC/Wood Head, 2009
4. Venugopal, V. "Seafood Processing: Adding Value through Quick Freezing, Retort able Packaging and Cook-Chilling & other methods" (Food Science and Technology Vol.13) , CRC press, 2006

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Acquire the basic knowledge about meat and meat products in India.

**CO2:** Recognize the various processes involved in slaughter house.

**CO3:** Recall the advanced processing methods and safety standards underlying meat and meat products.

**CO4:** Assess the production processes, quality characteristics and plant layout for poultry products.

**CO5:** Demonstrate different types of processes and preservation methods for marine products.



## Program Elective-II

### Advances in Food Packaging

Semester I  
23MEFE21

Hours of Instruction/week: 3T  
No. of credits: 3

#### Objectives:

**CLO1:** To understand the various properties of food packaging materials for different food substances

**CLO2:** To prepare the students to learn the concepts of novel packaging techniques for foods.

#### UNIT I - Novel packaging techniques

9

Novel packaging techniques- Active and intelligent packaging, Active packaging techniques. Intelligent packaging techniques, Oxygen scavenging technology. Ethylene scavenging technology. Antimicrobial food packaging: Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.

#### UNIT II- Bio based packaging

9

Bio based packaging of foods-Non-migratory bioactive polymers (NMBP) in food packaging, Advantages of NMBP, limitations, inherently bioactive synthetic polymers: Types and applications, Polymers with immobilized bioactive compounds.

#### UNIT III- Time-temperature indicators

9

Time-temperature indicators (TTIs) - Requirements for TTIs, Development of TTIs, Current TTI systems, maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution, Using TTIs to optimize distribution and stock rotation.

#### UNIT IV- Modified Atmospheric Packaging

9

Modified Atmospheric Packaging (MAP)- MAP applications for fresh-prepared produce, Novel MAP gases, Applying high O<sub>2</sub> MAP Testing novel MAP applications. Packaging-flavour interactions. Factors affecting flavour absorption- role of the food matrix- role of differing packaging materials- Case study: packaging and lipid oxidation, Modelling flavour absorption.

9

#### UNIT V- Modern packaging systems

Modern packaging systems: Green plastics for food packaging –biopolymers in food packaging- Developing novel biodegradable materials- Current applications- Integrating intelligent packaging - role of packaging in the supply chain-Creating integrated packaging, storage and distribution.

Traceability: Radio Frequency Identification. Recycling packaging materials: recyclability of packaging plastics- Improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging.

**Total: 45 Hours**

#### Reference Books

1. Ahvenainen R., Novel Food Packaging Techniques. CRC, 2001.
2. Painy FA, A Handbook of Food Packaging. Blackie, 1992.
3. Palling SJ., Developments in Food Packaging. App. Sci. Publ., 1980.
4. Rooney ML., Active Food Packaging. Chapman & Hall, 1988.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Define types of Novel packaging techniques

**CO2:** Understand the important and limitation of Bio based packaging

**CO3:** Explain the requirements, development and usage of TTIs

**CO4:** Elucidate the different applications of Modified Atmospheric Packaging

**CO5:** Discuss about significant of Modern packaging systems

## Non Thermal Processing Techniques in Foods

Semester I  
23MEFE22

Hours of Instruction/week: 3T  
No. of credits: 3

### Objectives:

**CLO1:** To understand working principles and application of various non thermal processing techniques in foods

**CLO2:** To describe the emerging techniques in food processing.

### Unit I - High Pressure Processing of Foods 9

Principles – applications to food systems – effect on quality – textural, nutritional and Microbiological quality – factors affecting the quality – modelling of high pressure processes – High Pressure Freezing, Principles and Applications

### Unit II - Radiation Processing of Foods 9

Principle, Types of radiation sources. Biological effects of irradiation, Irradiation of Foods Gamma Irradiation, X-Ray Irradiation, UV Irradiation–Combined treatments.Applications and Limitations.

### Unit III - Osmotic Dehydration of Foods 9

Principle – Mechanism of osmotic dehydration – Effect of process parameters on mass. Transfer–Methods to increase the rate of mass transfer – Applications – Limitations of osmotic Dehydration – Management of osmotic solutions

### Unit IV - Ohmic and Ultrasound Processing of Food 9

Principle of ultrasound – Fundamentals – Ultrasound as a processing and preservation aid – Effect on properties of foods Basics of ohmic heating – Electrical conductivity - generic configurations-treatment of products.

### Unit V - Pulsed Light and Hurdle Technology 9

Basics of hurdle technology – Mechanism Application to foods - Newer Chemical and Biochemical hurdles- organic acids – Plant derived antimicrobials – Antimicrobial enzymes – bacteriocins – chitin / chitosan (only one representative example for each group of chemical and biochemical hurdle) Pulsed Electric Field Processing of Foods: Principles – Mechanism of action – PEF treatment systems – Main processing parameters – PEF Technology – Equipments – Mechanism of microbial and enzyme inactivation- safety aspects– Processing of liquid foods using PEF – Process models – Comparison of High pressure processing and PEF – Enzymatic Inactivation by PEF, Examples – Microbiological and chemical safety of PEF foods.

**Total: 45 Hours**

### Reference Books

1. Leistner L. and Gould G. Hurdle Technologies – Combination treatments for food Stability safety and quality, Kluwer Academics / Plenum Publishers, 2002.
2. Da-wen Sun: Emerging Technologies for Food Processing, Elsevier Academic Press and Marcel DekkerInc, 2014.
3. Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Soledad Tapia, M. Pilar Cano, Novel Food Processing Technologies (Food Science and Technology Series), CRC Press,2004.
4. Knoerzer, K., Juliano, P., Roupas, P.,&Versteeg, C. (Eds.).Innovative food processingtechnologies: advances in multiphysics simulation. John Wiley & Sons,2011.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Understand the basic principles and application of high pressure processing of foods

**CO2:** Describe the various types of radiation process of foods

**CO3:** Demonstrate the basic principle and mechanism of osmotic dehydration

**CO4:** Distinguish between ohmic and ultrasound processing of food

**CO5:** Interpret the mechanism involved in Pulsed Light and Hurdle Technology

## Advanced Food Chemistry and Microbiology

Semester I  
23MEFE23

Hours of Instruction/week: 3T  
No. of credits: 3

### Objectives:

**CLO1:** To develop the knowledge of students in the basic concepts of water relations in food, food lipids and antioxidants

**CLO2:** To summarize the complexities of the chemical components and role of microbes in foods.

### UNIT I-Water Relations in Food, Food Lipids and Antioxidants

9

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymatic, physical and microbial changes); Glass transitions and molecular mobility in foods, their relevance to quality and shelf life of food systems. Chemistry of oils and fats, free radical chemistry, types of oxidative reactions, Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

### UNIT II- Food Proteins and Enzymes

9

Chemistry, structure and functions of amino acids and proteins. Enzymic reactions, kinetics, Maillard reactions, enzymic browning, Role of enzyme in food processing. Functional properties of proteins: modified proteins, application in product formulation.

### UNIT III-Starch, Hydrocolloids and Gums

9

Starch, hydrocolloids and gums: occurrence, functions in food systems, properties, gelatinization, retro gradation and modified starches; Food carbohydrates: structural, analytical, physicochemical, nutritional and functional properties of carbohydrates and polysaccharides of plant and microbial origin.

### UNIT IV-Food Fermentation and Spoilage

9

History of microbiology of food; Microbial growth pattern, Microbial growth in food: intrinsic, extrinsic and implicit factors. Microbes of importance in food fermentations: lactic acid bacteria fermentation and starter cultures. Alcoholic fermentations - yeast fermentations, fungal fermentations. Food fermentations- yoghurt, cheese, fermented milks, breads, idli, soy products, fermented vegetables and meats. Types of micro-organism associated with foods spoilage-mold, yeast and bacteria; Biochemical changes caused by microorganisms, microbial contamination and deterioration of vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing.

### UNIT V-Food Pathogens

9

Food poisoning and microbial toxins, Food borne intoxicants and mycotoxins; Microbial interactions; Use of antimicrobial chemicals - organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, benzoates, sorbates / propionates naturally occurring antimicrobials – Their mode of action; Microbial standards for different foods.

**Total: 45 Hours**

### Reference Books

1. Chopra, H.K and Panesar, P.S. "Food Chemistry", Narosa, 2010.
2. Damodaran, S., Parkin, K.L. and Fennema, O.R. "Food Chemistry", 4th Edition, CRC /Taylor & Francis, 2008
3. Belitz, H.D., Grosch, W and Schieberle, P. "Food Chemistry", 3rd Edition, Springer, 2004
4. Walstra, P. "Physical Chemistry of Foods", Marcel Dekker, 2003.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Understand the chemistry and mechanisms of water relations in food, food lipids and antioxidants

**CO2:** Identify the functions of amino acids and functional properties of proteins

**CO3:** Analyse the physicochemical, nutritional and functional properties of starch, hydrocolloids and gums

**CO4:** Develop innovative fermentation process and techniques

**CO5:** Demonstrate about Microbial interactions and it's mode of action on food

**Program Elective-III**  
**Milk and Milk Products Technology**

**Semester II**  
**23MEFE31**

**Hours of Instruction/week: 3T**  
**No. of credits: 3**

**Objectives:**

**CLO1:**To prepare the students to learn the unit operations involved in processing of milk products.

**CLO2:** To gain knowledge in quality control parameters involved in milk and its products

**UNIT I Introduction and Homogenization of milk** **9**

Present status of milk & milk products in India and Abroad; market milk- Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equipment.

Principle of homogenization, Effect of homogenization, single and double stage homogenizers care and maintenance of homogenizers, efficiency of homogenization, design principles of homogenizers, operation and maintenance, application of homogenization in dairy industry.

**UNIT II Equipment in milk processing** **9**

Designs and equipment of tank, types of tanks, pumps in dairy industry. Agitation and mixing, construction of agitators and patterns of flow. Separation by gravity and centrifugal force, clarifiers and separators, centrifugal separator and efficiency of separation, flow rate and power consumption.

**UNIT III Pasteurization and concentration of milk** **9**

Pasteurization of milk; Holding methods, HTST pasteurizer and design principle and thermal death kinetics, care and maintenance, Advantages of HTST pasteurization, UHT processing of milk, quality changes during processing of milk.

Concentration of milk, evaporator, food properties in relation to evaporator performance, Construction and types of evaporator, heat and mass balance in single and multiple effect evaporator, performance characteristics of evaporators and their selection criteria steam economy. Recent advances in evaporating techniques.

**UNIT IV Drying** **9**

Theory of drying, estimation of drying rates and drying time, drying equipment, particle size calculation, design of spray and drum dryer, skim milk and whole milk powders manufacturing methods. Fluidized bed drying, principles of fluidized bed method, types of fluidized bed drier, drying and cooling times in fluidized bed; Freeze drying, agglomeration, methods of agglomeration, recent advances in drying.

**UNIT V Types of milk products** **9**

Dairy products- butter; ghee; cheese; casein and its derivatives; condensed and evaporated milk, traditional products; whey powder, protein concentrate and isolate; lactose their composition, standards, manufacturing, process control and quality control parameters.

**Total: 45 Hours**

## Reference Books

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. Technology of Indian Milk Products. Dairy India Publ,2002.
2. De S.1980. Outlines of Dairy Technology. Oxford Univ. Press,1980.
3. Walstra P. (Ed.).Dairy Science and Technology. 2nd Ed. Taylor & Francis,2006.
4. Rathore NS et al. Fundamentals of Dairy Technology - Theory & Practices.HimanshuPublcn.,2008.
5. Walstra, P., Walstra, P., Wouters, J. T., &Geurts, T. J. Dairy science and technology. CRC press,2005.

## Course Outcomes:

Upon completion of the course, the student will be able to

**CO1:** Emphasis the various equipment employed in dairy processing industry.

**CO2:** Develop value added products from milk.

**CO3:** Analyse the importance of effluent treatment in dairy industry.

**CO4:** Demonstrate the working principle and application of driers used for the production of milk products

**CO5:** Assess the process and quality control parameters involved in milk and its products.



## Technology of Frozen Foods

Semester II

Hours of Instruction/week: 3T

23MEFE32

No. of credits: 3

### Objectives:

**CLO1:**To enable the students to gain knowledge on processing methods of frozen foods.

**CLO2:**To analyse the packaging material for different types of frozen foods.

### UNIT I Introduction to frozen foods

9

Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, thermo-physical properties of frozen foods, freezing loads and freezing time calculation, innovations in freezing process

### UNITII Equipment for freezing

9

Freezing methods and equipment, Transportation of frozen foods, Retail display equipment and management, Monitoring and control of the cold chain.

### UNIT III Quality and safety of frozen foods

9

Quality and safety of frozen fruits and vegetables, Quality and safety of frozen dairy products, Quality and safety of frozen ready meals, Quality and safety of frozen bakery products. Quality and safety of frozen meat and meat, egg and poultry products, Safety and quality of frozen fish, Shellfish, and related products.

### UNIT IV Chemical and sensory analysis of frozen foods

9

Chemical Measurements, Sensory analysis of frozen foods, Foodborne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods.

### UNIT V Frozen food packaging

9

Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery

**Total: 45 Hours**

### Reference Books

1. Kennedy, C. J. (Ed.). Managing frozen foods. Elsevier, 2000.
2. Hui, Y. H., Legarretta, I. G., Lim, M. H., Murrell, K. D., & Nip, W. K. (Eds.). Handbook of frozen foods (Vol. 133). CRC Press, 2004.
3. Erickson, M. C., & Hung, Y. C. Quality in frozen food. Springer Science & Business Media, 2012.
4. Mallett, C. P. (Ed.). Frozen food technology. Springer Science & Business Media, 1993.

### Course Outcomes:

Upon completion of the course, the student will be able to

**CO1:** Acquire knowledge on the fundamentals of frozen foods.

**CO2:** Identify the properties and method adopted to produce frozen foods.

**CO3:** Perceive the quality and safety of frozen food products.

**CO4:** Interpret the chemical and sensory analysis of frozen food products.

**CO5:** Select suitable packaging material for different types of frozen foods.

## **Instrumental Techniques in Food Analysis**

**Semester II**

**Hours of Instruction/week: 3T**

**23MEFE33**

**No. of credits: 3**

**Objectives:**

**CLO1:**To enable the students to apply the knowledge in real time analytical instruments in food processing.

**CLO2:**To analyze the knowledge in advanced analytical techniques used in food industry.

**9**

**UNIT I Calibration and standardization of instruments**

Sampling techniques; Calibration and standardization of different instruments, water activity- its measurements and significance in food quality.

**9**

**UNIT II Spectroscopic techniques**

Spectroscopic techniques using UV/Vis, fluorescence, IR, FTIR, NIR, NMR, atomic absorption, ICP, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.). Color measurements in raw and processed foods.

**9**

**UNIT III Chromatographic techniques**

Chromatographic techniques: Adsorption, column, partition, affinity, ion exchange, size exclusion, GC, GLC, HPLC, HPTLC, GCMS, LCMS.

**UNIT IV Separation techniques**

Separation techniques: Gel filtration, Dialysis, Electrophoresis, Sedimentation, ultrafiltration and ultracentrifugation, solid phase extraction, supercritical fluid extraction, isoelectric focusing, manometric techniques-membrane separation techniques

**9**

**UNIT V Special Instrumental techniques**

Special techniques: immunoassay techniques; isotopic, non-isotopic and enzyme immunoassays; surface tension and its significance in food analysis - enzymatic methods of food analysis; thermal methods in food analysis -differential scanning calorimetry.Texture analysis of foods- viscosity measurements and its significance in food quality.

**9**

**Total: 45 Hours**

**Reference Books**

1. Pare, J. R. J., &Bélanger, J. M. (Eds.).Instrumental methods in food analysis. Elsevier,1997.
2. MacLeod, A. J. Instrumental methods of food analysis. Elek Science,1973.
3. Pomeranz, Y. (Ed.). Food analysis: theory and practice. Springer Science & Business Media,2013.
4. Nag, A. Analytical and Instrumental Techniques in Agriculture, Environmental and Food Engineering. PHI Learning Pvt. Ltd,2015.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Acquire knowledge in calibration and standardization of analytical instruments.

**CO2:** Identify the composition and characteristics of various food samples using advanced chromatographic techniques.

**CO3:** Demonstrate the working and application of various types of chromatographic techniques.

**CO4:** Interpret the separation techniques involved in food analysis.

**CO5:** Perceive the importance of advanced analytical techniques used in food industry.

**Program Elective-IV**  
**Food Waste Management and By-Products Utilization**

**Semester II**  
**23MEFE41**

**Hours of Instruction/week: 3T**  
**No. of credits: 3**

**Objectives:**

**CLO1:**To gain knowledge on food wastes obtained from various food industries..

**CLO2:** To Acquire knowledge involved for processing of the ways to convert them into valuable by products.

**UNIT I- Introduction about Food Industry Waste Utilization** **9**

Waste from rice mill industry – agricultural waste based furnace- types, design. Utilization of rice husk- cement preparation, ceramic materials. Utilization of rice bran - problems in processing of rice bran-stabilization- methods of utilization- rice bran stabilizers-extraction of rice bran-refining-uses of bran, bran oil and defatted bran.

**UNIT II-Fruit and Vegetable Industry Waste Utilization** **9**

Different sources of wastes from fruit and vegetable industries and their availability in India- Status and types of waste available- possible byproducts. Utilization of mango, citrus, apple, guava, grape waste-vinegar production. SCP production, organic acid production from vegetable waste. Utilization of moringa, potato, leafy vegetable waste.

**UNIT III-Tuber Crops Waste Utilization** **9**

Waste from tuber crops - effluent safe disposal- effluent treatment plant- waste recycling plant - feasibility report for food industries using food waste and by products. Alcohol production from cane sugar industry waste.

**UNIT IV- Fish and Poultry Water Utilization** **9**

Fish industry by products- methods and production of fish meal, fish protein concentrate-fish and body oils. Poultry waste- recycling. Tapioca waste utilization- furfural production methods-paper making from cellulosic waste

**UNIT V-By-Product Utilization of Coconut Waste** **9**

Waste from Coconuts – uses of coir pith-biogas production-particle board, utilization of coconut husk-coir fibre. Coconut shell utilization - methods for production of shell charcoal- fuel briquette-machineries used.

**Total: 45 Hours**

**Reference Books**

1. IP. N. Chereminoff& A.C Morresi, "Energy from Solid Wastes" 1976,
2. Onwueme, I. C. The tropical tuber crops: yams, cassava, sweet potato, and cocoyams. John Wiley and Sons,1978.
3. Hui, Y. H. Handbook of fruits and fruit processing. John Wiley & Sons,2008.
4. Borgstrom, G. (Ed.).Fish As Food V2: Nutrition, Sanitation, and Utilization. Elsevier,2012.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Identify the nature of wastes obtained from different food processing industries.

**CO2:** Classify the different sources of food waste from fruit and vegetable industry and its by-products.

**CO3:** Recognize the waste generated from tubers and process involved in conversion of valuable products.

**CO4:** Perceive the waste developed from marine products and its by-products utilization.

**CO5:** Acquire knowledge involved for processing of Coconut waste and its by-product.

## **IoT and Sensors for Food Technology**

**Semester II**

**Hours of Instruction/week: 3T**

**23MEFE42**

**No. of credits: 3**

**Objectives:**

**CLO1:**To acquaint the students on the application of IoT and sensors used in food sector.

**CLO2:** To Designe and Develop the biosensors used for quality assurance in food industry

**Unit I- IOT**

**9**

Introduction to Internet of Things: Overview of Internet of Things- the Edge, Cloud and the Application Development, Anatomy of the Thing, Industrial Internet of Things (MOT - Industry 4.0), Quality Assurance, Predictive Maintenance, Real Time Diagnostics, Design and Development for IOT, Understanding System Design for IOT, Design Model for IOT.

**Unit II- IOT and their challenges**

**9**

Domain specific IOT and their challenges: Illustrated domains-home automation, smart cities, environment, energy, retail, logistics, health and life style.

**Unit III- Biosensors**

**9**

Biosensors, Basic construction and measurement principles of Amperometric, Applications of amperometric biosensors. Principles of optical detection, Types of optical biosensors, Optical biosensors for food quality and food safety

**Unit IV Biosensors for quality assurance in food industry**

**9**

Biosensors -Base devices and sensing agents, Principles of immune analysis, Detection of microorganisms.Applications and future trends.

**Unit V- Novel sensors**

**9**

Novel sensing receptors, Electronic nose, tongue and testers and application in food analysis

**Total: 45 Hours**

**Reference Books**

1. Erika Kress-Rogers. Instrumentation and sensors for the food industry, CRC Press Publishers,2001.
2. I.E. Tothill (Editor).Rapid and On-Line Instrumentation for Food Quality Assurance (Woodhead Publishing in Food Science and Technology).Woodhead Publishing, England,2000.
3. Mutlu, M. (Ed.).Biosensors in food processing, safety, and quality control. CRC Press,2016.
4. Turner, A., Karube, I., & Wilson, G. S.Biosensors: fundamentals and applications. Oxford university press,1987.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Acquire the basic knowledge on the application of IoT in food sector.

**CO2:** Demonstrate the challenges while adopting IoT in food sector.

**CO3:** Recognise the types of biosensors in food sector application.

**CO4:** Appraise the biosensors used for quality assurance in food industry.

**CO5:** Identify the Novel sensors and its application in foods.

## Safety Standards and Quality Auditing

Semester II

Hours of Instruction/week: 3T

23MEFE43

No. of credits: 3

### Objectives:

**CLO1:**To impart knowledge on food safety standards, and labelling as well as sanitation of food

**CLO2:** To gain knowledge in quality monitoring techniques of food allergy.

9

### UNIT I- Principles of Food Safety & Food Quality

Principles of food safety and food quality- quality management principles – methods of food quality evaluation – risk analysis – Food safety testing. Pesticidal residue analysis.

### UNIT II- Food Additives & Adulterants

9

Food additives and preservatives – antioxidants, sweeteners flavours, colours, vitamins, stabilizers. Types of adulterants – test to detect adulterants in foods – metal contaminants - contaminants of processed foods - contaminants of smoked foods. Types of hazards- physical, chemical and biological - Food toxins.

### UNIT III- Food Safety Standards & FSSAI

9

Quality assurance of food commodities – Raw material supply certification of standards for export – APEDA, MPEDA, BVQS, SGS, BIS, BQS, quality system certification - ISO, HACCP, GMP- Indian and International food laws and regulations. FSSAI - Food safety and Standards Act – organizational chart – role of individual authority – principles to be followed – Responsibilities of the food business operator – Liability of manufacturers, packers, wholesalers, distributors and sellers – Enforcement of the act – Licensing and registration of food business

### UNIT IV- Hazard Analysis – HACCP

9

Codex Alimentarius - HACCP - History definition - preliminary task - principles - hazard analysis - record keeping - HACCP implementation and maintenance. General principle of microbial risk - assessment - hazard determination - HACCP worksheet. Critical Control Point - identification of critical points in the process - Methods by which obstacles can be overcome. HACCP implementation for dairy, bakery, fruit and vegetable and meat processing industries

### UNIT V- Food Labelling & Sanitation in Food Industries

9

Food labeling - Food allergy - Food intolerance - Sanitation - Need for sanitation- safe handling – cross contamination -cleaning and cleaners- CIP cleaning sanitizers, hygiene and safety rules for building and equipments – cleaner production in food industry – fruit and vegetable processing - sea food processing - brewing and wine processing

**Total: 45 Hours**

### Reference Books

1. Krammer, A. and Twigg, B.A. “Quality control for the food industry”. Third Ed., AVI. Westport. 1970.
2. InteazAlli, “Food Quality assurance-Principles and Practices”, CRC Press, 2004.
3. Sara Mortimore and Carol Wallace, “HACCP – A practical Approach”, Chapman & Hall, 2003.
4. Mehta R. and George J., “Food Safety Regulation Concerns And Trade- The Developing Country Perspective”, Macmillan India Ltd., New Delhi. 2005.



**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Appraise the safety standards & quality testing of different foods.

**CO2:** Identify the types of food adulterants and its hazards in food processing.

**CO3:** Compile food safety standards and procedures followed in food industries.

**CO4:** Identify the working principles and steps adopted for HACCP in food industries.

**CO5:** Apply the process involved in food labelling and sanitation procedure in food industries.

**Open Elective**  
**Industrial safety and GMP in Food Industries**

**Semester III**  
**23MEFO01**

**Hours of Instruction/week: 3T**  
**No. of credits: 3**

**Objectives:**

**CLO1:**To gain knowledge on the importance of industrial safety

**CLO2:** To understand the good manufacturing practices adopted in food industries.

**UNIT I- Industrial safety** **9**

Need for safety, Safety Legislation: Acts and rules, Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety colour codes. Fire prevention and fire fighting, equipment and methods.

**UNIT II- Fundamentals of Maintenance Engineering** **9**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment

**UNIT III- Wear and Corrosion and their prevention** **9**

Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**UNIT IV- Fault tracing** **9**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's .Types of faults in machine tools and their general causes.

**UNIT V- Periodic and preventive maintenance and GMP** **9**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance. Good Manufacturing Practices (GMP) in food industries.

**Total: 45 Hours**

**Reference Books**

1. Higgins, L. R., Mobley, R. K., & Smith, R. (2002). Maintenance engineering handbook (pp.1-3). New York: McGraw-Hill,2002.
2. Morrow, L. C. Maintenance engineering handbook. Meh,1966.
3. Kececioglu, D. (2003). Maintainability, availability, and operational readiness engineering handbook (Vol. 1) DEStech Publications, Inc.,2003.
4. Dyro, J. (Ed.). Clinical engineering handbook. Elsevier,2004.

**Course Outcomes:**

Upon completion of the course, the student will be able to

**CO1:** Recognize the importance of industrial safety and recall the safety acts

**CO2:** Analyse the significance of maintenance engineering.

**CO2:** Review the types, effects of damages due to wear and corrosion in industries and appropriate preventive measures and methods.

**CO4:** Comprehend the importance of fault tracing.

**CO5:** Adopt Good Manufacturing Practices (GMP) in food industries.

**Audit Course-I**  
**English for Research Paper Writing**  
**(Non-credit Mandatory Course)**

**Semester I**  
**21MEMA11**

**Hours of Instruction/week: 3T**

**Objectives:**

**CLO1:** To familiarize with language for a research paper and research ethics

**CLO2:** To educate the students to write an effective research paper

**Unit I Language of a Research Paper and Ethics**

**9**

Scientific Papers - Definition, Key characteristics - Clarity, Understanding the signals, Language of a scientific paper, Research ethics, rights and permissions- originality and authorship, avoiding ambiguity and vagueness

**Unit II Title Writing**

**9**

Components of a research paper- Importance and requirements while choosing a title. Importance of Syntax in title, Title as a label, matching title to relevance of study

**Unit III Abstract and Content Writing**

**9**

Preparation of abstract. Types of abstracts, Economy of words, Introduction, Reasons for rules, Citations and abbreviations; Writing of Materials and Methods- Purpose, Materials, online resources, Methods, Measurements and analysis, Need for -Tabular materials, References and correct form and Grammar, Abbreviations and Jargons

**Unit IV Result Writing**

**9**

Results and discussion: Results - Contents, Striving for clarity, Handling of numbers, Discussion-components, Factual relationship, significance of the paper, Defining scientific truth. Tables and Illustrations- Graphs, Photographs-when, where and how to use. Importance of Conclusion

**Unit V Journal Writing**

**9**

Citing of references - Rules to follow, reference styles and systems, Titles and inclusive pages, Journal abbreviations. Journal publication - Factors to be considered in choosing the journal, Cover letter to journals for publishing the manuscript. Use and misuse of English in manuscript, Ten commandments of good writing.

**Total hours: 45**

### Reference Books:

1. **Day R**, “**How to Write and Publish a Scientific Paper**”, Cambridge University Press, 2006.
2. **Goldbort R**, “**Writing for Science**”, Yale University Press (available on Google Books), 2006.
3. **Day R**, “**How to Write and Publish a Scientific Paper**”, Cambridge University Press, 2006.
4. **Highman N**, “**Handbook of Writing for the Mathematical Sciences**”, SIAM. Highman’s book, 1998.
5. **Adrian Wallwork**, “**English for Writing Research Papers**”, Springer New York Dordrecht Heidelberg London, 2011.

### Course Outcomes:

Upon completion of the course, the student will be able to:

- CO1:** Write technical papers in a proper format with clarity and readability.
- CO2:** Describe the key components of a research paper and choose an appropriate title.
- CO3:** Develop the writing style of the sections in a manuscript.
- CO4:** Comprehend the results and discussions with clarity.
- CO5:** Apply correct style of referencing, identify a good journal and develop a good quality research paper for publication.

**Audit Course-I**  
Disaster Management  
**(Non-credit Mandatory Course)**

**Semester I**  
21MEMA12

**Hours of Instruction/week: 3T**

**Objectives:**

**CLO1:** To provide broad understanding about the basic concepts of disaster management.

**CLO2:** To be familiar with the concepts of risk assessment and disaster mitigation.

**Unit I Introduction** **9**

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**Unit II Repercussions of Disasters and Hazards** **9**

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

**Unit III Disaster Prone Areas in India** **9**

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

**Unit IV Disaster Preparedness and Management** **9**

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness

**Unit V Risk Assessment and Disaster Mitigation** **9**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co- Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**Total Hours: 45**

**Reference Books:**

1. **R. Nishith, Singh AK, “Disaster Management in India: Perspectives, Issues and Strategies”,** New Royal book Company, 2004.
2. **Sahni, Pardeep et.al. (Eds.), “Disaster Mitigation Experiences and Reflections”,** Prentice Hall of India, New Delhi, 2009.
3. **Goel S. L., “Disaster Administration and Management Text and Case Studies”,** Deep & Deep Publication Pvt. Ltd., New Delhi, 2008.

**Course Outcomes:**

Upon completion of the course, the students will be able to:

- CO1:** Differentiate between natural and man-made disasters.
- CO2:** Deliberate on the repercussions of disasters and hazards and their impact on society, economy and human lives.
- CO3:** Identify the disaster prone zones in India.
- CO4:** Analyze the phenomena triggering a disaster, evaluate risk and manage disasters
- CO5:** Illustrate the concepts of risk assessment and disaster mitigation.

**Audit Course-I**  
**Research and Publication Ethics**  
**(Non-credit Mandatory Course)**

**Semester I**  
**21MEMA13**

**Hours of Instruction/week: 3T**

**Objectives:**

**CLO1:** To understand the basics of philosophy of science and ethics, research integrity, publication ethics and identify research misconducts.

**CLO2:** To understand indexing and citation database, open access publications, research metrics and plagiarism tools.

**Unit I Philosophy, Ethics and Scientific Conduct** **9**

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions
3. Ethics with respect to science and research
4. Intellectual honesty and research integrity
5. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
6. Redundant publications: duplicate and overlapping publications, salami slicing
7. Selective reporting and misrepresentation of data

**Unit II Publication Ethics** **9**

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

**PRACTICE**

**Unit III Open Access Publishing & Publication Misconduct** **9**

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

**Unit IV: Publication Misconduct** **9**



**A. Group Discussions** Subject specific ethical issues, FFP, authorship

1. Conflicts of interest
2. Complaints and appeals: examples and fraud from India and abroad

**B. Software Tools**

1. Use of plagiarism software like Turnitin, Urkund and other open source software tools

**Unit V: Databases and Research Metrics**

**9**

**A. Databases**

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

**B. Research Metrics**

1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g index, HO index, altmetrics

**Total hours: 45**

**Reference Books:**

1. **Bird, A.** “**Philosophy of Science**”. Routledge, 2006
2. **MacIntyre, Alasdair** “**A Short History of Ethics**”. London. 1967
3. **P. Chaddah,** “**Ethics in Competitive Research: Do not get scooped; do not get plagiarized**”, ISBN:978- 9387480865 2018
4. **National Academy of Sciences, National Academy of Engineering and Institute of Medicine. On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition.** National Academies Press. 2009
5. **Resnik, D. B. What is ethics in research & why is it important.** National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>6. **Beall, J. (2012).** Predatory publishers are corrupting open access. *Nature*, 489(7415), 179-179. <https://doi.org/10.1038/489179a> 2011
6. **Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance,** ISBN: 978-81-939482-1-7. [http://www.insaindia.res.in/pdf/ Ethics Book. pdf](http://www.insaindia.res.in/pdf/Ethics%20Book.pdf) 2019.

**Course Outcomes:**

**At the end of the course, the student will be able to**

- CO1:** Infer the importance of publication ethics, scientific misconduct and honesty
- CO2:** Apply open access publishing concepts.
- CO3:** Use available data bases and research metrics for their paper publications.
- CO4:** Comprehend the philosophy of science and ethics and research integrity.
- CO5:** Differentiate indexing and citation databases, open access publication and research metrics.

**Audit Course-II**  
**Pedagogy Studies**  
**(Non-credit Mandatory Course)**

**Semester II**  
**21MEMA21**

**Hours of Instruction/week: 3T**

**Objective:**

**CLO1:** To impart knowledge about pedagogy methods

**CLO2:** To be able to evaluate attainment in learning

**Unit I Introduction and Methodology**

**9**

Understanding student's cognitive and perceptual abilities, Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teaching Learning outcome, Teacher education, Research questions, Overview of methodology and Searching.

**Unit II Thematic Overview and Learner Intelligences**

**9**

Pedagogical practices, formal and informal classroom, multiple intelligences, Curriculum and syllabus, adopting teaching methods that appeal to different intelligences

**Unit III Evidence on the Effectiveness of Pedagogical Practices**

**9**

Methodology of teaching, Materials for teaching, support system for effective pedagogical practices, online and blended classrooms, Think-Write-Pair-Share, developing e content, approaches and strategies, engaging learners in the virtual mode, Brain-based learning, Principles of Brain based learning

**Unit IV Professional Development**

**9**

Follow-up support, Peer, Individual, group learning, Barriers to learning, Special Learning Disabilities, Dyslexia, Dysgraphia, Dyspraxia, Dyscalculia. Use of technological tools to enhance learning, Classroom management, online teaching for rural India

**Unit V Measuring Attainment in Learning and Future Directions**

**9**

Difference between assessment and Evaluation, Formative and Summative Assessment, Methods of assessing in classroom, Concept Questions and Peer Instruction, Background Knowledge Probe and Peer Review. Rubrics Methods of Evaluation, Inspiring students to be autonomous learners, online tests, and evaluation (Quizzes. Polling, drag and drop, identification, chat, software tools etc.), motivating students with career guidance and research focus.

**Total Hours: 45**

**Reference Books:**

1. <http://www.jensenlearning.com/what-is-brain-based-research>

2. **Anandan, K.N.**, “**Tuition to Intuition**”, Transcent, Calicut, 2006
3. **Daniel Kenneth Apple**, “**Process Education: Teaching Institute Handbook : Teaching, Learning, Self-grower, Assessment, Facilitation, Curriculum Design**”, Pacific Crest Software, 1998
4. **Thomas A. Angelo, K. Patricia Cross**, “**Classroom Assessment Techniques: A Handbook for College Teachers**”, Wiley, 1993
5. **Harwell, J. M**, “**Complete Learning Disabilities Handbooks**”, New York. The Centre for Applied Research in Education, 1989
6. **Raj, F**, “**Breaking Through, A Handbook for Teachers and Parents of Children with Specific Learning Disabilities**”. VIFA Publications, Secunderabad, 2010.
5. **Seffetullah Kuldass, Hairul Nizam Ismail, Shahabuddin Hashim**, Unconscious learning processes: mental integration of verbal and pictorial instructional materials

**Course Outcomes:**

Upon completion of the course, the students will be able to:

- CO1:** Recognize conceptual framework and enhance teaching learning outcomes.
- CO2:** Differentiate different pedagogical practices and teaching methodologies.
- CO3:** Understand teaching methods, identify materials and support systems for effective pedagogical practices.
- CO4:** Communicate in a better way with learners of diverse cognitive abilities.
- CO5:** Differentiate between assessment and evaluation, attainment of targeted learning outcomes and appreciate the tools for evaluation.

**Audit Course-II**  
**Value Education**  
**(Non-credit Mandatory Course)**

**Semester II**  
**21MEMA22**

**Hours of Instruction/week: 3T**

**Objectives:**

**CLO1:** To understand value of education and self- development

**CLO2:** To motivate students to imbibe good values.

**Unit I Value Education and Human Rights** **9**

Value education-Meaning, objectives, importance, Scope and needs. Types-Personal, social, religious, spiritual, universal, cultural and moral values. Values in life and developing a Mission statement. Human rights- meaning, and laws on violation of human rights.

**Unit II Values, Goals and Standards** **9**

Values, goals and standards-meaning and importance in life. Goals- short term and long term goals. Personal goals, family goals. Relationship among values, goals and standards in life. Standards- meaning and its importance and criteria in setting standards and practicing.

**Unit III Human Values and Cultivation of Values** **9**

Self-assessment and self-awareness. Importance of cultivation of values-sense of duty, devotion, self-reliance, confidence, concentration, truthfulness, Cleanliness, honesty, humanity, Power of faith, National unity, Love for nature, Discipline. Corporate ethics-Ethical values and global values.

**Unit IV Personality and Behavior Development** **9**

Social and scientific attitude, developing responsible attitude- Accepting responsibilities in personal and professional life, developing readiness to accept changes in life and society. Integrity and discipline, Effective personality- 7 habits of effective people. Positive thinking-meaning and importance. Understanding positive thinking and self-talk, How to avoid negative thinking, Putting into practice and practicing positive thinking in everyday life.

**Unit V Importance of Character and Competence** **9**

Character and competence, Achievement motivation, Self-management and good health Importance of religion in life- Holy books vs. Blind faith, Role of women in inculcating moral values in family to nurture good citizens of the society. Self-control-meaning, importance and ways to help improve self-control and build good habits.

**Total Hours: 45**

### Reference Books:

1. **R.P.Shukla** “Value Education and Education for Human Rights” - Sarup and sons, New Delhi, 2004.
2. **Chakraborty S.K.**, “Values and Ethics for Organizations- Theory and Practice”, Oxford University Press, New Delhi, 1998.
3. **Peale Norman Vincent**, “The Power of Positive Thinking” Edition 1, 2016.
4. **Home management - Values, Goals and Standards – Brain Kart**  
[www.brainkart.com](http://www.brainkart.com) › article › Home-management
5. **Frances Bridges** “Contributor Careers- Self-control, 2018.

### Course Outcomes:

Upon completion of the course, the students will be able to:

- CO1:** Differentiate the values in life and recognize human rights.
- CO2:** Realize the significance of goals and standards in life.
- CO3:** Develop good habits and lead a disciplined and meaningful life.
- CO4:** Accept the responsibilities, develop an effective personality and avoid negative thinking.
- CO5:** Practice self-control and inculcate moral values to become good citizens of the society.

## Community and Social Service (CSS)

Semester II  
23MXCSS1

Hours of Instruction/week: 2

### Objectives:

**CLO1:**To create awareness on needs and problems of the community with social awareness and a caring attitude for needy people

**CLO2:** To develop skills in organizing women into groups for collective action

### Unit I Profile of Women in India

6

Profile of women in terms of literacy, work participation, health, reproductive health and nutrition and social and political participation. Survey to find out the literacy rate in different areas.

### Unit II Government Programmes for the upliftment of Women

6

Education, Employment and Health

### Unit III Organizational support for Women

6

Self-help Groups, a strategy for Entrepreneurship among women. Role of NGOs for upliftment of women, organizing women into groups.

### Unit IV Women and Political Participation

6

Need for political empowerment of women, 73rd amendment, 1/3rd reservation of women in Panchayat and local bodies performances, problems and prospects of elected women. Study the participation of women in local bodies

### Unit V Students involvement in community Social Services

6

Data base on women – literacy, employment, issues related to work participation, marital problems and disability. Awareness generation programmes – child labour, violence against women, blood donation and legal provisions safeguarding women. Activities oriented: adult literacy and subject related activities

**Total: 30 Hours**

### Reference Books

1. Department of Home Science Extension, 2006, approaches to women and Development, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore.

### Course Outcome:

Upon completion of the course, the students will be able to

**CO1:** To possess the attributes of being morally and intellectually responsive with social awareness and a caring attitude for needy people

**CO2:** To serve the community by applying their professional knowledge and skills and to organize various types of community service activities and awareness programmes.

**CO3:**To develop a right attitude of life, good interpersonal and communication skills and a sense of social awareness

