PAAVAI ENGINEERING COLLEGE

B. TECH FOOD TECHNOLOGY

REGULATION 2016

CURRICULUM

SEMESTER – V

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	FT16501	Food Process Engineering I	3	0	0	3
2.	PC	FT16502	Dairy Technology	3	0	0	3
3.	PC	FT16503	Baking and Confectionery Technology	3	0	0	3
4.	PC	FT16504	Meat, Fish and Poultry Processing Technology	3	0	0	3
5.	PC	FT16505	Process Control and Instrumentation	3	0	0	3
6.	PE	FT1615*	Professional Elective I	3	0	0	3
Practicals							
7.	PC	FT16506	Dairy Engineering Laboratory	0	0	4	2
8.	PC	FT16507	Baking and Confectionery Laboratory	0	0	4	2
9.	EE	EN16501	Career Development Laboratory I	0	0	2	1
			Total	**18**	**2**	**10**	**23**

SEMESTER – VI

S.No.	Category	Course Code	Course Title	L	T	P	C
Theory							
1.	PC	FT16601	Fruits and Vegetables Processing Technology	3	0	0	3
2.	PC	FT16602	Food Process Engineering II	3	0	0	3
3.	PC	FT16603	Food Packaging Technology	3	0	0	3
4.	PC	FT16604	Technology of Snack and Extruded Foods	3	0	0	3
5.	PC	FT16605	Process Economics and Management	3	0	0	3
6.	PE	FT1690*	Open Elective I	3	0	0	3
Practicals							
7.	PC	FT16606	Food Process Engineering Laboratory	0	0	4	2
8.	PC	FT16607	Fruits, Vegetables Processing and Food Packaging Laboratory	0	0	4	2
9.	EE	EN16601	Career Development Laboratory II	0	0	2	1
			Total	**18**	**2**	**10**	**23**

PROFESSIONAL ELECTIVE COURSES (PE)

S.No.	Category	Course Code	Course Title	L	T	P	C
1.	PE	FT16151	Milling Technology	3	0	0	3
2.	PE	FT16152	Technology of Fats and Oils	3	0	0	3
3.	PE	FT16153	Food Additives and Nutraceuticals	3	0	0	3
4.	PE	FT16154	Bioprocess Engineering	3	0	0	3
			Total	**12**	**0**	**0**	**12**

OPEN ELECTIVE COURSES (OE)

S.No.	Category		Course Title	L	T	P	C
1.	OE	FT16901	Fundamentals of Food Processing	3	0	0	3
2.	OE	FT16902	Food Chemistry of Macronutrients	3	0	0	3
			Total	**6**	**0**	**0**	**6**

FT16501 **FOOD PROCESS ENGINEERING I** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about processing operations of engineering equipment
- understand the importance of drying and its processes
- know about the different types of dryers
- learn about different thermal preservation techniques of food
- learn about preservation by cooling

UNIT I PROCESSING OPERATIONS 9

Post-harvest losses in field crops – Cleaning - Wet and Dry cleaning, Screen Cleaners, Air Screen Cleaners. Peeling- Flash steam, Knife, Abrasion, Caustic and Flame peeling. Grading and Sorting - Principles, types and equipments. Moisture content – free moisture, bound and unbound moisture. Equilibrium moisture content – determination methods, models, Importance and hysteresis effect. Water activity and its importance.

UNIT II DRYING 9

Drying: Theory and mechanism of drying - Drying characteristics of materials. Psychrometric chart – applications. Thin layer and deep bed drying. Methods of drying agricultural materials - batch and continuous drying. Drying equipment design and performance of various drying equipments

UNIT III TYPES OF DRYERS 9

Tunnel Dryer, Belt Dryer, Drum Dryer, Spray Dryer, Fluidized Bed Dryer, Spouted bed dryer, Pneumatic Dryer, Rotary Dryer, Vacuum Drying, Freeze Drying, Heat Pump drying, Dielectric drying and Micro wave drying.

UNIT IV PRESERVATION BY HEATING 9

Preservation by Heating: Methods of applying heat to food - Blanching, Pasteurization, Sterilization: Thermal death time relationships (D, Z and F values). Process calculations: General method, Ball's formula method. Sterilization– methods and equipments. UHT sterilization

UNIT V PRESERVATION BY COOLING 9

Chilling - Equipments, Cold storage. Freezing - Thermodynamics of food freezing, Phase diagrams, Ice crystals formation, Properties of frozen foods. Freezing time calculations, Freezing equipments. Freeze concentration.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- adapt specific pre - processing operations and estimate the moisture content of food materials
- infer the concepts of food drying
- classify the dryers and illustrate the working of dryers
- elaborate the techniques of preservation by cooling
- appraise the techniques of preservation by heating

TEXT BOOKS

1. Fellows P.J., —Food processing Technology: Principles and Practice‖, 3rd Edition, Wood Head Publishing Limited, New Delhi, 2009
2. Sahay K.M. and Singh K. K., —Unit Operations of Agricultural Processing‖, 2nd Edition, Vikas Publishing
   a. House Pvt. Ltd., New Delhi, 2012.

REFERENCES

1. Earle R.L., —Unit Operations in Food Processing‖, Web Edition, Pergamon Press, U.K., 2004.
2. Paul Singh R. and Dennis R. Heldman, —Introduction to Food Process Engineering‖, 5th Edition, Academic Press, USA, 2014.
3. James G Brennan, —Food Processing Handbook‖, 2nd Edition, Wiley VCH, Weinheim, 2011.

CO/PO MAPPING:

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

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

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

FT16502 **DAIRY TECHNOLOGY** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about importance of milk
- understand the importance milk collection and its processes.
- know about the different types of fluid milk processing
- learn about different design and equipment for milk processing
- learn about cleaning and sanitation processes

UNIT I MILK 9

Indian Dairy industry, Milk - Definition, types of market milk, Composition of milk, Factors affecting composition of milk, System of pricing of milk, Nutritive value of milk, Physico-chemical properties of milk: Color, Flavour, Specific Gravity, Boiling point, Freezing point, Refractive Index, Acidity and pH, Viscosity, Surface Tension

UNIT II RAW MILK COLLECTION, TRANSPORTATION AND RECEPTION 9

Raw milk collection system, Cooling and Transportation of milk, Platform tests of milk: Smell, Appearance, Temperature, Sediment, Acidity, Lactometer Reading, Fat, Solids-Not-Fat, Dye Reduction Test: MBRT test, Resazurin tests, Mastitis test, Filtration/Clarification of raw milk, Bactofugation of milk, Cooling and storage of raw milk, Bulk transportation technologies – carbondioxide impregnation.

UNIT III FLUID MILK PROCESSING 9

Milk Standardization, Cream separation, Homogenization, Milk Pasteurization: HTST and Batch Pasteurization, Milk Sterilization, Bottling/Packaging of milk, Liquid milk filling, Aseptic filling of milk. Milk Products: Manufacture of cheese, ice-cream, yoghurt, condensed milk, milk powder.

UNIT IV DESIGN OF EQUIPMENTS 9

Selection of Accessories - Pipes, Aseptic valves, Filters, Pumps, Blenders, Storage Tank. Design of dairy equipments – Heat exchangers, Homogenizer, Spray dryer, Bulk coolers, Evaporators, Butter churner, Separators. Calculation of Refrigeration Load. Process Automation.

UNIT V CLEANING AND SANITIZATION OF DAIRY EQUIPMENTS 9

Basic principles, Cleaning and Sanitizing – agents and methods. Can washer - Rotary type and Straight through type. Selection and maintenance of can washers, CIP - Types of CIP system, Design of CIP system, CIP of dairy equipments.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify the physico-chemical properties of milk
- apply the acquired knowledge on raw milk collection, transportation and reception
- infer the technical aspects of fluid milk processing and production of milk products
- select and design appropriate dairy processing equipment's
- choose suitable cleaning operations in dairy industry

TEXT BOOKS

1. Sukumar De, —Outlines of Dairy Technology‖, Royal Oxford University Press, Delhi, 2010.
2. Tufail Ahmed, —Dairy Plant Engineering and Management‖, KitabMahal, New Delhi, 2012.

REFERENCES

1. Jane Selia dos Reis Coimbra, Jose A. Teixeira, —Engineering Aspects of Milk and Dairy Products‖, CRC Press, New York, 2010.
2. Robinson R.K., —Modern Dairy Technology: Advances in Milk Products‖, Volume 2, Springer London Ltd 2012.:
3. Hui,Y.H,, —Dairy Science and Technology Handbook: Applications Science, Technology and Engineering‖, Volume 3, Wiley, New Delhi, 2014.

CO/PO MAPPING:

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

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

FT16503 BAKING AND CONFECTIONERY TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about the science behind baking
- understand the importance of equipment in baking
- know about the process of bread making
- learn about different bakery products
- learn about different confectionery products.

UNIT I SCIENCE BEHIND BAKING 9

Classification of bakery products. Bakery ingredients and their functions- flour, yeast, sugar, fat, egg, water, salt, coloring agents, flavoring agents, milk, milk powder, emulsifiers, leaveners, antioxidants and improvers.

UNIT II EQUIPMENTS 9

Handling of ingredients- dough mixers, dividers, rounder, sheeter, laminating equipments, fermentation enclosures and brew equipment, ovens and slicers. Rheology of dough- Farinograph, Amylograph, Alveograph, and Extensiograph.

UNIT III BREAD MAKING PROCESS 9

Chemistry of Dough Development. Bread making methods- Straight dough/bulk fermentation, Sponge and dough, Activated dough development, Chorley wood bread process, No time process. Characteristics of good bread- Internal and external characters. Bread defects/faults and remedies. Spoilage of bread-Causes, detection and prevention.

UNIT IV BAKERY PRODUCTS 9

Biscuit making – Ingredients and their functions. Types of biscuit dough – Developed dough, short dough's, semi- sweet, enzyme modified dough_s and batters. Methods of biscuit manufacturing. Cake making- Ingredients and their function. Methods for different types of cakes manufacture. Miscellaneous bakery products production - Wafers, puff pastry, chemically leavened bakery products. Problems of baking.

UNIT V CONFECTIONERY PRODUCTS 9

Definition, importance of sugar confectionery, ingredients, Formulation and Processing methods. Industrial sugar confectionery manufacture - compositional effects, prevention of re-crystallization and stickiness. Manufacturing of Caramel, Toffee and Fudge. Aerated confectionery- Methods of aeration and Manufacturing processes. Confectionery product quality parameters, faults and corrective measures. Spoilage of confectionery products.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- choose the ingredients for production of bakery products
- select appropriate equipment's for baking process
- adapt bread making process and identify defects in bread
- formulate various bakery products
- develop confectionery products and identify cause for defects

TEXT BOOKS

1. Samuel A. Matz, —Bakery Technology and Engineering‖, 3rd Edition, Chapman and Hall, London, 2005.
2. Cauvain, Stanley, P. and Young, Linda S., —Technology of Bread Making‖, 2nd Edition, Aspen Publication; Maryland, 1999.

REFERENCES

1. ServetGulumSumnu and SerpilSahin, —Food Engineering Aspects of Baking Sweet Goods‖, CRC Press, USA, 2008.
2. Samuel A. Matz, —Equipment for Bakers‖, Pan Tech International Publication, 1988.
3. Ferenc A. Mohos, —Confectionery and Chocolate Engineering: Principles and Applications‖, Wiley Blackwell,UK, 2010.

CO/PO MAPPING:

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

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

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

FT16504 MEAT, FISH AND POULTRY PROCESSING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- develop the knowledge in the area of meat processing and its technology
- learn the processing of fish from harvesting to its value-added products
- know the principles behind poultry processing and its treated products
- identify the process behind the packaged egg through industrial procedures
- appreciate the application of scientific principles in the processing of these materials

UNIT I MEAT PROCESSING 9

Types of Meat and its sources, composition, structure of meat. Ante mortem handling, slaughtering of animals, inspection and grading of meat. Introduction to Halal. Post-mortem changes of meat. Meat -Tenderization, Aging. Meat quality evaluation. Wholesale and retail cuts. Preservation of meat- curing, smoking, drying, freezing. Processed meat products- Hamburgers, sausages and meat balls.

UNIT II FISH PROCESSING 9

Types of fish, composition and nutritive value of fish. Harvesting of fish. Spoilage factors of fish. Post-mortem changes in fish. Preservation- Freezing and Individual quick freezing, Canning and smoking operations, Salting and drying of fish, pickling.

UNIT III POULTRY PROCESSING 9

Types and characteristics of poultry products. Unit operation in poultry processing. Pre-slaughter factors affecting poultry meat quality. Types of poultry cuts. Factors affecting the shelf-life of poultry meat. Sensory quality of poultry meat- color, texture and flavor. Preservation techniques: chemical treatments, heating, drying and irradiation.

UNIT IV EGG PROCESSING 9

Structure, composition, nutritive value of egg. Functional properties of eggs, Factors affecting egg quality and measures of egg quality. Preservation of egg by different methods. Egg powder processing-spray drying, Foam mat drying

UNIT V HYGIENE AND SANITATION 9

Handling and maintenance of tools and core equipment. Meat plant layout. Meat processing hygiene. Cleaning and sanitation in meat plants. Food safety measures –GMP and GHP.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- elaborate handling and processing of meat
- recommend fish processing and preservation techniques
- select appropriate techniques for egg processing
- select appropriate techniques for egg processing
- adapt hygiene and sanitation procedures in meat industry

TEXT BOOKS

1. Panada P.C., —Text book on Egg and Poultry Technology‖, 1st Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 1996.
2. Gunter Heinz and Peter Hautzinger, —Meat Processing Technology‖, 1st Edition, Rap Publication, Monteplier, 2007.

REFERENCES

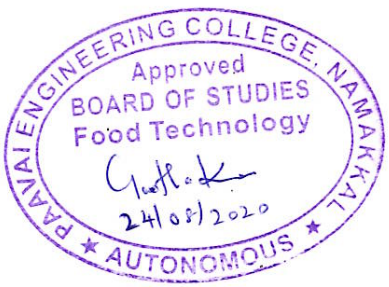
1. Ionnis S. Boziaris, —Seafood Handbook: Technology, Quality and Safety‖, Wiley Blackwell, UK, 2014.
2. Alan R. Sams, —Poultry Meat Processing‖, 1st Edition, CRC Press, London, 2001.
3. Mead G.C., —Poultry Meat Processing and Quality‖, 1st Edition, CRC Press, London, 2004.

CO/PO MAPPING:

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

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

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



FT16505 PROCESS CONTROL AND INSTRUMENTATION 3 0 0 3

COURSE OBJECTIVES

To enable students to

- introduce the dynamic response of open and closed loop systems, control loop components and stability of control systems.
- learn instrumentation for the measurement of key process variables in food processing
- update the applications of sensors in food processing Industry.
- apply principles of process control to analyse the performance of industrial processes.
- apply concepts of measurement and sensor selection to specify, install, configure, calibrate, troubleshoot, and maintain various process instruments commonly used in industry.

UNIT I SENSORS AND TRANSDUCERS 9

Introduction to measurement system - Resistive Transducers: Strain gauges - Resistance thermometers - Thermistors - Hotwire anemometer - Piezo resistive sensors - Humidity sensors - Inductive Transducers: LVDT - Induction potentiometer - Electromagnetic sensors - Capacitive Transducers: Variable air gap type – Variablepermittivity type.

UNIT II FLOW AND TEMPERATURE MEASUREMENTS 9

Level measurement: Float gauges - level switches - bubbler tube. Capacitance type - Ultrasonic type - FlowMeasurement: Fixed and variable type flow meter - turbine flow meter - Electromagnetic flow meter – Temperature Measurement: RTD - Thermistor - Thermocouple - Dry and wet bulb psychrometers - Viscosity measurements.

UNIT III PROCESS MODEL AND CONTROLLER 9

Introduction to open and closed loop system - Building blocks of mechanical and electrical systems -Single and Two tank system model - Controller Design: ON-OFF Control - P - Mode - I - Mode - D -Mode - P+I+D mode of controller - Digital Controller: Position and Velocity control.

UNIT IV TIME AND FREQUENCY RESPONSE ANALYSIS 9

Time response - time domain specifications - Standard test inputs - Frequency response characteristics: Bode diagram - Nyquist plot and Stability analysis - Jury's stability test.

UNIT V INSTRUMENTATION AND SENSORS FOR THE FOOD INDUSTRY 9

Optical Inspection Systems: Computer Vision system, Colour sorter- Food component analysis using NIR and FTNIR. Principles of measurement - Calibrations application in food industry. Practical considerations for implementing online measurements. Radiation thermometers: Principles of measurements and applications. Introduction to automation in food processing. Biosensors -equipment - e nose, NIR.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- analyse the different kinds of sensors and transducers and their specific application in food industry
- evaluate the operation of fluid flow and temperature measurement devices
- implement the process controllers in food processing operations
- Examine the concepts of system representation, time and frequency responses
- Execute the automation in food processing in food processing industry

TEXT BOOKS

1. Erika Kress-Rogers and Christopher J. B. Brimelow, Instrumentation and sensors for the food industry, Wood head publishing, 2nd Edition, 2001, CRC Press.
2. Coughnowr, D., "Process Systems Analysis and Control ", 3rd Edition, McGraw Hill, New York, 2008.

REFERENCES

1. D. Patranabis, Sensors and Transducers, Prentice Hall India Pvt. Ltd, 2007.
2. E. O. Doeblin, Measurement Systems: Applications and Design, Tata McGraw-Hill Book Co., 2008.
3. D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 2011.
4. Donald P. Eckman, Industrial Instrumentation, Wiley Eastern Limited, 2006.

CO/PO MAPPING:

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

FT16506 **DAIRY ENGINEERING LABORATORY** 0 0 4 2

COURSE OBJECTIVES

To enable students to

- identify the quality of milk
- know the constituents of milk and its nature
- practice the quality procedures in milk processing industry.
- gain knowledge about the physical and chemical properties of milk.

LIST OF EXPERIMENTS

1. Studies on milk sampling, judging and grading of milk.
2. Determination of acidity, specific gravity and clot-on-boil test of milk.
3. Determination of fat, SNF and total solids content in milk.
4. Determination of MBRT and alcohol index test of milk.
5. Determination of pasteurization efficiency of milk.
6. Estimation of homogenization efficiency.
7. Detection of adulterants in milk.
8. Estimation of surface tension of milk.
9. Determination of total milk protein content in milk.
10. Determination of churning efficiency of butter churner.
11. Determination of efficiency of spray dryer.
12. Determination of separation efficiency of cream separator.

TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze the physico-chemical properties of milk
- apply platform tests for assessing milk quality
- estimate the efficiency of dairy processing equipment's
- analyze the quality of milk products

REFERENCES

1. Sukumar De, —Outlines of Dairy Technology‖, Royal Oxford University Press, New Delhi, 2010.
2. Tufail Ahmed, —Dairy Plant Engineering and Management‖, KitabMahal, New Delhi, 2012.
3. Manual of Methods of Analysis of Foods (Milk And Milk Products), Directorate General ofHealth Services, Ministry of Health and Family Welfare, 2005.

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

FT16507 **BAKING AND CONFECTIONERY LABORATORY** 0 0 4 2

COURSE OBJECTIVES

To enable students to

- study the behaviour of wheat flour and its binding mechanism
- gain knowledge about yeast and its importance in baking industry
- learn various confectionery products, production and its quality
- know about the importance of processing methods and quality analysis of baking goods

LIST OF EXPERIMENTS

1. Estimation of wet and dry gluten content of wheat flour
2. Estimation of water absorption power of wheat flour
3. Determination of sedimentation value of wheat flour
4. Determination of dough rising capacity of wet and dry yeast
5. Estimation of quality parameters of bakery ingredients
6. Experiment on leavening power of baking powder, sodium-bicarbonate and ammonium-bicarbonate
7. Preparation and analysis of bread
8. Preparation and analysis of biscuits and cookies
9. Preparation and analysis of cake
10. Preparation and analysis of candy
11. Preparation and analysis of toffee
12. Preparation and analysis of cocoa based confectionery

TOTAL PERIODS 60

COURSE OUTCOMES

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

- analyze the quality of ingredients used in bakery products
- develop different bakery products
- formulate various confectioneries
- analyze the quality of confectionery products

REFERENCES

1.Duncan Manley, Biscuit, Cracker and Cookie Recipes for the Food Industry‖, Woodhead Publishing, England, 2001.

2.YogambalAshokkumar, —Text book of Bakery and Confectionery‖, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.

3. Samuel A. Matz, —Bakery Technology and Engineering‖, 3rd Edition, Chapman and Hall, London, 2005.

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

EN16501 **CAREER DEVELOPMENT LABORATORY I** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer
- provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning
- articulate their thoughts on a given topic – in English and also to make decent write ups in English on any given topic
- practice and score well in Aptitude tests conducted by corporate / prospective employers
- Prepare for any group discussion evaluation or presenting their credentials during a face –to face interview leading to selection and employment
- become a knowledgeable person on the various evaluation processes leading to employment

UNIT I BASICS - SELF ANALYSIS **6**

Introduction - Self Explorations: Who Am I, Personal Attributes, Self Confidence and Self Esteem - Communication Skills: Introduction to communication - Flow of communication, Listening, Barriers of communications, How to overcome the barriers of communications - Leadership Qualities: Skills for a good Leader - Leadership styles - SWOT Analysis, - Time Management: Time is a resource, Identify Timewasters, Time Management Styles, Techniques for better time management - Group Dynamics/ Team Building: Importance of group in organizations, Team Building, Interaction with the team, How to build the good team

UNIT II PERSONALITY DEVELOPMENT **6**

Motivation: Introduction, Relevance and types of motivation, Analysis of motivation - Attitude: Factors, Influencing Attitude, Challenges and lessons from attitude - Creativity: Out of box thinking, Lateral thinking - Goal Setting: Wish list; Blue print for success; Short, long, life time goals

UNIT III QUANTITATIVE APTITUDE **6**

Number System - LCM & HCF - Square root & Cube root – Percentage - Time speed & Distance

UNIT IV QUANTITATIVE APTITUDE **6**

Trains - Boats & Streams – Average – Ages - Area 6 Series Completion

UNIT V LOGICAL AND VERBAL REASONING **6**

Number Series, Letter series, Symbol Series - Blood Relation - Coding and decoding - Logical Sequence – Analogy- Character Puzzles – Classification - Data sufficiency

TOTAL PERIODS 30

COURSE OUTCOMES

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

- demonstrate aptitude & reasoning skills
- enhance verbal & written ability.
- improve his/her grooming and presentation skills.
- interact effectively on any recent event/happenings/ current affairs.
- be a knowledgeable person on the various evaluation processes leading to employment and face the same with confidence.

REFERENCES

1. Agarwal, r.s. "A Modern Approach to Verbal & Non Verbal Reasoning", S.Chand & co ltd, NewDelhi.
2. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw hill.
3. "Word power made easy" by norman lewis, wr.goyal publications.
4. Johnson, D.W. reaching out interpersonal effectiveness and self-actualization. boston: allyn and bacon
5. Agarwal, R.S. "Objective General English", S.Chand&Co
6. Infosys Campus Connect Program students" guide for soft skills.

SEMESTER VI

FT16601 FRUITS AND VEGETABLES PROCESSING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about physiological development of fruits and vegetables
- understand the importance of different preservation and storage methods
- know about the different processing methods of fruits and vegetables
- learn about different speciality products
- learn about the different methods such as canning and waste utilization

UNIT I PHYSIOLOGICAL DEVELOPMENT 9

Classification of fruits and vegetables. General structure, composition and nutritional aspects. Physiological Development - maturation, ripening, senescence. Harvesting – methods and tools. Deterioration factors - physical, chemical and biological. Changes during deterioration. Methods of reducing deterioration.

UNIT II PRESERVATION AND STORAGE METHODS 9

Pre-cooling and evaporative cooling. Preparatory operations and related equipments - washing, cleaning, grading, peeling and blanching methods. Storage of fruit and vegetables - under ambient conditions, low temperature storage. Freezing –Air blast, Fluidized bed and immersion freezer. Controlled and modified atmosphere storage - concepts and methods. Irradiation. Waxing.

UNIT III PROCESSING OF FRUITS AND VEGETABLES 9

Juice and pulp extraction equipment –Juice, Squash, cordial, concentrated juice, nectar, RTS. Clarification and concentration by membranes. Production of IMF - jam, jellies and marmalades - Defects in jam and jelly. Candies and preserves. Fermented vegetable products - Sauerkraut and Pickle. Fermented fruit beverages- Wine and vinegar production.

UNIT IV SPECIALTY PRODUCTS 9

Fresh cut fruit and vegetables – processing, quality parameters, physiological and biochemical changes. Production of Fruit powders and Fruit bar. Osmotic dehydration - Tuttifruiti. Edible coating of fruits – Processing, quality parameters, physiological and biochemical changes.

UNIT V CANNING AND WASTE UTILIZATION OF FRUITS AND VEGETABLES 9

Types of cans and materials, preparation of fruits and vegetables for canning, Filling, closing and sterilization operation. Precautions in canning operations. Spoilage of canned products. Utilization of waste from fruit and

TOTAL PERIODS 45

COURSE OUTCOMES

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

- interpret physiological development of fruit and deterioration factors.
- identify different preprocessing methods, preservation and storage.
- select suitable processing methods for fruits and vegetables.
- elaborate the techniques involved in processing of specialty products
- perform canning operations and utilize fruits /vegetable waste

TEXT BOOKS

1. Hui Y.H., —Handbook of fruits and fruit processing‖,1st Edition, Blackwell Publishing, USA, 2006.
2. Desrosier N.W., —The Technology of Food Preservation‖, 4th Edition, CBS Publisher and Distributions, New Delhi, 2006.

REFERENCES

1.Wim Jongen, —Fruit and Vegetable Processing- Improving Quality‖, Wood Head Publishing Ltd, England, 2002.
2. Thompson A.K., —Fruits and Vegetable - Harvesting, Handling and Storage‖, Blackwell Publishing, USA, 2003.
3. Lal G., Siddappa G. and Tondon G.L., —Preservation of Fruits and Vegetables‖, Indian Council of Agricultural Research, New Delhi, 1986.

CO/PO MAPPING:

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

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

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

FT16602 **FOOD PROCESS ENGINEERING II** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- learn about processing operations of size reduction
- understand the importance of mechanical separation and its processes.
- know about the importance of crystallization
- learn about different types of mixing.
- learn about extrusion and its process.

UNIT I SIZE REDUCTION **9**

Fibrous foods, Dry foods and Liquid foods – Energy Used in Grinding. New Surface Formed by Grinding. Grinding and Cutting equipments - Crushers, Hammer mills, Fixed head mills, Ball mills, Plate mills and Roller mills. Cutters - Slicers, Dicers, Shredder and Pulper. Size reduction in liquids

UNIT II MECHANICAL SEPARATION **9**

Sedimentation in liquids - Gravitational sedimentation – Floatation - Sedimentation of particles in gas. Centrifugal separation – Velocity of particles – Radius of neutral zone – Equipments. Filtration – Constant rate and Constant pressure filtration - Equipments, Sieving effectiveness and Applications

UNIT III CRYSTALLIZATION **9**

Crystallization Equilibrium – Nucleation – Meta stable region – Seed Crystals. Heat of Crystallization - Rate of crystal growth. Stage equilibrium crystallization. Equipments - Types – Applications

UNIT IV MIXING **9**

Characteristics of mixtures. Measurement of mixing - sample size, sample composition. Particle mixing and Liquid Mixing - mixing index. Mixing of different quantities. Rate of Mixing and Energy Input in Mixing. Mixing equipments - Liquid Mixers, Powder and Particle Mixers, Dough and Paste Mixers

UNIT V EXTRUSION **9**

Theory - Rheological properties and Operating Characteristics. Single and Twinscrew extruders – Ancillary Equipments. Applications and Effects on Foods. Material handling: Types of handling and conveying system for food products - Belt conveyor, screw conveyor, bucket elevator and pneumatic conveyor.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- apply size reduction techniques for solids and liquids.
- appraise the mechanical separation in food processing.
- demonstrate the crystallization process.
- characterize the mixtures and select appropriate mixing equipment.
- adapt extrusion process and select suitable material handling systems.

TEXT BOOKS

1. Fellows P.J., —Food processing Technology: Principles and Practice‖, 3rd Edition, Woodhead Publishing Ltd.New Delhi, 2009.
2. Earle R.L., —Unit Operations in Food Processing‖, Web Edition, Pergamon Press, UK, 2004.

REFERENCES

1. James G Brennan, —Food Processing Handbook‖, 2nd Edition, Wiley VCH, Weinheim, 2011.
2. Paul Singh R and Dennis R. Heldman, —Introduction to Food Process Engineering‖, 5th Edition, Academic Press, USA, 2014.
3. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processing‖, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2012.

CO/PO MAPPING:

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CO3	2	2	2	1	-	-	-	-	-	1	2	-	2	3
CO4	2	-	2	-	2	-	3	-	-	2	2	-	3	2
CO5	1	2	2	3	2	-	2	-	-	2	2	-	3	2

FT16603 FOOD PACKAGING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about packaging and its standards
- understand the importance of metal cans
- know about the different types plastic packaging
- learn about different paper and paper board packaging
- learn about different trends in food packaging

UNIT I BASICS IN FOOD PACKAGING 9

Definitions and basic functions of a food package. Food package design and development. Packaged product quality and shelf life. Current status in food packaging in India. Package standards and regulation. Labeling, Bar coding

UNIT II METAL CANS 9

Raw materials for can making – steel, aluminium. Can making processes - three piece welded cans, DWI, DRD cans – end making processes – coating. Film laminates and inks, metal packages – corrosion and sulphur staining. Application of metal containers in food industries. Glass containers: Definition and composition. Glass container manufacture – melting, forming, surface treatments. Closure selection. Glass bottle design and specification. Application of glass containers in food industries

UNIT III PLASTIC PACKAGING 9

Types of plastics used in packaging – PE, PP, PET, PVC, EVOH, PVA. Secondary conversion techniques – film, extrusion and thermal lamination. Printing of plastic films and rigid plastic containers. Food contact and barrier properties. Sealability and closure. Application of plastics for food packaging.

UNIT IV PAPER AND PAPERBOARD PACKAGING 9

Properties of paper and paperboard. Paper and paperboard manufacture - SBB, SUB, FBB, WLC. Package types – paper, pouches, sachets, cartons, boxes, tubes, tubs, containers, drums, tapes, cushion, cap liners and diaphragm . Application of paper and paperboards for food packaging

UNIT V TRENDS IN FOOD PACKAGING 9

Active packaging, modified atmosphere packaging - vacuum and Inert gas Packaging, Biodegradable and edible packaging, Aseptic packaging, Shrink wrapping, Nano packaging, Antimicrobial packaging, self-heating and cooling cans.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- infer basic concepts in food packaging.
- choose appropriate metal and glass containers for food packaging.
- classify plastics and elaborate their properties.
- make use of paper and paperboards for various food applications.
- adapt recent trends in food packaging.

TEXT BOOKS

1. Richard Coles and Mark J. Kirwan, —Food and Beverage Packaging Technology‖, 2nd Edition, Blackwell Publishing Asia Pty Ltd, CRC press, USA, 2011.
2. Robertson Gordon L., —Food Packaging: Principles and Practice‖, 3rd Edition, Marcel Dekker Inc, USA, 2012.

REFERENCES

1. Han Jung H., —Innovations in Food Packaging‖, 2nd Edition, Academic Press, USA 2013.
2. Dong Sun Lee, Kit L. Yam and Luciano Piergiovanni, —Food Packaging Science and Technology, CRC press, USA, 2008.
3. Otto G. Piringer and A.L. Baner, —Plastic Packaging Materials for Food‖, 1st Edition, WileyVCH, Germany, 2008.

CO/PO MAPPING:

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CO4	3	2	2	-	-	1	-	-	-	-	2	-	2	3
CO5	2	3	3	2	1	3	3	1	-	1	2	-	2	3

FT16604 TECHNOLOGY OF SNACK AND EXTRUDED FOODS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- gain knowledge about various physiology behind snack foods
- know the structure formation of starch and grains while undergoing various technology
- understand the processing of corn and its products
- learn extrusion technology used in food industries and the working principles of extruders
- gain knowledge about various physiology behind snack foods

UNIT I INTRODUCTION 9

Current status of snack food industry in India. Types of snack food – Raw Vegetable Snack, Formed dough products from potato and maize derivatives, Half Products, Directly expanded extruded snack, Puffed Snacks and other. Types and Functions of ingredients – structure forming materials, dispersed phase/filling materials, plasticizers/lubricants, soluble solids, nucleating substances, coloring and flavouring substances.

UNIT II POTATO AND RICE BASED SNACKS 9

Potato Chip - Pre cleaning and peeling, slicing, drying/frying, salting and seasoning, quality control. Fabricated potato snacks – potato flakes, potato granules, potato starch, ground and crushed dehydrated potato. Rice based Snacks – Products using whole grains – Gun puffed rice. Products using flours.

UNIT III CORN BASED SNACKS 9

Tortilla chip – Corn soaking and smoking, Grinding, Masa flour, Sheeting and Cutting, Baking and Frying. Popcorn– Popping methods, oil popping and dry popping. Commercial and industrial popcorn process. Flavorings and Applicators.

UNIT IV EXTRUSION BASED SNACKS 9

Extruder components – Single and Twin screw, Single and Multiple die extruders. Second generation and Third generation snacks, Co extruded snacks, Masa based snacks, Flat bread, Crisp bread.

UNIT V PASTA PRODUCTS 9

Raw materials. Preparation of raw materials for extrusion. Spaghetti, noodles, macaroni and similar products. Dry and frozen pasta products. Pretzel – Types – Formulation and Processing - mixing, extrusion, proofing, cooking, surface salting, baking and drying. Problems in pretzel manufacture.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- choose appropriate ingredient based on their functionality
- infer the production of potato and ricebased snacks
- apply suitable techniques for corn based snacks production
- elaborate the production of extruded snack foods
- categorize and formulate pasta products

TEXT BOOKS

1. Edmund W. Lusas and Lloyd W. Rooney, —Snack Food Processing‖, 1st Edition, CRC Press, Florida, 2001.
2. Robin Guy, —Extrusion cooking: Technologies and Applications‖, 1st Edition, CRC Press, Florida, 2000

REFERENCES

1. Panda H., —The Complete Technology Book on Snack Foods‖, National Institute of Industrial Research, New Delhi, 2003.
2. Sergio O. Serna-Saldivar, —Industrial Manufacture of Snack Food‖, Woodhead Publishing, New Delhi, 2008.
3. Mian N. Riaz., —Extruders in Food Application‖, CRC Press, Florida, 2000.

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CO5	3	2	1	2	1	1	1	1	-	-	-	3	3	2

FT16605 PROCESS ECONOMICS AND MANAGEMENT 3 0 0 3

COURSE OBJECTIVES

To enable the students to

- have the knowledge on planning and techniques of measurement of work.
- attain the importance of cost estimation and projects.
- estimate the project profit and techniques for investment.
- analyze the performance, preparation of annual report.
- sustain the knowledge on economic balance.

UNIT I PRINCIPLES OF MANAGEMENT AND ORGANISATION 9

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations. Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II INVESTMENT COSTS AND COST ESTIMATION 9

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, capital budgeting and project feasibility.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT 9

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 9

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT V ECONOMIC BALANCE 9

Economic decisions in Chemical Plant - Economics of size - Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat exchanger

TOTAL PERIODS 45

COURSE OUTCOMES

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

- know the importance of planning and types of organization.
- have knowledge on value of money and how to utilize for the projects.
- impact the investment alternatives and its forecasting.
- gain the knowledge on balance sheet and their performance.
- attain the idea of economic growth and balance.

TEXT BOOKS

1. Peters, M. S. and Timmerhaus, C. D. RE West , "Plant Design and Economics for Chemical Engineers", 3rd Edn, McGraw Hill, (2003).
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., "Introduction to Process Economics", 2nd Edn, John Wiley, (1983)

REFERENCES

1. Perry, R. H. and Green, D., "Chemical Engineer's Handbook ", 8th Edition, McGraw Hill.(2007)
2. Allen, L.A., "Management and Organization", McGraw Hill. (2013)
3. V.Sivasubramanian, "Process Economics And Industrial Management", 1st Edition, Galgotia publishers (2008)
4. Dr. Rajan Mishra, "Industrial Economics and Management Principles", 1st Edition, Laxmi publishers (2008)

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CO5	3	2	-	2	2	1	1	1	-	-	2	3	3	2

PAAVAI ENGINEERING COLLEGE NAMAKKAL
Approved
BOARD OF STUDIES
Food Technology
24/08/2020
AUTONOMOUS

FT16606 **FOOD PROCESS ENGINEERING LABORATORY** **0 0 4 2**

COURSE OBJECTIVES

To enable students to

- enable the students to solve problems in Food Engineering process of value addition and quality improvement.
- impart knowledge on the principles of Food Process Engineering and its importance for the Food Industry.
- make the student to understand units and dimensions,
- solve engineering problems related to food processing, and familiarization with some food processing unit operations.

LIST OF EXPERIMENTS

1. Determination of size, roundness, sphericity and 1000 grain weight of food grains
2. Determination of bulk density, true density and porosity
3. Determination of angle of repose for grain sample
4. Determination of co efficient of friction for grain sample
5. Experiment on drying characteristics of food material using tray dryer
6. Determination of fineness modulus for ground material using ball mill
7. Determination of separation efficiency of inclined belt separator
8. Determination of conveying efficiency and power requirement of screw conveyor
9. Experiment on analysis of particle size distribution using hammer mill
10. Experiment on paddy dehusker to determine the shelling efficiency
11. Experiment on terminal velocity apparatus
12. Experiment on drying characteristics of food material using fluidized bed dryer

TOTAL PERIODS 60

COURSE OUTCOMES

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

- estimate engineering properties of agricultural produce
- evaluate the performance of agro processing equipments
- assess the effectiveness of size reduction equipments
- analyze the efficiency of the particles

REFERENCES

1. Sharma Shri K., Mulvaney Steven J. and Rizvi Syed S. H., —Food Process Engineering: Theory and Laboratory Experimentsǁ, 1st Edition, Wiley Inter-science, New Jersey, 1999.
2. Rao M., Syed. S.H. Rizvi and Ashim K. Datta, —Engineering Properties of Foodsǁ, 4th Edition, CRC Press, Florida, 2005.

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CO4	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	1	-	-	-	-	-	-	-	-	-	-	-

FT16607 **FRUITS, VEGETABLES PROCESSING AND FOOD PACKAGING LABORATORY** 0 0 4 2

COURSE OBJECTIVES

To enable students to

- learn about different kinds of fruits and vegetables
- understand the importance fruit and vegetable processing.
- know about the methods to preserve fruits and vegetables and thermal preservation techniques of food
- learn about packaging materials.

LIST OF EXPERIMENTS

1. Experiment on juice extractor and pulper
2. Experiment on osmotic dehydration of fruits and vegetables
3. Preparation and analysis of jam/jelly
4. Preparation and analysis of squash
5. Preparation and analysis of sauce
6. Preparation and analysis of fruit bar
7. Estimation of bursting strength of packaging materials
8. Determination of tear / puncture resistance of packaging materials
9. Estimation of water absorption capacity of paper based packaging materials
10. Estimation of water vapour permeability of different packaging materials
11. Determination of overall migration of different plastic packaging materials
12. Determination of shelf life of modified atmospheric packed food

TOTAL PERIODS 60

COURSE OUTCOMES

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

- demonstrate knowledge on extraction, pulping, dehydration and prepare fruit/vegetable based products
- evaluate mechanical properties of packaging materials
- estimate water barrier properties of packaging materials
- analyze the cost and quality of the meterials

REFERENCES

1. Ranganna S., —Handbook of Analysis and Quality Control for Fruit and Vegetable‖, Tata McGraw-Hill, 2001.
2. Gordon L. Robertson, —Food Packaging and Shelf Life: A Practical Guide‖, CRC Press, USA, 2009

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CO4	1	-	-	-	-	-	-	-	-	-	-	-	2	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	2	2

EN16601 **CAREER DEVELOPMENT LABORATORY II** **0 0 2 1**

COURSE OBJECTIVES

To enable students to

- understand their capabilities and enhance their grooming and showcasing his/her capabilities to a prospective employer
- provide opportunity for the students to become acquainted with corporate opportunities relevant to their academic learning
- articulate their thoughts on a given topic – in English and also to make decent write ups in English on any given topic
- practice and score well in Aptitude tests conducted by corporate / prospective employers
- Prepare for any group discussion evaluation or presenting their credentials during a face –toface interview leading to selection and employment
- become a knowledgeable person on the various evaluation processes leading to employment

UNIT I CORPORATE READINESS **6**

Business communication – Email, Paragraph, Letter Writing Skills - Public speaking skills : Rules of Public speaking skills; Extempore, JAM - Inter and intra personal skills : Introduction ; Need for Inter and Intra personal skills in organizations - Stress management : Causes of stress and its impact, How to manage and distress, Circle of control, stress busters - Emotional Intelligence : What is emotional Intelligence, Why Emotional Intelligence Matters, Managing Emotions,

UNIT II INTERVIEW SKILLS **6**

Interview Basics : General Selection process, Grooming, Dress code, Supporting Documents to carry - Resume Building : Impact of Powerful CV, Do"s and don"ts in CV - Group Discussion : Introduction to GD, Important of Listening and Speaking skills, Do"s and Don"t in GD - Face to face interview / Hire me: Rules for face to face interview, body language, Self Introduction - Psychometric Assessment : Importance of Psychometric assessment, Why psychometric assessment

UNIT III QUANTITATIVE APTITUDE **6**

Simplification - Time and work - Pipes and cisterns - Ratio and Proportion – Partnership

UNIT IV QUANTITATIVE APTITUDE **6**

Simple interest and Compound interest - Profit and loss - Permutation and combination Probability – Calendar

UNIT V LOGICAL AND VERBAL REASONING **6**

Seating arrangement – Direction - Arithmetic reasoning – Syllogisms - Making Judgments - Statements and conclusions - Matching definition - Cause and effect

TOTAL PERIODS 30

COURSE OUTCOMES

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

- demonstrate Aptitude & Reasoning Skills
- enhanceVerbal& Written Ability.
- improvehis/her Grooming and Presentation Skills.
- interacteffectively on any recent event/happenings/ current affairs.
- Be a knowledgeable person on the various evaluation processes leading to employment and face the same with Confidence.

REFERENCES

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2. Abhijit Guha, "Quantitative Aptitude ", Tata-Mc Graw hill.
3. "Word power made easy" by Norman Lewis, Wr.Goyalpublications.
4. Johnson, D.W. reaching out interpersonal effectiveness and self-actualization. boston: Allyn and Bacon
5. Agarwal, R.S. "Objective General English", S.Chand&Co
6. Infosys Campus Connect Program students" guide for soft skills.
7. Mitra,Barun. K, "Personalaity Development & Softskills", Oxford University

FT16151 MILLING TECHNOLOGY 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about the structure of grains
- understand the importance of milling of paddy
- know about the different types of milling of wheat
- learn about different milling techniques for corn and pulses
- learn about methods of milling of oil seeds

UNIT I STRUCTURE, STORAGE AND PEST MANAGEMENT OF GRAINS 9

Grains - Definition. Importance. Physical properties of grains. Structure, Composition and Nutritional value – paddy, wheat, maize, oat, sorghum. Grain storage systems - farm level storage, bagged storage, bulk storage, hermetic storage, outdoor storage. Losses during storage, Grain protection methods – physical and chemical methods. Integrated stored grain pest management.

UNIT II MILLING OF PADDY 9

type separator. Whitening – friction type and abrasive type whiteners. Color sorter. New quality control instruments Byproducts from rice milling.

UNIT III MILLING OF WHEAT 9

Types of wheat. Wheat milling – Simple and detailed flow sheet. Preparation of Wheat for Milling – wheat blending, tempering or conditioning, Roller milling – break rolls and reduction rolls, operation and corrugation specification, Sifting – Plan sifters, Purifying - purifier. Milling performance evaluation. Functional properties of flour. Flour treatment – Enrichment, Enhancement of flour appearance, Improvement of functional properties. By products from wheat milling.

UNIT IV MILLING OF CORN AND PULSES 9

Types of corn. Dry milling – Tempering, dehulling, degermination and milling. Wet milling – Steeping, Germ, fiber, starch and gluten separation, starch refinement. By products from corn milling. Legumes – Structure, Types, Nutritional and Anti-nutritional factors. Pulse Milling – Conditioning, Pitting, Oil/water treatment, drying, (CTAE) design, Schule design, CFTRI mini dhal mill, Husk separation and grading, Splitting – Equipments. Milling – Dry and wet milling, Dehulling efficiency

UNIT V MILLING OF OIL SEEDS 9

Types of Oil seeds. Oil seed processing - Mechanical extraction – Hydraulic press, Screw press, Filter press. Mechanical extraction of coconut oil and palm oil. Cold pressing and Hot Pressing. Solvent extraction – Flow sheet. Factors influencing extraction. Refining of oil – Degumming, Dewaxing, Neutralization, Bleaching, Filtration and Deodorization. Hydrogenation. Winterization. Oil seed flour concentrates and isolate.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- identify grain properties and recommend suitable storage structures against pest infestation
- adapt suitable parboiling and milling methods for paddy
- apply wheat milling process
- elaborate the process involved in corn and pulse milling
- choose suitable technologies for extraction and refining of oil

TEXT BOOKS

1. Chakraverty A., —Post-Harvest Technology of Cereals, Pulses and Oil Seeds‖, 3rd Edition, Oxford IBH Publishing Co. Pvt. Ltd., New Delhi, 2008.
2. Sahay K.M. and Singh K.K., —Unit Operations of Agricultural Processing‖, 2nd Edition, Vikas Publishing House, New Delhi, 2008.

REFERENCES

1. Chakraverty A., Mujumdar A.S., VijayaRaghavan G.S. and Ramaswamy H.S., —Handbook of Postharvest Technology - Cereals, Fruits, Vegetables, Tea, and Spices‖, Marcel Dekker, Inc., New York, 2003.
2. Kulp K. and Pont J.G., —Handbook of Cereal Science and Technology‖, 2nd Edition, Marcel Dekker, Inc., New York, 2000.
3. Richard D. O'Brien, —Fats and Oils: Formulating and Processing for Applications‖, 3rd Edition, CRC Press, London, 2008.

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CO3	2	2	2	-	2	-	3	-	-	1	2	-	2	3
CO4	2	-	2	-	2	-	3	-	-	2	2	-	3	3
CO5	-	-	2	-	2	-	3	-	-	2	2	-	2	2

FT16152 TECHNOLOGY OF FATS AND OILS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about the properties of oil and fats
- understand the importance of vegetable oil and fat production
- know about the different methods of solvent extraction and refining of oils
- learn about different kinds of edible oil, fat products and modification of oils
- learn about packaging and storage of oil

UNIT I PROPERTIES OF OILS AND FATS 9

Oils and fats – sources, composition. Nutritional importance of fats and oils. Physical properties of fats and oils - color, odour, consistency, melting point, flash point, smoke point. Chemical properties of fats and oils – iodine value, saponification value, free fatty acids, peroxide value.

UNIT II VEGETABLE OIL AND ANIMAL FAT PRODUCTION 9

Industrial production of oils- seed handling and storage. Preparation of seed for extraction of oil. Processing- peanut oil, rice bran oil, sunflower oil and soy bean oil. Production of cod liver oil. Method of extraction- cold pressing and hot pressing, Equipments- Filter press, hydraulic press. Production of margarine. Production of Lard.

UNIT III SOLVENT EXTRACTION AND REFINING OF OILS 9

Solvent extraction – prepress and direct extraction, removal and recovery of solvent from miscella and extracted residue. Physical refining, Chemical Refining, Degumming - types, dewaxing/winterization, bleaching – deodorizing, hydrogenation.

UNIT IV EDIBLE OIL, FAT PRODUCTS AND MODIFICATION OF OILS 9

substitutes and its types.

UNIT V PACKAGING AND STORAGE OF OIL 9

Changes during storage of oil. Role of fat or oil in frying. Selection of frying oil. Applications of frying oil. Rancidity - atmospheric oxidation and enzyme action. Quality standards of oil - Packaging of oils and fats.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- assess the physical and chemical properties of fats and oils.
- recommend suitable mechanical methods for oil extraction.
- apply solvent extraction and refining of oils.
- develop edible oil, fat products and modified oil.
- choose an appropriate package and storage for oils.

TEXT BOOKS

1. FereidoonShahidi, —Bailey's Industrial Oil and Fat Products‖, 6th Edition, Wiley - Interscience, New Jersey, 2005.
2. Richard D. O'Brien, —Fats and Oils: Formulating and Processing for Applications‖, 3rd Edition, CRC Press, London, 2010.

REFERENCES

1. Casimir C. Akoh and David B. Min, —Food Lipids: Chemistry, Nutrition and Biotechnology‖, CRC Press, USA, 2008.
2. Wolf Hamm and Richard J. Hamilton, —Edible Oil Processing‖, Wiley - Blackwell, UK, 2013.
3. Kanes K. Rajah, —Fats in Food Technology‖, Sheffield Academic Press, UK, 2002.

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

FT16153 **FOOD ADDITIVES AND NUTRACEUTICALS** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- learn about the different food additives
- understand the importance of food colors, emulsifiers and stabilizers
- know about the different safety regulation and quality standards
- learn about different nutraceutical products
- learn about role of health promotion and disease prevention.

UNIT I FOOD ADDITIVES 9

Definition; their function in food processing and preservation; Preservatives – definition; natural preservatives; chemical preservatives; acidulants and low pH –organic acids and esters; sulphur dioxide and its salts; nitrites; antibiotics; surface preservation; Permitted preservatives in foods –Antioxidants; natural and chemical antioxidants; mechanism of antioxidant function; primary and secondary antioxidants; sequestrants; selection and application of antioxidants in foods; evaluation of antioxidant effectiveness –permitted antioxidants in foods

UNIT II FOOD COLORS, EMULSIFIERS AND STABILIZERS 9

Natural and synthetic colors; fake colors; inorganic pigments; application of colors in food industry; restriction on the use of colors in foods. Flavoring agents –concept of flavors in foods; natural flavors; nature identical flavors; artificial flavoring substances; restrictions on the use of flavoring agents in Foods. Definition, properties of HLB value; function of emulsifiers and stabilizers in foods; permitted emulsifiers and stabilizers used in foods; polyols– physical and chemical properties of polyols, application in food industry, permitted polyols in foods

UNIT III SAFETY, REGULATION AND QUALITY STANDARDS 9

Safety limits of Food additives; Risk assessment and risk benefit Indices of human exposure, acute toxicity, mutagenicity and carcinogenicity, reproductive and developmental toxicity, teratogenicity, neurotoxicity and behavioral effect, immunotoxicity. Determination of the limit for addition – NOEL – Method of determining toxicity – LD50. FSSAI regulations and GRAS additives.

UNIT IV NUTRACEUTICALS 9

Introduction, definition and difference from nutrients. Plant and animal based nutraceuticals. Health benefits of antioxidants, Flavonoids, Omega-3 Fatty Acids, Carotenoids.Technologies to recover Nutraceuticals compounds: Distillation, ultrahydrostatic pressure treatment, dense carbon-di-oxide treatment, encapsulation of nutraceuticals – materials, mechanical processes and chemical based processes, nano encapsulation.

UNIT V ROLE IN HEALTH PROMOTION AND DISEASE PREVENTION 9

Nutraceuticals in prevention and treatment of gastrointestinal disorder, Cardiovascular and Chronic Diseases. End User Market Products - supplements forms- tablets, capsules, powders, soft gels, gel caps, liquids; Nutraceuticals currently available in the market, regulation for nutraceuticals.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- acquire insight on various food additives.
- choose suitable food colors, emulsifiers and stabilizers.
- identify the safety, regulations and quality standards of food additives.
- developnutraceutical products.
- infer the effect of Nutraceuticals in health promotion and disease prevention.

TEXT BOOKS

1. Belitz H.D., Grosch W. and Schieberle P., —Food Chemistry‖, 3rd Edition, Springer-Verley, Berlin, 2004.
2. Wildman, Robert E.C., —Handbook of Nutraceuticals and Functional Foods‖, 2nd Edition, CRC Press, New York, 2006.

REFERENCES

1. Clare M. Hasler, —Regulation of Functional Foods and Nutraceuticals: A Global Perspective‖, 1st Edition, Wiley, Chicago, 2008.
2. YashwantPathak, —Hand Book of Nutraceuticals‖, Volume 1, 1st Edition, CRC Press, USA, 2011.
3. Lockwood, Brian, and Rapport, Lisa, —Nutraceuticals: A Guide for Healthcare Professionals‖, 2nd Edition, Pharmaceutical Press, London, 2007.

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CO5	1	-	2	-	-	2	3	2	-	2	2	2	3	3

FT16154 **BIOPROCESS ENGINEERING** 3 0 0 3

COURSE OBJECTIVES

To enable students to

- learn about enzyme and its kinetics
- understand the importance of microbial strain improvement.
- know about the stoichiometry of cell growth and product formation
- learn about different kinds of fermentation and sterilization
- learn about bio-reactors.

UNIT I ENZYME 9

Introduction, Single and Multi-substrate reactions - mechanisms and kinetics; turnover number; Enzyme Inhibition and Kinetics- competitive, non-competitive and uncompetitive; Enzyme Immobilization – Physical and chemical methods.

UNIT II MICROBIAL STRAIN IMPROVEMENT 9

Media – composition, design, formulation and optimization. Microbial Strains: Isolation, cultivation and preservation techniques; strain selection and improvement - Recombinant DNA Techniques and Cloning Strategies

UNIT III STOICHIOMETRY OF CELL GROWTH AND PRODUCT FORMATION 9

Elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation.

UNIT IV FERMENTATION AND STERILIZATION 9

Batch, fed batch and continuous fermentation. Main parameters to be monitored and controlled in fermentation processes. Microbial growth kinetics model - Simple unstructured and Monod model. Sterilization methods, Thermal death kinetics of microorganisms, batch and continuous heat sterilization, filter sterilization

UNIT V BIOREACTORS 9

Basic configuration of bioreactor and ancillaries. Types of reactor- Air Lift Reactor, Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed and membrane reactors.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- interpret the kinetics of enzymatic reactions, enzyme inhibition and enzyme immobilization.
- demonstrate the microbial strain preservation and improvement techniques.
- perform the stoichiometric calculation of microbial growth and product formation.
- choose appropriate fermentation process and sterilization methods.
- classify and appraise the working of bio-reactors.

TEXT BOOKS

1. Trevor Palmer and Philip L.R. Bonner, —Enzymes: Biochemistry, Biotechnology, Clinical Chemistry‖, 2nd Edition, Woodhead Publishing, Cambridge, 2007.
2. Stanbury P.F., Whitaker A. and Hall S.J., —Principles of Fermentation Technology‖, 2nd Edition, Pergamon, USA, 1995.

REFERENCES

1. Shuler M.L. and Kargi F., —Bioprocess Engineering: Basic Concepts‖, 2nd Edition, PHI, New Delhi, 2002.
2. Najafpour, D. Ghasem, —Biochemical Engineering and Biotechnology‖, Elsevier, USA, 2007.
3. Michael J. Waites, Neil L. Morgan and Gary Higton, —Industrial Microbiology: An Introduction‖, Wiley-Blackwell, UK, 2001.

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OPEN ELECTIVE COURSES (OE)

FT16901 **FUNDAMENTALS OF FOOD PROCESSING** **3 0 0 3**

COURSE OBJECTIVES

To enable students to

- provide students with the knowledge of basic terminology and illustrate various aspects of food spoilage.
- develop understanding about food preservation and its methods.
- understand mechanism of heat transfer in food preservation using various drying methods.
- explain methods of preservation by using chemical additives and its role.
- equip students with knowledge and understanding of modern aspects of non-thermal food preserving techniques.

UNIT I FOOD PRESERVATION AND ITS METHODS 9

Sources, types and perishability of foods; Causes and types of food spoilage; Scope and benefit of food preservation, Methods of food preservation; Preservation by salt and sugar: Principle, method and effect on food quality

UNIT II PRESERVATION BY HEAT 9

Preservation by heat treatment: Principle and equipment for blanching, canning, pasteurization, sterilization, Preservation by use of low temperature: Principle, methods, equipment.

UNIT III PRESERVATION BY DRYING 9

Preservation by drying, dehydration and concentration: Principle, methods, equipment, Preservation by irradiation: Principle, methods, equipment

UNIT IV PRESERVATION BY CHEMICALS 9

Preservation by chemicals- antioxidants, mould inhibitors, antibodies, acidulants, Hurdle technology etc., Preservation by fermentation: Principles, methods, equipment;

UNIT V NON-THERMAL PRESERVATION 9

Nonthermal preservation processes: Principles, equipment –Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, etc.; Quality tests and shelf-life of preserved foods.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- summarize and critically discuss/ understand both fundamental and applied aspects of food technology.
- explain functions of specific methods in food preservation.

- identifying specific spoilage and apply principles from the various facets of food technology and related disciplines to solve practical as well as real-world problems.
- use current information technologies to locate and apply evidence-based guidelines and protocols.
- get imparted with critical thinking to take leadership roles in the field of food processing.

TEXT BOOKS

1. P. Fellows. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, oca Raton FL, USA.,
2. Norman N. Potter and Joseph H. Hotchkiss. 1995. Food Science, 5th Ed. Chapman & Hall, NY, USA.

REFERENCES

1. N. ShakuntalaManay, Foods Facts and Principles, new age international publishers,1 January 2008.
2. M. ShafiurRahman. 2007. Handbook of Food Preservation, 2nd Ed. CRC Press, Boca Raton, FL, USA.
3. Norman W. Desrosier and James N. Desrosier. 1977. The Technology of Food Preservation, 4 th Ed. AVI Publishing Co., Connecticut, USA.

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CO5	2	1	2	-	2	2	3	2	-	-	2	-	2	3

FT16902 FOOD CHEMISTRY OF MACRONUTRIENTS 3 0 0 3

COURSE OBJECTIVES

To enable students to

- provide an understanding of the chemical function and properties of major food components
- examine the basis of food chemistry-related issues in food
- gain knowledge about the protein structure and its effect during processing
- provide an understanding of the chemical interactions of food components and their effects
- familiarize the student with common analytical and experimental methods used in the study of the major food Components.

UNIT I WATER 9

Moisture in foods, role and type of water in foods, functional properties of water, water activity and sorption isotherm, molecular mobility and foods stability; Dispersed systems of foods: Physicochemical aspects of food dispersion system (Sol, gel, foam, emulations); Rheology of diphase systems.

UNIT II CARBOHYDRATES 9

Monosaccharaides, disaccharides and polysaccharides, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates.

UNIT III PROTEINS 9

Proteins in foods, Proteins and nutrition, Functional properties of proteins, Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein.

UNIT IV LIPIDS 9

Lipids in foods, Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, chemistry of frying technology of fat and oil; Oil processing: Refining, hydrogenations, inter esterification, use of oils and fats in food formulation; Enzymatic and chemical reactions of fats; Rancidity and its types, detection techniques, chemical aspects of lipids, antioxidants.

UNIT V ANALYSIS METHODS 9

Determination of crude protein by micro-Kjeldhal method, protein by spectrophometer method, Determination of fat content in food by Soxhelet method, Identification of acid value of fat/oil, saponification value fat/oil, Iodine number for fat/oil, Texture profile analysis of Food Samples.

TOTAL PERIODS 45

COURSE OUTCOMES

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

- understand and be able to control the major chemical and biochemical (enzymatic) reactions
- understand how the properties of different food components and interactions among these components modulate the specific quality attributes of food systems
- understand the principles that underlies the biochemical/enzymatic techniques used in food analysis efficiently apply the procedures to process different food ingredients

- influence food quality with emphasis on food industry applications
- understand the analysis method to determine the macronutrients in food and texture analysis of food samples

TEXT BOOKS

1. Chang Yong Lee and John M Deman and W Jeffrey Hurst and John W Finley. 2018. Principles of Food Chemistry, 4th Edition, Springer.
2. Owen R, Fennema. 1996. Food Chemistry, 3rd Ed. Marcel Dekker, Inc., New York, USA.

REFERENCES

1. Lillian Hoagland Meyer. 1974. Food Chemistry. The AVI Publishing Co Inc., Connecticut, MA, USA.
2. H.-D. Belitz, W. Grosch and P. Schieberle. 2009. Food Chemisry, 4th Ed. Springer-Verlag Berlin Heidelberg.
3. John W. Brady. 2013. Introductory Food Chemistry. Comstock Publishing Associates, Cornell University Press, Ithaca, USA.

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CO4	2	2	-	-	-	1	-	2	-	-	2	-	3	2
CO5	2	-	2	2	1	3	-	2	-	-	-	-	2	3