



**JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR**

## **SYLLABUS**

# **MASTER OF TECHNOLOGY (M.TECH.) IN FOOD TECHNOLOGY (FT)**

**DURATION – 2 YEARS ( 4 SEMESTERS)**

**SYLLABUS FOR:**

**I Year**

**FACULTY OF ENGINEERING & TECHNOLOGY**

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**M.Tech. Food Technology  
I-Semester**

<b>Nature of Course</b>	<b>Name of Course</b>	<b>C</b>	<b>T</b>	<b>D&amp;T</b>	<b>P</b>	<b>P.S.</b>
Core Food Technology	<b>Advances in Food Engineering</b>	7	6	1	0	0
	<b>Biostatistics</b>	9.6	6.5	2	0.6	0.5
	<b>Advances in Food Analysis</b>	9.5	6	1	1.5	1
	<b>Food Safety &amp; Quality Assurance</b>	9	5.5	1	1.5	1
	<b>Advances in Post Harvest Technology of Fruits &amp; Vegetables</b>	9	5.5	1	1.5	1
University Compulsory Course	Curriculum Training & Exposure	1	0	0	1	0
	Community Development Activities	1	0	0	1	0
University optional course	Professional activities	-	-	-	-	-
<b>Total Credits</b>		46.1	29.5	6	7.1	3.5

**Note:**

- **C** represents number of credit per course
- **T** represents number of theory credit per course
- **P** represents number of practical and per course
- **D & T** represents **Demonstration/Tutorial in the lecture hall**
- **P.S.** represents **Practice Session**

## Program Structure - I Year

1<sup>st</sup> Year consists of I, II Semester

<b>M.Tech. Food Technology I SEMESTER</b>					
Nature of Course	Course Name	C	T	D&T	P
	<b>Advances in Food Engineering I:</b> Overview of Food engineering	3	2.5	0.5	0
	<b>Advances in Food Engineering II:</b> Thermal Properties of Foods	3	2.5	0.5	0
	<b>Advances in Food Engineering III:</b> Frozen Properties of Foods	2.5	2.5	0	0
	<b>Advances in Food Analysis I:</b> Overview of Spectroscopy & Chromatography	3.5	2.5	0.5	0.5
	<b>Advances in Food Analysis II:</b> Overview of instrumentation	3.5	2.5	0.5	0.5
	<b>Advances in Food Analysis III:</b> Molecular Analysis	3.5	2.5	0.5	0.5
	<b>Food Safety &amp; Quality Assurance I:</b> Food Quality Management	3.5	2.5	0.5	0.5
	<b>Food Safety &amp; Quality Assurance II:</b> Indian Food Law & Regulations	3.5	2.5	0.5	0.5
	<b>Food Safety &amp; Quality Assurance III:</b> Food Adulteration	2	1.5	0	0.5
	<b>Advances in Post Harvest Technology of Fruits &amp; Vegetables I:</b> Production & Assessment of Fruit Quality	3	2	0.5	0.5
	<b>Advances in Post Harvest Technology of Fruits &amp; Vegetables II:</b> Advanced Harvesting & Post Harvesting Operations	3	2	0.5	0.5
	<b>Advances in Post Harvest Technology of Fruits &amp; Vegetables III:</b> Effects of Post Harvesting on Fruits & Vegetables	2	1.5	0	0.5
<b>Biostatistics</b>	Biostatistics I: Basics of Algebra & Probability	2.9	1.8	1	0.1

	Biostatistics II: Correlation, Regression & Sampling	3.2	2.2	0.5	0.5
	Biostatistics III: Vital Statistics & ANOVA	3	2.5	0.5	0
	<i>10 Practice session based on Unit-III in Computer Lab</i>	1	0	0	<b>10 sessions</b>
<b>University Compulsory Course</b>	Curriculum Training & Exposure	1	0	0	1
	<b>Community Development Activities</b>	1	0	0	1
<b>University optional course</b>	<b>Professional Activities</b>	-	-	-	-
<b>Total Credit</b>		<b>46.1</b>			

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- **P** represents number of practical and per course
- **D/T** represents Demonstration/Tutorial in the lecture hall



**M.Tech. Food Technology  
II-Semester**

<b>Nature of Course</b>	<b>Name of Course</b>	<b>C</b>	<b>T</b>	<b>D&amp;T</b>	<b>P</b>	<b>P.S.</b>
Core Food Technology	<b>Advanced Food Process Technology</b>	7	6	1	0	0
	<b>Advances in Cereal Science &amp; Technology</b>	8.5	6	0	1.5	1
	<b>Food Additives and Contaminants</b>	9	6	0.5	1.5	1
	<b>Technology of Frozen Foods</b>	8.5	5.5	0.5	1.5	1
	<b>Novel Food Packaging</b>	7.5	5.5	0	1.5	01
University Compulsory Course	<b>English communication</b>	2	2	0	0	0
	Curriculum Training and Exposure	1	0	0	1	0
	Community Development Activities	1	0	0	1	0
University optional course	Professional activities	-	-	-	-	-
<b>Total Credits</b>		44.5	31	2	8	4

**M.Tech. Food Technology II SEMESTER**

<b>Nature of Course</b>	<b>Course Name</b>	<b>C</b>	<b>T</b>	<b>D&amp;T</b>	<b>P</b>
Core Food Technology	<b>Advanced Food Process Technology I:</b> Membrane Technology & Supercritical Fluid Extration	2.5	2	0.5	0
	<b>Advanced Food Process Technology II:</b> Processing of Foods	2.5	2	0.5	0
	<b>Advanced Food Process Technology III:</b> Advanced Techniques in Food Processing	2	2	0	0
	<b>Advances in Cereal Science &amp; Technology I:</b> Status & Future of Cereal Grains in India	2.5	2	0	0.5
	<b>Advances in Cereal Science &amp; Technology II:</b> Advances in role of wheat proteins	2.5	2	0	0.5
	<b>Advances in Cereal Science &amp; Technology III:</b> Paddy, Rice & Barely varieties, their composition	2.5	2	0	0.5
	<b>Food Additives and Contaminants I:</b> Properties & Functions of Additives	2	2	0	0
	<b>Food Additives and Contaminants II:</b> Food contaminants	2.5	1.5	0	1
	<b>Food Additives and Contaminants III:</b> Food contaminants from industrial wastes	2.5	2	0	0.5
	<b>Technology of Frozen Foods I:</b> Active and intelligent packaging techniques		2	0	1
	<b>Technology of Frozen Foods II:</b> Overview of Cold Chain	2	1.5	0	0.5
<b>Technology of Frozen Foods III:</b> Quality & Safety of Frozen Foods	2.5	2	0	0.5	
University Compulsory Course	<b>English communication</b>	2	2	0	0
	Curriculum Training & Exposure	1	0	0	1
	<b>Community Development Activities</b>	1	0	0	1
University Compulsory Course	<b>Professional Activities</b>	-	-	-	-
	<b>Total</b>	44.5			

**Note:**

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- **T represents number of theory credit per course**
- **P represents number of practical and per course**
- **D/T represents Demonstration/Tutorial in the lecture hall**



## I Semester

### ADVANCES IN FOOD ENGINEERING

#### UNIT-I ((2.5-0.5-0) (D&T-0.5) (Overview of Food engineering)

Engineering properties of foods, their significance in equipment design. Constraints and need of innovation. Challenges for food engineering. Tools and concepts in process design microbial survivor curves, general method for process calculation. Sterilization of continuous flowing fluid.

Fluid flow handling systems for Newtonian liquids, force balance on a fluid element flowing in a pipe, derivation of Bernoulli equation. Measurement of viscosity, capillary tube viscometer. Flow characteristics of non Newtonian fluids. Properties of non-Newtonian fluids. Velocity profile of a power law. Pumps-characteristics, types and selection.

#### UNIT-II (1.5-0.5-0) (D&T-0.5) (Thermal Properties of Foods)

Thermal properties of foods. Steady state and unsteady state heat transfer: Conduction in multilayered systems. Estimation of convective heat-transfer coefficient. Forced and free convection. Estimation of overall heat-transfer coefficient. NTU method for designing heat changers. Design of a plate heat exchanger, Design of a tubular heat exchanger.

#### UNIT-III (2-0-0) (Frozen Properties of Foods)

Pressure-enthalpy charts. Frozen-food properties. Freezing point curves, phase diagrams, methods of freeze concentration, design problems. Freezing of foods, freeze concentration and drying, freezing time: plank's equation and Pham's method, theory of ultra-filtration and reverse osmosis, selection and types of membranes and properties, Properties of steam. Steam traps Methods of estimating steam consumption.

#### Recommended text books:

1. Rao, M. A., Rizvi, S. S. H. and Datta A.K. (2005). *Engineering Properties of Foods*: CRC Press.
2. Heldman, D. R. (2007). *Food Process Engineering*: AVI Publications.

#### Reference Books

1. Toledo, R. T. (1997). *Fundamentals of Food Process Engineering* (2 ed.): CBS Publications, New Delhi.
2. Rizvi, S. S. H. and Mittal, G. S. (1992). *Experimental Methods in Food Engineering*: Van Nostrand Reinhold.
3. Chanes J.W., Gustavo (2002) *Engineering and Food for the 21<sup>st</sup> Century* CRC Press.
4. Theodoros V.C., *Food Engineering Handbook* (2011) CRC Press

### ADVANCES IN FOOD ANALYSIS

#### UNIT-I (Overview of Spectroscopy & Chromatography) (2-0.5-0.5) (D&T-0.5)

##### (Theory 2)

Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometry, Fluorescence spectroscopy, Emission spectroscopy, Mass-spectroscopy, Fourier Transform Infra-Red.

Methods of separation and analysis of biochemical compounds and macromolecules: Principles and applications of Gas Chromatography, High Performance Liquid Chromatography, Thin layer chromatography.

##### (Practicals 0.5)

S.No.	Practicals	Credit
1	Determination of titratable acidity in foods using a potentiometric titration	0.2
2	Diastatic activity of honey, determination of hydroxymethylfurfural in honey	0.2
3	UV-Visible Spectro-photometric analysis of a carotenoid	0.1

#### UNIT-II (Overview of instrumentation) (2-0.5-0.5) (D&T-0.5)

##### (Theory 2)

Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy, particle size analysis, Thermal techniques in food analysis: Differential scanning calorimetry and Thermo gravimetric analysis.

##### (Practicals 0.5)

S.No.	Practicals	Credit
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1	thin layer chromatography (TLC) of food colors,	0.2
2	Microstructural and partical size analysis of starch	0.2
=3	Determination of thermal properties of food samples	0.1

### UNIT-III (2-0-0.5) (Molecular Analysis)

#### (Theory 2)

Electrophoresis: Different kinds of electrophoresis, western blotting, gel documentation, DNA analysis: DNA purification, PCR-based analysis, DNA fingerprinting.

#### (Practicals 0.5)

S.No.	Practicals	Credit
1	Extraction of different types of proteins and identification using electrophoresis	0.2
2	DNA Extraction of Plant Tissue	0.3

### Recommended text books:

1. Pare, J. R. J. and Bélanger, J. M. R. (2015). *Instrumental Methods of Food Analysis*: Elsevier
2. Pomeranz, Y. and Meloan, C. E. (1996). *Food Analysis: Theory and Practice* (3 ed.): CBS Publications, New Delhi

### Reference Books

1. Winton, A. L. (2001). *Techniques of Food Analysis*: Agrobios, Jodhpur.
2. Sharma, B. K. (1994). *Instrumental Methods of Chemical Analysis*: Krishna, Meerut.
3. Skoog, D. A., Holler, F. J. and Nieman, T. A. (1998). *Principles of Instrumental Analysis* (5 ed.): Harcourt, Singapore.
4. Gopalan, R., Subramanian, P. S. and Rangarajan, K. (2008). *Elements of Analytical Chemistry*: Sultan Chand & Sons

## FOOD SAFETY AND QUALITY ASSURANCE

### UNIT-I (Food Quality Management) (2-0.5-0.5) (D&T-0.5)

#### (Theory 2)

Sampling, specification, labeling, safety and quality assessment of fruits and vegetable, cereals, dairy products, meat, fish, poultry and processed food products, Sensory evaluation: Introduction, panel screening, selection methods, interaction and thresholds

Developments, objective and functions of food safety and quality assurance, Quality enhancement models, Statistical Quality Control for food industry, Food Quality Management Systems, implementation of quality control programmes, Quality control tools, Quality control charts for food plant sanitation, Food Safety Management Systems, Causes of failure of Food Safety Programs

#### (Practical 0.5)

S.No.	Practicals	Credit
1	Measurement of the water activity (aw) of raw and cooked food using Awmeter	0.1
2	Assessing the texture of raw and cooked food using penetrometer	0.1
3	Extraction of pigments from various fruits and vegetables and influence of heating time and pH	0.1
4	Performance of the sensitivity tests for four basic tests (Sweet, salty, sour and bitter)	0.1
5	Identification and ranking of food product attributes using Sensory evaluation scales (Hedonic rating, Ranking difference, Triangle test)	0.1

## UNIT-II (Indian Food Law & Regulations) (2-0.5-0.5) (D&T-0.5)

### (Theory 2)

Indian food laws and regulations, Food safety acts, Regulations for waste disposals, Codex alimentarius, ISO series, World Trade Organization, Food and Agricultural Organization, World Health Organization, Food safety and legislation in USA and Europe, Technical Barriers in Trade, Enforcers of food laws approval process for food additives, additives food labeling, Intellectual Property Right, HACCP and its application.

### (Practical 0.5)

S.No.	Practicals	Credit
1	Sensory evaluation of milk and detection of flavor defects in milk	0.2
2	Qualitative tests for fats and oils, spices and condiments	0.2
3	Determination of thermal properties of food samples	0.1

## UNIT-III (Food Adulteration) (1.5-0-0.5)

### (Theory 1.5)

Food adulteration: Types of adulterants, Common adulterants for foods like milk and milk products, honey, wheat flours, edible oils, cereals, condiments (whole and ground) pulses, coffee, tea, confectionery, baking powder, non-alcoholic beverages, vinegar, besan and curry powder

### (Practical 0.5)

S.No.	Practicals	Credit
1	Detection of adulteration in food products viz. honey, other sweetening agents, spices (whole and powder)	0.2
2	Detection of adulteration in food products viz. pulses, oils, cereals, sweets, tea, coffee	0.3

### Recommended text books:

1. Lawless, H. T. and Heymann, H. (2013). *Sensory Evaluation of Food: Principles and Practices*: Springer, New Delhi.
2. Shapton, D. A. and Shapton, N. F. (1993). *Principles and Practice for the Safe Processing of Foods*: Heinemann, Oxford.

### Reference Books

1. Schmidt, R. H. and Rodrick, G. E. (2003). *Food Safety Handbook*: John Wiley, New Jersey.
2. Rees, N. and Watson, D. (2000). *International Standards for Food Safety*: Aspen, America.
3. Anjaneyulu, Y. and Marayya, R. (2009). *Quality Assurance and Quality Management in Pharmaceutical Industry*: Pharma, Hyderabad.
4. Ho, S. K. M. (1999). *Operations and Quality Management*: ITP, London.

## ADVANCES IN POST-HARVEST TECHNOLOGY OF FRUITS AND VEGETABLES

### UNIT-I (Production & Assessment of Fruit Quality) (2-0.5-0.5) (D&T-0.5)

#### (Theory 2)

Fruit and vegetable production, classification, structure and composition; Importance and scope of post-harvest management of fruits and vegetables in Indian economy, Pre-harvest factors affecting post-harvest quality, post-harvest losses, Maturity indices and standards for selected fruits and vegetables, instrumental methods of maturity determination, standards and specifications for fresh fruits and vegetable, Assessment of Fruit Quality, advances in non-destructive quality measurement of fruits and vegetables.

#### (Practical 0.5)

S.No.	Practicals	Credit
1	Studies on morphological features of some selected	0.2

	fruits and vegetables, maturity indices and quality evaluation of fresh fruits	
2	physico-chemical analysis of fresh fruits	0.1
3	Effects of pre-cooling and types of storage on quality of fruits and vegetables	0.1
4	studies on use of chemicals for ripening and Studies of regulations of ripening of banana, mango, papaya	0.1

**UNIT-II (Advanced Harvesting & Post Harvesting Operations) (2-0.5-0.5) (D&T-0.5)  
(Theory 2)**

Advanced harvesting tools and their design aspects, advances in Post-Harvest Handling operations; Cleaning, washing of fruits and vegetables, types of cleaners, screens, types of screens, rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Sorting and grading: Sorting, grading, methods of grading, Size grading, color grading, specific gravity grading, screening, equipment for grading of fruits and vegetables, grading efficiency, care and maintenance, Separation: Magnetic separator, de stoners, electrostatic separators, pneumatic separators.

**(Practical 0.5)**

S.No.	Practicals	Credit
1	Effects of pre-processing treatments on shelf-life of fruit, edible coating, preparation of fruit juice concentrate powders and their quality evaluation	0.2
2	estimation of browning and various pigments in pulp and products	0.2
3	estimation of chemical additives in processed fruit products	0.1

**UNIT-III (Effects of Post Harvesting on Fruits & Vegetables) (1.5-0-0.5)  
(Theory 1.5)**

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits; changes during ripening; Role of ethylene in fruit ripening, ripening chambers, Field heat of fruits and vegetables and primary processing operations Post harvest treatments, advances in pre-cooling, equipment Commodity pretreatments-chemicals, types of coating, pre-packaging, irradiation, blanching, peeling and other pre-processing operations; transportation and storage operations, Mechanism and Advances in CA and MA, hypobaric storage, cold storage design, Zero energy cool chamber  
Post-harvest disorders chilling injury and diseases, Biological, Physical and Chemical Control of postharvest Diseases, advances in drying and packaging of fruits and vegetables, cushioning materials used in packaging of fresh fruits, Minimal processing.

**(Practical 0.5)**

S.No.	Practicals	Credit
1	dehydration of fruits and measurements of dehydration and rehydration ratio	0.3
2	Studies on minimal processing of fruits.	0.2

**Recommended text books:**

- Haard, N.F. and Salunkhe, D.K. (1975). *Postharvest Biology and Handling of Fruits and Vegetable*: AVI, Westport.
- Kader, A. A. (1992). *Post-harvest Technology of Horticultural Crops*, (2ed.): University of California, Division of Agriculture and National Resources, California.

**Reference Books**

- Salunkhe, D.K. and Kadam, S.S. (2005). *Handbook of Fruit Science and technology, Production, Composition, Storage, and Processing*: Marcel Dekker, USA.
- Thompson, A.K. 1995. *Post-Harvest Technology of Fruits and Vegetables*: Blackwell publication.

5. Wills-Ron B.H. and Golding, J.B. (2015). *Advances in Postharvest Fruit and Vegetable Technology*: Taylor and Francis, CRC Press.
6. Siddiqui, M. W., (2015). *Post-Harvest Biology and Technology of Horticultural Crops: Principles and Practices for Quality Maintenance*: Apple Academic Press Inc.

## **Biostatistics**

### **UNIT I (Basics of Algebra & Probability) (1.8 -0.1)**

#### **Theory (1.8 Credits) (D&T-1)**

Laws of indices, Trigonometric Ratios, Arithmetic Progression, Geometric Progressions, and Harmonic progression (General term and sum), Logarithms, Elementary Differentiation and Integration. Descriptive Statistics (averages, dispersion), Elementary Probability theory, Probability Distribution: Poisson distributions and their applications in biology, Gaussian probability models.

### **UNIT II (Correlation, Regression & Sampling) (2.2 --0.5)**

#### **Theory (2.5 Credits) (D&T-0.5)**

Classification and tabulation of data, Frequency distribution, Histogram, Frequency polygon and frequency curve, cumulative frequency curves, Measures of central tendency: mean, median, mode; Measures of dispersion: range, quartile deviation, mean deviation, variance and standard deviation. Correlation: Positive and negative correlation and calculation of Karl Pearson's coefficient of correlation. Regression: Linear regression equations and Prediction of an unknown variable using regression equation. Sampling: concept of population and sample, Sampling distribution and standard error. Hypotheses testing: null and alternative hypothesis, Type I and Type II errors, test of significance, test for proportions, Small sample test, T-test, Chi-square test, goodness of fit test and homogeneity of samples, F-test.

#### **Practicals: (0.5credits)**

<b>Sr. no.</b>	<b>Name of practical</b>	<b>Nature</b>	<b>Credit</b>	<b>P.S</b>
1	To find out Mean	Practical/ Practice	0.2	0.2
2	To find out Median	Practical/ Practice	0.2	0.2
3	To find out Mode	Practical/ Practice	0.1	0.1

### **UNIT III (Vital Statistics & ANOVA) (2.5-0)**

#### **Theory (2.5 Credits) (D&T-0.5)**

Concept and Importance of Vital statistics, Vital Index, Death Rates: Crude death rate, Specific death rate, Standardized death rate, Life Tables, Method of construction of life tables, and their

applications, Birth rates: Crude birth rate, specific birth rate, general fertility rate, and Total fertility rate. ANOVA: one way and two way analysis of variance, Design of experiments. Use of statistical packages for data analysis (SPSS).

**Text Books:**

1. Elements of Mathematical Statistics; S.C. Gupta and V.K. Kapur; Sultan Chand & Sons, New Delhi
2. Elements of Biostatistics; S. Prasad; Rastogi Publications, Meerut

**Suggested Readings:**

1. Basic Statistics:-B.L.Agarwal
2. Principles and Procedure of Statistics:-A Biometrical Approach:-R.G.D. Steel and J.H.torrie
3. Fundamentals of Applied Statistics, S.C. Gupta and V.K. Kapur; Sultan Chand & Sons, New De

## II Semester

### ADVANCED FOOD PROCESS TECHNOLOGY

#### UNIT-I (Membrane Technology & Supercritical Fluid Extraction) (2-0.5-0) (D&T-0.5)

Membrane Technology: Introduction to pressure activated membrane processes, RO/UF/NF applications and technology, Food Irradiation: radiation sources, absorbed dose, regulations, advantage and limitations of food irradiation - nutritional and microbiological changes in irradiated foods.

Supercritical Fluid Extraction: Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application, Microwave Energy in Foods: working principle of magnetron, microwave blanching, sterilization and finish drying, Ohmic and Ultrasound Processing of Foods: Principle of ultrasound – fundamentals – ultrasound as a processing and preservation method – Effect on properties of foods, Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonic as an analytical tool and processing techniques, Basics of ohmic heating, electrical conductivity- generic configurations- treatment of products.

#### UNIT-II (Processing of Foods) (2-0.5-0) (D&T-0.5)

High Pressure Processing of Foods: Principles and concept – applications to food systems effect on quality, textural, Nutritional and microbiological quality – factors affecting the quality, applications in food processing, Pulsed Electric field Processing of Food (PEF): Principles Mechanism of action-PEF treatment systems, main processing parameters – PEF Technology – equipments – mechanism of microbial and enzyme inactivation- safety aspects – processing of liquid foods using PEF – process models – comparison of high pressure processing and PEF – Enzymatic inactivation by PEF, examples – microbiological and chemical safety of PEF foods, Oscillating magnetic field.

#### UNIT-III (Advanced Techniques in Food Processing) (2-0-0)

Hurdle Technology: Concept, chemical and biochemical hurdles- organic acids – plant derived antimicrobials, Antimicrobial enzymes, bacteriocin, applications of hurdle technology, Advanced Techniques in Food Processing: Application of technologies of high intensity light, Nanotechnology: Principles and mechanism Radio-frequency heating and drying applications; Hybrid drying technologies- combined microwave vacuum drying, combining microwave vacuum drying with other processes.

#### Recommended text books:

1. Sun, Da-Wen (2005). *Emerging Technologies for Food Processing*: Academic Press.

#### Reference Books

2. Barbosa- Canovas, G. V., Tapia, M. S. and Cano, M. P. (2004). *Novel Food Processing Technologies*: CRC Press.
3. Leistner L. and Gould G. (2002). *Hurdle Technologies – Combination Treatments for Food Stability, Safety and Quality*: Kluwer Academics /Plenum Publishers, New York.

### ADVANCES IN CEREAL SCIENCE AND TECHNOLOGY

#### UNIT-I (Status & Future of Cereal Grains in India) (2-0-0.5)

Present status and future prospects of cereal grains in India, food grain production and consumption trends. Coarse grain processing. Wheat kernel structure, wheat grading, roller flour milling, influence of wheat type and grain quality on flour yield, grain hardness and its relevance to end product quality, advances in wheat cleaning, conditioning and milling, wheat flour component interactions (protein-starch, protein-lipid and starch-lipid) and their influence on end product quality, advances in isolation, biochemical characterization, micro-structural and functionality of wheat gluten proteins.

#### (Practical 0.5)

S.No.	Practicals	Credit
1	Grading of wheat varieties, milling quality of hard and soft wheat varieties	0.2
2	effect of conditioning on the flour extraction rates	0.1
3	effect of grains parameters on the flour yield and quality	0.1

4	quality assessment of wheat gluten	0.1
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### UNIT-II (Advances in role of wheat proteins) (2-0-0.5)

Advances in role of wheat proteins in dough and gluten visco-elasticity, micro-structure of dough, conversion of dough foam structure to bread sponge structure during bread baking, concept of gas retention in wheat dough during fermentation and baking, advances in bread making processes, effect of wheat components and ingredients on the growth of yeast during fermentation operation, bread staling and its prevention, production of variety biscuits, breads and pasta products.

#### (Practical 0.5)

S.No.	Practicals	Credit
1	damaged starch and bread flour quality	0.2
2	effect of damaged starch of flour on biscuit quality	0.1
3	factors affecting water absorption of wheat flour	0.1
4	effect of ingredients and processing parameters of yeast growth	0.1

### UNIT-III (Paddy, Rice & Barely varieties, their composition) (2-0-0.5)

Paddy varieties, their composition and quality characteristics, advances in methods of paddy parboiling, advantages and limitation of parboiling, paddy dehusking processes, Rice ageing, accelerated ageing, modern rice milling, factors affecting head rice yields and losses at different stages of milling, rice mill machinery, Rice based products and their quality. Methods of rice bran oil extraction and refining.

Dry and wet milling of maize, modern methods of maize processing, gluten and starch separation, maize starch conversion into value added products, acid hydrolysis, enzyme hydrolysis, processing for dextrose, malto-dextrin and other products, Barley varieties, composition and quality characteristics, malting process and industrial applications of barley malt and malt products.

#### (Practical 0.5)

S.No.	Practicals	Credit
1	assessment of dough rheology using doughLab and mixolab, bread, biscuits, noodles making potential of different wheat flours	0.3
2	quality assessment of bakery products	0.2

### Recommended text books:

1. Kulp K. & Ponte J. G. (2014). *Handbook of Cereal Science & Technology*, 2<sup>nd</sup> edition: CRC press.

### Reference Books

2. Wrigley C.W. & Batey I. L. (2010). *Cereal grains, assessing and managing quality*, CRC press.
3. Dendy D. A. V. & Dobsasoczky B. J. (2001). *Cereal and Cereal Products, Chemistry and Technology: An ASPEN publication*.
4. Owens G. (2000). *Cereal Processing Technology*: CRC Press.
5. Faridi H. & Faubin J. M. (1997). *Dough Rheology & Baked product Texture*: CBS Publishers.

### NOVEL FOOD PACKAGING

#### UNIT-I (Active and intelligent packaging techniques) (2-0-0)

##### (Theory 2)

Active and intelligent packaging techniques, oxygen, ethylene and other scavengers: Oxygen scavenging technology, selection of right type of oxygen scavengers, ethylene scavenging technology, carbon dioxide and other scavengers, antimicrobial food packaging, antimicrobial packaging system, effectiveness of antimicrobial packaging.

Advantages of non-migratory bioactive polymers, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds, defining and classifying time temperature indicators (TTIs), requirements for TTIs, development of TTIs, maximizing the effectiveness of TTIs to



monitor shelf-life during distribution, use of freshness indicator in packaging: Compounds indicating the quality of packaged food products, pathogen indicators, moisture regulation: Silica gel, clay, molecular sieve, humectants, irreversible adsorption.

**UNIT-II (Modified atmosphere packaging) (1.5-0-1)**

**(Theory 2)**

Developments in modified atmosphere packaging (MAP): Novel MAP applications for fresh-prepared produce, novel MAP gases, testing novel MAP applications, Applying high O<sub>2</sub> MAP. Combining MAP with other preservation techniques, packaging-flavour interactions: Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials.

**(Practical 1)**

S.No.	Practicals	Credit
1	Testing of properties of different packaging materials (paper, plastic, glass and metal)	0.4
2	Study of symbols and labels used on food packages	0.2
3	Vacuum packaging, form-fill- seal packaging	0.2
4	Determination of changes in packaged foods	0.2

**UNIT-III (Modern packaging systems) (2-0-0.5)**

**(Theory 2)**

Modern packaging systems: Green plastics for food packaging, problem of plastic packaging waste, range of biopolymers, developing novel biodegradable materials, Integrating intelligent packaging: role of packaging in the supply chain, creating integrated packaging, storage and distribution: alarm systems and time temperature indicators, traceability: radio frequency identification, recycling packaging materials: recyclability of packaging plastics, improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, using recycled plastics in packaging, methods for testing consumer responses to new packaging concepts.

**(Practical 0.5)**

S.No.	Practicals	Credit
1	Packaging of foods under different conditions	0.2
2	Preparation and application of edible coatings	0.1
3	Comparative evaluation of different packages for fragile foods	0.1
4	Estimation of shelf life of food under different packaging materials	0.1

**Recommended text books:**

1. Jung, H. H. (2014). *Innovations in Food Packaging*: Oxford, London.

**Reference Books**

2. Ahvenainen. R. (2003). *Novel Food Packaging Techniques*:CRC Publications.
3. Robertson, G. L. (2010). *Food Packaging and Shelf Life*: CRC Publications, New York.
4. Robertson, G. L. (2006). *Food Packaging: Principles and Practice* (2 ed.): CRC Publications, Boca Raton.

**FOOD ADDITIVES AND CONTAMINANTS**

**UNIT-I (Properties & Functions of Additives) (2-0-0)**

**(Theory 2)**

Additives in food processing and preservation: Classification, need, properties, functions and safety, quality evaluation of additives, Food labeling, Laws and regulations for food additives

Chemistry, uses and functions: Chemical preservative, bio-preservatives, fortification, antioxidants, emulsifiers, humectants, stabilizers, chelating agents, pH control agents and acidulants, texturizing agents, plasticizers, flavor enhancers, enzymes, coloring agents, sweeteners, flavoring agents

**UNIT-II (Food contaminants) (1.5-0-1)**

**(Theory 2)**

Food contaminants: biological, chemical, physical and environmental contaminants, Inorganic and organometallic food contaminants, Sources and their impact on human health

**(Practical 1)**

S.No.	Practicals	Credit
1	Detection of non-permitted food additives in market food samples, sweets, ice-creams and beverages products	0.4
2	estimation of antioxidants	0.2
3	Estimation of residual sulphur dioxide in beverages	0.2
4	Estimation of benzoic acid in tomato sauce and fruit beverage	0.2

**UNIT-III (Food contaminants from industrial wastes) (2-0-0.5)****(Theory 2)**

Food contaminants from industrial wastes: Heavy metals, polychlorinated polyphenyls, dioxins, Toxicants formed during food processing polycyclic aromatic hydrocarbons, nitrosamines, veterinary drug residues and melamine contaminations, Pesticide residues in food

**(Practical 0.5)**

S.No.	Practicals	Credit
1	Analysis of edible common salt for moisture content and total chlorides	0.2
2	Identification of natural colors, Isolation and estimation of synthetic food colors	0.1
3	Estimation of contaminants, chemical residues and aflatoxins, pesticides and heavy metals contaminants in foods	0.1
4	Estimation of pesticide residues in food/water	0.1

**Recommended text books:**

1. Branen, A. L., Davidson, P. M. and Salminen, S. (2002). *Food Additives*: Marcel Dekker, New York.

**Reference Books**

2. Wood, R., Foster, L., Damant, A. and Pauline, K. (2004). *Analytical Methods for Food Additives*: Boca Raton, New York.
3. Watson, D. H. (2014). *Food Chemical Safety: Additives*: WP, New Delhi.
4. Steinhart, E., Doyle, M. E. and Cochrane, B. A. (1995). *Food Microbiology and Toxicology*: Marcel Dekker, New York.

**TECHNOLOGY OF FROZEN FOODS****UNIT-I (Freezing of Foods)(2-0-1)****(Theory 2)**

Food freezing :importance and potentialities, nutritive values of frozen foods, Microbiology of frozen foods , Freezing methods and equipment, sharp freezers the Quick freezing systems –Freezing cabinets and walk in freezers, Frozen food locker plants, Glass transitions in frozen foods and biomaterials, Thermo-physical properties of frozen foods, Freezing loads and Freezing time calculation, Innovations in freezing process.

**(Practical 0.5)**

S.No.	Practicals	Credit
1	Determination of effective freezing time, cooling and half cooling time	0.4
2	Quality evaluation of frozen foods, mechanism and driving force for freezer burn, adequacy of thawing	0.2
3	Standardization of procedure for preparation of frozen peas and corn	0.2
4	Frozen food packaging and shelf –life evaluation	0.2

**UNIT-II (Overview of Cold Chain) (1.5-0-0.5)**

Cold Chain: Cold store design and maintenance, Packaging and machineries, Transportation, Retail display equipments and management, Household refrigerators and freezers, Monitoring and control of the cold chain, Cold storage and thawing of foods – Adaptability of vegetables to freezing, preparation and freezing of meat, poultry and fish, freezing of Dairy products, precooked frozen foods, storage of frozen food.

**(Practical 0.5)**

S.No.	Practicals	Credit
1	Tests of adequacy of blanching of raw material before freezing	0.2
2	Mineral impurities in frozen vegetables	0.1
3	Color grading of fresh and frozen fruit juices	0.1
4	Packaging of frozen food	0.1

**UNIT-III (Quality & Safety of Frozen Foods) (2-0.5-0) (D&T 0.5)**

**(Theory 2)**

Quality and Safety of Frozen Foods: Importance of quality control and standards in the frozen food industries, Quality and safety of frozen meat and meat products, frozen fish, Shellfish, and related products, frozen vegetables, frozen fruits, frozen dairy products, frozen ready meals, frozen bakery products, frozen eggs and egg products, Sensory analysis of frozen foods, Monitoring and Measuring Techniques for Quality and Safety, Chemical Measurements, Food borne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods.

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

**Recommended text books:**

1. Sun, Da-Wen (2012). *Handbook of Frozen Food Processing and Packaging*: Taylor & Francis, United State of America.

**Reference Books**

2. Kennedy, C. J. (2000). *Managing Frozen Foods*: CRC Press, New York.
3. Potter, S. (2006). *Food Science*: Sage, New Delhi.

# *ENGLISH COMMUNICATION*

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## *SYLLABUS*

**Objective:** To enable students to develop Four major skills Reading, Writing, Speaking and Listening in relevance to English culture according to time and venue.

### **Unit 1: Reading and Listening**

- Types of passages, purpose of reading, reading strategies, vocabulary building, antonyms and synonyms and one-word substitution etc.
- Role of Listening, Barriers of Listening, Remedies to remove the barriers. Listening to Narratives, Listening to specific information or data, listening to Conversational contexts etc.

### **Unit 2: Writing and Speaking**

- Subject- Verb Concord, Sentence Pattern (SVOCA), Time and Tenses. Different Letter Writing Formats: Application, Cover Letter, Notice, Report etc. Resume Building.
- Introduction to the sounds of English-Vowels, Diphthongs and Consonants phonetic sounds, Introduction to Stress and Intonation, Situational Dialogues / Role Play 'Just a minute' Sessions (JAM), action verbs (play way method), Describing Objects/ Situations/ People (personality), Debates (current topics), Turn Coat, Telephonic Conversation.

### **Recommended Books:**

- Phonetics by Peter Roach, Oxford University Press 2004.
- Better English Pronunciation by J.D.O'Connor, OUP 2010.
- Accents of English by J.C.Wells, Cambridge University Press.
- English Grammar Today with CD: An A-Z of Spoken and Written
- Grammar by Ronald Carter, Michael Mac Carthy, Geraldine Mark
- Anne O'Keeffe, Cambridge University Press, 2009.
- Alred, Gerald J. . The Business Writers Handbook. 9th ed. Boston:

- Bedford/St. Martins, 2009.
- Geeta Jajivan, Kiranmai: Course Listening and Speaking Skills part 1. Foundation Books Pvt Ltd.
- Lorven: Enrich Your Communication in English