Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A' Grade by NAAC.Recognised by UGC under Section 12 B
Coimbatore - 641 043, Tamil Nadu, India
School of Engineering

M.E. Food Technology

Programme Specific Outcomes:
PSO1: Apply appropriate technologies to develop innovative and safe food products.
PSO2: Promote graduates for a prospective career and pursue higher education.

Scheme of Instruction & Examination
(For students admitted from 2019-20 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		
First Semester											
I	**Core Courses (CC)**										
	19MEFC01	Operations Research	4	-	3	40	-	60	-	100	4
	19MEFC02	Unit Operations in Food Process Engineering	4	-	3	40	-	60	-	100	4
	19MEFC03	Food Engineering Practicals	-	4	3	-	40	-	60	100	2
	19MEFC04	Food Packaging Practicals	-	4	3	-	40	-	60	100	2
	19MEFC05	Research Methodology and IPR	4	-	3	40	-	60	-	100	4
	Program Electives (PE)										
	19MEFE11/ 19MEFE12/ 19MEFE13	Program Elective-I	4	-	3	40	-	60	-	100	4
	19MEFE21/ 19MEFE22/ 19MEFE23	Program Elective-II	4	-	3	40	-	60	-	100	4
II	**Non Credit Mandatory Courses (NCMC)**										
	Audit Course (AC)										
	19MEMA11/ 19MEMA12	Audit Course-I	3	-	2	100	-	-	-	100	Remark
	Extracurricular Course (ECC)										
		CSS	2		-						-

Program Elective-I: 19MEFE11 Drying Technology/ 19MEFE12 Food Preservation Technology/19MEFE13 Storage Engineering

Program Elective –II: 19MEFE21 Advances in Food Packaging / 19MEFE22Non Thermal Processing Techniques in Foods/ 19MEFE23 Engineering Properties of Foods

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		
	Second Semester										
I	**Core Courses (CC)**										
	19MEFC06	Fruits and Vegetables Processing Technology	3	-	3	40	-	60	-	100	3
	19MEFC07	Cereal, Pulse and Oilseeds Processing Technology	3	-	3	40	-	60	-	100	3
	19MEFC08	Food Processing and Preservation Practicals	-	4	3	-	40	-	60	100	2
	19MEFC09	Food Analysis Practicals	-	4	3	-	40	-	60	100	2
	19MEFC10	Mini Project with Seminar	-	2	-	-	100	-	-	100	1
	Professional Certification Course (PCC)										
	19MEFP01	Professional Certification Course	-	-	-	100	-	-	-	100	2
	Program Electives (PE)										
	19MEFE31/ 19MEFE32/ 19MEFE33	Program Elective-III	4	-	3	40	-	60	-	100	4
	19MEFE41/ 19MEFE42/ 19MEFE43	Program Elective-IV	4	-	3	40	-	60	-	100	4
II	**Non Credit Mandatory Courses (NCMC)**										
	Audit Course (AC)										
	19MEMA21/ 19MEMA22	Audit Course-II	3	-	2	100	-	-	-	100	Remark
	Extracurricular Course (ECC)										
	19MECS01	CSS	2	-	2	50	50	-	-	100	Remark
Internship during summer vacation for one month											
Program Elective –III: 19MEFE31 Milk and Milk Products Technology / 19MEFE32Flavour, spices and plantation products/19MEFE33 Modern Baking and Confectionery Technology											
Program Elective-IV:19MEFE41Instrumental Techniques in Food Analysis/ 19MEFE42 Advances in Food Chemistry and Technology/19MEFE43 Sensors for Food Technology											
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		
	Third Semester										
I	**Core Courses (CC)**										
	19MEFC11	Dissertation-I	-	20	-	-	100	-	-	100	10
	19MEFC12	Internship	-	-	-	-	100	-	-	100	1
I	**Program Electives (PE)**										
	19MEFE51/ 19MEFE52/ 19MEFE53	Program Elective-V	4	-	3	40	-	60	-	100	4
I	**Open Electives (OE)**										
	19MEMO01/ 19MEMO02/ 19MEMO03	Open Elective	4	-	3	40	-	60	-	100	4
Program Elective V: 19MEFE51Food Safety and Quality Management /19MEFE52 Food Process Design and Layout/ 19MEFE53Advances in Meat, Fish and Poultry Technology											

Open Electives :		19MEBO01Quality Assurance and Safety in Hospitals/19MEOO01 Web Mining/19MELO01 Waste to Energy									
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		
Fourth Semester											
I	**Core Course (CC)**										
	19MEFC13	Dissertation-II	-	32	-	-	200	-	200	400	16
										Total	**80**

Total credits required to earn the degree: 80 and successful completion of Non-Credit Mandatory Courses

Other courses to be undergone by the students: MOOC Course – 2 credits

List of Program Electives

S.No	Course Code	Course Title
1.	19MEFE11	Drying Technology
2.	19MEFE12	Food Preservation Technology
3.	19MEFE13	Storage Engineering
4.	19MEFE21	Advances in Food Packaging
5.	19MEFE22	Non Thermal Processing Techniques in Foods
6.	19MEFE23	Engineering Properties of foods
7.	19MEFE31	Milk and Milk Products Technology
8.	19MEFE32	Flavour, spices and plantation products
9.	19MEFE33	Modern Baking and Confectionery Technology
10.	19MEFE41	Instrumental Techniques in Food Analysis
11.	19MEFE42	Advances in Food Chemistry and Technology
12.	19MEFE43	Sensors for Food Technology
13.	19MEFE51	Food Safety and Quality Management
14.	19MEFE52	Food Process Design and Layout
15.	19MEFE53	Advances in Meat, Fish and Poultry Technology

Open Electives (OE)

S.No	Course Code	Course Title
1.	19MEFO01	Industrial safety and GMP in Food Industries

List of Audit Courses (Non-Credit Mandatory Course)

S. No	Course Code	Audit Course - I
1.	19MEMA11	English for Research Paper Writing
2.	19MEMA12	Disaster Management

S. No	Course Code	Audit Course - II
1.	19MEMA21	Pedagogy Studies
2.	19MEMA22	Value Education

***Any one course by MOOC from Swayam (NPTEL)**

S. No	Course Code	Course Title
1.	19MEFMC1	MOOC [Title of the course completed with certificate]

Operations Research

Semester I **Hours of Instruction/week: 4T**
19MEFC01 **No. of credits: 4**

Objective:

- To study the mathematical modeling of real life situations, getting their solutions, transportation, sequencing and replacement models and simulation techniques

Outcomes:
At the end of the course, the student will be able to

CO1: formulate and solve linear programming problems, transportation and assignment problems using various optimizationtechniques
CO2: expose to sequencing problems
CO3: solve inventory problems in decision making
CO4: solve replacement problems
CO5: apply simulation technique to real world problems

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 detoriate 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

References:

1. Handy A.Taha, 2005, Operations Research (Seventh edition) Prentice Hall of India (P) Ltd., New Delhi.
2. KantiSwarup, P.K.Gupta, Man Mohan, 2005, Operations Research, Sultan Chand and sons Educational Publishers, New Delhi.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes (PSOs)	
19MEFC01	CO1	H			M									**1**	**2**
	CO2		H		H							M		M	
	CO3	H													
	CO4	H	H		M							L			
	CO 5	H	H												M

Unit Operations in Food Process Engineering

Semester I

19MEFC02 **Hours of Instruction/week: 4T**

No. of credits: 4

Course Objective:

- To know the various types of equipment,operation and utilization in the food industry.

Course Outcomes:

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

CO1:Define the various unit operations in food processing.

CO2:Compute the moisture content of food materials.

CO3:Describe and demonstrate the various process equipments

CO4:Evaluate the different operations in food processing.

CO5:Estimate the energy requirement for the different unit operations.

Unit I - DRYING AND DEHYDRATION : **12**

Moisture and its measurements - direct and indirect methods – Equilibrium moisture – methods of determination – EMC Models – Henderson ,Kelvin, PET and GAB models – importance of EMC- water activity – psychrometry — Drying theory – Drying rate – Mechanical Drying – hot air dryers – Types- fixed -fluidized bed – LSU drier-Spray drier- Osmotic dryer - vacuum shelf dryer – freeze dryer.

Unit II - MECHANICAL SEPARATION : **12**

Screening: Types, Equipments; Filtration: Filter media types and requirement – constant rate filtration – constant pressure filtration – filter cake resistance – filtration equipments – filter press – rotary drum filters – sedimentation – gravitational sedimentation – Stoke's law – sedimentation in cyclones. Centrifugal separations – rate of separation – centrifuge equipment.

Unit III - EVAPORATION : **12**

Definition – liquid characteristics – Types of evaporators -single and multiple effect evaporators - once through and circulation evaporators – Agitated film evaporators. Performance – evaporator capacity – boiling point elevation and Duhring's rule. Heat transfer coefficients – Evaporators economy – enthalpy balance of single effect evaporator – multiple effect evaporator – methods of feeding. Capacity and economy of multiple effect evaporator.

Unit IV - SIZE REDUCTION: **12**

Principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products – energy and power requirements – Rittinger's, Kick's and Bond's law – Size reduction equipments – crushers – hammer mill – Ball mill-Colloidal mill-attrition mills.

Unit V - MIXING : **12**

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 : 60 Hours

Text Books

1. DG Rao, "Fundamentals of Food Engineering" PHI Learning Private Limited, New Delhi.

2. Geankoplis CJ, "Transport Processes and Separation Processes Principles" .Printice Hall India, New Delhi, ISBN-978-81-203-2614-9, 2008

3. Warren,L McCabe, J.C. Smith and Peter Harriot,"Unit Operations of Chemical Engineering " McGraw Hill International Edition, Singapore, ISBN-007-424740-6, 2005

Reference Book

1. Earle, R.L, "Unit Operations in Food Processing". Pergamon Press .2nd edition UK,2003.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes (PSOs)	
														1	2
19MEFC02	CO1		H												
	CO2			M								M		M	
	CO3		H												
	CO4	H										M			
	CO 5			M											M

SEMESTER I **Food Engineering Practicals** **Hours of instruction/week: 4P**
19MEFC03 **No. of credits: 2**

Course Objective:

- To acquaint with the various types of equipment, operation and utilization in the food industry.

Course outcomes:

After completion of the course the students are able to

CO 1- Apply the processing technique in the manufacturing of various food products.

CO 2- Demonstratethe various machineries or equipments involved in the processing of food products.

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
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

Total: 30 Hours

Semester I **Food Packaging Practicals**

19MEFC04 **Hours of instruction/week: 4P**

No. of credits: 2

Objective:

To impart knowledge and skills related to designing packaging system in food products and developing skills in handling of packaging equipment in the students.

Course outcomes:

On completion of the course the students are able to

CO 1-Demonstrate and explain food packaging techniques used to determine the strength of food materials.

CO 2- Apply knowledge in the development of new packaging with proper quality parameters.

1. Identification of different types of packaging and packaging materials.
2. Determination of tensile strength of given material.
3. To perform different destructive tests for glass containers.
4. To perform non-destructive tests for glass containers.
5. Determination of wax weight.
6. Determination of tearing strength of paper.
7. Measurement of thickness of packaging materials.
8. To perform grease-resistance test in plastic pouches.
9. Determination of bursting strength of packaging material.
10. Determination of water-vapor transmission rate.
11. Demonstration of can-seaming operation.
12. Testing of chemical resistance of packaging materials.
13. Determination of drop test of food package.
14. Visit to relevant industries.

Total :30 Hours

Semester I **Research Methodology and IPR** **Hours of Instruction/week:4T**
19MEFC05 **No. of credits: 4**

Objective:
To impart knowledge related to research problem formulation and Intellectual Property Rights.

Course Outcomes:
At the end of this course, students will be able to

CO1: Understand research problem formulation.
CO2: Understand about literature studies
CO3:Analyze research related informationand follow research ethics
CO4:Emphasisethe need of information about technical writing and research.
CO5:Understandabout Patent Rights.

12

Unit 1: 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: Effective literature studies approaches, analysis Plagiarism, Research ethics 12

Unit III: 12
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: 12
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: 12
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical IndicationsNew Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.

References: **Total: 60 Hours**

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2.Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5..Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
6..T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	**Program Specific Outcomes (PSOs)**	
														1	**2**
19MEFC05	CO1		H												
	CO2			M								M			
	CO3													M	
	CO4														M
	CO 5			M									M		

SEMESTER II **Fruits and Vegetables Processing Technology**

19 MEF C06 **Hours of Instruction/week: 3T**

No. of credits: 3

Objective:

To impart knowledge related to various processing techniques involved in the processing of fruits and vegetables.

Course Outcomes:

At the end of this course, students will be able to

CO1: Demonstrate the various processing techniques involved in the processing of fruits and vegetables.

CO2: Apply knowledge in selection of packaging types for fruits and vegetables and its products

CO3: Develop new innovative products from fruits and vegetables.

CO4:Emphasiseon the recent techniques in processing of fruits and vegetables.

CO5:Understandabout quality attributes of fresh fruits and vegetables.

UNIT I **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.

9

UNIT II

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 **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.

9

UNIT IV

Recent 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.

9

UNIT V

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

1. Hui Y. H., 2006. *Hand book of fruits and fruit processing*. Blackwell publishing.
2. Jongen W. M. F. 2002. *Fruits and vegetable processing improving quality*. Wood head Publishing Limited, CRC Press LLC

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	**Program Specific Outcomes (PSOs)**	
														1	**2**
19 MEF C06	CO1		H												
	CO2											M			
	CO3				M								M		
	CO4		H											M	
	CO 5			M									M		

SEMESTER II **Cereal, Pulse and Oil Seeds Processing Technology**

19 MEF C07 **Hours of Instruction/week: 3T**

No. of credits: 3

Objective:

To impart knowledge related to various processing techniques involved in the processing of cereal, pulse and oil seeds.

Course Outcomes:

At the end of this course, students will be able to

CO1: Demonstrate the various processing techniques involved in the processing of Cereals ,Pulses and Oil seeds

CO2: Apply knowledge in rice processingand its products

CO3:Understand aboutwheat processingand its products.

CO4: Emphasise on the recent techniques in processing of pulses.

CO5:Understandabout Importance and trends of oil seed processing.

UNIT I **9**

Introduction -production and utilization trends; Structure and Composition of common cereals, pulses and oilseeds. Food grain storage structure: recent trends - Fumigation processes, aeration and drying during storage- Problems of dust explosion in grain storages- Quality changes of grains during storages and remedial measures.

UNIT II **9**

Rice: Present scenario of rice processing industries. Effect of different factors on milling yield and rice quality.Modern methods of paddy parboiling. Paddy milling- pretreatments -their advantages - by-products and their utilization. Recent methods of paddy processing and quality testing. Isolation, modification and utilization of rice starch. Modern, convenience and extruded products from rice.

UNIT III **9**

Wheat: Present scenario of wheat processing industries- quality testing of wheat grain and the milled product (flour, dough etc)- factors affecting yield and quality of flour- milling equipments- composite and alternate flours, air classification and their applications. Wheat starch processing, modification and utilization, development of wheat based extruded products.

Maize, coarse and pseudo cereals: Modern dry and wet milling methods of maize, working of milling equipment- Production and utilization of corn starch derivatives- equipments used in the milling of coarse and pseudo cereals. Nutritional products and their recovery in coarse cereals, recent utilization trends in course and pseudo cereals. Latest quality evaluation methods the coarse cereal grains.

UNIT IV **9**

Pulses: Pretreatments given to pulses before milling- anti nutritional factors-processing methods-Latest quality evaluation methods for pulses. Modern pulse milling methods. Losses during milling and their control. Utilization trend of pulses.

UNIT V **9**

Oil Seeds: Importance and trends of oil seed processing in India- Machinery and equipments used in the crude oil extraction and its refining- Latest production technology of shortenings, lecithin, confectionery coatings.

Total: 45 Hours

References

1. Chakrabarty MM. 2003. Chemistry and Technology of Oils and Fats. Prentice Hall.
2. Dendy DAV &Dobraszczyk BJ. 2001. Cereal and Cereal Products. Aspen.
3. Hamilton RJ &Bhati A. 1980. Fats and Oils - Chemistry and Technology. App. Sci. Publ.
4. Hoseney RS. 1994. Principles of Cereal Science and Technology. 2nd Ed

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	**Program Specific Outcomes (PSOs)**	
														1	**2**
19 MEF C07	CO1														
	CO2			H								M			
	CO3		M												
	CO4				H									M	
	CO 5			M											

SEMESTER II

19MEFC08 Food Processing and Preservation Practicals

Hours of Instruction/week: 4P
No. of credits: 2

Course Outcomes:
After completion of the course the students will be

CO 1- Able to determine the quantitative parameters involved in food preservation.
CO 2-Apply knowledge in the development new packaging materials to give better shelf life.

1. Estimation of shelf life of products packed in metal containers-Glass container-flexible packages
2. Determination of permeability of films
3. Determination of WVTR
4. Determination of OTR
5. Estimation of microbial load inside food packages
6. Estimation of tensile strength of plastic films
7. Determination of rheological properties of food samples
8. Design of cold storage for fruits and vegetables
9. Experiments on size reduction of fruits and vegetables
10. Experiment on milling of grains.

Total: 60 Hours

Semester II **Food Analysis Practicals**

19MEFC09 **Hours of Instruction/week: 4P**

No. of credits: 2

Course outcomes:

On completion of the course the students are able to

CO 1-Demonstrate and explain various analytical techniques used to determine the quality of food materials.

CO 2- Apply knowledge in the development of new products with proper quality Parameters

1. Measuring water activity in any hygroscopic food material (for instance - biscuits/potato chips/coffee powder).
2. Estimation of tannin/phytic acid by spectrometric method.
3. Separation of amino acids/coal tar dyes by two dimensional paper chromatography.
4. Separation and identification of sugars in fruit juices.
5. Electrophoretic Techniques in food analysis.
6. Separation of proteins by ion-exchange chromatography.
7. Separation and identification of carotenoids by column chromatography.
8. Identification and determination of organic acids by HPLC.
9. Analysis of dietary fibre/glucose by enzymatic method.
10. Microbial analysis in foods.

Total : 60 hours

Program Electives

Semester I **Drying Technology**
19MEFE11 **Hours of Instruction/week: 4T**
No. of credits: 4

Objective:

- To impart knowledge related to the basic theory of drying and its significance in food systems.

Course Outcomes:

At the end of this course, students will be able to

CO1: Demonstrate ondrying principles and psychrometric chart.
CO2: Apply knowledge principles to solve problem on drying.
CO3:Understand aboutdifferent types of dryers for different food materials.
CO4: Emphasise on design dryers for different types of foods.
CO5:Understandabout radiation and dielectric dryers.

Unit I - THEORY OF DRYING:

Principles of drying – Fundamentals of air-water mixtures – Psychrometric chart – Problems based on pyschrometry – Drying curves – constant and falling rate period - Heat and mass transfer in dryers – moisture content in foods – determination of moisture content and its measurement - methods of determination - Equilibrium moisture content – methods of determination – EMC models

Unit II - DRYING METHODS :

Selection of dryers – design of dryers - Conduction drying – convection drying – Pneumatic or fluidized bed drying – natural air drying – heated air drying – recirculatory dryer (non mixing type) – LSU dryer (continuous mixing type) – Baffle dryer - Radiation drying – Sun drying and infrared drying – Dielectric drying – chemical drying -Thin layer and deep bed drying - dryer performance

Unit III - DRUM DRYER, FOAM MAT DRYER AND FREEZE DRYER :

Drum driers - Types of Drum Dryers - Principles of Operation of the Drum Dryer – rotary dryers Cabinet drying – vacuum tray dryers - Foam Mat Drying- Principles- Equipments- Factors affecting Foam mat drying – Freeze dryers - Fundamentals of freeze drying – Freezing – Primary drying stage – secondary drying stage -Changes during freeze drying – Condensation, defrosting – Industrial freeze driers.

Unit IV - FLUIDIZED BED DRYER, SPRAY DRYER, OSMOTIC DRYING :

Fluidized bed dryer – Spouted bed dryer - spray drying of foods - Principles of Spray Drying Processes – Atomizers and nozzles - Reconstitution of powders – Foam spray drying - Osmotic dehydration – Principles – Factors affecting osmosisEquipment used.

Unit V - RADIATION AND DIELECTRIC DRYERS :

Infrared drying – principles - microwave drying of foods – dielectric concepts – construction and working – Radio Frequency drying – principles – working - Flash Dryers - Design of Flash Dryers - Materials Dried in Flash Dryers.

Text Books

1. Arun S. Mujumdar, “Handbook of Industrial Drying”, CHIPS, 3rd Edition, 2006.
2. Chakraverty. A. “ Post Harvest Technology of Cereals, Pulses and Oil seeds”, Oxford and IBH Publishing Co.Pvt. Ltd. New Delhi, 2014.

Reference Books

1. Paul Singh, R and Dennis R. Heldman.. Introduction to Food Engineering Academic Press, 2001
2. Hui Y. H,:”Food Drying Science and Technology, Microbiology, Chemistry, Application”, CHIPS, 2008. 3. Loesecke,H. W. V, “Drying & Dehydration of Foods”, Published by Agrobios, 2005.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes (PSOs)	
														1	2
19MEFE11	CO1		H												
	CO2	H										M			
	CO3			M											M
	CO4		H												
	CO 5			M										M	

Semester I **Food Preservation Technology**

19MEFE12 **Hours of Instruction/week: 4T**

No. of credits: 4

OBJECTIVES

- To expose the students to the principles and different methods of food preservation.
- To understand the principles of food preservation.

OUTCOME

At the end of this course, students will be able to

CO1:Understand the changes occurring during various food processing techniques

CO2: Analyse the changes during storage and preservation o Effect of enzymes on spoilage reactions of foods

CO3:To understand the role of different methods of preservation on different foods and their impact on the shelf life, quality, and other physical and sensory characteristics of foods.

CO4: To familiarize with the recent methods of minimal processing of foods

CO5:To understand the materials and types of packaging for foods

UNIT I FOOD AND ITS PRESERVATION **12**

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 **12**

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, RETORT PROCESING, CONCENTRATION AND DRYING **12**

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. Drying – Traditional and modern methods of drying, types of driers, influence of drying on pigments and enzymes; Dehydration of fruits, vegetables, milk, animal products etc.; osmotic methods. Principles of preservation by use of acid, sugar and salt; High solid - high acid foods; Pectin and gel formation; Invert sugar, jelly making, other food products, food concentrates. Pickling and curing with microorganisms, use of salt, and microbial fermentation.

UNIT IV NON-THERMAL METHODS **12**

Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology; Hurdle technology, application of infra-red microwaves; ohmic heating; control of water activity

UNIT V FOOD PACKAGING **12**

Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

TOTAL : 60 Hours

TEXT BOOKS

1. Subbulakshmi, G., and Shobha A. Udipi “Food Processing and Preservation”.New Age Publications, 2006.

2. HUi, Y.H. “Handbook of Vegetable Preservation and Processing”. Marcel Dekker, 2003.

REFERENCES

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.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes (PSOs)	
														1	2
19MEFE12	CO1			H											
	CO2		H									M			**M**
	CO3	M		M											
	CO4		H											M	
	CO 5			M											M

Semester I **Storage Engineering**

19MEFE13 **Hours of Instruction/week: 4T**

No. of credits: 4

Course Objectives :

- To enable the student to understand: The need for effective and scientific storage of food commodities.
- To provide an opportunity for students to develop skills in evaluating storage structures and also to designstructures for various perishable commodities.

Course Outcomes :

At the end of this course, students will be able to

CO1: Recognize the need for adaptation of scientific storage methodologies for food commodities.
CO2: Distinguish between traditional storage structures and modern storage structures.
CO3: Design and construct modified storage structure based on the requirement on the farm.
CO4: Calculate the amount of CO_2 & O_2 that can be permissible in storage structures and systems.
CO5:Evaluate the efficiency of commercial storage structures.

Unit I - PHYSICO - CHEMICAL AND THERMAL PROPERTIES OF GRAINS **12**

Grain dimensions, bulk density, true density, porosity, 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 **12**

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. Karunya University 2017 Food Processing and Engineering

Unit III - GRAIN STORAGE STRUCTURES 12

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 IV - GRAIN STORAGE THEORY **12**

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

Unit V - CONTROLLED ATMOSPHERE STORAGE 12

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 : 60 Hours

Text Book

1. Sahay K.M and K.K.Singh. “Unit Operations of Agricultural Processing” Vikas Publications, New Delhi, ISBN-81-259-1142-1, 2007.

Reference Book

1. Shejbal, J. (ed) 1980. Controlled atmosphere storage of grains. Elsevier Scientific Publishing Co. London

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes (PSOs)	
														1	2
19MEFE13	CO1	H	M												
	CO2			H								M			M
	CO3			M										M	
	CO4														
	CO 5	H		M											M

Semester I **Advances in Food Packaging**

19MEFE21

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

Course Objectives :

- To enable the student to understandNovel packaging techniques in foods.

Course Outcomes :

At the end of this course, students will be able to

CO1: Apply and examine the knowledge of properties for selection of packaging materials for foods& food products.
CO2: Select between different techniques of food packaging.
CO3: Relate the properties of food packages to processing and packaging technologies.
CO4: Describe the technology involved in different packaging materials.
CO5: Evaluate the efficiency of new and emerging technologies in food packaging.

12

UNIT I

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 **12**

Biobased 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 **12**

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 **12**

Modified Atmospheric Packaging (MAP)- MAP applications for fresh-prepared produce, Novel MAP gases, Applying high O2 MAP Testing novel MAP applications.

Packaging-flavor interactions. Factors affecting flavour absorption- role of the food matrix- role of differing packaging materials- Case study: packaging and lipid oxidation, Modeling flavour absorption.

UNIT V **12**

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: 60 Hours

References:

1. Ahvenainen R. 2001. Novel Food Packaging Techniques. CRC.
2. Crosby NT. 1981. Food Packaging Materials. App. Sci. Publ.
3. Mahadeviah M &Gowramma RV. 1996. Food Packaging Materials. Tata McGraw Hill.
4. Painy FA. 1992. A Handbook of Food Packaging. Blackie.

5. Palling SJ. 1980. Developments in Food Packaging. App. Sci. Publ.
6. Rooney ML. 1988. Active Food Packaging. Chapman & Hall.
7. Sacharow S & Griffin RC.1980. Principles of Food Packaging. AVI Publ.

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	**Program Specific Outcomes (PSOs)**	
														1	**2**
19MEFE21	CO1		M												
	CO2	H		M								M			M
	CO3			M										M	
	CO4		M												
	CO 5	H		M											M

Semester I **Non Thermal Processing Techniques in Foods**
19MEFE22

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

Course Objective:

To impart the understanding about different Emerging technology in Food Processing and enable the students to apply the knowledge in real time Food Processing Innovations.

Course Outcomes:

After completing the course, the students will be able to

CO1: To know the emerging technologies applied to food processing

CO2: To understand the relative advantages and disadvantages of emerging technologies over existingtechnologies

CO3: To visualize the equipment used and process stages of emerging technologies

CO4: To apply the non thermal technologies as alternative food processing methods

CO5: To identify the potential of newer technologies for commercialization&develop strategies for applying the technologies to wide range of food

Unit I - HIGH PRESSURE PROCESSING OF FOODS 12

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 12

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 **12**

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 FOODS **12**

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 **12**

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 : 60 Hours

Text Book

1. Da-wen Sun: Emerging Technologies for Food Processing, Elsevier Academic Press and Marcel Dekker Inc, 2014.

Reference Books

1. Leistner L. and Gould G. Hurdle Technologies – Combination treatments for food stability safety and quality, Kluwer Academics / Plenum Publishers, 2002.
2. 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.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO2
19MEFE22	CO1	H	H	M									M	H	
	CO2		H	M											M
	CO3		H	M		H							M	H	
	CO4	H		M										H	
	CO 5	H		M									M		M

Semester I **Engineering Properties of foods**
19MEFE23

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

Course Objectives:
To study about the different engineering properties of foods and the methods determining the quality and properties of different foods.

Course outcomes:
On successful completion of course, students can be able to

CO1:Design the material handling and storage equipment
CO2:Employ the measurement techniques of engineering properties of food
CO3:Assess liquid and solid food properties using measurement device
CO4:Identify food properties and quality of thermal and non-thermal processed food
CO5: Comprehend the dielectric properties of foods.

Unit I Physical Properties &Aero and hydrodynamic properties **12**

Properties of foods and measurement-Size, Shape, Volume, Density, Porosity, coefficients of friction, and angle of repose.

Aero and hydrodynamic characteristics: Concepts and application of drag coefficients, terminal velocity in agricultural products processing and handling

Unit II Thermal properties of foods **12**

Definition and scope , specific heat,Thermal conductivity, measurement of thermal properties of foods , Thermal Diffusivity , Surface Heat Transfer co-efficient

Unit III Rheological properties of solid foods **12**

Introduction to Rheology, Flow of Material, Newton's Law of Viscosity, Viscous Fluids, Newtonian Fluids, Non-Newtonian Fluids, Plastic Fluids, Bingham Plastic Fluids, Non-Bingham Plastic Fluids

Viscosity Measurement

Capillary Flow Viscometers, Rotational Viscometers, Concentric Cylinder (Coaxial Rotational)Viscometers, Cone and Plate Viscometers, Parallel Plate Viscometers, Single-Spindle Viscometers (Brookfield Viscometer)

Unit IV Thermodynamic properties of foods **12**

Water Activity Measurement methods of Foods, Freezing Point: Measurement, Data and Prediction, glass transition, crystallization and gelatinization measurement.

Unit VDielectric Properties of Foods **12**

Definition, Basic Principles of Microwave Heating, Ionic Interaction, Dipolar Rotation, Dielectric properties of food components, Assessment of Quality of Foods by Using Dielectric Properties, Measurement of Dielectric Properties.

Total Hours:60

Referencebooks:

1. Nuri N. Mohsenin: Physical Properties of Plant and Animal Materials Gordon and Reach Science Publishers (2010)
2. Nuri N. Mohsenin: Thermal Properties of Food &Agricultutral materials Gordon and Reach Science Publishers (2009)
3.SerpilSahin and ServetG¨ul¨umSumnu. (2006) Physical Properties of Foods, Springer Science +Business Media, LLC.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE23	CO1	H	M	H									M	H	
	CO2	H	-	M											M
	CO3		H	M		H							M	M	H
	CO4	H		M										H	M
	CO5	H		M									M		M

SEMESTR II **Milk and Milk Products Technology**

19 MEFE31 **Hours of Instruction/week: 4T**

No. of credits: 4

Course Objectives:

To study about the different milk based products and the dairy technology adopted in the food industry.

Course Outcomes:

After completion of the course the students are able

CO1: To understand the various physiochemical properties involved in dairy processing

CO2: To gain knowledge of the various equipments employed in the dairy processing industry

CO3: To explain the unit operations involved in the processing various dairy based products

CO4: To understand effluent treatment in dairy industry

CO5: To identify the dairy based products and its processing methods in detail

UNIT I **12**

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 equipments**.**

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 **12**

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 **12**

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 **12**

Theory of drying, estimation of drying rates and drying time, drying equipments, 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 **12**

Frozen 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: 60 Hours

REFERENCES:

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

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE31	CO1	H	M	H									M	H	
	CO2			M											H
	CO3		H			H							M	H	M
	CO4	H	H										M	H	
	CO5	H		M									M		M

SEMESTER II **Flavour, Spices and Plantation Products**
19MEFE32

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

Course objective:
This course aims to explain the flavor, Spice and Plantation crops application in food Industry

Course outcomes:
After completion of course the students are able to
CO 1:To understand the flavor profiling, analytical and processing techniques, qualityaspects of flavor, spices and plantation products
CO2 :To acquire knowledge about stability studies on storage, processing, transportation.
CO 2: To Apply preventive measures and control methods to minimize the hazards.
CO 3:Able to gain knowledge in different processing of plantation crops, spices.
CO 4: To learn about the quality and functional value of spices.
CO 5: To gain the knowledge about spice processing.

UNIT I FLAVOR – INTRODUCTION **12**
Definition and Description of flavor, flavor profile. Measurement of flavor, particularly for wine, tea, coffee, spices and condiments. Natural and synthetic flavoring substances and their chemical characteristics. Flavor components/constituents of fruit and vegetables, coffee, tea and cocoa bean, spices and condiments

UNIT II FLAVOR PROCESSING AND STABILITY STUDIES **12**
Effect of storage, cooking condition of various foods, processing, transportation and environmental condition on flavor components. Processing (industrial/commercial) technologies / methods of flavoring compounds of plant foods and their utilization and application ,Recent developments in flavor research, processing and technology

UNIT III PLANTATION CROPS **12**
Tea: Processing of tea, various types of tea, chemistry of constituents, fermentation, tea concentrates decaffeination process, Evaluation and grading of tea. Coffee: Processing of coffee, type of coffee, drying, fermentation, roasting and browning processes and their importance, chicory chemistry and technology. Analysis of tea and coffee, quality components - standards and specification of tea and coffee products. Processing and analysis of cocoa bean, beverages and study of factors that affect quality and uses for the consumers

UNIT IV SPICES- CLASSIFICATION, QUALITY AND FUNCTIONAL VALUE **12**
Scope of spice processing in India, Types, spice qualities and specification, uses and physiological effects, components, antimicrobial and antioxidant properties, Medicinal value of condiments and spice products

UNIT V SPICE PROCESSING **12**
Important spices added in food products, Processing and manufacturing of major Indian Spices: Pepper, cinnamon, cardamom, Nutmeg, saffron, turmeric and Ginger, minor spices- cloves, leafy spices, bay oregano, and seed spices. Spice processing machineries, packaging and handling of spices. Spice blends and extractives, essential and encapsulated oils, oleoresins – uses in processed foods

Total : 60Hours

REFERENCES
1. Heath, H.B. “Flavor Chemistry and Technology”, CBS Publications, 2005
2. Spanier, A.M *et al*., “Food Flavor and Chemistry: Explorations into the 21st Century”, RSC, 2005
3. Reineccius, G. “Flavor Chemistry and Technology”, 2nd Edition, Taylor & Francis, 2006
4. Hirasa, K and Takemasa, M. “Spice Science and Technology”, Marcel Dekker, 1998

5. Pruthi, S. “Quality Assurance in Spices and Spice Products (Modern methods of analysis)”, Allied Publishers, 1999

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE32	CO1	H		H									M	H	
	CO2	H	M												M
	CO3		H	M		H								M	
	CO4	H	M										M	H	M
	CO5	H		M											M

SEMESTER II **Modern Baking and Confectionery Technology**

19MEFE33 **Hours of instruction/week: 4T**

No. of credits: 4

Course objective:

This course aims to provide knowledge on modern baking and confectionery technology employed in the food processing industry

Course outcomes:

After completion of course the students are able to

CO1: Adapt the standards and regulations followed in bakery and confectionaryindustry

CO2: Grasp basic knowledge about food ingredients and its used in bakery products

CO3: Utilize bakery unit processing machinery effectively

CO4: Handle confectionary products and check quality in process line

CO5: Adapt various process flow line in confectionary and bakery products

Unit I : INTRODUCTION **12**

Raw materials required for bread making and their functional properties. Essential ingredients: Flour, yeast, water, salt. Other ingredients: Sugar, color, flavor, fat, milk and milk powder and bread improvers. Functions of various raw materials used in baking industries. Materials of baking. Leaveners and yeast foods, shortenings, emulsifiers, antioxidants, sweeteners, water and salt, Ingredients from milk and eggs.

Unit II BAKERY EQUIPMENT **12**

Introduction to utensils and equipments used in bakery unit and their uses, small equipment, big equipments and oven. Bulk handling of ingredients, Dough mixing and mixers, dividing, rounding, sheeting and laminating, fermentation enclosures and brew equipment. Ovens and slicers, Packaging material and equipment.

Unit III BREAD MANUFACTURING PROCESS **12**

Straight dough fermentation, sponge and dough, Accelerated processing. Chorely wood bread process, Dough retarding and freezing. Stages in processing of bread and bread making methods, advantages and disadvantages of various methods of bread making. Characteristic of good bread: Internal characters, external characters. Bread defects/ faults and remedies. Spoilage of bread causes, detection and prevention.

Unit IV BISCUITS AND COOKIES **12**

Production of cakes and cookies/ biscuits. Types of biscuits dough- Developed dough, short dough's, semi sweet, enzyme modified dough's and batters – importance of the consistency the dough. Cake making: Ingredients and their function structure builders. Tenderizers, moistener andflavor enhancer- Selection and preparation of mould temperature and time required for different type of cake, problems of baking.

Unit V CONFECTIONARY PRODUCTS **12**

Definition, importance of sugar confectionary and flour confectioner. Types of confectionary products– chocolate boiled sweet caramel toffees. Fondant, manufacturing process and spoilage of confectionary products. Good Manufacturing Practices (GMP) in baking and confectionary industries. Computerization in plant and laboratory, sanitation and safety.

Total: 60 Hours

TEXT BOOK

1. Yogambal Ashok. "Textbook of Bakery and Confectionary". PHI Learning Pvt. Ltd, 2012.

2. Matz, Samuel A. "Bakery Technology and Engineering", 3rd Edition. CBS Publishers, 2008.

REFERENCE BOOK

1. Stanley Cauvain and Linda Young. "Baked Products- Science, Technology and Practise".

2. Stanley P Cauvain, Linda S Young, “Technology of Bread Making”, Aspen Publication, 2nd Edition, 2007.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE33	CO1	H		H					M				M	H	
	CO2	H		M										M	
	CO3		M			H							M		H
	CO4	H	M										M		M
	CO5	H		M									M	H	

SEMESTER II **Instrumental Techniques in Food Analysis**

19MEFE41 **Hours of instruction/week: 4T**

No. of credits: 4

Course Objective:

To understand the instrumental techniques in Food Analysis and enable the students to apply the knowledge in real time Food Processing Innovations.

Course outcomes:

After completion of course the students are able

CO1: To identify reasons for determining composition and characteristics of food.

CO2: To give basic knowledge on instrumental methods of chemical analysis.

CO3: To understand the principles behind analytical techniques associated with food.

CO4: To know methods of selecting appropriate analytical techniques when presented with a practical problem.

CO5: To provide an understanding of and skills in advanced methods of separation and analysis.

UNIT I **12**

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

UNIT II **12**

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.

UNIT III **12**

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

UNIT IV **12**

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

UNIT V **12**

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 colorimetry.Texture analysis of foods- viscosity measurements and its significance in food quality.

Total: 60 Hours

References:

1. AOAC International. 2003. Official methods of analysis of AOAC
2. International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
3. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed.
4. Leo ML. 2004. Handbook of Food Analysis. 2nd Ed. Vols. I-III.
5. Linden G. 1996. Analytical Techniques for Foods and Agricultural Products. VCH.
6. Macleod AJ. 1973. Instrumental Methods of Food Analysis. Elek Sci.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE41	CO1	H		M		M							M	H	-
	CO2	H	H										M		M
	CO3	M		H										H	
	CO4		H											M	
	CO5	M		H									M	-	H

Semester II **Advances in Food Chemistry and Technology**

19MEFE42 **Hours of instruction/week: 4T**

No. of credits: 4

Objective:

To study the properties of food components and interactions and their effect on the food product quality.

Course outcomes:

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

CO1: Understand and be able to learn the major chemical and biochemical reactions that influence food quality with emphasis on food industry applications.

CO2: Understand how the properties of different food components and interactions modulate the specific quality attributes of food systems.

CO3: Develop an understanding of the principles whereby food molecules can be selected for use as ingredients in food formulations

CO4: Understand the principles that underlies the biochemical changes in the macronutrients of foods.

CO5: Demonstrate depth and breadth of knowledge in food chemistry as they apply to food systems

UNIT I **12**

Interactions among food components and their effect on sensory, nutritional and processing quality. 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 stability of food products.

UNIT II **12**

Food Carbohydrates: Structural, analytical, physicochemical, nutritional and functional aspects of carbohydrates. Significance in diet, isolation from natural sources, chemistry and changes during processing. Chemical & enzymatic modification of carbohydrates.

Manufacture of maltodextrins and corn syrups. Cyclodextrins – chemistry, technology and food applications. Polysaccharides of plant and microbial origin. Newer carbohydrates for food applications such as xanthan, dextran, pullulan, gellan, curdlan and β-glucans (nutraceutical and functional properties).

UNIT III **12**

Food Proteins -Structure and chemistry; Protein –protein interactions, Methods of evaluation of protein quality. Production of proteins, protein concentrates/isolates from legumes, oilseeds, fish, seafood, leaf, microbes.

Modification of proteins by enzymatic (manufacture of protein hydrolysates, their characterization and applications), chemical and physical methods. Interactions of proteins with flavours, polysaccharides, lipids and their technological effects, Protein-based fat substitutes, Protein engineering.

UNIT IV **12**

Food lipids and their sources– omega-3 and omega-6 fatty acids and their significance. Trans-fatty acids- formation during processing and nutritional aspects. Enzymatic approach to tailor made fats.

Formulation and characterization of low-fat spreads, whipped creams, margarines, mayonnaise, salad dressings etc. Bakeryshortenings- chemistry, formulation and technology.Measurement of lipid degradation parametersduring deep-fat frying and storage of foods. Flavour emulsions and their stability. Phytosterols and their nutraceutical significance

UNIT V **12**

Fragrance and flavouring compounds: essential oils, terpenoids-oleoresins- biochemical pathways for the production of volatile compounds in specific plant species. Interactions among food flavours and packaging materials.Interactions among food additives and their significance in food processing. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

Total ; 60 Hours

References:

1.ClairN.Sawyer and Perry L.McCarty. (2003) Chemistry for Environmental Engineering & Science, McGraw Hill Book Company.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE42	CO1	H		H									M	M	H
	CO2	H	M										M		H
	CO3	H		H										M	
	CO4	H		M									M		H
	CO5	H		M									M		M

Semester II

19MEFE43 **Sensors for Food Technology**

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

Course Objective

To provide basic understanding of the types of sensors used in food technology applications.

Course Outcomes:

At the end of the course, the student will be able to
CO1: Understand about biosensors in food engineering
CO2: Understand the fundamentals of sensing for the food industry including process control.
CO3: Know how to use the different types of sensor systems in the food industries.
CO4: Gain knowledge on commercial devices based on biosensors
CO5: Acquaint with new biosensors in food processing applications

Unit I Biosensors in Food Engineering **12**

Amperometric biosensors, Basic construction and measurement principles, Applications of amperometric biosensors.

Unit 2 Optical biosensors **12**

Principles of optical detection, Types of optical biosensors, Optical biosensors for food quality and food safety.

Unit 3 Biosensors for quality assurance in food industry **12**

Base devices and sensing agents, Principles of immune analysis, Detection of microorganisms.

Unit 4 Commercial devices based on biosensors **12**

Principles of signal generation, Applications and future trends.

Unit 5New biosensors **12**

Novel sensing receptors, Electronic nose, tongue and testers

References: **Total: 60 Hours**

1.Erika Kress-Rogers (2001). Instrumentation and sensors for the food industry, CRC Press Publishers

2.I.E. Tothill (Editor) (2000.) Rapid and On-Line Instrumentation for Food Quality Assurance (Woodhead Publishing in Food Science and Technology). Woodhead Publishing, England.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE43	CO1	H		H									M	M	H
	CO2	H	M												H
	CO3	H	M	H									M	M	
	CO4	M		H									M	H	M
	CO5	H		H									M		H

SEMESTER III

19MEFE51 Food Safety and Quality Management

Hours of Instruction/week: 4T

No. of credits: 4

Course outcomes:

After completion of course the students are able

CO1: To know the principles of Food Safety & Quality

CO2: To Apply preventive measures and control methods to minimize the hazards

CO3: To know the requirements of regulatory bodies of safe food.

CO4: To learn the principles of HACCP and to develop procedures and approaches to identify food safety hazards in food processing

CO5: To gain the knowledge about the Food labeling and sanitation of food industries.

UNIT I **12**

Food safety-need for control and safety-strategy and criteria for food, food Toxicology- toxic potential of food- classification of food toxicants- physical, biological and chemical contaminants, food additives and derived substance.

UNIT II **12**

Designing safety in products and processing- intrinsic factor, establishing a safe raw materials supply, establishing safe and achievable shelf life process equipments and machinery auditing.

UNIT III 12

Laws relating to Food Processing Industries in India - FPO, MMPO, PFA, APEDA, MPEDA, AGMARK, BIS Quality systems and FSSAI. International Food Standards CAC, ISO 9000, 22000 and related standards- Impact of food safety on global trade.

UNIT IV 12

Personnel hygienic standards, preventive pest control, cleaning and disinfesting system, biological factors underlying food safety, preservation and stability.

UNIT V **12**

HACCP - principles- establishment, implementation, application, Risk assessment in hygiene management, Good manufacturing practice (GMP) in the food industry, standard operating procedures.

Total: 60 Hours

References

1. Lelieveld H. L. M., M. A. Mostert and J. Holah.2005. Handbook of hygienecontrol in the food Industry. Woodhead Publishing Limited, England
2. Chesworth ,N.1997.Food Hygiene and Auditing,Blackie Academic Professional. Hall
3. Sara Mortimore and Carol wallace.1977. HACCP - A practical Approach. Chapman &Hall.
4. David A. Shapton and Naroh F.Shapton.1991. Principles and practices for the safe processing of foods. Butterworth-Heinemann Ltd

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE51	CO1	H		H									M	M	H
	CO2	H	H	M									M		H
	CO3	H		M			H						M	H	
	CO4	H		M										M	
	CO5	M		H									M	H	

Semester III

19 MEFE52 **Food Process Design and Layout**

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

Course objective:

Design a layout for food processing plant and estimation of cost

Course Outcomes:

After completion of course the students are able to

CO1:Design and setting up of new food processing plant as Entrepreneur and/or consultant

CO2:The importance HACCP and food safety laws governing food industries

CO3:Implement the food safety standards in food industries

CO4:Prepare cost estimate and economic analysis of food industry

CO5:Help to minimize the food industry losses and maximize the processed food production

Unit I: SITE SELECTION:

Site selection - Factors - Case Study: Site Selection - Product Capacity and quality – Storage of Raw materials and Product - Waste Disposal, Utilities – Requirements for water, electricity, labor, transportation facilities, refrigeration, boiler- laboratory - Plans for Future ExpansionHours of Operation- Completion Date- Safety

Unit II: PLANT DESIGN, SAFETY, POLLUTION AND ITS ABATEMENT:

Manufacturing Plant Design – Building design – Legal aspects – Building bylaws, Expansion – Plant Location – The structure – Facilities Lay-out Office, toilet, laboratory- Problem of pollution - Determining Pollution Standards- Meeting Pollution Standards- Air and Water Pollution Abatement Methods- BOD and COD

Unit III: CLEANING AND SANITATION:

Goals of cleaning and sanitizing – Types of soil – Cleaning criteria and measurement – The cleaning process – Environmental aspects – Cleaning Kinetics – Hygienic design – Cleanability test methods – Water treatment

Unit IV: LAYOUT AND COST ESTIMATION:

New Plant Layout- Product and process layout - Expansion and Improvements of Existing Facilities- Case Study: Layout and Warehouse Requirements – Inventory control - Cost Indexes - Capacity vis-a-vis Costs - Factored Cost Estimate – Break – even point - Improvements– Module Cost Estimation - Unit Operations Estimate- Detailed Cost Estimate- Accuracy of Estimates- Case Study: Capital Cost Estimation.

Unit V: ECONOMIC EVALUATION:

Cost of Producing a Product- Capital - Elementary Profitability Measures- Time Value of Money- Compound Interest- Net Present Value- Rate of Return- Comparison of Net Present Value and Rate of Return Methods- Proper Interest Rates - Expected Return on the Investment Economic Evaluation – Depreciation – Amortization- Depletion Allowance- Investment CreditSpecial Tax Rules - Problems.

TEXT BOOK **Total: 45 Hours**

1. Dennis R. Heldman and Daryl B. Lund. “Hand Book of Food Engineering”, Second edition, CRC Press, Taylor and Francis Group, 2007.

2. R.K. Sinnot. “Coulson and Richardsons Chemical Engineering” Vo. 6., 4th Edition, Elsevier Publication. 2005.

3. Max S. Peters and Klaus D. Timmerhaus and Ronald West. “Plant Design And Economics For Chemical Engineers”, 5th Edition, Tata Mc-Graw Hill

Education. 2003.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE52	CO1	H		H										H	H
	CO2	M		H									M		M
	CO3	H		M									M	H	M
	CO4	H			H									H	
	CO5	H		M										H	M

Semester III **Advances in Meat, Fish and Poultry Technology**
19MEFE53

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

Course objective:
To understand the advance methods of processsing the meat, fish and poultry based foods in the food processing sectors.

Course outcomes:
CO1: To familiarize with the advanced treatment of the concepts involved in the production, processing an acceptance of meat, poultry and fish
CO2: To provide an understanding of the Poultry meat processing industry
CO3: To familiarize with the by-products derived from meat, poultry and fish.
CO4: To gain knowledge on the marine processing and preservation techniques
CO5: To learn about meat inspection, sanitation and preservation techniques.

UNIT I **12**

Industrial profile of meat and poultry industry- Meat production and trade practices- current trends in the production of fresh meat in world.

12

UNIT II

Functional behavior of animal tissues and its effect on meat quality- postmortem glycolysis, onset of rigor mortis- preslaughter handling, -Conditioning or Aging. meat quality. Slaughtering methods and carcass fabrication -ante and post mortem inspection and humane slaughter techniques and dressing percentage. Types of carcass, indication of quality, regional variation and different meat cutting techniques.

12

UNIT III

Eating quality of meat: Color, chemical nature of myoglobin, methods to improve meat color, discoloration of meat, water holding capacity and juiciness, factors determining exudation, texture and tenderness, preslaughter and post slaughter factors effecting tenderness, Electrical stimulation to improve tenderness.

UNIT IV **12**

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
Eggs- egg products- Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

UNIT V **12**

Commercially important marine products from India; product export and its sustenance; basic biochemistry and microbiology; indicators of fish freshness; transportation in refrigerated vehicles; prerequisites and characteristics of transport systems; design of refrigerated and insulated trucks; grading and preservation of shell fish; pickling and preparation of fish protein concentrate, fish oil and other by products.

Total: 60 Hours

References:

1. Hui YH. 2001. Meat Science and Applications. Marcel Dekker.
2. Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
3. Levie A. 1984. Meat Hand Book. 4th Ed. AVI Publ.
4. Mead M. 2004. Poultry Meat Processing and Quality. Woodhead Publ.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFE53	CO1	H		M	-	M							M	H	M
	CO2	H												M	
	CO3	H		H									M	H	M
	CO4	M			H										M
	CO5	H												H	M

OPEN ELECTIVE

Semester III **Industrial Safety and GMP in Food Industries**

19MEFO01 **Hours of Instruction/week: 4T**

No. of credits: 4

Course objective

To provide knowledge on the concepts and causes of Industrial safety and GMP in food industries.

Course Outcomes:

Students will be able to

CO1:Gain knowledge on the causes and prevention of accident.

CO2: Understand the functions and types of maintainance

CO3:Illustrate the factors and prevention of Wear and Corrossion

CO4:Understand the concept of Fault tracing

CO5:Apply preventive maintainence and Good manufacturing practices

Unit-I: **12**

Industrial safety: 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: **12**

Fundamentals of maintenance engineering: 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: **12**

Wear and Corrosion and their prevention: 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: **12**

Fault tracing: 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: **12**

Periodic and preventive maintenance and GMP: 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: 60 Hours

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.

2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Compressors, Audels,Mcgrew Hill Publication.

4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

CO/PO Matrix

Sub Code	POs	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Program Specific Outcomes	
														PSO1	PSO1
19MEFO01	CO1	H		M									M	H	M
	CO2	M	H											H	
	CO3	H											M		
	CO4				M										M
	CO5	H											M		M

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

Semester I **Hours of Instruction/week:2**
19MEMA11

Objective:
To make the students to write an effective research paper

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

CO1 : Understand how to improve writing skills and level of readability
CO2 : Learn about the writing method in each section
CO3 : Understand and develop the research papers
CO4 : Identify the key skills and useful phrases for writing good quality of paper
CO5 : Substantiate with evidences for results and outcome.

Unit I Planning and Preparation **6**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit II Findings and Review **6**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction, charts, tables for data and results.

Unit III Review of Literature **6**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check

Unit IV Key Skills **6**

Key skills needed when writing a title, key skills needed when writing an abstract, key skill needed when writing an introduction, skills needed when writing a review of the literature

Unit V Quality **6**

Useful phrases, how to ensure paper is as good as it could possibly be at the time of first- time submission and substantiated with valid research evidences.

Total hours: 30

Reference Books:

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

Disaster Management

(Non-credit Mandatory Course)

Semester I **Hours of Instruction/week:2**

19MEMA12

Objective:

To provide board understanding about the basic concepts of disaster management

Course Outcomes:

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

CO1 : Familiarize between natural and man-made disaster

CO2 : Learn about the repercussions of disasters and hazards

CO3 : Observe the various disaster prone areas in India

CO4 : Describe the different monitoring phenomena, evaluation of risk and management

CO5 : Understand the concepts of risk assessment and disaster mitigation

Unit I Introduction **6**

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 Hazards6

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 **6**

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 **6**

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 Assessmentand Disaster Mitigation **6**

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: 30

Reference Books:

1. ***R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies"***New Royal book Company,2004.
2. ***Sahni, Pardeepet.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., NewDelhi,2008.

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

Semester II **Hours of Instruction/week:2**

19MEMA21

Objective:

To provide the knowledge about pedagogy studies

Course Outcomes:

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

- CO1 : Understand conceptual framework and terminology
- CO2 : Develop Pedagogical practices used by teachers for the study
- CO3 : Understand the effectiveness of pedagogical practices and methodology indepth
- CO4 : Create professional development with classroom practices and know the barriers to learning
- CO5 : Understand the research gaps and future directions of research impact.

Unit I Introduction and Methodology **6**

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions**,** Overview of methodology and Searching.

Unit II Thematic overview **6**

Pedagogical practices that are used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit III Evidence on the effectiveness of pedagogical practices **6**

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy. Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV Professional development **6**

Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V Research gaps and future directions **6**

Research design, context, Pedagogy, Teacher education, curriculum and assessment
Dissemination and research impact.

Total Hours: 30

Reference Books:

1. Ackers J. Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2): 245-261. 2001
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3):361-379. 2004
3. Akyeampong K, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID. 2003
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic mathsand reading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3):272–282. 2013
5. Alexander RJ "Culture and pedagogy: International comparisons in primary education". Oxford and Boston: Blackwell. 2001

6. Chavan M, “Read India: Amassscale, “Rapid, ‘learning to read’ campaign”. 2003

Value Education
(Non-credit Mandatory Course)

Semester II **Hours of Instruction/week:2**

19MEMA22

Objectives

Students will be able to understand value of education and self- development

Course Outcomes:

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

CO1 : Understand the values of self-development
CO2 : Learn the importance of Human values
CO3 : Develop their personality
CO4 : Understand the importance of moral values in our life
CO5 :Cultivate Professional ethics

Unit I Values and self-development **6**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments

Unit II Importance of cultivation of values **6**

Importance of cultivation of values - Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity. Patriotism. Love for nature, Discipline

Unit III Personality and Behavior Development **6**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking,

Unit IV Importance of Human Values **6**

Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature

Unit V Importance of Character and Competence **6**

Character and Competence –Holy books vs. Blind faith, Self-management and Good health. Science of reincarnation, Equality, Non-violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, studying effectively

Total Hours: 30

Reference Books:

1. ***Chakroborty, S.K. “Values and Ethics for Organizations Theory and practice”,*** Oxford University Press, New Delhi.