

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.



CIRCULAR NO.SU/Sci./University Deptt./NEP/02/2024

It is hereby inform to all concerned that, the syllabi prepared by The Departmental Committee and recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 05 June 2024 has accepted** the following Syllabi under the Faculty of Science & Technology **as per Norms of National Education Policy - 2020 run at University Department, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapathi Sambhajinagar** as appended herewith.

Sr.No.	Syllabi of the Department.	Semester
1.	Revised B.Tech. (Chemical) Food Technology	Ist and IInd Semester.
2.	Revised B.Tech. (Chemical) Pharmaceutical & Fine Chemicals Technology	Ist and IInd Semester.
3.	Revised M.Tech. (Chemical) Drugs & Pharmaceuticals	Ist and IInd Semester.
4.	Revised M.Sc. Food Technology	Ist and IInd Semester.

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus. *
Chhatrapati Sambhajinagar - 431 004. *
REF.NO.SU/NEP/2024/892-900 *
Date:- 18.06.2024. *


Deputy Registrar,
Academic Section.

Copy forwarded with compliments to :-

- 1] **Head of the Department, Department of Chemical Technology,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 2] **The Director, University Network & Information Centre, UNIC,** with a request to upload this Circular on University Website.

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- 1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
- 2] The Section Officer,[M.Sc.,Engg. Unit,] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
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- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

AURANGABAD

DEPARTMENT OF CHEMICAL TECHNOLOGY



Reaccredited with 'A' Grade

FACULTY OF SCIENCE & TECHNOLOGY

2 Years P.G. Programme in Science

(M.Sc.)

(Food Technology)

As per National Education Policy - 2020

(To be implemented from Academic Year - 2023-24)

Course Structure and Curriculum

(Outcome based Credit System)

Specialization: Food Technology

(Effective from 2023-24)

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CHAIRMAN
Adhoc Board in
Chemical Technology

2. Course Structure

Two-Year Post-graduate Program
Course and Credits Distribution of Two years Master's Degree Program with Entry & Exit option
Faculty of Science and Technology

Year / Level	Se m.	Major subject		RM	OJT /FP	RP	Credits	Degree
		DSC Core Mandatory	DSE (Elective)					
First year 6.0	I	3 (4) + 2 = 14	4	4			22	PG Diploma (After 3 years degree)
	II	3 (4) +2 = 14	4		4		22	
Cum. Cr. For PG Diploma		28	08	4	4		44	
<i>Exit option with Post-graduate Diploma (44 credits) after first year or two semesters with completion of courses equivalent to 44 credits</i>								
Second Year 6.5	III	3 (4) + 2 = 14	4			4	22	PG Degree after 3 years UG or PG Degree after 4 years UG
	IV	3 (4) = 12	4			6	22	
Cum. Cr. For 1 year PG Degree		26	8			10	44	
Cum. Cr. For 2 years PG Degree		54	16	4	4	10	88	
2 Years -4 sem.PG Degree (88 credits) after three-year UG Degree or 1 Year -2 sem. PG Degree (44 credits) after four-year UG degree								

Note- DSC-is based on specialization

ABBREVIATION:

Major – Comprising Mandatory –is based on specialization

DSE- Discipline Specific Elective

OJT – On-the- Job Training

FP – Field Project (Corresponding to the Major (Core) Subject

RP – Research Project (Corresponding to the Major (Core) Subject

Internship/Apprenticeship - (Corresponding to the Major (Core) Subject

AS PER NEP 2020

**Illustrative Credit distribution structure for Two Years/One Year Programme with Multiple
Entry and Exit options –
(Discipline Specific Core in (Food Technology))**

Class: M. Sc. First Year

Semester: Ist

Subject: Food Technology

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	MFT/MJ/500-T		2		2		14
	MFT/MJ/501-T		2		2		
	MFT/MJ/502-T		2		2		
	MFT/MJ/503-P			4		2	
	MFT/MJ/504-P			4		2	
	MFT/MJ/505-P			4		2	
	MFT/MJ/506-P			4		2	
DSE (Choose any one from pool of courses)	MFT/DSE/507-T		2		2		04
	MFT/DSE/508-P			4		2	
	or						
	MFT/DSE/509-T		2		2		
RM	MFT/RM/511-T		4		4		04
	MFT/NC/512-T		2 (NC)		2 (NC)		2 (NC)
			12	20	12	10	22 credits

1. Major Mandatory (DSC)

MFT/MJ/500-T	Principles of Food Processing & Preservation
MFT/MJ/501-T	Food Chemistry
MFT/MJ/502-T	Food Microbiology
MFT/MJ/503-P	Lab-I: Principles of Food Processing & Preservation
MFT/MJ/504-P	Lab-II: Food Chemistry
MFT/MJ/505-P	Lab-III: Food Microbiology
MFT/MJ/506-P	Lab-IV: Techniques in Food Analysis

2. Discipline Specific Electives: (Choose any one from Pool /Basket)

MFT/DSE/507-T	Food Packaging Technology
MFT/DSE/508-P	Lab-I: Food Packaging Technology
or	
MFT/DSE/509-T	Human Nutrition
MFT/DSE/510-P	Lab-II: Human Nutrition

3. Research Methodology (RM): MFT/RM/511-T

4. Constitution of India: MFT/NC/512-T

Class: M. Sc. First Year

Semester: IInd

Subject: Food Technology

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	MFT/MJ/550-T		2		2		14
	MFT/MJ/551-T		2		2		
	MFT/MJ/552-T		2		2		
	MFT/MJ/553-P			4		2	
	MFT/MJ/554-P			4		2	
	MFT/MJ/555-P			4		2	
	MFT/MJ/556-P			4		2	
DSE (Choose any one from pool of courses)	MFT/DSE/557-T		2		2		04
	MFT/DSE/558-P			4		2	
	or						
	MFT/DSE/559-T		2		2		
	MFT/DSE/560-P			4		2	
OJT/FP	MFT/OJT/FP/561-T			8		4	04
			08	28	08	14	22 credits

1. Major Mandatory (DSC)

MFT/MJ/550-T	Cereal, Legumes, and Oil seed Technology
MFT/MJ/551-T	Fruits and Vegetables Technology
MFT/MJ/552-T	Bakery and Confectionary Technology
MFT/MJ/553-P	Lab-I: Cereal, Legumes, and Oil seed Technology
MFT/MJ/554-P	Lab-II: Fruits and Vegetables Technology
MFT/MJ/555-P	Lab-III: Bakery and Confectionary Technology
MFT/MJ/556-P	Lab-IV: Sensory Evaluation of foods

2. Discipline Specific Electives: (Choose any one from Pool /Basket)

MFT/DSE/557-T	Beverage Technology
MFT/DSE/558-P	Lab-I: Beverage Technology
or	
MFT/DSE/559-T	Fermentation Technology
MFT/DSE/560-P	Lab-II: Fermentation Technology

3. OJT/FP-1: Field Project-I: MFT/OJT/FP/561-P

Class: M. Sc. Second Year Semester: IIIrd

Subject: Food Technology

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory DSC	MFT/MJ/600-T		2		2		14
	MFT/MJ/601-T		2		2		
	MFT/MJ/602-T		4		4		
	MFT/MJ/603-T		2		2		
	MFT/MJ/604-P			4		2	
	MFT/MJ/605-P			4		2	
DSE (Choose any one from pool of courses)	MFT/DSE/606-T		4		4		04
	Or						
	MFT/DSE/607-T		4		4		
RP-1	MFT/RP-1/649-P			8		4	04
			14	16	14	08	22 credits

1. Major Mandatory (DSC)

MFT/MJ/600-T	Unit Operations in Food Processing
MFT/MJ/601-T	Dairy Technology
MFT/MJ/602-T	Food Laws and Regulations
MFT/MJ/603-T	Communication Skills and Personality Development
MFT/MJ/604-P	Lab-I: Unit Operations in Food Processing
MFT/MJ/605-P	Lab-II: Dairy Technology

2. Discipline Specific Electives: (Choose any one from Pool /Basket)

MFT/DSE/606-T	Food Extrusion Technology
or	
MFT/DSE/607-T	Entrepreneurship in Food Processing

3. RP-1: Research Project-1: MFT/RP-1/649-P

12. CURRICULUM FOR SEMESTER – I

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 01)

Course Code No.: MFT/MJ/500-T		No. of Credits: 02	Hours: 30
Course Title	Principles of Food Processing & Preservation		
Course Objectives: To identify and select preservation methods appropriate for specific foods and to learn the effects of preservation methods on the quality of food.			
Unit	Course Content	Periods	
I	Introduction: Definition and scope of Food science and technology, historical development of food processing and preservation, general principles of food preservation Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking Baking: Principle of baking and several changes in baked products.	06	
II	Radiation: Source of radiations, mode of action effect on microorganisms and different nutrients dose requirements for radiation preservation of food. Microwave heating: Principles and application in Food processing	06	
III	Refrigeration and Freezing Preservation: Refrigeration and storage of fresh food major requirement of refrigeration plant atmospheric storage, refrigerated storage of various food freezing point of selected food influence of freezing and quality of the food product. Method of freezing, freeze drying, storage, and thawing of frozen food.	06	
IV	Chemical Preservation: Preservation of food by use of sugar, salt, chemicals, antibiotics & by smoking Concentration: Application in food industry processes and equipment for manufacture of various concentrated foods and their keeping quality Fermentation: Application in preservation of food pickling, curing etc	06	
V	Drying: Processing and preservation by drying, various methods employed in production of dehydrated food products, selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying, tray or tunnel drying, spray drying, drum drying, fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated food products.	06	

Course Outcomes:

Students shall develop the knowledge of need of food processing and learn various preservation techniques. To impart knowledge on the causes of food spoilage and principles of different techniques used in processing and preservation of foods. Knowledge about baking and milling of process.

Text books and Reference materials

1. Desrosier N W & James N. (2007). Technology of food preservation. AVI. Publishers
2. Fellows, P.J. (2005). Food processing technology: Principle and Practice. 2nd Ed. CRC Publishers
3. Jelen, P. (2005). Introduction to Food Processing. Prentice Hall
4. N. M. Potter, Food Science and Technology.

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 02)

Course Code No.: MFT/MJ/501-T		No. of Credits: 02	Hours: 30
Course Title	Food Chemistry		
Course Objectives:			
Unit	Course Content		Periods
I	Water - Structure of water, Water binding and chemical reactions mediated by water , Determination of moisture in food		05
II	Food proteins - Classification and physicochemical properties , Reactions involved in processing and reactions with alkali , Theories of formation of texturized proteins		05
III	Food lipids- Edible fats and oils - classification and chemical composition, reactions involved during deep frying of food, Lipoprotein – definition, Classification and involvement in the formation of biological membranes		05
IV	Food carbohydrates- Polysaccharide - linear, branched and modified , Properties and utilization of common polysaccharides , Enzymatic degradation of polysaccharides		05
V	Minerals in food - Main elements and trace elements in eggs, cereals & cereal products, vegetables and fruits		05
VI	Food enzymes- Hydrolases, lipases and other important enzymes in food , Utilization in food industry and effect of inhibitors, ph and temperature		05

1. TEXT BOOKS

Sr. No.	Name of Book	Author
1	Food Science (The AVI Publishing Co., Connecticut)	Potter, N. M.
2	Food Chemistry (Reinhold Publ. Corporation, New York)	Meyer, L. H.
3	Food Chemistry (Marcel Dekker, Inc., New York.)	Fennama, O. R.
4	Food Chemistry. (Springer, Berlin)	Belitz, H. D., Grosch, W. and Schieberler, P.

2. REFERENCE BOOKS:

1. Aurand, L. W. and Wood, A. E. (1973). Food Chemistry. The AVI Publishing Co., Connecticut.
2. DeMan, J. M. (1999). Principles of Food Chemistry. A Chapman and Hall Food Science Book, Aspen Publ., Inc., Gaithersburg, Maryland.
3. Gopalan, C., Rama Sastri, B.V., and Balasubramaniam, S.C. (1991). Nutritive value of Indian Foods. National Institute of Nutrition (NIN), Indian Council of Medical Research (ICMR), Hyderabad.

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 03)

Course Code No.: MFT/MJ/502-T		No. of Credits: 02	Hours: 30
Course Title	Food Microbiology		
Course Objectives: To understand the role and significance of different microbes and their activity in food safety, food quality and food shelf life especially during food production to food storage.			
Unit	Course Content		Periods
I	Definition, Historical Development, Classification, propagation and importance of Yeast, Mold and Bacteria. Importance and significance of microorganisms in Food science. Factors affecting the growth of microorganisms in food - Intrinsic and Extrinsic parameters that affect microbial growth.		06
II	Food Hygiene and Sanitation: Contamination during handling and processing and its control. Indicator organisms; rapid methods in detection of microorganisms. Sterilization, Thermal inactivation of microbes- Concept, determination & importance of TDT, F, Z & D values, factors affecting heat resistance, pasteurization. Protection and preservation of Foods: Modified atmosphere, Radiation.		06
III	Water: Chemistry, role in food storage, water activity and growth of microorganisms, physical, chemical and microbiological characteristics of water. Outlines of indicators of water and food safety and quality-Microbiological criteria of foods and their significance.		06
IV	Food spoilage: Characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat, poultry and sea foods, milk and milk products, packed and canned foods. Food borne diseases: Bacterial food borne diseases (Staphylococcal intoxication, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritis), Mycotoxins: Aflatoxicosis, Deoxyvalenol Mycotoxicosis, Ergotism.		06
V	Food Fermentation: Microbial culture in food fermentations and their maintenance & evaluation. factors affecting activity of culture, single and mixed cultures of cultures; Therapeutic value of fermented foods. Probiotics and Prebiotics: definition, characteristics, history and classification, Safety considerations on probiotics, application of probiotics and prebiotics in food industry		06

RECOMMENDED BOOKS:

1. James M. Jay (2000). Modern Food Microbiology, 5th Edition, CBS Publishers.
2. Banwart, G.J. (1997). Basic Food Microbiology, CBS Publishers.
3. Adam M.R. & Moss, M.O. (1995). Food Microbiology, New Age International Pvt. Ltd Publishers.
4. Bibek Ray (1996). Fundamental Food Microbiology, CRC Press.
5. Stanier, R.Y. (1996). General Microbiology, Vth Edition, MacMillan
6. K. S. Bilgrami, Essentials of Microbiology, CBS Publishers, Delhi
7. WC Frazier, Food Microbiology, Tata McGraw Hill, Delhi
8. Pelczar, Chan and Krieg; Microbiology; Tata McGraw Hill, Delhi

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 04)

Course Code No.: MFT/MJ/503-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-I: Principles of Food Processing & Preservation		
Course Objectives: To get students acquainted with the fundamental principles and various techniques of food preservation.			
	Course Content		Periods
List of Practi cals	1. Demonstration of various machineries used in food processing.		
	2. Demonstration on effect of blanching on quality of foods.		
	3. Demonstration on canning and bottling of fruits and vegetables.		
	4. Preservation of food by high concentration of sugar i.e. preparation of jam/ Jellies/Marmalades etc.		
	5. Preservation of food by using salt e.g. Pickle		
	6. Preservation of food by using chemicals.		
	7. Drying of fruit slices in cabinet drier		
	8. Demonstration on drying of green leafy vegetables		
	9. Osmotic dehydration of foods e.g. candy		
	10. Visit to any food processing industry/unit.		

List of Reference Books

1. Fruit and Vegetable Preservation: Principles and Practices -Srivastava R.P. and Sanjeev Kumar
2. Preservation of Fruits and Vegetables-Khader
3. Fruit and Vegetable Preservation -Bhutani R.C.
4. Principles of Fruit Preservation- Morris, Thomas Norman.
5. Preservation of fruits and vegetables- Giridharilal, G.S. Siddappa and G.L. Tandon.
6. Fruit and Vegetable Technology- Duckworth.

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 05)

Course Code No.: MFT/MJ/504-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-II: Food Chemistry		
Course Objectives: To get students acquainted with the fundamental principles constituents in foods and methods to analyse it.			
	Course Content		Periods
List of Practicals	<ol style="list-style-type: none"> 1. Determination of moisture in a given food sample by hot air oven method. 2. Qualitative tests for carbohydrates. 3. Qualitative tests for proteins. 4. Determination of carbohydrates in a given food sample. 5. Determination of crude protein in a given food sample by Kjeldhal Method 6. Determination of crude fat in a given food sample by Soxhlet method. 7. Determination of ash in a given food sample. 8. Preparation of mineral solution by tri-acid digestion. 9. Determination of crude fibre in a given food sample 10. Determination of vitamin C (Ascorbic acid) in given food sample. 11. Determination of Acid Value of given oil sample. 12. Determination of Iodine Value of given oil sample. 		

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 06)

Course Code No.: MFT/MJ/505-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-III: Food Microbiology		
Course Objectives: To get students acquainted with the fundamental principles constituents in foods and methods to analyse it.			
	Course Content		Periods
List of Practicals	1. Preparation of common laboratory media and special media for cultivation of bacteria, yeast and molds.		
	2. Isolation and identification of pathogens.		
	3. Coliforms analysis of milk and water samples.		
	4. Identification tests for bacteria in foods: IMVIC urease, catalase, coagulase, gelatin and fermentation (acid/gas).		
	5. Determination of thermal death characteristics of bacteria.		
	6. Determination of DNA and RNA of spoilage microorganism using PCR.		
	7. Detection of DNA of trace components allergens, like nuts using ELISA.		
	8. Determination of growth and activity of microorganisms in incubator.		
	9. Process time calculation for an indicator organism		
	10. Microbes responsible recall – case studies.		

Suggested Readings:

Sr. No.	Name of Book	Author
1	Microbiology for Food and Health, Technological Developments and Advances	Verma, DK.
2	Advances in Microbial Food Safety	J Sofos
3	Food Safety Handbook	Ronald H. Schmidt and Gary E. Rodrick
4	Microbial Control and Food Preservation	Vijay K. Juneja, Hari P. Dwivedi, John N. Sofos
5	Food-Borne Pathogens: Microbiology and Molecular Biology	Fratamico PM, Bhunia AK and Smith JL
6	Fundamental Food Microbiology	Ray, B., and A. Bhunia
7	Fermentation Microbiology and Biotechnology	Mansi El-Mansi and Charlie Bryce

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 07)

Course Code No.: MFT/MJ/506-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-IV: Techniques in Food Analysis		
Course Objectives: To get students acquainted with the various qualitative and quantitative methods of food analysis.			
	Course Content		Periods
List of Practi -cals	1. Sampling plan; Sample collection and preparation for analysis		
	2. Study of different chromatographic techniques		
	3. Analysis of heavy metals		
	4. Quantitative determination of sugars and fatty acid profile by GLC		
	5. Identification of organic acids by paper electrophoresis		
	6. Gel-electrophoresis for analytic techniques		
	7. Estimation of phytic acid using spectrophotometer		
	8. Quantitative make-up of water soluble vitamins		
	9. Estimation of chlorophyll content by different methods		
	10. Analysis of minor constituents of foods		

Suggested Readings:

1. Ronald S. Kirk, Ronald, Sawyer, (1991). *Pearson;s Composition & Analysis of foods*, 9th Edition Longman scientific & Technical, U.K.
2. Pomeranz, Y. & Mrloan (1978). *Food Analysis: Theory and Practice*, Westport, connectiant: AVI.
3. Amerine, M.A. Pangborn, R.M., and Rosseler, E.B. 1965. *Principles of Sensory Evaluation of Food*. Academic Press, New York.

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 01)

Course Code No.: MFT/DSE/507-T		No. of Credits: 02	Hours: 30
Course Title	Food Packaging Technology		
Course Objectives:			
Unit	Course Content		Periods
I	<p>Introduction to Food Packaging: definition, factors involved in the evolution and selection of a food package, functions of food packaging (containment, protection, convenience, and communication).</p> <p>Paper and paper-based packaging materials: types of paper (Kraft, bleached, greaseproof, glassine), paper products (paper bags, cartons, drums and molded paper containers), functional properties of paper; testing of paper packaging materials.</p>		06
II	<p>Plastic packaging materials: classification of polymers, functional and mechanical properties of thermoplastic polymers; processing and converting of thermoplastic polymers (extrusion, blow molding, injection molding, compression molding, lamination and heat sealing); testing of plastic packages.</p>		06
III	<p>Metal packaging materials: container making processes (end manufacture, three-piece can manufacture and protective and decorative coatings); functional properties of metal containers; Tin plate containers- quality control tests.</p> <p>Glass packaging materials: composition and manufacture of glass containers; glass container nomenclature; glass containers-closure functions, closure terminology and construction; properties of glass containers – mechanical, thermal and optical properties; testing of glass containers.</p>		06
IV	<p>Aseptic packaging of foods: sterilization of packaging material food contact surfaces & aseptic packaging systems; active food packaging – definition, scope, physical and chemical principles involved.</p> <p>Edible films and coatings– use of edible active layers to control water vapor transfer, gas exchange, modification of surface conditions with edible active layers.</p> <p>Oxygen absorbents – classification and main types of oxygen absorbents, factors influencing the choice of oxygen absorbents, application of oxygen absorbents for shelf-life extension of food and advantages and disadvantages of oxygen absorbents.</p>		06
V	<p>Ethanol vapor: ethanol vapour generator, uses of ethicap for shelf-life extension of food, effect of ethanol vapour on food spoilage/food poisoning bacteria, and advantages and disadvantages of ethanol/vapour generators.</p> <p>Safety considerations in food packaging – types of food safety problems associated with package, package labeling and food safety.</p> <p>Packaging requirements of selected foods- cereal and snack food, beverages, milk and dairy products, poultry & eggs, red meat, frozen foods, horticultural products and microwavable foods.</p>		06

REFERENCE BOOKS:

Sr. No.	Name of Book	Author
1	Novel Food Packaging Techniques	Ahvenainen R
2	Food Packaging	Robertson GL
3	Handbook of Package Engineering	Hanlon, J F, Kelsey R J and Forcinio H
4	A Handbook of Food Packaging	Painy FA
5	Active Food Packaging	Rooney ML
6	Food and Beverage Packaging Technology	Coles R and Kirwan M
7	Innovations in Food Packaging	Han J and Han J
8	Emerging Food Packaging Technologies	Yam K and Lee D

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 02)

Course Code No.: MFT/DSE/508-P		No. of Credits: 02	Hours: 4 Hrs/Week
Course Title	Lab-I: Food Packaging Technology		
Course Objectives: To get students acquainted with the various types of packaging materials, their characteristics and application in food industry.			
	Course Content		Periods
List of Practi- -cals	<ol style="list-style-type: none"> 1. Identification of packaging materials 2. Measurement of thickness of packaging films, papers and boards 3. Measurement of water absorption of paper, paper boards 4. Measurement of bursting strength of paper of paper boards 5. Measurement tear resistance of papers 6. Measurement of puncture resistance of paper and paperboard 7. Measurement of tensile strength of paper of paper boards 8. Determination of gas transmission rate of package films 9. Determination of WVTR of films 10. Determination of coating on package materials 11. Tests for identification of plastic films 12. Prepackaging practices followed for packing of fruits and vegetables 13. Visit to packaging industry 		

Suggested readings

Sr. No.	Name of Book	Author	Publisher
1	Handbook of Package Engineering	Joseph F. Hanlon	CRC Press ISBN: 9781566763066
2	Food Packaging: Principles and Practice, Third Edition	Robertson G.L.	CRC Press, 2012 ISBN: 9781439862414
3	Food Packaging	Sacharow and Griffin	AVI Publishing Company, 1980 ISBN: 9780870553479
4	Principles of Food Packaging	R. Heiss	Keppler, 1970
5	Food Packaging	Kadoya T.	Academic Press, 1990

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 03)

Course Code No.: MFT/DSE/509-T		No. of Credits: 02	Hours: 30
Course Title	Human Nutrition		
Course Objectives: To acquaint the students about Nutrition of various foods, human dietary requirement and assessment of nutritional status.			
Unit	Course Content		Periods
I	Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients		05
II	Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings; Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR		05
III	Formulation of diets: Classification of balanced diet; Preparation of balanced diet for various groups; Diets and disorders Recommended dietary allowances; For various age group; According physiological status; Athletic and sports man; Geriatric persons		05
IV	Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition infection and immunity; Nutrition education		05
V	Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information		05
VI	In-born error of metabolism: Blood constituents; Nutrients; Hormones and enzymes; Miscellaneous disorders		05

Suggested Readings:

Sr. No.	Name of Book	Author	Publisher
1	Advanced Text Book on Food & Nutrition (Volume I and II)	Swaminathan M	The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2	ABC of Nutrition (4 th edition)	Stewart Truswell	BMJ Publishing Group 2003 ISBN 0727916645
3	Encyclopedia of Human Nutrition	Benjamin C., Lindsay A., Andrew P.	Elsevier Academic Press, 2005 ISBN 0121501108
4	Barasi's Human Nutrition – A Health Perspective	Mike Lean and E. Combet	Second Edition CRC Press, London
5	Principles of Human Nutrition	Martin Eastwood	Blackwell Publishing, Boca Rotan
6	Encyclopedia of Foods – A Guide to Healthy Nutrition	Mayo Clinic and Dole Food Company Inc.	Academic Press – An Imprint of Elsevier, San Diego, California

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 04)

Course Code No.: MFT/DSE/510-P		No. of Credits: 02	Hours: 4 Hrs/Week
Course Title	Lab-II: Human Nutrition		
Course Objectives: To get students acquainted with the various types of packaging materials, their characteristics and application in food industry.			
	Course Content		Periods
List of Practi -cals	<ol style="list-style-type: none"> 1. Role of various national and international agencies in field of human nutrition 2. Nutritive value of different food groups 3. Nutritional labeling of food products 4. Calculation of BMR 5. Calculation of BMI 6. Anthropometric measurements 7. Preparation of balance diet and RDA of nutrients 8. Techniques in animal feeding experiments 9. Computation of energy requirements 10. Determination of energy value of food by bomb calorimeter 11. Diet for specific health condition 12. Visit to Pathological laboratory 		

Suggested readings

REFERENCE BOOK

Sr. No.	Name of Book	Author	Publisher
1	Essentials of Human Nutrition	Jim M. and Stewart T.	Oxford University Press, 2002 ISBN 019850861
2	Introduction to Human Nutrition	Micheal J. G., Susan A.L. Aedin C. and Hester H.V.	Wiley-Blackwell Publication, UK 2009 ISBN 9781405168076
3	Nutrition and Health	Gerald W.	Taylor and Francis, London 2002 ISBN 0415278740
4	Handbook of Nutrition and Food	Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer	2nd Ed. CRC Press, Boca Raton, FL, USA. 2008
5	Nutrition and Physical Fitness	Bogert L.J., Goerge M.B, Doris H.C.	W.B. Saunders Company, Toronto, Canada

DEPARTMENT OF CHEMICAL TECHNOLOGY

Course Code No.: MFT/RM/511-T		No. of Credits: 04	Hours: 60
Course Title	Research Methodology		
Course Objectives: To study research methodology for scientific writing.			
Unit	Course Content	Periods	
I	Introduction to Research, Objective and Importance of Research, Types of Research, Steps Involved in Research, Ethical Considerations in Research, Defining Research Problem, Research Design, Methods of Research Design, Laboratory Safety Considerations.	10	
II	Sampling Techniques, Classification of Data, Methods of Data Food Informatics. Collection, Designing of Experiments, Characteristics of a Good Design: Selection of Variables, Design Matrix, Factorial Design, Fractional Factorial Design, Principal Component Analysis, Taguchi Methods.	10	
III	Data Analysis and Interpretation Data Analysis, Statistical Techniques and Choosing an Appropriate Statistical Technique, Optimization Techniques, Bioassays- Direct and Indirect.	10	
IV	Hypothesis, Hypothesis Testing, Sampling and Non- Sampling Errors, Data Processing Software, Statistical Inference, Interpretation of Results.	10	
V	Technical Writing and Reporting of Research, Referencing and Referencing Styles, Research Journals, Indexing and Citation of Journals, Acknowledgement, Conflict of Interest, Plagiarism. Research Report, Types and significance, Structure of Research Report, Ethical Issues in Research, Presentation of Report.	10	
VI	Application of Computer in Research: Basic Principles of Statistical Computation Using Various software's; Design of Experiments and Analysis of Results Using Various Software's (MATLAB, ORIGIN, SIGMAPLOT, Design Expert)	10	

REFERENCE BOOKS:

Sr. No.	Name of Book	Author
1	Research design: Qualitative, quantitative, and mixed methods approaches	Creswell, John W.
2	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar
3	Research Methodology Methods and Techniques	C. R. Kothari, Gaurav Garg
4	Statistical Methods for Food Science	John A. Bower
5	Handbook of Science Communication	Anthony Wilson
6	Design and Analysis of Experiments	Douglas C. Montgomery
7	Statistical Methods	George W. Snecdecor and William G. Cochran
8	Computer aided techniques in Food Technology	Pages Israel Saguy

DEPARTMENT OF CHEMICAL TECHNOLOGY

Course Code No.: MFT/NC/512-T	No. of Credits: 02 (Non-credit)	Hours: 30
Course Title	Constitution of India	

13. CURRICULUM FOR SEMESTER – II

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 01)

Course Code No.: MFT/MJ/550-T		No. of Credits: 02	Hours: 30
Course Title	Cereal, Legumes, and Oil seed Technology		
Course Objectives: <ul style="list-style-type: none">• To know physicochemical properties of cereals, legumes, and oilseeds.• To prepare various value-added products from cereals, legumes, and oilseeds.• To demonstrate different post-harvest operations for cereals, legumes, and oilseeds			
Unit	Course Content	Periods	
I	Present status and prospects of cereals, legumes, and oilseeds in India. Production, morphology, physicochemical properties Classification and types, composition, and nutritive value	06	
II	Post-harvest processing of cereals, legumes and oilseeds at home scale, cottage scale and commercial scale for drying, Parboiling of paddy, rice, corn sorghum, pearl millet processing, dal milling. Wheat types, classification milling, flour types, Uses for manufacture of cakes, breads, biscuits, macaroni products	06	
III	Soaking, cooking of grains Sprouting, fermentation of grains and manufacture of processed products. Oil extraction from oilseeds by different method oil refining, oilseeds and legumes meals and manufacture of different products.	06	
IV	Manufacture of different products from cereals, legumes and oilseeds flours such as bhakri, roti, traditional products.	06	
V	Byproducts of wheat milling industry, rice milling industry and their utilization Byproducts of oil extraction industry, legume milling industry and their utilization	06	

Course Outcomes:

Students shall able to identify cereals legumes and pulses, classify cereals legumes and pulses and remember various preparations from cereals.

Text books

- 1) Technology of Cereals, Kent NL, Woodhead Publishing 1983
- 2) Post Harvest Technology of Cereals, Pulses and Oil seeds by A. Chakravarthy, Oxford and IBH Publishing Company, 2014
- 3) Legumes Chemistry, Technology and Human Nutrition by Mathews RH, Marcel Dekker, 1989
- 4) Post harvest technology of cereals: pulses and oilseeds by Chakraverty A., Oxford & ibh

publishing company, 1988.

- 5) Bailey's Industrial Oil & Fat Products by Bailey A.E. and Shahidi F. Wiley Publication, 2005

Additional Reading:

- 1) Rice-utilization by Luh B.S, Springer 1991
- 2) Post harvest biotechnology of cereals by Salunke D.K, CRC press 1985
- 3) Handbook of post-harvest and technology, Cereals fruit and vegetables tea and spices by Chakraverty A. Mujumdar A.S, Hosahalli S.R., CRC press 1990
- 4) Food and feed from legumes and oilseeds, Smartt J and Nwokolo E, Springer 2012
- 5) Legumes and oilseeds crops Bajaj Y P S, Springer 2012

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 02)

Course Code No.: MFT/MJ/551-T		No. of Credits: 02	Hours: 30
Course Title	Fruits and Vegetables Technology		
Course Objectives: The student will understand various technologies for the processing and preservation of different fruits and vegetables, and their value-added products.			
Unit	Course Content	Periods	
I	Production & processing scenario of fruits & vegetables in India & World. PHM- post harvest losses & their control. Scope of fruit and vegetable preservation industry in India. Present status, constraints, and prospects.	06	
II	Morphology, structure and composition of F & V. Maturity standards, maturity indices for selected F & V, Harvesting, Fruit ripening: chemical changes, regulations & methods.	06	
III	Storage practices: MA, CA, & Cold storage. Commodity treatments- chemicals, wax coating, pre-packaging etc. PH handling, packaging & transport systems, packaging house operations. Basic principles and preservation methods of fruits & vegetables. Commercial processing of major fruits and vegetables.	06	
IV	Processing technology for manufacturing of fruit juices, pulp, RTS beverage, nectars, squash, syrups, cordials, carbonated beverages etc. as per FSSAI specifications. Commercial canning of fruits and vegetables (fruit pulp, fruit slices, green peas, okra etc.)	06	
V	Processing of tomato into various value-added processed products. Drying and dehydration technology of fruits and vegetables. Fermented fruits and vegetables products like sauerkraut, pickles, wines etc. Utilization of by-products and wastes from fruits and vegetables processing industry.	06	

Course Outcomes:

- Student will acquire knowledge on post-harvest losses and quality evaluation of fruits and vegetables.
- The students acquire insight into specific process like peeling and blanching and learn about quality, safety, authenticity, etc. of raw materials and products.
- Student will acquire knowledge on Different operations like cleaning, grading, peeling pulping, juice extraction fruit juices, concentration, and different aroma recovery systems. etc involved in processing fruits and vegetables.
- Student will acquire knowledge on processes employed in the manufacture of fruit and vegetable-based products like jam, jelly, beverages, and tomato products.
- Student will acquire knowledge on thermal processing and dehydration and freezing fruit and vegetable.

Text books

- 1) Fruit and vegetable preservation: principles and practices by Srivastava R.P and Sanjeev Kumar, International Book Distributing Company, New Delhi 2005
- 2) Post harvest technology of fruits and vegetables: Handling, processing, fermentation and waste management Vol-I and Vol-II, Varma L. R. and Joshi V.K., Indus Publishing, 2000
- 3) Preservation of Fruits and Vegetables, Vijaya Khader, Kalyani Publishers, 1999
- 4) Preservation of Fruits and Vegetables, G. Lal, G.S. Siddappa, G.L. Tandan, ICAR Publication, New Delhi 1996
- 5) Post-harvest Handling and Processing of Fruit and Vegetable, I. S. Singh, Westville Publishing house, 2009

Additional Reading:

- 1) Fruit and vegetable processing, M. G. Danthy, FAO, Rome, Italy
- 2) Handbook of fruit and vegetable processing, Sinha and Hui, John Willey, and sons, 2010
- 3) Fruit processing nutrition products and quality management, Philip R Ashurst and David Arthey, second edition springer publication, US, 2000
- 4) Handbook of fruit and vegetable flavours, Y H Hur, John Willey and Sons, Inc., Hoboken New Jersey, 2010
- 5) Fruit and vegetable preservation: principles and practices, Srivastava R P and Kumar S, International book distributors 2003
- 6) Handbook of fruit science and technology-production, composition and processing by Salunkhe D K and Kadam S S, Marceldekker 1995

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 03)

Course Code No.: MFT/MJ/552-T		No. of Credits: 02	Hours: 30
Course Title	Bakery and Confectionary Technology		
<p>Course Objectives: This course covers the fundamentals of equipment and raw material identification while focusing on the needs of bakers to understand measurements, scaling, and basic baking techniques</p> <p>Inspect raw material for bakery and confectionary products and set up process flow for confectionary products</p>			
Unit	Course Content		Periods
I	Milling of wheat- Roller flour milling process, break rolls, reduction roll, design and operation of wheat milling process. Physico-chemical and Rheological properties of dough.		06
II	Bakery products-Role of bakery ingredients, bread making methods i.e. straight and sponge dough method, Quality control and testing of raw material, testing of final product, bread faults, staleness and ropiness in bread		06
III	Baked products from soft wheat-Cookies, Biscuits, cakes, role of ingredients, faults and remedies. Setting of bakery unit, bakery norms, specifications for raw materials packaging, marketing of products, project report preparation		06
IV	Confectionery Technology- History, traditional confectionery goods, types of confectionery. Raw materials/ Ingredients-sugar, sugar qualities, physical, chemical properties dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, mannitol, soya maltose, isomalt etc.+ High boiled sweets- Introduction, composition, properties of high boiled sweets, preparation of high boiled sweets, different types of high boiled sweets. Chocolate processing technology- Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom.		07
V	Toffee- Definition, composition, types of toffee ingredient and their role, batch and continuous method of toffee. Fondents-Fudge/ Creamy- Ingredients, methods, productivity lozenges- definition, manufacturing methods, composition, faults and remedy. Packaging requirements of bakery and confectionery products.		05

Course Outcomes:

- Develop an understanding of process technology of bakery and confectionery products
- Exhibit the use of sanitation and safety practices in bakery and confectionery Production in industry.
- Identify the right, machinery based on application
- To study the different Preservatives in bakery products with good knowledge in chemical property of preservatives

Text books

- 1) Bakery science and Cereal Technology- Neelam Khetarpaul
- 2) Technology of Cereals- Kent.
- 3) Basic Baking- S.C. Dubey.
- 4) Flour Milling Process-Scott
- 5) Sugar Confectionery and Chocolate Manufacture- R. Less and E.B.
- 6) Chocolate, Cocoa & Confectionery Sci. & Tech.-Bernard W. Minifie
- 7) Industrial Chocolate Manufacture and use-S.T. Beekelt I

Additional Reading:

1. <https://www.niftem.ac.in>
2. <https://theconfectionary.com>

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 04)

Course Code No.: MFT/MJ/553-P		No. of Credits: 02	Hours: 30
Course Title	Lab-I: Cereal, Legumes, and Oil seed Technology		
Course Objectives: To familiarize with various technologies involved in processing of cereal, legumes and oilseeds and their effect on properties of food products.			
	Course Content		Periods
	1. Study of morphology of cereals and legumes		
	2. Study of physical properties of cereals and legumes		
	3. Study of conditioning of wheat		
	4. Study of par boiling of paddy		
List	5. Preparation of different wheat-based products		
of	6. Preparation of breakfast and puff products from cereals		
Practi	7. Preparation of fermented products from legumes		30
cals	8. Study of extraction of oil from oil seeds		
	9. Preparation of traditional cereal products		
	10. Preparation of extruded products from cereals and legumes		
	11. Determination of gluten content from wheat flour		
	12. Determination of moisture content of given cereal and legume grains		
	13. Visit to cereals, legumes and oilseeds processing industry		

List of Reference Books

1. Technology of Cereals, Kent NL, Woodhead Publishing 1983
2. Post Harvest Technology of Cereals, Pulses and Oil seeds by A. Chakravarthy, Oxford and IBH Publishing Company, 2014
3. Legumes Chemistry, Technology and Human Nutrition by Mathews RH, Marcel Dekker, 1989
4. Post harvest technology of cereals: pulses and oilseeds by Chakraverty A., Oxford & ibh publishing company, 1988.
5. Bailey's Industrial Oil & Fat Products by Bailey A.E. and Shahidi F. Wiley Publication, 2005

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 05)

Course Code No.: MFT/MJ/554-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-II: Fruits and Vegetables Technology		
Course Objectives: To address the technological aspects of fruits and vegetables with specific reference to harvesting, storage, processing, packaging, and transportation. Students will also be introduced on how to apply technologies learn in the course to minimize postharvest loss and consequently increase storage-life.			
	Course Content		Periods
List of Practicals	1. Demonstration of various machineries used in processing and preservation of fruit and vegetables		30
	2. Studies on maturity indices of various fruit and vegetables		
	3. Study of post-harvest management of fruits and vegetables		
	4. Extraction techniques of pulp from various fruits and vegetables & its preservation		
	5. Preparation of Amla preserve/guava jelly/mixed fruit jam/marmalade		
	6. Preparation of fruit squash/nectar/cordial		
	7. Preparation of RTS beverage		
	8. Dehydration technology of leafy vegetables/fruit slices/raisins		
	9. Preparation of pickle from fruits and vegetables		
	10. Preparation of fruit toffee/leather/candy		
	11. Preparation of tomato products		
	12. Preparation of fruit concentrate/syrups		
	13. Bottling/Canning of mango/guava/ papaya fruits/vegetables		
	14. Visit to fruit and vegetable processing industry		

List of Reference Books

1. Preservation of Fruits & Vegetables, Girdhari Lal, G. S. Siddappa, G. L, Indian Council of Agricultural Research, Publications 1996
2. Fruit and Vegetable Preservation -Principles and Practices, Srivastava RP & Kumar S, International Book Distributors, 2003
3. Handbook of Fruit Science &Technology: Production, Composition and Processing., Salunkhe DK & Kadam SS. Marcel Dekker 1995
4. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Ranganna S. 2nd Ed. Tata-McGraw-Hills Publication Co. Ltd. 2001.

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 06)

Course Code No.: MFT/MJ/555-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-III: Bakery and Confectionary Technology		
Course Objectives: To get acquainted with different techniques of processing and preservation bakery and confectionery products.			
	Course Content		Periods
List of Practicals	1. Determination of gluten content in wheat flour sample		30
	2. Determination of dough raising capacity of wheat flour.		
	3. Manufacturing technology of bread making		
	4. Manufacturing technology of cake and cookies making.		
	5. Manufacturing technology of biscuit making		
	6. Manufacturing technology of different chikki		
	7. Manufacturing technology of Chocolate.		
	8. Manufacturing technology of fruit toffee.		
	9. Manufacturing technology of fruit candy.		
	10. Manufacturing technology of high boiled sweets.		
	11. Manufacturing technology of Nan- Katie.		
	12. Visit to bakery and confectionery industry.		

List of Reference Books

1. Bakery science and Cereal Technology- Neelam Khetarpaul
2. Technology of Cereals- Kent.
3. Basic Baking- S.C. Dubey
4. Flour Milling Process-Scott
5. Sugar Confectionery and Chocolate Manufacture- R. Less and E.B. Jackson
6. Chocolate, Cocoa & Confectionery Sci. & Tech.-Bernared W. Minifie
7. Industrial Chocolate Manufacture and use-S.T. Beekelt I.

Additional Reading:

<https://chefibca.com>

www.mondlezinternational.com

<https://bakerpedia.com>

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(MANDATORY SUBJECT- 07)

Course Code No.: MFT/MJ/556-P		No. of Credits: 02	Hours: 4 hrs/week
Course Title	Lab-IV: Sensory Evaluation of foods		
Course Objectives: To get acquainted with different techniques of Sensory analysis of various food products.			
	Course Content		Periods
List of Practicals	1. Determination of threshold value for basic tastes		30
	2. Odour recognition		
	3. Determination of threshold value for various odours		
	4. Perform preference tests: Paired Comparison		
	5. Perform discrimination tests: Duo-trio, Triangle & Ranking test		
	6. Selection of judging panel		
	7. Training of judges, for recognition of certain common flavour and texture defects using different types of sensory tests		
	8. Descriptive analysis methodology- Perform descriptive sensory test		
	9. Sensory evaluation of various food products using different scales, score cards etc.		
	10. Texture profile analysis of selected food product		
	11. Estimation of color of food product		
	12. Relationship between objective and subjective methods		

List of Reference Books

1. Amerine, M.A., Pangborn, R.M. and Rossles, E.B. 1965. Principles of Sensory Evaluation of Food. Academic Press, London.
2. Jellinek, G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwood.
3. Lawless, H.T. and Klein, B.P. 1991. Sensory Science Theory and Applications in Foods. Marcel Dekker.
4. Macrae, R., Rolonson Roles and Sadlu, M.J. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XI. Academic Press.
5. Piggot, J.R. 1984. Sensory Evaluation of Foods. Elbview Applied Science Publ.
6. Potter, N.N. and Hotchleiss, J.H. 1997. Food Science, 5th Ed. CBS Publishers, Delhi.
7. Rai, S.C. and Bhatia, V.K. 1988. Sensory Evaluation of Agricultural Products. Indian Agricultural Statistics Research Institute (ICAR), New Delhi.
8. Stone, H. and Sidel, J.L. 1985. Sensory Evaluation Practices. Academic Press, London.
9. Harry, T. Lawless, Hildegarde Heymann. 2010. Sensory Evaluation of Food: Principles and Practices, 2 nd Ed., Springer, New York or Dordrecht Heidelberg, London

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 01)

Course Code No.: MFT/DSE/557-T		No. of Credits: 02	Hours: 30
Course Title	Beverage Technology		
Course Objectives: The course aims to educate students on basic ingredients used in production of alcoholic and non- alcoholic beverages and familiarize students with regulations and quality control involved in beverage industry			
Unit	Course Content		Periods
I	Beverage-definition-why we drink beverages-ingredients- water, carbon dioxide, bulk and intense sweeteners, water miscible and water dispersible flavouring agents, colours – natural and artificial, Micro and nano emulsions of flavours and colors in beverages, preservatives, emulsifiers and stabilizers. Plant based beverages – fruits, vegetables, cereals and pulses.		06
II	BEER AND WINE Ingredients- Malt- hops- adjuncts- water, yeast. Beer manufacturing process, distillation, malting, preparation of sweet wort, brewing, fermentation, pasteurization and packaging. Beer defects and Spoilage. Wine-fermentation-types –red and white. Wine defects and spoilage		06
III	CARBONATED BEVERAGES Procedures-carbonation equipment-ingredients-preparation of the Syrups-Filling system packaging containers and closures		06
IV	NON-CARBONATED BEVERAGES Coffee bean preparation-processing-brewing-decaffeination- instant Coffee-Teatypes- black, green and oolong- fruit juices, nectars, quash, RTS beverages, isotonic Beverages. Flash pasteurization, Canning and Aseptic Packaging of beverages		06
V	PACKAGING AND QUALITY CONTROL Packaging of beverages – selection and effectiveness of pack, Effective application of quality controls, brix, acidity to brix ratio, single strength of juice- sanitation and hygiene in beverage Industry-Quality of water used in beverages - threshold limits of various ingredients according to PFA, EFSA and FDA – Absolute requirements of Soluble solids and titrable acidity in beverages.		06

Course Outcomes:

At the end of the course the students would have the knowledge to

- Formulate the beverages using selected ingredients
- Apply Unit operations involved in the carbonated beverage manufacturing
- Explain the various production techniques in non-carbonated beverages
- Evaluate the quality parameters of fermented beverages
- Implement the food laws and regulations of beverages

REFERENCE BOOKS:

Sr. No.	Name of Book
1	Ashurst, P.R, "Chemistry and technology of Soft drink and fruit juices", Blackwell Publishing Ltd. 2nd edition 2005.
2	Steen, D.P and Ashurst, P.R, "Carbonated soft drinks – Formulation and manufacture", Blackwell Publishing Ltd. 1st edition 2000.
3	Shankunthala Manay, N. and Shadakdharaswamy, M, "Foods – Facts and Principles", New Age International Pvt. Ltd, 3rd revised edition 2000. 48
4	Charles, W. Bamforth, "Food, fermentation and microorganisms", Blackwell Science Publishing Ltd. 4th edition 2005.
5	Amalendu Chakraverty et al, "Handbook of Post-Harvest Technology", Ed.:, Marcel Dekker Inc. volume 9 (Special Indian edition) 2000.
6	Woodroof JG and Phillips GF.1974. Beverages: Carbonated and Non-Carbonated. AVI Publ

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(ELECTIVE SUBJECT- 02)

Course Code No.: MFT/DSE/558-P		No. of Credits: 02	Hours: 4 Hrs/Week
Course Title	Lab-I: Beverage Technology		
Course Objectives:			
1. To acquaint students with the production of industrial beverages			
2. To familiarize students with the quality control tests of importance in the beverage industry			
	Course Content		Periods
	Suitable nos. of practicals on following topics		
List of Practi- cals	1. Physical and Chemical analysis of raw water quality		30
	2. Microbiological analysis of raw water quality		
	3. Preparation of regional fruit juices		
	4. Preparation of whey-based beverages		
	5. Preparation of soy milk		
	6. Preparation of Non-Carbonated Beverages		
	7. Preparation and Evaluation of Wine		
	8. Estimation of Sulphur Dioxide in Beverages		
	9. Estimation of Ascorbic Acid Content of Commercial Juices		
	10. Estimation of Phenolic Content in Beverages		
	11. Preparation of herbal beverages		
	12. Visit to relevant processing units.		

Suggested readings

Sr. No.	Name of Book
1	Ashurst, P.R, "Chemistry and technology of Soft drink and fruit juices", Blackwell Publishing Ltd. 2nd edition 2005.
2	Steen, D.P and Ashurst, P.R, "Carbonated soft drinks – Formulation and manufacture", Blackwell Publishing Ltd. 1st edition 2000.
3	Shankunthala Manay, N. and Shadakdharaswamy, M, "Foods – Facts and Principles", New Age International Pvt. Ltd, 3rd revised edition 2000. 48
4	Charles, W. Bamforth, "Food, fermentation and microorganisms", Blackwell Science Publishing Ltd. 4th edition 2005.
5	Amalendu Chakraverty et al, "Handbook of Post-Harvest Technology", Ed.:., Marcel Dekker Inc. volume 9 (Special Indian edition) 2000.
6	Woodroof JG and Phillips GF.1974. Beverages: Carbonated and Non-Carbonated. AVI Publ

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 03)

Course Code No.: MFT/DSE/559-T		No. of Credits: 02	Hours: 30
Course Title	Fermentation Technology		
Course Objectives: This course will facilitate in understanding various concepts and application of microbes for the development of various conventional fermented food products and industrial products.			
Unit	Course Content	Periods	
I	Concept of fermented foods, scope & development in fermented foods & beverage industry; benefits of fermented foods	06	
II	Food fermentation, stock culture and inoculum preparation; fermented milk products- Curd, Yoghurt, Acidophilic milk, Bulgarian milk, Koumiss and Kefir	06	
III	Fermented legume products- soy sauce, miso, tempeh, idli; fermented fruit and vegetable products- Sauerkraut, Kimchi, Cucumber pickles	06	
IV	Fermented meat products- fermented meat sausages; fermented alcoholic beverages- Beer, wine, vinegar Malting, brewing, steeping, germination, kilning and curing; chemical and biochemical changes during malting and mashing; separation of wort, wort boiling and hops addition; fermentation, separation, maturation, carbonation and packaging	06	
V	Microbial production of organic acids, amino acids, vitamins and enzymes	06	

Course outcomes:

On completion of the course, students are expected to be able to

- 1- Will learn about various nutritional requirements of microorganism used for fermentation and understand basic needs of a fermentation process like sterilization in ocular development etc.
- 2- Acquires knowledge about conventional fermented food production process of Baker's yeast alcoholic beverages like beer, wine and distilled beverages.
- 3- Learns about the microbial production of various organic acids, amino acid, vitamins and enzymes.
- 4- Understands different types of fermentation processes.

TEXT AND REFERENCE BOOKS:

Sr. No.	Name of Book	Author
1	Industrial Microbiology	RH Patel, Laxmi House Publication
2	Industrial Microbiology	LE Casida. JR. New Age International Publishers
3	Industrial Microbiology (An Introduction)	Michael J Waites, Neil I Morgan. Jhon S Rockej and Gary Higton

DEPARTMENT OF CHEMICAL TECHNOLOGY

(ELECTIVE SUBJECT- 04)

Course Code No.: MFT/DSE/560-P		No. of Credits: 02	Hours: 4 Hrs/Week
Course Title	Lab-II: Fermentation Technology		
Course Objectives: This course will facilitate in understanding various concepts and application of microbes for the development of various conventional fermented food products and industrial products.			
	Course Content		Periods
List of Practi-cals	<ol style="list-style-type: none"> 1. To draw layouts of different food industries. 2. To plan normal and therapeutic diets. 3. Preparation of juice, squash, syrup, jam, chutney, ketchup. 4. Drying of vegetables, canning of vegetables/fruits. 5. Standardization of milk. 6. Preparation of dahi, lassi, shrikhand, paneer, chhana, flavoured milk. 7. Preparation of cakes. 8. Preparation of idli, dhokla, dosa warha etc. 9. Preparation of boiled egg, poached egg, fried egg, omelet, scrambled egg. 10. To study the design of fermenter and its working. 11. To study the production of a. Citric Acid b. Ethanol c. Amylase d. Protease 		30

Suggested readings

Sr. No.	Name of Book	Author
1	Industrial Microbiology	RH Patel, Laxmi House Publication
2	Industrial Microbiology	LE Casida. JR. New Age International Publishers
3	Industrial Microbiology (An Introduction)	Michael J Waites, Neil I Morgan. Jhon S Rockej and Gary Higton

DEPARTMENT OF CHEMICAL TECHNOLOGY

Course Code No.: MFT/OJT/561-P	No. of Credits: 08	Hours: 16 Hrs/Week
Course Title	Field Project-I	
Course Objectives: This course objective is to impart competent skills to thrive in research institutions and industries.		
Course Content		
<p>1. Project/training work will involve experimental work.</p> <p>2. Students are required to do an individual research project/Industrial training.</p> <p>3. Students are required to submit a report for assessment and need to demonstrate the working of research/training findings.</p> <p>4. Students will be asked their choice for Project/Industrial work at the end of II semester and all formalities of topic (if they choose project) and mentor selection will be completed by this time.</p> <p>5. The IPR rights of all such work lie with the University only</p>		

Course outcomes

Upon successful completion students should be able to:

- 1: In-plant Training is intended to expose the students to an environment in which they are expected to be associated in their future careers.
- 2: The students will gain hands-on experience in one or more commercial establishments.
 1. List the objectives and state the hypothesis of the research project.
 2. Outline the methodology that will be followed to achieve the listed objectives.
 3. Employ the finalized methodology to solve the problem which has been undertaken.
 4. Analyze the data which has been generated by carrying out several experiments.
 5. Evaluate the data – accuracy and precision, sources of errors, specificity, sensitivity and detection limits, regression analysis, reporting results.
 6. Organize the inferences to prove the hypothesis.

14. CURRICULUM FOR SEMESTER – III

DEPARTMENT OF CHEMICAL TECHNOLOGY

(MANDATORY SUBJECT- 01)

Course Code No.: MFT/MJ/600-T		No. of Credits: 02	Hours: 30
Course Title	Unit Operations in Food Processing		
Course Objectives: To understand the principle of Unit operation and to acquaint with fundamentals of food engineering and its process. It will also enable to understand the basics of thermal processing and other advanced technologies and their applications.			
Unit	Course Content	Periods	
I	Preliminary Unit operation: Cleaning, sorting & Grading - aims, methods and applications.	06	
II	Conveying and Handling Various unit operations in post-harvest handling, study of different conveying systems like belt conveyors, chain conveyors, screw conveyors, pneumatic conveyors, vibrating and oscillating conveyors, bucket elevators – their selection, operation and maintenance	06	
III	Size Reduction and Sieve Analysis Theory of Comminution; Calculation of energy required during size reduction. Crushing efficiency; Size reduction equipment; Size reduction of fibrous, dry and liquid foods; effects of size reduction on sensory characteristics and nutritive value of food.	06	
IV	Mixing, Agitating, kneading, blending, homogenization and related equipment. Separation Processes Principles of Filtration, Sedimentation, Crystallization and Distillation and equipment used.	06	
V	Transportation and Storage - Preparation of fresh produce for transportation/or storage - Different modes of transportation for fresh and processed foods - Storage structures like cold stores, bins, silos and godowns – Operation and maintenance	06	