Loyola Academy Degree & PG College
M.Sc. Food Technology and Management (2021-23) (Choice-Based Credit System)

Year	Sem.	Course -1	Course -2	Course -3	Course -4	Course -5	Course -6	Hr	Remedial courses/ Bridge courses/ Competitive exam guidance	Credits	
I	I	*Communicative Competence (2) (AECC-1)	Technology of Food Processing & Preservation(2) (SEC-1)	Food Process Engineering -1 (4) (Core-1)	Technology of Animal based food & food products (4) (Core-2)	Advanced Food Chemistry (4+2) (Core-3)	Food Microbiology (4+2) (Core -4)	31	5	24	AECC-1 CORE-4 SEC-1 Bridge course-1
I	II	*Human values & professional ethics (2) (AECC-2)	Post harvest Technology of Plantation crops (4) (Core-5)	Research Methodology(4) (Core – 6)	Food Process Engineering –II (4+2) (Core-7)	Instrumental methods of Food Analysis (4) (Core -8)	Technology of Cereals and Milling (4+2) (Core -9)	28	8	26	AECC-1 CORE- 5
II	I	* Computer Applications (2) (AECC-3)	Tech. of Food Fermentation/ Tech. of Sugar confectionery & chocolate processing (4) (DSE-1)	Extrusion Technology (4) (Core-10)	Adv. Food Packaging (5+2) (Core – 11)	Food Quality systems & Management (4+2) (Core -12)	Energy Conservation & auditing (4) (Core-13)	33	3	27	AECC-1 DSE-1 CORE-4 Add on Course-1
II	**II**	Technology of Baking Science (2) (SEC-2)	$Food and Nutrition / Food Processing and Preservation(4) (GE-1)	Nutraceuticals and functional foods / Food Toxicology & Allergens (4) (DSE- 2)	Food Supply & Cold Chain Management (4) (Core – 14)	Project work (6)		32	4	20	SEC- 2 GE – 1 DSE – 1 CORE – 1
Legend	**1. Ability Enhancement Compulsory Course (AECC) : 03** **2. Generic Elective (GE) : 01** **3. Skill Enhancement Course (SEC) : 02** **4. Core : 14** **5. Discipline-Specific Elective (DSE) : 02**						**Total**	**124**		**97**	

- *Ability Enhancement Compulsory Course (AECC) Marks are not included in CGPA score in the main certificate, but it is compulsory to pass in the examination.
- $GE paper will be offered to the students of other PG departments.
- ≠ In third semester students will take one month summer project of 2 credits (non-CGPA)

M.Sc. Food Technology & Management

Batch: 2021-2023

YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
M.Sc. FOOD TECHNOLOGY & MANAGEMENT
FIRST SEMESTER
ACADEMIC YEAR 2021-2022 BATCH 2021-23(CBCS)

S. No	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
1	I	MFT13101	*Communicative Competence (2) (AECC-1)	2	2	20	30	50	2
2	II	MFT19102	Technology of Food Processing & Preservation (SEC-1)	3	3	40	60	100	2
3	II	MFT13103	Food Process Engineering -1 (Core-1)	5	3	40	60	100	4
4	II	MFT13104	Technology of Animal based food & food products (Core-2)	5	3	40	60	100	4
5	II	MFT13105	Advanced Food Chemistry (Core-3)	5	3	40	60	100	4
6	II	MFT13106	Food Microbiology (Core -4)	5	3	40	60	100	4
PRACTICALS									
7	II	MFT13107	Advanced Food Chemistry (Core-3)	3	3	40	60	100	2
8	II	MFT13108	Food Microbiology (Core -4)	3	3	40	60	100	2
	TOTAL			31		300	450	750	24

- *Ability Enhancement Compulsory Course (AECC) marks not included in CGPA score in the main certificate, but it is compulsory to pass in the examination.
- CIA components for internal marks of theory paper: (i) Weekly test: 5M (ii) Mid Sem: 10 M (iii) Prefinal: 16M (iv) Assignment : 2M (v) Viva : 2M (vi)Attendance: 4M
  CIAcomponents for practical Internal marks: (i) Attendence/Record 5M (ii) Practical skill : 10M (iii) Prefinal : 15M

S. No	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
1	I	MFT13201	*Human Values & Professional Ethics (AECC-2)	2	2	20	30	50	2
2	II	MFT13202	Post Harvest Technology of Plantation crops (Core-5)	4	3	40	60	100	4
3	II	MFT19203	Research Methodology (Core – 6)	4	3	40	60	100	4
4	II	MFT13204	Food Process Engineering–II (Core-7)	4	3	40	60	100	4
5	II	MFT13205	Instrumental methods of Food Analysis (Core-8)	4	3	40	60	100	4
6	II	MFT19206	Technology of Cereals and Milling (Core -9)	4	3	40	60	100	4
PRACTICALS									
7	II	MFT13207	Food Process Engineering (Core-7)	3	3	40	60	100	2
8	II	MFT19208	Technology of Cereals and Milling (Core -9)	3	3	40	60	100	2
	TOTAL			28		300	440	750	26

- *Ability Enhancement Compulsory Course (AECC) marks not included in CGPA score in the main certificate, but it is compulsory to pass in the examination.
- CIA components for internal marks of theory paper: (i) Weekly test: 5M (ii) Mid Sem: 10 M (iii) Prefinal: 16M (iv) Assignment : 2M (v) Viva : 2M (vi)Attendance: 4M
  CIAcomponents for practical Internal marks: (i) Attendence/Record 5M (ii) Practical skill : 10M (iii) Prefinal : 15M

S. No	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
1	I	MFT13301	*Computer Applications (AECC -3)	2	2	20	30	50	2
2	II	MFT13302A / MFT13302B	Tech. of Food Fermentation/ Tech. of Sugar confectionery & chocolate processing (DSE-1)	5	3	40	60	100	4
3	II	MFT13303	Extrusion Technology (Core-10)	5	3	40	60	100	4
4	II	MFT13304	Adv. Food Packaging (Core – 11)	5	3	40	60	100	5
5	II	MFT13305	Food Quality systems & Management (Core -12)	5	3	40	60	100	4
6	II	MFT13306	Energy Conservation & auditing (Core-13)	5	3	40	60	100	4
PRACTICALS									
7	II	MFT13307	Adv. Food Packaging (Core – 11)	3	3	40	60	100	2
8	II	MFT13308	Food Quality systems & Management (Core -12)	3	3	40	60	100	2
	TOTAL			33		340	510	850	27

- *Ability Enhancement Compulsory Course (AECC) marks not included in CGPA score in the main certificate, but it is compulsory to pass in the examination.
- CIA components for internal marks of theory paper: (i) Weekly test: 5M (ii) Mid Sem: 10 M (iii) Prefinal: 16M (iv) Assignment : 2M (v) Viva : 2M (vi)Attendance: 4M
  CIAcomponents for practical Internal marks: (i) Attendence/Record 5M (ii) Practical skill : 10M (iii) Prefinal : 15M

S. No	Part	Subject Code	Title of the Subject	Hours /Week	Duration of Exam (hrs)	Marks			Credits
						Internal	External	Total	
1	I	MFT19401	Technology of Baking Science (SEC-2)	2	3	40	60	100	2
2	II	MFT13402 A/ MFT13402 B	Food and Nutrition / Food Processing and Preservation (GE-1)	4	3	40	60	100	4
3	II	MFT19403 A/ MFT13403 B	Nutraceuticals& Functional foods / Food Toxicology & Allergens (DSE- 2)	4	3	40	60	100	4
7	II	MFT13404	Food Supply & Cold Chain Management (Core – 14)	6	3	40	60	100	4
8	II	MFT13405	Project work	16		40	60	100	6
	TOTAL			32		200	300	500	20

- Skill Enhancement Course (SEC)
- Generic Elective (GE)
- Discipline Specific Elective (DSE)
- CIA components for internal marks of theory paper: (i) Weekly test: 5M (ii) Mid Sem: 10 M (iii) Prefinal: 16M (iv) Assignment : 2M (v) Viva : 2M (vi)Attendance: 4M
  CIAcomponents for practical Internal marks: (i) Attendence/Record 5M (ii) Practical skill : 10M (iii) Prefinal : 15M

COMPUTER APPLICATIONS

Credits: 2 **II Year/Semester: III**
Subject code: MFSN 13301 **No. of lecture hours: 30**

Objective: To study the applications of computer and its techniques in food industry.

Outcome: Students will gain knowledge about computer aided applications in food industry.

UNIT–I **(6Hrs)**

- History of computers, generations of computers 1
- Characteristics of computers 1
- Data representation – number system 1
- Binary, octal and hexadecimal 1
- Conversion from one number system to another 1
- Hardware, Software, Translators, Compilers and interpreters 1

UNIT – II **(6Hrs)**

- System software, application software 1
- Simple operating concepts, flowchart 1
- Algorithms with simple examples 1
- DOS commands – Internal and external commands 2
- File management and directory structure 1

UNIT – III **(6Hrs)**

- **WINDOWS** 3
  - Working with windows explorer
  - Creating a new directory, copy files from one directory to another, deleting files.
  - Control panel- background, Mouse settings, screen saver
- M.S-WORD 3
  - Creating a new document, designing documents setting margins, headers and footers, tabs & tables
  - Formatting a document editing – find and replace text
  - Protecting documents, Mail Merge and Newsprint.

UNIT – IV **(6Hrs)**

- **POWERPOINT** 2
  - Creating, opening and saving presentations

- Working on different views - Working with slides
- Formatting paragraphs, drawing and working with objectives

- **EXCEL** 4
  - Creating a new worksheet-select, edit (Copy, move, format, setting column width etc.)
  - Referencing cells (Addressing methods).
  - Functions-logical, mathematical, statistical, date and time.
  - Formulae, charts, macros.
  - Creating an excel database-sort and filter database. Performing what –if analysis on worksheet data.
  - Analysis data with pivot tables.

UNIT- V **(6Hrs)**
ACCESS

- Access basics: Database, tables, records, fields 1
- The database window: Tables, Queries, forms, reports, Macros, and modules 1
- Creating a table, setting field properties, modifying the structure, setting primary key, adding and deleting fields 1
- Entering table data. Creating forms 1
- Queries on data- select query, update query, delete Query, Append query 1
- Designing reports 1

Recommended Readings:

1. Deepak, B. 2002. **Fundamentals of Information Technology**. New Delhi: Pentagon Press publishers.
2. Sharon Crawford and Neil, J. 1998. **ABCs of Windows**. New Delhi: BPB Publications.

TECHNOLOGY OF FOOD FERMENTATION

Credits : 4 **II Year/Semester: III**
Course Code : MFT13302 (A) **No. of Lecture hours: 60**

Objectives:

- To understand the principles of food fermentation technology
- To study the types of starters used in Food Industry
- To study the production of various fermented food

Outcomes:

Students will gain understanding about the levels of fermentation and its impact on food development.

UNIT I

Fermented Foods **(12 Hrs)**

- Fermentation 1
- Fermented foods – sauerkraut, cucumber pickles, olive pickles. 3
- Oriental fermented foods – soy sauce, tofu, miso, tempeh, ontjons, hamanatto, natto. 4
- Traditional fermented foods – idli, dosa, etc., 1
- fermented meat and milk products 3

UNIT II

Introduction to Beverages & Water **(12 Hrs)**

- Beverages – Classification, Types, Scope and importance 2
- status of beverage industry in India 1
- Packaged drinking water- definition, types, 2
  - manufacturing processes of raw and processed water 2
  - Quality evaluation of raw and processed water 1
  - methods of water treatment 1
  - BIS quality standards (for bottled water; mineral water, natural spring water, flavoured water, carbonated water). 3

UNIT III

Fruit & Speciality Beverages **(12Hrs)**

- Fruits Beverages – Types, Definitions 1
- Manufacturing process and technology 1
- Packaging, storage 2
- quality evaluation 1
- Recent advances in juice processing technology 1
- Equipments & tools for juice extraction 1
- Note on Specialty beverages based on 5
  - tea, coffee

- cocoa, spices
- Plant extracts, herbs, nuts
- dairy and imitation dairy-based beverages

UNIT IV

Synthetic Beverages **(12Hrs)**

- Synthetic beverages – technology of; 7
  - Still & carbonated beverages
  - Low-calorie and dry beverages
  - Isotonic and sports drinks
- Role of various ingredients of soft drinks 1
- Carbonation of soft drinks 2
- Storage and quality characteristics 2

UNIT V

Fermented Beverages **(12Hrs)**

- Fermented Beverages & distilled spirits 6
  - Types, manufacturing processes
  - Quality evaluation
- Role of yeast in technology of brewing process 3
- Equipments used for brewing and distillation 3

Recommended Readings:

- Ravinder, A. Srinivas Maloo and Dr.Emmanuel, S.J. 2013. **Hand Book of Fermented foods and Beverages**, 1st edition. Mumbai: Himalaya Books Publishing House.
- Priest, F.G. and Stewart, G.G. 2006. **Handbook of Brewing**. 2nd edition. New Delhi: CRC Publication.
- Richard, P. 1981. **Commercial Wine Making - Processing and Controls**. New Delhi: AVI Publication.
- Prescott, S.C. and Dunn, C.G. 1959. **Industrial Microbiology**. 6th edition. New Delhi: Tata McGraw Hill.
- Varnam, A.H.and Sutherland, J.P. 1994. **Beverages: Technology, Chemistry and Microbiology**. Scotland: Chapman & Hall.
- Woodroof, J.G.and Phillips, G.F.1974. **Beverages: Carbonated and Non Carbonated**. New Delhi: AVI Publication.

TECHNOLOGY OF SUGAR CONFECTIONERY & CHOCOLATE PROCESSING

Credits : 4 **II Year/Semester: III**
Course Code : MFT13302 (B) **No. of Lecture hours: 60**

Objectives:

- Understanding status of confectionery industry in India
- To learn the technologies of confectionery products.
- To know about innovations in this sector.

Outcomes:

Students will gain knowledge about the role of confectionery industry and learn the processing techniques of several Indian confectioneries.

UNIT I

Introduction to Confectionery Industry **(12Hrs)**

- Raw Materials for Confectionery Manufacture 6
  - Important properties – Sugar, glucose syrup, Dried milk products, cocoa, Speciality fats, Emulsifiers, Nut kernels, Alcoholic ingredients and other minor ingredients.
- General technical aspects of industrial sugar confectionery manufacture. 2
- Confectionery – composition, structure 2
- Quality aspects 2

UNIT II

Manufacture of Confectionery I **(12Hrs)**

- Flour confectionery 4
  - Ingredients
  - importance of the consistency
- Indian flour confections: 2
  - ingredients
  - Flour specification
- Manufacturing process of flour 2
- Sugar Confectionery manufacture 4
  - High boiled sweets– Ingredients, Methods of manufacture– Product types.

UNIT III

Manufacture of Confectionery II **(12Hrs)**

- Manufacture of Caramel 2
- Manufacture of Toffee and fudge 3
- Manufacture of Liquorices paste 2
- Manufacture of Count Lines 2

- Manufacture of Aerated confectionery 3

UNIT IV

Manufacture of Confectionery III (12Hrs)

- Manufacture of Lozenges 2
- Manufacture of Fruit confections 2
- Manufacture of sugar panned sweets 2
- Manufacture of gums & jellies 3
- Chewing gum Technology 3

UNIT V

Chocolate Processing (12Hrs)

- Chocolate Processing Technology: 6
  - Cocoa bean – harvesting, processing
  - production of cocoa liquor
  - cocoa butter processing
  - cocoa butter substitutes.
- Manufacture of chocolate 2
- Tempering technology 2
- Enrobing technology 2
- Dark, milk and white chocolate - manufacturing processes. 2

Recommended Readings:

- Jackson, E.B.1999. **Sugar Confectionery Manufacture**. 2nd Edition. New york: Aspen Publication.
- Junk, W.R. and Pancost, H.M. 1973**.** **Hand Book of Sugars for Processors**. Chemists and Technologists. New Delhi: AVI Publications.
- Francis, F.J. 2000. **Wiley Encyclopaedia of Food Science & Technology**. India: John Wiley & Sons.

EXTRUSION TECHNOLOGY

Credits : 4 **II Year/Semester: III**
Course Code : MFT13303 **No. of Lecture hours: 60**

Objectives:

- To acquaint with design aspects of food extruders.
- To acquaint with influence of process and feed characteristics on product quality and application of extrusion technology in human foods

Outcomes:

Students will gain knowledge about the technology involved in the development of varied extruded products.

UNIT I

Introduction to Extrusion **(12Hrs)**

- Extrusion 6
  - definition, introduction to extruders
  - Extruders in the food industry – History, uses, principles and types
  - Chemical and nutritional changes in food during extrusion.
- Single screw extruder 6
  - principle of working, net flow
  - factors affecting extrusion process
  - co-kneaders

UNIT II

Extruders **(12Hrs)**

- Twin screw extruder: 5
  - counter rotating and co-rotating twin screw extruder.
  - Process characteristics of the twin screw extruder
- Heat transfer and energy balances. 2
- Problems associated with twin screw extruder. 2
- Interpreted flight expanders/ extruders, dry extruders. 3

UNIT III

Pre Conditioning & Practical considerations **(12 Hrs)**

- Pre-conditioning of raw materials used in extrusion process 2
- Pre-conditioning operations 2
- benefits of pre-conditioning 2
- Practical considerations in extrusion processing: 6
  - pre-extrusion processes

- Extrusion cooking technology
- post extrusion processes

UNIT IV

Breakfast Cereals & Texturized vegetable proteins **(12Hrs)**

- Breakfast cereals Introduction 1
- Texturized vegetable proteins 2
  - Introduction, Definition, classification,
- Formulation and processing technology 4
- Types of processes: traditional and extrusion methods. 5

Unit V

Snack Food Extrusion **(12Hrs)**

- Snack food extrusion:
  - Direct expanded (DX) 2
  - Third generation (3G) Snacks: types, available brands, 4
  - Co- extruded snack 2
  - Indirect-expanded products 4

Recommended Readings:

- Frame, N.D .1994.**The Technology of Extrusion Cooking**. London: Blackie Academic Publication.
- Gordon, B.R.1990. **Snack Food**. 1st edition. New York: AVI Publication.
- Samuel AM.1976. **Snack Food Technology**. 3rd edition. New York: AVI Publication.

ADVANCES IN FOOD PACKAGING

Credits : 5 **II Year/Semester: III**
Course Code : MFT13304 **No. of Lecture hours: 60**

Objectives:

- To impart comprehensive overview of the scientific and technical aspects of food packaging.
- To instill knowledge on packaging machinery, systems, testing and regulations of packaging.

Outcomes:

Students will gain knowledge about the importance of packaging and understand different techniques involved in packing foods and its role in preserve shelf life of foods.

UNIT I

Introduction to Packaging Technology **(12Hrs)**

- Packaging – Definition, objectives and functions 2
- Packaging requirements and selection of packaging materials 2
- Types of packaging materials and their properties 2
- Food packaging systems: Forms of packaging and different packaging systems for foods 2
- Packaging equipment and machinery 2
- Antimicrobial food packaging: system construction 1
- Factors affecting the effectiveness of antimicrobial packaging 1

UNIT II

Packaging Techniques **(12Hrs)**

- Active and intelligent packaging – packaging techniques 2
- Current use of novel packaging techniques, Oxygen, ethylene and other scavengers and scavenging technology 3
- Non-migratory bioactive polymers (NMBP) in food packaging 2
- Advantages, limitations 1
- inherently bioactive synthetic polymers: types and applications 2
- Polymers with immobilized bioactive compounds 2

UNIT III

Package Interactions & Novel Applications **(12Hrs)**

- Packaging-flavor interactions; Factors affecting flavor absorption 2
- role of the food matrix; role of differing packaging materials 3
- Active packaging – Novel applications 2

- Time-temperature indicators (TTIs), Definitions, classification, Requirements 3
- Development – Current TTI systems – effectiveness and utilization 2

UNIT-IV

Modern packaging systems **(12Hrs)**

- Modern packaging systems: Green plastics for food packaging 2
- Developing novel biodegradable materials 2
- Legislative issues, Current applications 2
- Integrating intelligent packaging 2
- Creating integrated packaging, storage and distribution 2
- Role of packaging in the supply chain 2

UNIT V

Shelf Life Studies **(12Hrs)**

- Shelf life of foods, processed and packaged foods 2
- Factors influencing the shelf life of a product 2
- Labelling and label regulations 2
- shelf life studyof food products 2
- determination of shelf life – direct methods, indirect methods 2
- Accelerated studies; Challenge testing; Extended shelf life foods 2

Recommended Readings:

- Crosby, N.T. 1981. **Food Packaging: Aspects of Analysis and Migration Contaminants**. London: Applied Science Pubications.
- Kadoya, T.1990. **Food Packaging**. London: Academic Press.
- Mahadeviah, M. and Gowramma, R.V. 1996**. Food Packaging Materials**. New Delhi: Tata McGraw Hill.
- Palling, S.J. 1980. **Developments in Food Packaging**. London: Applied Science Pubications.
- Painy, F.A. 1992. **A Handbook of Food Packaging**. London: Blackie Academic Publication.
- Sacharow, S. and Griffin, R.C. 1980. **Principles of Food Packaging**. New York: AVI Publications.
- Stanley, S. and Roger, C.G.1970. **Food Packaging**. New York: AVI Publications.

FOOD QUALITY SYSTEMS & MANAGEMENT

Credits : 4 **II Year/Semesters: III**
Course Code : MFT13305 **No. of Lecture hours: 60**

Objectives:

- To learn about quality management in food production chain.
- To learn about physical, chemical contaminants in foods
- To learn about latest trends and techniques in food science
- To understand the significance of safe processing of foods.

Outcomes:

Students will gain knowledge about the role and importance of quality control systems and understand the techniques used to safeguard foods from several contaminants and make is safer for human consumption.

UNIT I

Introduction to Quality Control (12Hrs)

- Concept of quality: Quality attributes- physical, chemical 2
- nutritional, microbial– their measurement and evaluation 2
- Instrumental methods for testing quality of milk 2
- fruits, vegetables, grains and oilseeds, meat and poultry 2
- beverages, ready-to-eat and convenience foods 2
- other processed and packaged food products 2

UNIT II

Sensory Analysis & Statistical Control (12Hrs)

- Sensory analysis: Introduction, general testing conditions 2
- Requirements of sensory laboratory 1
- Factors influencing sensory measurements 2
- Sensory quality parameters – Selection of sensory panelists 1
- Detection, threshold and dilution tests 1
- Sensory evaluation tests: discrimination, descriptive, affective 1
- Flavor profile tests; Computer-aided sensory evaluation of food & beverage 2
- statistical analysis of sensory data 2

UNIT III

Concepts of QC, QA & Quality Management (12Hrs)

- Quality control and Quality assurance 2
- Objectives, importance and functions 1
- Concepts of quality management 1

- Quality management systems in India 2
- Total Quality Management 2
- GMP/GHP; GLP, GAP 1
- Sanitary and hygienic practices 1
- HACCP 1
- FSMS (ISO 22000) 1

UNIT IV

Organizations & Regulations for Quality Management (12Hrs)

- Organizations dealing with inspection, traceability and authentication 2
- certification and quality assurance 3
- FSSAI, AGMARK, BIS, Domestic regulations 3
- Laboratory quality procedures: sampling plans and techniques 2
- Assessment of laboratory performance 2

UNIT-V

Global Food Safety Standards (12Hrs)

- Global Food safety Initiative 2
- Quality manuals, International quality systems and standards 2
- ISO and Food Codex; Export import policy, export documentation 2
- Food adulteration and food safety documentation and audits 4
- Labelling issues: International scenario 1
- International food standards 1

Recommended Readings:

- Amerine, M.A. Pangborn, R.M. and Rosslos, E.B. 1965. **Principles of Sensory Evaluation of Food**. London: Academic Press.
- Early, R.1995. **Guide to Quality Management Systems for Food Industries**. London: Blackie Academic publications.
- Krammer, A. and Twigg, B.A. 1973. **Quality Control in Food Industry**. Volume: I and II. New York: AVI Publications.
- Macrae, R. Roloson, R. and Sadlu, M.J. 1994. **Encyclopedia of Food Science & Technology & Nutrition**. Volume: XVI. London: Academic Press.
- Ranganna, S. 2001. **Handbook of Analysis and Quality Control for Fruit and Vegetable Products**. 2nd edition. New Deihi: Tata-McGraw-Hill.

ENERGY CONSERVATION & AUDITING

Credits : 4 **II Year/Semester: III**
Course Code : MFT13306 **No. of Lecture hours: 60**

Objectives:

- Identify the demand supply gap of energy in Indian scenario.
- Carry out energy audit of an industry/Organization.
- Draw the energy flow diagram of an industry and identify the energy wasted or a waste stream.
- Select appropriate energy conservation method to reduce the wastage of energy.
- Evaluate the techno economic feasibility of the energy conservation technique adopted.

Outcome:

Student will gain knowledge about the energy conservation pattern in food industry and learn the measures taken to conserve energy from being wasted to provide it for future industrial growth.

UNIT I

Introduction to Energy Conservation **(12Hrs)**

- Basic principles & fundamentals of energy conservation 3
- thermodynamic laws 3
- opportunities of energy conservation in food processing industries 3
- Status of energy utilization for food processing in India and abroad 3

UNIT II

Energy conservation in thermal utilities **(12Hrs)**

- Energy conservation in thermal utilities 2
- fuel & combustion 1
- boilers, steam system 1
- furnaces, insulation & refrigeration 2
- FBC boilers 2
- Cogeneration principles 2
- waste heat recovery 2

UNIT III

Energy management & auditing I **(12Hrs)**

- Energy management & auditing 2
- ISO:14000; EMS 2
- Energy auditing methodology 4
- Reporting format 2
- Understanding energy costs 2

UNIT-IV

Energy management & auditing II **(12Hrs)**

- Benchmarking & energy performance 3
- matching energy usage to requirements 3
- maximizing system efficiency 3
- fuel and energy substitution 3

UNIT V

Energy management & auditing III **(12Hrs)**

- Energy audit instruments 2
- material & energy balance 2
- energy action planning 2
- financial management 2
- Carbon Credits 2
- energy monitoring and targeting 2

Recommended Readings:

- Chaturvedi, P. 2000. **Energy Management: Challenges for the Next Millennium. Energy Conservation through Waste Utilization.** New York: American Society of Mechanical Engineers.
- Kreit, F. and Goswami, D.Y. 2008. **Energy Management and Conservation Hand Book**. New Delhi: CRC Press.
- Murphy, W.R and Mckay, G. 1982. **Energy Management**. New Delhi: BS Publications.
- Patrick, D.R. 1982. **Energy Management and Conservation**. Netherlands: Elsevier Publications.

ADVANCES IN FOOD PACKAGING PRACTICALS

Credits : 2 **II Year/Semester: III**
Course Code : MFT13307 **No. of Practical hours: 30**

Objective:

- To identify properties of Packaging materials used in food industries

Outcome:

- Students will gain knowledge and understand the properties of Packaging materials used in food industries.

Contents:

● Identification and testing of packaging materials	2
● Testing of lacquered tin plate sheets	2
● Measurement of tin coating weight by Clarke's method	2
● Sulphide stain test and ferricyanide paper test for porosity	2
● Determination of equilibrium moisture content	2
● Grading of glass bottles	2
● Determination of water vapour transmission rate of packaging material	2
● To perform vacuum packaging of food sample and carry out its storage study	2
● Testing the compression strength of the boxes	2
● Packaging the food material in seal and shrink packaging machine and study its shelf life	2
● Testing the strength of glass containers by thermal shock test	2
● Testing the strength of filled pouches by drop tester	2
● Industrial visit to packaging industry	6

Recommended Readings:

- Crosby, N.T. 1981. Food Packaging: Aspects of Analysis and Migration Contaminants. London: Applied Science Pubications.
- Kadoya, T.1990. Food Packaging. London: Academic Press.
- Mahadeviah, M. and Gowramma, R.V. 1996. Food Packaging Materials. New Delhi: Tata McGraw Hill.
- Palling, S.J. 1980. Developments in Food Packaging. London: Applied Science Pubications.
- Painy, F.A. 1992. A Handbook of Food Packaging. London: Blackie Academic Publication.

FOOD QUALITY SYSTEMS & MANAGEMENT PRACTICALS

Credits : 2 **II Year/ Semester: III**
Course Code : MFT13308 **No. of Practical hours: 30**

Objective:

- To Understand quality policy and documentations of food sectors through testing and evaluation of quality attributes.

Outcome:

- Students will gain knowledge about quality policy and documentations of food sectors through testing and evaluation of quality attributes.

• Testing and evaluation of quality attributes of raw and processed foods	4
• Sensory evaluation of foods	2
• Quality assurance procedure, GMP, GAP documentation	2
• Preparation of quality policy & documentation	2
• Application of HACCP to products	2
• Preparation of HACCP chart	2
• Preparation of documentation & records	2
• Visit to Units with ISO systems	2
• Visit to Units with HACCP certification	2
• Visit to Units implementing GMP, GAP	2
• Mini-project on preparation of a model laboratory manual	8

Recommended Readings:

- Amerine, M.A. Pangborn, R.M. and Rosslos, E.B. 1965. Principles of Sensory Evaluation of Food. London: Academic Press.
- Early, R.1995. Guide to Quality Management Systems for Food Industries. London: Blackie Academic publications.
- Krammer, A. and Twigg, B.A. 1973. Quality Control in Food Industry. Volume: I and II. New York: AVI Publications.
- Macrae, R. Roloson, R. and Sadlu, M.J. 1994. Encyclopedia of Food Science & Technology & Nutrition. Volume: XVI. London: Academic Press.
- Ranganna, S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd edition. New Deihi: Tata-McGraw-Hill.

TECHNOLOGY OF BAKING SCIENCE

Credits : 2 **II Year / IV Semester**
Subject Code : MFT19401 **No. of Lecture hours: 45**

Objective: To familiarize the students with different aspects in Baking industry.
Outcomes: Students will gain knowledge on principles of milling and baking science, technology of production and industry trends.

UNIT I **(9 Hrs)**

- Bakery industry : Introduction, recent trends, 2
- Present status of Bakery Industry in India. 1
- Raw materials used in bakery industry and their properties 3
- Quality parameters in bakery Industry. 3

UNIT II **(9 Hrs)**

- Wheat milling - products and by-products; 2
- Manufacture of whole wheat *Atta* 2
- Methods of dough mixing 2
- Dough development 1
- Dough chemistry 1

UNIT III **(9Hrs)**

- Rheological testing of dough:
  - Farinograph, Mixograph, Extensograph, 2
  - Amylograph / Alveo consistograph, 2
  - Rapid Visco Analyzer, 1
  - Falling number, 1
  - Hosney's dough, stickiness tester and interpretation of the data. *;* 1
- Factors affecting quality parameters; physical, chemical and rheological tests on wheat flour. 2

UNIT IV **(9Hrs)**

- Additives used in bakery products :
  - flour improvers and bleaching agents. 2
  - Emulsifiers 1
  - leavening agents 2
  - Preservatives 2
  - Miscillaneous agents 2

UNIT V **(9 Hrs)**

- Technology for manufacture of bakery products : 3
  - bread, biscuits, cookies, cakes;
- pasta products and various processed cereal-based foods; 2
- effect of variations in formulation and process parameters on the quality of the finished product; 2
- quality consideration and parameters; 2

Recommended Readings:

1. Manley DJR.1983. Technology of Biscuits, Crackers, and Cookies. Ellis Horwood.
2. Matz SA. 1992. Bakery Technology and Engineering. 3rd Ed. Chapman & Hall.
3. Dubey SC. 2002. *Basic Baking*. The Society of Indian Bakers, New Delhi.
4. Pyler EJ. *Bakery Science & Technology*. 3rd Ed. Vols. I, II. Sosland Publ.
5. Bent A, Bennion EB & Bamford GST. 1997. The Technology of Cake Making. 6th Ed. Blackie.

FOOD AND NUTRITION

Credits : 4 **II Year/Semester: IV**
Subject Code: MFT13402 (A) **No. of lecture hours: 45**

Objectives:

- Understand the relationship between food, nutrition and health.
- Understand the functions of food.
- Learn about various food groups and balanced diet.
- Understand digestion, absorption and function of various nutrients and their sources.

Outcomes:

Students will gain knowledge about importance of nutrition and understand digestion, absorption and function of various nutrients and their sources.

Unit – I **(9Hrs)**
Nutrition & Nutrients

- Basic definition- Nutrition, health, nutrient, proximate principles 1
- Food – definition, classification – based on nutritive value 1
- Classification – based on functions 2
- Carbohydrates – classification, examples, sources, deficiency, functions 1
- Lipids – classification, examples, sources, deficiency, functions 1
- Protein – classification, examples, sources, deficiency, functions 1
- Deficiency symptoms – Kwashiorkor, marasmus, PEM 2

Unit – II **(9Hrs)**
Vitamins & Minerals

- Vitamins – definitions, classification, examples 1
- Vitamins – Sources, deficiency symptoms 2
  Vitamins – requirements (fat & water soluble) 2
- Minerals – definitions, classification, examples 1
- Minerals – sources, deficiency symptoms 2
- Minerals – requirements 1

Unit – III **(9Hrs)**
Food Energy & RDA

- Energy-Definition, methods to determine energy value of foods 1
- Physiological fuel value - Energy requirements 2
- Balanced diet – Recommended daily allowances 1
- Nutritional requirements for different age groups: infants, Pre-school children 1

- Nutritional requirements for different age groups - school children, Adolescents 1

- Nutritional requirements for different age groups - Adults, old age 1
- Nutritional requirements for different age groups – Pregnancy, lactation 1
- Nutritional requirements for different age groups – Industrial workers 1

Unit – IV **(9Hrs)**
Assessment of Nutritional Status

- Assessment of nutritional status –
  - Anthropometric measurements 1
  - Clinical assessment; Radiological & biophysical methods 1
  - Biochemical methods; Diet surveys 1
- Programs to combat Malnutrition of deficiency disorders
  - Applied Nutrition program; Supplementary feeding program 2
  - Anemia prophylaxis program, Goitre control program 2
  - Vit – A deficiency control program; 1
  - Integrated child development program 1

Unit – V **(9Hrs)**
Supplementary Foods & Novel Foods

- Supplementary foods & Novel foods 1
- Role of international agencies in overcoming malnutrition – CARE 1
- Role of international agencies in overcoming malnutrition – WHO, FAO 1
- Role of international agencies in overcoming malnutrition – UNICEF 1
- Therapeutic diets 1
- Modification of diet – Clear fluid diet, full fluid diet & Soft diet 1
- Obesity, Food faddism 1
- Faulty food habits 1
- Food allergy 1

Recommended Readings:

- Swaminathan, M. S. **Essential of Food and Nutrition.** Volume: I and II. Bangalore: Printing and Publishing Co. Ltd.
- Swaminathan, M. S. 1978. **Hand book of Food and Nutrition.** Bangalore: Bappco Ltd.
- Srilakshmi. 2007. **Food Science**, 4th edition. Hyderabad: New Age International Ltd.
- Khanna, K. Gupta, S. Seth, R. Mahna, R. and Rekhi, T. (2004). **The Art and Science of Cooking: A Practical Manual.** India: Elite Publications.

- Seth, V. and Singh, K. (2005). **Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual.** 4th edition. India: Elite Publications.
- ICMR (2010). **Nutrient Requirements and Recommended Dietary Allowances for Indians**. 2nd edition. Hyderabad: NIN.

TECHNOLOGY OF FOOD PRESERVATION & PROCESSING

Credits : 4 **II Year/Semester: IV**
Course Code : MFT13402 (B) **No. of Lecture hours: 45**

Objectives:

- To study the importance microorganisms in food preservation
- To introduce the basics of various food processing and preservation technologies.

UNIT I

Introduction & High Temperature Processing (9Hrs)

- Food preservation and processing – Scope, historical developments, principles 1
- Processing and preservation by heat;
  - blanching, pasteurization, sterilization and UHT processing 3
  - canning, extrusion cooking, dielectric heating 3
  - Microwave heating, baking, roasting and frying, etc. 2

UNIT II

Low Temperature Processing (9Hrs)

- Processing and preservation by low-temperature-
  - refrigeration, freezing 2
  - CA, MA 2
  - dehydro freezing 1
- Processing and preservation by
  - Drying– Types of dryers - suitability for different food products. 1
  - Concentration, evaporation 2
  - Crystallization 1

UNIT III

Membrane Technology (9Hrs)

- Membrane technology - Introduction to pressure activated membrane processes:
  - micro- filtration 2
  - UF 2
  - NF 2
  - RO 2
- Industrial applications of Membrane technology 1

Unit IV

Food Additives & Fermentation (9Hrs)

- Preservation by Food additives: types and functions 1
- Permissible limits and safety aspects. 2
- Use and application of;
  - Enzymes in processing and preservation of foods 2

- Microorganisms in processing and preservation of foods 2
- Food fermentations. 2

UNIT V

New Techniques of Preservation (9Hrs)

- New techniques in food processing 1
- Processing and preservation by non-thermal methods
  - Irradiation 1
  - high pressure, high intensity light, 1
  - pulsed electric field, 1
  - ohmic heating 1
  - IR heating, inductive heating 1
  - pulsed X-rays 1
- Hurdle technology 1
- Nanotechnology: Principles and applications in foods 1

Recommended Readings:

- Arsdel, W.B. Copley, M.J. and Morgan, A.I. 1973**. Food Dehydration**. 2nd Edition. Volume: I and II. New York: AVI Publications.
- Desrosier, N.W and James, N. 1977. **Technology of Food Preservation**. 4th Edition. New York: AVI Publications.
- Fellows, P.J. 2005. **Food Processing Technology: Principle and Practice**. 2nd edition. New York: CRC publications.
- Ramaswamy, H. and Marcotte, M. 2006. **Food Processing: Principles and Applications.** Florida: CRC publications.

NUTRACEUTICALS AND FUNCTIONAL FOODS

Credits : 4 **II Year/Semester: IV**
Course Code : MFT19403 (A) **No. of Lecture hours:45**

Objective: To familiarize the students with basics of Functional foods and Nutraceuticals and their applications.

Outcomes: Students will gain knowledge on major nutraceuticals and functional foods.

Unit I **9 Hrs**

- Functional foods and Nutraceuticals terminology 1
- Historical perspective and classification of functional foods and Nutraceuticals 2
- The food industry's role in promoting functional foods 2
- The role of marketing Communication in the introduction of functional foods to the consumer 2
- Sources of functional foods and Nutraceuticals. 1

Unit II **9 Hrs**

- Relation of functional foods & Nutraceutical (FFN) to foods & drugs 2
- Applications of herbs to functional foods. 1
- Functional foods and Nutraceuticals remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia 3
- Nephrological disorders, Liver disorder 1
- Probiotics and prebiotics 1
- Polyunsaturated fatty acids, lecithin 1

Unit III **9 Hrs**

- Brief idea about some Nutraceutical rich supplements 2
- Soy proteins and soy isoflavones in human health 2
- Bee pollen, Caffeine, Green tea, 1
- Lecithin, Mushroom extract, 1
- Chlorophyll, Kelp and *Spirulina* 1
- Role of Dietary fibers in disease prevention. 2

Unit IV **9 Hrs**

- Effect of Functional foods on Immune system 1
- Antioxidant system of the human organism 2
- Cardiovascular diseases 1
- Types of cancer 2

- Osteoporosis 1
- Psoriasis and Ulcers 2

Unit V **9 Hrs**

- Vegetables, Cereals, milk and dairy products as Functional foods 2
- Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals 2
- Glucosamine, Lycopene and Melatonin 1
- Health effects of common beans, *Capsicum,* mustards, Ginseng, 2
- Health effects of garlic, grape, citrus fruits, fish oils, and sea foods 2

Recommended Readings:

- Aluko, Rotimi E. ***Functional Foods and Nutraceuticals*** 2012. University of Manitoba, Winnipeg, Canada.
- Robert, E.C. ***Handbook of Nutraceuticals and Functional Foods*** (Modern Nutrition) 1st Edition, Kindle Edition
- Casimir C. Akoh ***Functional Foods and Nutraceuticals*** *The University of Georgia, Athens, USA CRC Press*

FOOD TOXICOLOGY AND ALLERGENS

Credits : 4 **II Year/Semester : IV**
Subject Code: MFT13403 (B) **No. of lecture hours: 45**

Objectives:

- Gain knowledge of the scope, basic principles of food toxicology.
- To distinguish between safety, hazard and toxicity.
- Gain knowledge of toxic substances in food and their toxic effects in people.
- Gain knowledge of the scope, basic principles of food toxicology.
- To distinguish between safety, hazard and toxicity

Outcome:

Students will gain knowledge on major food toxicants and allergens and the acute and chronic diseases related to them.

UNIT I **(9Hrs)**

- Definition and need for understanding food toxicology. 2
- Hazards - Microbiological, nutritional and environmental. 2
- Basics of immune resources - humoral and cell media resources. 2
- Allergen and mechanism of allergic resources. 3

UNIT II **(9Hrs)**

Food allergy and sensitivity:

- Chemistry of food allergens. 2
- Celiac disease. 1
- Food disorders associated with metabolism. 2
- Lactose intolerance. 2
- Asthma. 2

UNIT III **(9Hrs)**

Principles of toxicology:

- Natural food toxicants:
  - toxicity of mushroom alkaloids, 1
  - seafood, 1
  - vegetables & fruits, 1
  - pulses, 1
- antinutritional compounds. 1
- Biological factors that influence toxicity, 1
- toxin absorption in the G.I.track 2
- Industrial microflora, storage and excretion of toxins 1

UNIT IV **(9Hrs)**

- Quantitative and qualitative analysis of toxicants in foods 1
- Biological determination of toxicants 1
- Assessment of food safety:
  - Risk assessment and risk benefit indices of human exposure, 1
  - Acute toxicity, 1
  - Mutagen city and carcinogenicity, 2
  - Reproductive and developmental toxicity, 1
  - Neurotoxicity and behavioural effect. 1
  - Immunotoxicity. 1

UNIT V **(9Hrs)**

Toxicants formed during food processing:

- Intentional direct additives, preservatives, nitrate, nitrite, and N- nitroso compound flavor enhancers, food colours, indirect additives, residues and contaminants, heavy metals, other organic residues and packaging materials. 5
- Toxicity of heated and processed foods, 1
- Food carcinogens and mutagens
  - Polycyclic aromatic hydrocarbons, 1
  - N - nitrosamines, 1
  - Acrylamide and their mode of action 1

Recommended Readings:

- Helferich, William and Carl, K. 2001. **Food Toxicology.** New York: CRC Publications.
- Shibamoto, Taka yuki and Leonard, F. 2009. **Introduction to Food Toxicology.** 2nd edition. Cambridge, USA: Academic Press.
- Maleki, Soheila J. A.Wesley Burks, and Ricki M.Helm. 2006. **Food Allergy.** Washington DC: ASM Press.
  Cliver, Dean, O. and Hans, P. 2002. **Food Borne Diseases.** 2nd edition. Cambridge, USA: Academic Press/Elsevier.
- Hans, P. and Dean, O. **Food Borne Infections and Intoxications.** 3rd edition. Cambridge, USA: Academic Press/Elsevier.

FOOD SUPPLY & COLD CHAIN MANAGEMENT

Credits : 4 **Semester: IV**
Course Code : MFT13404 **No. of Lecture hours: 45**

Objectives:

- To understand the fundamentals of supply chain management and cold chain management.
- To learn the importance of supply chain and cold chain management in Food preservation.
- To learn about the opportunities available in the country

Outcome:

The students will gain knowledge on supply chain management and cold chain management for consumable and perishable food commodities

UNIT I **(9Hrs)**

- Introduction, scope and importance of cold chain in food processing industry 1
- retail chain, components of cold chain and integration 2
- Products going in cold chain 1
- temperature and humidity requirements 1
- packaging needs and their compatibility in cold chain 2
- Stages and points of control in cold storages and structures 2

UNIT II **(9Hrs)**

- Functions in cold storages, pallet layout and stacking options 2
- flexibility storage systems cold chain transportation in land 2
- export, retail & supermarket cold chain & display systems 2
- internet auctions, e-market 1
- electronic business process optimization 2

UNIT-III **(9Hrs)**

- Temperature recording devices used during transport 2
- documentation and traceability 1
- Risk management problem diagnosis 2
- cost benefit studies for type of transport 2
- loading & unloading, storage duration 2

UNIT IV **(9Hrs)**

- Building blocks of supply chain network 2
- performance measures 1

- decisions in supply world and models 1
- Supply chain inventory management 2
- economic order quantity models 1
- recorder point models 1
- multi echelon inventory systems 1

UNIT V **(9Hrs)**

- Use of stochastic models and combinatorial optimization in;
    - SC planning, layout 2
    - capacity planning 1
    - inventory optimization 1
    - dynamic routing and scheduling 1
- Internet technologies and electronic commerce in SCM related to;
    - ERP 2
    - Q-procurement, e-logistics 2

SUGGESTED READINGS

- Chopra, S. and Meindel, P. 2002. **Supply Chain Management: Strategy, Planning and Operation.** New Jersey, US: Prentice Hall Publications.
- Handfield, R.B. and Nochols, E.L. 1999. **Introduction to Supply Chain Management**. New Jersey, US: Prentice Hall Publications.
- Levi, D.S. Kaminsky, P. and Levi, E.S. 2000**. Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies**. New Delhi: Tata McGraw Hill.
- Viswanadham, N & Narahari, Y. 1998. **Performance Modeling of Automated Manufacturing Systems**. New Jersey, US: Prentice Hall Publications.

PROJECT WORK

Credits : 6 **II Year/Semester: IV**
Course Code : MFT13405

Objective:

- To develop research and project writing skills in students.

Outcome:

- Students get a hand on experience related to different aspects of new Product development, food standards and regulations and usage of various equipments and machineries.

A research project will be allotted to each student after the III semester. They will be required to complete the data collection, analysis and writing of dissertation so as to submit it at the end of IV Semester and to present it at seminar.

TECHNOLOGY OF FOOD PROCESSING & PRESERVATION

Credits : 4 **I Year / I Semester**
Subject Code : MFT13102 **No. of Lecture hours: 60**

Objectives:

- To understand the methods to increase the shelf-life of food using different preservation techniques.
- To make food attractive and safe for the consumers

Outcomes:

Students will gain knowledge about different techniques used to process and preserve foods and make it safer for human consumption

UNIT I: Introduction & High Temperature Processing **12Hrs**

- Food preservation and processing – Scope, historical developments, principles 2
- Processing and preservation by heat; 10
  - blanching, pasteurization, sterilization and UHT processing
  - canning, extrusion cooking, dielectric heating
  - Microwave heating, baking, roasting and frying, etc.

UNIT II: Low Temperature Processing **12Hrs**

- Processing and preservation by low-temperature- 6
  - refrigeration, freezing, dehydro freezing
  - CA, MA
- Processing and preservation by 6
  - Drying– Types of dryers - suitability for different food products.
  - Concentration, evaporation
  - Crystallization

UNIT III: Food Additives **12Hrs**

- Preservation by Food additives: types and functions 6
- Permissible limits and safety aspects. 2
- Use and application of; 4
  - Enzymes & Microorganisms in processing and preservation of foods

UNIT IV Membrane Technology **12Hrs**

- Membrane technology - Introduction to pressure activated membrane processes: 9
  - micro- filtration
  - UF
  - NF

- RO
- Industrial applications of Membrane technology 3

UNIT V New Techniques of Preservation **12Hrs**

- New techniques in food processing 2
- Processing and preservation by non-thermal methods 6
  - Irradiation
  - high pressure, high intensity light,
  - pulsed electric field,
  - ohmic heating
  - IR heating, inductive heating
  - pulsed X-rays
- Hurdle technology 2
- Nanotechnology: Principles and applications in foods 2

Recommended Readings:

1. Arsdel WB, Copley MJ & Morgan AI. 1973. *Food Dehydration*. 2nd Ed.Vols. I, II. AVI Publ.
2. Desrosier NW & James N.1977. *Technology of Food Preservation*. 4th Ed.AVI. Publ.
3. Fellows PJ. 2005. *Food Processing Technology: Principle and Practice*. 2nd Ed. CRC.
4. Jelen P. 1985. *Introduction to Food Processing*. Prentice Hall.
5. Potter NN & Hotchkiss 1997. *Food Science*. 5th Ed. CBS.
6. Potty VH & Mulky MJ. 1993. *Food Processing*. Oxford & IBH.
7. Ramaswamy H & Marcotte M. 2006. *Food Processing: Principles and Applications*. Taylor & Francis.

FOOD PROCESS ENGINEERING- I

Credits : 4 **I Year / I Semester**
Subject Code : MFT13103 **No. of Lecture hours: 60**

Objectives:

To impart students with knowledge related to engineering aspects in food technology.

Outcomes:

The students will be able to understand the principles of food science and the properties of components associated with it.

UNIT - I: Material Balance & Energy Balance **12Hrs**

- Material Balances: Basic Principles 3
- Problems in: 9
  - Dilution
  - Concentration
  - Dehydration
  - Blending of Food Ingredients

UNIT - II: Energy Balance **12Hrs**

- Energy Balances: Basic Principles – Energy terms 3
- Heat properties of saturated and super heated steam 5
- Problems & Examples in Heat balances 4

UNIT – III: Gases and vapors-I **12Hrs**

- Gases and vapors: definition-equation of state for an ideal and real gases 3
- Ideal gas equation - P.V.T relationship for ideal gases-gas mixture 3
- Thermodynamics: thermodynamic variables- define enthalpy 3
- The relationship between C_p and C_v for gases 3

UNIT – IV: Gases and vapors-II **12Hrs**

- P.V.T relationship for ideal gases in thermodynamic process 4
- Changes in thermodynamic properties 4
- Work and Heat associated with thermodynamic processes 4

UNIT –V Rheological & Colligative properties **12Hrs**

- Rheological properties of food materials: 6
  - Rheology – Viscosity – effect of temperature on viscosity
  - Viscosity of gases – brook field viscometer.
- Colligative properties and surface tension 6
  - Boiling point elevation- freezing point depression

- surface tension
- Cohesion, adhesion and spreading

Recommended Readings:

- Basics of Food Engineering, Romeo Toledo
- Brennan JG, Butter JR, Corell ND & Lilly AVE. 1990. *Food Engineering Operations*. Elsevier.
- Charm SE, McCabe WL, Smith JC & Harriott P.1993. *Unit Operations of Chemical Engineering*. McGraw Hills.
- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- Fellows P. 1988. *Food Processing Technology*. VCH Ellis Horwood.
- Heldman DR & Singh RP.1995. *Food Process Engineering*. AVI Publ.
- McCabe WL & and Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural Processing*. Vikas Publ. House.
- Singh RP & Heldman DR. 1993. *Introduction to Food Engineering*. Academic Press.

TECHNOLOGY OF ANIMAL BASED FOOD & FOOD PRODUCTS

Credits : 4 **I Year / I Semester**
Subject Code : MFT13104 **No. of Lecture hours: 60**

Objectives:

To Impart students with knowledge about various animal sources used for consumption and the processing techniques involved in the production of various animal based byproducts.

Outcomes:

Students will able to understand and equip knowledge about the importance and production of various animal based food products**.**

UNIT I: Avian Foods	**12Hrs**
• Avian Foods: Egg & Poultry industry in India	1
• classification, composition	1
• nutritive value, grading	1
• Processing, packaging	1
• microbiology, storage	2
• quality characteristics and spoilage factors	2
• Lay-out and design of poultry processing plants	1
• operations, equipment & Plant sanitation	2
• Poultry by-products	1

UNIT II : Meat	**12Hrs**
• Livestock: Meat production from different sources in India	1
• muscle structure, chemistry and compositions	1
• ante mortem and post-mortem handling	1
• Meat tenderization	1
• Grading, Processing, preservation, packaging	2
• microbiology, storage	1
• safety, quality characteristics and spoilage factors	2
• Meat products – Moisture, IM and dried foods	1
• offal handling and inspection; inedible by-product	1
• Modern abattoirs and design of facilities - typical layout and features	1

UNIT III: Sea Foods	**12Hrs**
• Sea Food: Grading, postharvest freshness	2
• biochemistry, microbiology	2
• preservation and transportation of fish and other sea foods	2
• Preparation of fish protein concentrate, fish oil and other by products	2
• Commercially important marine products from India	2

- product export and its sustenance 2

UNIT IV: Dairy Processing **12Hrs**

- Dairy: Present status of milk & milk products in Indian market 3
- Milk – Composition, chemistry 2
- procurement, transportation 2
- processing, Packaging, storage 2
- Quality evaluation and testing of milk 3

UNIT V: Dairy products **12Hrs**

Definition, classification, composition, physiochemical properties, methods of manufacture, packaging, storage, quality evaluation and defects of;

- Special milks - Condensed milk 1
- dried milk powder (instantiation) 2
- Cream, Butter 2
- Ice cream 1
- Cheese 2
- Indigenous milk products 4

Recommended Readings:

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology ofIndian Milk Products*. Dairy India Publ.
- De S.1980. *Outlines of Dairy Technology*. Oxford Univ. Press.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory &Practices*. Himanshu Publ
- Web BH, Johnson AH & Lford JA. 1987. *Fundamental of Dairy Chemistry*. 3rd Ed. AVI Publ.
- Forrest JC. 1975. *Principles of Meat Science*. Freeman.
- Govindan TK. 1985. *Fish Processing Technology*. Oxford & IBH.
- Hui YH. 2001. *Meat Science and Applications*. Marcel Dekker.
- Kerry J. *et al.* 2002. *Meat Processing*. Woodhead Publ. CRC Press.
- Levie A. 1984. *Meat Hand Book*. 4th Ed. AVI Publ.
- Mead M. 2004. *Poultry Meat Processing and Quality*. Woodhead Publ.
- Mead GC. 1989. *Processing of Poultry*. Elsevier.
- Pearson AM & Gillett TA. 1996. *Processed Meat*. 3rd Ed. Chapman & Hall.

ADVANCED FOOD CHEMISTRY

Credits : 4 **I Year / I Semester**
Subject Code : MFT13105 **No. of Lecture hours: 60**

Objectives:
To impart students with knowledge about the varied components present in foods and their interactions during processing and preservation.

Outcomes:
Students will be able to understand and learn the physio-chemical properties of foods during processing.

UNIT I: Major food constituents **12**

- **Carbohydrates:** 6
  - Definition and importance classification, physico- chemical properties, functional properties, Structural correlations. Interactions among food components- Effect on sensory and processing quality; Effect of processing on nutritional quality
- **Proteins:** 6
  - Definition and importance, classification, physico- chemical properties, functional properties, Structural correlations. Interactions among food components- Effect on sensory and processing quality; Effect of processing on nutritional quality

UNIT II: Major Food constituents **12**

- **Lipids:** 6
  - Definition and importance, classification, physico- chemical properties, functional properties, Structural correlations. Interactions among food components- Effect on sensory and processing quality; Effect of processing on nutritional quality
- **Water:** 6
  - Role in food, Relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymatic, physical and microbial changes).

UNIT III: Minor Food constituents and Enzymes **12**

- **Minor food constituents:** 8
  - Minerals, vitamins, pigments, allergens, toxins and anti-nutritional compounds - Properties; Interaction in food systems; Changes during storage and processing.
- **Enzymes:** 4
  - Definition, importance, classification and properties; Interactions among food-chemistry and mechanisms of action

UNIT IV: Food Additives & Toxicology **12**

- **Food Additives:**
  - Definition, importance, classification and properties; Interactions among food-chemistry and mechanisms of action 7

- Toxicology - evaluation techniques and uses 3
- Manufacturing and applications of fibres from food sources 2

UNIT V: Food & Nutrition **12**

- Food groups: Typical composition 2
- Essential nutrients: 3
  - sources, deficiency diseases; requirements and recommended dietary allowances
- Digestion, absorption, transport and metabolism of nutrients in human system 7

Recommended Readings:

1. Fennema OR.1996. *Food Chemistry*. Marcel Dekker.
2. Meyer LH. 1987. *Food Chemistry*. CBS.
3. Belitz HD.1999. *Food Chemistry*. Springer Verlag.
4. DeMan JM. 1976. *Principles of Food Chemistry*. AVI.
5. Bamji MS, Rao NA & Reddy V. 2003. *Textbook of Human Nutrition*.Oxford & IBH.
6. Swaminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh & Co.

FOOD MICROBIOLOGY

Credits : 4 **I Year / I Semester**
Subject Code : MFT13106 **No. of Lecture hours: 60**

Objectives

- To understand the nature of microorganisms involved in food spoilage, food infections and intoxications and also those used in food biotechnology (food fermentation and various food processing industries)
- To gain knowledge of principles of various techniques used in the prevention and control of the microorganisms in foods(food preservation)
- To understand criteria for microbiological safety in various foods operations to avoid public health hazards due to food contamination

Outcomes

- Students will gain knowledge on various qualitative and quantitative aspects related to microorganisms associated with foods and different rapid techniques to detect microorganisms in food.
- Students will gain knowledge on various quality control parameters of foods. They will be through with the basic pre-requisite programmers, national and international food regulations.

UNIT-I Introduction to Microbiology **12Hrs**

- Introduction to microbiology; Microorganisms – Definition, Classification 2
- Foods as ecological niches- Relevant microbial groups 2
- Microbial growth in food: 4
  - Intrinsic, extrinsic and implicit factors
  - survival of microorganisms in foods
  - Effect of injury on growth or survival.
- Biochemical changes - fermentation, putrefaction and lipolysis 2
- Antagonism and synergism in microorganisms. 2

UNIT II: Microbiology of Foods Health & Hygiene **12Hrs**

- Contamination and spoilage of foods: 5
  - Milk & Milk products
  - Fruits & vegetables – Products
  - Grains and oilseeds
  - meat and poultry

UNIT III: Health & Hygiene **12Hrs**

- Food poisoning, food borne infections 2
- Microbial toxins 2

- Food hygiene and sanitation control: 3
  - Methods to control microorganisms (Physical, Chemical, Thermal and Non- Thermal methods)

UNIT IV: Detection of Microbes **15Hrs**

- Methods for qualitative and quantitative assay for 2
  - Presence of microbes
  - Characterization of microbes
- Rapid methods in detection of microorganisms 2
- Microbes as 1
  - Test organisms
  - Indicator organisms
  - Sensors.

Unit V: Microbial Fermentation & Industry **12**Hrs

- Fermentation – Principles, systems, applications 3
- Modern methods of cell culture: 3
  - synchronous and co- cell culture
  - continuous cell culture in liquid and solid media
- Production of microbial proteins, lipids, polysaccharides, vitamins 2
- Cell immobilization and applications
- Pre and probiotics cultures; Utilization and disposal of industrial wastes through microorganisms; use of genetically modified microorganisms in food processing 2

Recommended Readings:

- Banawart GJ. 1989. *Basic Food Microbiology*. 2nd Ed. AVI Publ.
- Frazier J & Westhoff DC. 1988. *Food Microbiology*. 4th Ed. McGraw Hill.
- Garbutt J. 1997. *Essentials of Food Microbiology*. Arnold Heinemann.
- Jay JM, Loessner MJ & Golden DA. 2005. *Modern Food Microbiology 7* Ed.Springer.
- Ray B. 2004. *Fundamentals of Food Microbiology*.3rd Ed. CRC.
- Robinson RK. (Ed.). 1983. *Dairy Microbiology*. Applied Science.
- Steinkraus KS. 1996. *Handbook of Indigenous Fermented Foods*. Marcel Dekker.

ADVANCED FOOD CHEMISTRY

PRACTICALS

Credits : 2 **I Year / I Semester**
Subject Code : MFT13107 **No. of Practical hours: 30**

Objectives:
To impart students with knowledge about the various methods involved in analysis of components present in food

Outcomes
Students will be able to understand and learn through chemical assays about the physio-chemical properties of foods during processing.

- Importance of sampling and techniques of sampling 2
- Proximate analysis of foods 2
- Estimation of Calorific value of foods 2
- Estimation of Total solids; P_H; Acidity 2
- Estimation of browning intensity 2
- Determination of beta – carotene 2
- Estimation of sugars, TSS in Degree Brix 2
- Estimation of anti nutritional factors in foods 2
- Estimation of Ash and acid insoluble ash 2
- Estimation of starches, amino acids, 2
- Estimation of Crude fibre in foods. 2
- Determination of minerals-calcium, phosphorus, iron, 2
- Estimation of vitamins-ascorbic acid, carotene, thiamine. 2
- Analysis of lipids-saponification value, acid value, peroxide and iodine value. 2
- Determination of starch and pectic substances using different methods. 2

Recommended Readings:

- Fennema OR.1996. Food Chemistry. Marcel Dekker.
- Meyer LH. 1987. Food Chemistry. CBS.
- Belitz HD.1999. Food Chemistry. Springer Verlag.
- DeMan JM. 1976. Principles of Food Chemistry. AVI.
- Bamji MS, Rao NA & Reddy V. 2003. Textbook of Human Nutrition.Oxford & IBH.
- Swaminathan M. 1974. Essentials of Foods and Nutrition. Vol. II. Ganesh & Co.

FOOD MICROBIOLOGY
PRACTICALS

Credits : 2 **I Year / I Semester**
Subject Code : MFT13108 **No. of Lecture hours: 30**

Objectives

- To familiarize with the techniques used for cultivation and purification of microbes
- To know the methods used for quality check of food and water
- To know the techniques used for identification of different pathogenic microbes.

Outcomes

- Students will gain practical knowledge in different techniques used for identification of different pathogens and will be able to understand the quality aspects of food and water.

1) Microscopy and micrometry.
2) Preparation of nutrient media,
3) Sterilization and inoculation techniques,
4) Isolation of pure culture,
5) Use of chemicals in preservation of foods
6) Microscopic examination of bacteria, and yeast and molds
7) Standard plate count
8) Yeast and mould count
9) Spore count
10) Detection and enumeration of pathogenic and indicator organisms in food
11) MPN of coli forms;
12) Enumeration of physiological groups- psychrophile, thermodurics, osmophiles and halophiles.
13) Microbial examination of processed and natural food products

Recommended Readings:

- Ray B. 2004. *Fundamentals of Food Microbiology*.3rd Ed. CRC.
- Robinson RK. (Ed.). 1983. *Dairy Microbiology*. Applied Science.
- Steinkraus KS. 1996. *Handbook of Indigenous Fermented Foods*. Marcel Dekker.

HUMAN VALUES & PROFESSIONAL ETHICS

Credits : 2 **I Year/ Semester II**
Subject Code : MFT18201 **No. of lecture hours: 30**

Objective

- To emphasize the importance of human values and inculcating them for the betterment of the society.

Outcome

- The student will learn about the human values and professional ethics.

UNIT- I **6hrs**

INTRODUCTION TO ETHICS

- Reasons to have Ethics for Life 1
- Accepted Norms and Counter Values 1
- Happiness as life Goal 2
- Human Context-self and another 2

UNIT-II **6hrs**

TOWARDS A NEW SOCIETY

- What is true society 1
- Moral problem of the society 1
- Social desire, social fear, social satence, social indifference 1
- Values revealed and lived in various religions-practicing religious harmony 2
- Eradication of social evil-towards a new society 1

UNIT-III **6hrs**

GENDER SENSITIZATION

- Why we study it 1
- Socialization-making women and men 1
- Being together as equals-through the lens of gender 1
- Knowledge through the lens of gender 1
- Gender spectrum-beyond the binary 1
- Just relationship-being together as equals 1

UNIT-IV **6hrs**

PROFESSIONAL ETHICS

- Ethics, Professional Ethics, Environmental Ethics 1
- Ethical Situation, Current Ethical Issues 1
- Values, Policies and Organisation Culture 2
- Moral Situation, Rights and Duties, Codes of Ethics, Their Limitation 2

UNIT-V **6hrs**

ETHICS IN SCIENCE

- Professional Research in Academia and Industry, Scientific fraud 1
- Plagiarisum, Conflict of Interest 1
- Student-Advisor relationship, Intelectual property and Patents 2
- Acountability and Institutional Practices 2

TEXT BOOKS:

1. *Human Values - Development Programme - AIACHE*
2. *In Harmony*
3. S.S. Dara and D.D. Mishra 2010.**Environmental Chemistry and Pollution Control**New Delhi: *S. Chand Publisher.*
4. Jeffery Kovac, Ethics in Science, **Accountability in Research** *22*, 312, **2015**.
5. A.Suneetha, B.Uma, D. Vasanta, M. Rama, N. Vasundha, A. Raheed, G**,** Shamala, D. Sreenivas and S. Tharu 201. **Towardsa World of Equals: A Bilingual Text on Gender**. Hyderabad: Telugu Akademi.

POST HARVEST TECHNOLOGY OF PLANTATION CROPS

Credits : 4 **I Year / II Semester**
Subject Code : MFT13202 **No. of Lecture hours: 60**

Objectives:
To impart students the knowledge about the technology used to harvest and preserve several plant based foods.

Outcomes:
Students will be able to learn and understand about technological aspects with regard to processing and preservation of plantation crops.

UNIT -I **12Hrs**

- Coffee: Production, processing of coffee;
  - drying, fermentation, roasting and brewing of coffee;
- Types: decaffeinated coffee, coffee brew concentrate;
- Standards and specifications of coffee products;
- Chicory: technology of chicory powder and use in coffee products

UNIT -II **12Hrs**

- Tea: Production, composition and manufacturing;
- Types of tea;
- Tea products such as soluble tea, tea concentrate,
- Instant tea, decaffeinated and flavored tea;
- Quality evaluation and grading of tea.

UNIT -III **12Hrs**

- Cocoa: processing and analysis of cocoa beans;
- Changes taking place during fermentation of cocoa bean;
- Processing of cocoa products: cocoa powder, cocoa liquor manufacture, cocoa butter;
- Chocolates: types and technology of chocolate manufacturing

UNIT-IV

12Hrs

- Spices, condiments, seasonings and culinary herbs;
- Classification and beneficial properties of spices;
- processing and manufacturing of major Indian spice:
  - Pepper, cardamom, ginger, chili and turmeric, clove, garlic, Cumin, coriander, cinnamon, mint and vanilla.

UNIT-V **12Hrs**

- Oleoresins and essential oils: method of manufacture; chemistry of the volatiles;
- Enzymatic synthesis of flavor identical;
- Adulteration problem in spices,
- Packaging of spices

Recommended Readings:

1. Kenneth T. Farrell (1985). Spices, condiments and seasonings. The AVI Pub. Company.
2. Banerjee B. 2002. *Tea Production and Processing*. Oxford Univ. ress.
3. Kenji Hirasa and Mitsno Takemasa(1998). Spice Science and Technology, Marcell Dekker, Inc.
4. Minifie BW. 1999. *Chocolate, Cocoa and Confectionery Technology*. 3rd ed. Aspen Publ.
5. NIIR. 2004. *Handbook on Spices*. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
6. Sivetz M & Foote HE. 1963. *Coffee Processing Technology*. AVI Publ.

RESEARCH METHODOLOGY

Credits: 4 **Semester: II**
Subject Code: MFT19203 **No. of lecture hours: 60**

Objective: To give students a general understanding of statistics as applicable to business and its use in areas of management research.

Outcome: Students will be able to identify the overall process of designing a research study and also to evaluate its quality.

UNIT-I **12 Hrs**

Introduction

Definition of research – meaning – nature – scope and objectives of research (2)
basic research terms – types of research (4)
research problem defined – necessity – factors to be considered while defining research problem (3)
procedure and pre-requisites for undertaking research. (3)

UNIT-II **12 Hrs**

Hypothesis and Research Design

Hypothesis and related terms – formation of hypothesis – characteristics of good Hypothesis (4)
Fundamentals of Research Design – significance – features – steps – types of research design (4)
Review of literature – operational definitions (4)

UNIT-III **12 Hrs**

Data Collection

Data collection and measurement – definition and characteristics of data – primary data and secondary data – characteristics – advantages and disadvantages (4)
Sources of data – methods of data collection – observation method – personal interview forms, schedules and questionnaire method (4)
Documented sources of data – case study method. (4)

UNIT-IV **12 Hrs**

Sampling

Sampling and sampling design – definitions – variables – methods of sampling – probability sampling methods (4)

simple random sampling – stratified sampling – systematic sampling – multi-stage sampling – non-probability sampling – judgement sampling – convenience sampling – quota sampling – hit or accidental sampling (5)

size of sample – determination of sampling size – sampling and non-sampling errors. (3)

UNIT-V **12 Hrs**

Attitude Measurement, Data Processing, Report Writing

Attitude measurement and scales – definition of attitude – importance – measurement of attitudes – concept of scale (3)

basis for scale classifications – attitude scales – Thurston's scale – Likert's scale – Guttman's or cumulative scale – radio scales – opinion scales (3)

basic statistical tools. (1)

Data Processing – editing – codification – classification and tabulation of data quantitative analysis of data. (3)

Report writing and presentation – definition – purpose – report synopsis – types of report – characteristics of a good report – structure of a good research report – writing and formatting of reports. (2)

Recommended Readings:

1. Kothari, C.R. **Research Methodology.** 2013 print. New Delhi: Sage publications.
2. Swamy Krishna, R. and Ranganathan, M. 2008. **Methodology of Research in Social Sciences.** 1st edition. 2nd revised reprint. Mumbai: Himalaya Publications.
3. Sachdeva, J.K. 2008. **Business Research Methodology.** 1st edition. Mumbai: Himalaya Publications.

FOOD PROCESS ENGINEERING- II

Credits : 4 **I Year / II Semester**
Subject Code : MFT13204 **No. of Lecture hours: 60**

Objectives:
To impart students with knowledge related to engineering aspects in food technology.
Outcomes:
The students will be able to understand the principles of food science and the properties of components associated with it.

UNIT – I Fluid Dynamics **12Hrs**

- Newtonian and Non-Newtonian fluids
- Transportation of Fluids- Continuity principle
- Bernoulli equation- Reynolds number
- Flow measuring instruments: Orifice meter- Venturimeter- Rotometer
- Problems.

UNIT – II Psychrometry; Drying & Extraction **12Hrs**

- Mass transfer - Psychometry
- heat and Mass transfer in dehydration
- stage of drying- prediction of drying from drying rate data
- dehydration- water activity
- types of driers – problems
- extraction- types- principles- systems- problems.

UNIT – III **12Hrs**

- Heat transfer- types- estimation of thermal conductivity of food products, local heat transfer coefficients
- Fourier's law of heat transfer- temperature profile of unidirectional heat transfer through conduction
- heat transfer by convention- heat transfer by radiation
- kirchhoff's law- Stephan- boltz man- plank's distribution law, Wein's displacements law
- . microwave and direct electric heating
- Temperature measuring devices- various thermometers- Examples
- Steady state heat transfer- calculation

UNIT – IV **12Hrs**

- heat exchanger equipment- types; importance of counter current flow
- equation- heat transfer to non-Newtonian fluids in laminar flow- examples

- unsteady state heat transfer – Fourier number – Biot number – heisler and gurney, Lurie charts- calculations
- evaporation – single effect evaporators, improving the economy of evaporators, essence recovery – problems

UNIT- V **12**Hrs

1. Physical separation process:
    - Filtration
        - filtrate flow through filter cake
        - constant pressure filtration
        - optimization of filtration cycles- types of filtrations
    - Reverse osmosis
    - sieving- gravity separation
    - material handling equipment
    - Problems

Recommended Readings:

- Basics of Food Engineering, Romeo Toledo
- Brennan JG, Butter JR, Corell ND & Lilly AVE. 1990. *Food Engineering Operations*. Elsevier.
- Charm SE, McCabe WL, Smith JC & Harriott P.1993. *Unit Operations of Chemical Engineering*. McGraw Hills.
- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- Fellows P. 1988. *Food Processing Technology*. VCH Ellis Horwood.
- Heldman DR & Singh RP.1995. *Food Process Engineering*. AVI Publ.
- McCabe WL & and Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural Processing*. Vikas Publ. House.
- Singh RP & Heldman DR. 1993. *Introduction to Food Engineering*. Academic Press.

INSTRUMENTAL METHODS OF FOOD ANALYSIS

Credits : 4 **I Year / II Semester**
Subject Code : MFT13205 **No. of Lecture hours: 60**

Objectives

- To understand the principles and use of Instruments used for biochemical analysis.

Outcomes

- Students will be able to understand principle and applications of various Instruments used in biochemical analysis.

UNIT I: Introduction to Food Analysis	**12Hrs**
● Review of basic chemistry concepts	3
● Introduction to food analysis – Sampling techniques	3
● Water activity, its measurements and significance in food quality	3
● Calibration and standardization of different instruments	3
UNIT II: Spectroscopy	**12Hrs**
● Basic principles of spectroscopy	2
● Spectroscopic techniques using;	10
o UV/Vis, fluorescence	
o IR, FTIR	
o NIR, NMR	
o atomic absorption	
UNIT III: Refractometry & Microscopic Techniques	**12Hrs**
● ICP, polarimetry	2
● Refractometry	2
● microscopic techniques in food analysis	8
o light microscopy	
o SEM, TEM	
o XRD	
o particle size analysis	
o Image analysis	
UNIT IV Chromotographic Techniques	**12Hrs**
● Chromatographic techniques:	
o Adsorption, column	2
o partition, affinity	2
o ion exchange, size exclusion	2

- GC, GLC 2
- HPLC, HPTLC 2
- GCMS, LCMS. 2

UNIT V Separation Techniques **12Hrs**

- Separation techniques:
  - Gel filtration, dialysis 2
  - electrophoresis, sedimentation 2
  - ultra filtration and ultra-centrifugation 2
  - solid phase extraction 2
  - supercritical fluid extraction 2
  - iso-electric focusing 1
  - isotopic techniques, manometric techniques 1

Recommended Readings:

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

TECHNOLOGY OF CEREALS AND MILLING

Credits : 4 **I Year / II Semester**
Subject Code : MFT19206 **No. of Lecture hours: 60**

Objectives:

To impart students the knowledge about the technology involved in milling of cereals and processing them to several byproducts

Outcomes:

Students will be able to learn and understand about technological aspects with regard to processing and preservation of cereal crops.

Unit I **12Hrs**

- Structure and chemical composition of wheat grain;
- Criteria of wheat quality – physical and chemical factors; wheat types,
- Wheat milling – general principles and operations, cleaning, conditioning and roller milling systems; wheat milling – products and by-products,
- Flour extraction rates and various flour grades and types, flour improvers and bleaching agents;
- Criteria of flour quality, dough rheology and its measurement.

Unit II

12Hrs

- Structure and composition of corn grain, different types of corn;
- wet and dry milling of corn,
- products of wet and dry milling of corn,
- corn starch and corn sweeteners (high fructose corn syrups) and their uses.

Unit III

12Hrs

- Structure and chemical composition of rice grain;
- modern rice milling unit operation-dehusking, paddy separation, polishing and grading;
- factors affecting rice yield during milling; aging of rice;
- Rice bran as rice milling byproducts
- Rice parboiling technology, different parboiling methods, CFTRI process of parboiling, changes during parboiling, advantages and disadvantages of parboiling.
- Dimensional and cooking quality characteristics of rice and factors affecting cooking behaviour of rice grains.

Unit IV **12Hrs**

- Pulses- introduction, production, utilization trends;
- Structure, composition, anti-nutritional factors;
- Processing and storage;
- Manufacture of protein concentrates.
- Processing of oats, sorghum and millets.

Unit V **12Hrs**

- Rice convenience foods: precooked rice, canned rice, expanded rice, rice-based infant food formulation;
- Pasta products and various processed cereal based foods, quality consideration and parameters;
- Barley malting process: steeping, germination and drying;
- Different types of malts and their food applications
- Barley beta glucans and their food functionality.

Recommended Readings:

- Samuel, A.M.(1996) " *The Chemistry and Technology of Cereals as Food and Feed "*, CBS Publisher & Distribution, New Delhi.
- Pomeranz, Y.(1998) *" Wheat : Chemistry and Technology"*, Vol 1,3" Am. Assoc.
- Cereal Chemists. St. Paul, MN, USA.
- Honeney, R.C.(1986) *" Principles of Cereal Science and Technology"*, Am. Assoc.
- Cereal Chemists, St. Paul, MN, USA.
- Pomeranz, Y. (1976*) " Advances in Cereal Science and Technology",* Am. Assoc. Cereal
- Chemists St.Paul, MN, USA.
- Juliano, B.O.(1685*). " Rice Chemistry and Technology",* Am. Assoc. Cereal Chemists, St. Paul, MN,USA.
- Chakraverty, A. 1988. *Postharvest Technology of Cereals, Pulses and oilseeds*.
- Oxford and IBH, New Delhi.
- Kent, N.L. 1983. *Technology of Cereals.* 3rd Edn. Pergamon Press, Oxford, UK.

FOOD PROCESS ENGINEERING

Credits : 2 **I Year / II Semester**
Subject Code : MFT13207 **No. of Lecture hours: 30**

Objectives:
To impart students with knowledge related to engineering aspects in food technology.
Outcomes:
The students will be able to have practical knowledge & understanding about the principles of food science and the properties of components associated with it.

PRACTICALS

1) Determination of viscosity of Newtonian fluid and Non Newtonian fluids
2) Design of pumping systems
3) Determination of thermal properties of foods - thermal conductivity, thermal diffusivity, calorific value and specific heat
4) Calculation of freezing time for some typical foods
5) Study of different types of freezers
6) Calculation of thermal process time in canning of some foods
7) Determination of 'U' for PHE
8) Determination of 'U' for SSHE
9) Study of blast freezer
10) Visit to Food Processing Plants.

Recommended Readings:

- Fundamentals of food process engineering by Romeo T. Toledo 2nd edition, CBS publishers, New Delhi.
- Unit operations of chemical engineering by W.L. McCabe, Julian Smith 1993, McGraw Hill.
- Experiments in food process engineering by H. Pandey, First edition, 2004. CBS Publisher, Delhi.
- Experiments in food process Engineering by R. Paul Sing.

TECHNOLOGY OF CEREALS AND MILLING PRACTICALS

Credits : 2 **I Year / II Semester**
Subject Code : MFT13208 **No. of Lecture hours: 30**

Objectives

- To learn quality control of raw and processed food products.
- To conduct physical, chemical and nutritional analysis of commonly consumed raw and processed foods with or without additives.

Outcomes

- Students will gain practical knowledge in determining and estimating chemical composition of various food components through chemical and instrumental analysis.

PRACTICAL

1. Determination of dough relaxation constants and their interpretation
2. Effect of mixing method on the quality of baked product;
3. Effect of mixing time on the rheological characteristics of dough;
4. Effect of mixing time on the crispness and firmness of biscuits;
5. Effect of additives on the quality and textural characteristics of bakery products;
6. Development and quality evaluation of baked products based on composite flour;
7. Preparation and quality evaluation of cakes, croissant, doughnuts, and pizza base
8. Preparation and Quality evaluation of Confectionery Products
9. Preparation of chocolate
10. Quality evaluation of chocolate products
11. Visit to bakery industries.
12. Visit to confectionery industries

Recommended Readings:

- Samuel, A.M.(1996) " *The Chemistry and Technology of Cereals as Food and Feed* ", CBS Publisher & Distribution, New Delhi.

- Pomeranz, Y.(1998) *" Wheat : Chemistry and Technology"*, Vol 1,3" Am. Assoc.
- Cereal Chemists. St. Paul, MN, USA.
- Honeney, R.C.(1986) *" Principles of Cereal Science and Technology"*, Am. Assoc.
- Cereal Chemists, St. Paul, MN, USA.
- Pomeranz, Y. (1976*) " Advances in Cereal Science and Technology",* Am. Assoc. Cereal
- Chemists St.Paul, MN, USA.
- Juliano, B.O.(1685*). " Rice Chemistry and Technology",* Am. Assoc. Cereal Chemists, St. Paul, MN,USA.