# GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY
## SECTOR – 16 C, DWARKA, NEW DELHI - 110078

GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

## SIXTIETH (60th) MEETING
## OF
## THE ACADEMIC COUNCIL

**DATE : 11.06.2025**
**TIME : 11:00 AM**

## OFFLINE / ONLINE ON ZOOM PLATFORM

# MINUTES

The Academic Council ratified the agenda item, as reported.

**Agenda Item No. AC 60.29:** **To consider and approve the Scheme and Syllabus of M.Tech (Food Processing Technology) Programme, as per NEP, w.e.f. Academic Session 2025-26.**

The Academic Council considered and approved the agenda item, as proposed.

**Agenda Item No. AC 60.30:** **To consider and approve minor changes in the approved Scheme of M.Tech (Industrial Biotechnology) alongwith total credits & minimum credits requirement for award of degree.**

The Academic Council considered and approved the agenda item, as proposed.

**Agenda Item No. AC 60.31:** **To ratify the syllabus of Common Entrance Test (CET) for the programmes offered by University School of Environment Management w.e.f. Academic Session 2025-26.**

The Academic Council ratified the agenda item, as reported.

**Agenda Item No. AC 60.32:** **Opting of CET-2025 in addition to CUET and Merit based on last qualified examination for admission to M.Sc. (Environment Management), B.Sc. (Environmental Science) and PG in Applied Geoinformatics programmes offered by USEM w.e.f. Academic Session 2025-26.**

The Academic Council ratified the agenda item, as reported.

**Agenda Item No. AC 60.33:** **To ratify start of a new PG Programme in Applied Geoinformatics alongwith Eligibility and Admission Criteria, CUET mapping, seat intake and Scheme and Syllabus w.e.f. Admission Session 2025-26.**

The Academic Council ratified the agenda item, as reported.

# SCHEME OF EXAMINATION
## As per NEP

## for

# Masters of Technology
# (Food Processing Technology)
## 2025 onwards

**UNIVERSITY SCHOOL OF BIOTECHNOLOGY**
GGS INDRAPRASTHA UNIVERSITY
Sector 16C, Dwarka, New Delhi - 110078

# Masters of Technology (Food Processing Technology)

## Scheme as per NEP 2025

## Semester 1

| Course type | Course code | Course name | L | P | Credits |
|---|---|---|---|---|---|
| **Discipline Core** | | | | | **4*3=12** |
| | FPT-501 | Technology of Functional Foods and Nutraceuticals | 3 | | 3 |
| | FPT-503 | Advances in Food Chemistry and Microbiology | 3 | | 3 |
| | FPT-505 | Food Safety and Quality Assurance | 3 | | 3 |
| | MBT-517 | Research Methodology and IPR | 3 | | 3 |
| **Discipline Elective (Select any 2)** | | | | | **3*2=6** |
| | FPT-507 | Utilization of Food Industry Waste | 3 | | 3 |
| | FPT-509 | Advances in Animal Based Food Products | 3 | | 3 |
| | FPT-511 | Advances in Fruits and Vegetable Processing Technology | 3 | | 3 |
| | FPT-513 | Food Enzymes Technology | 3 | | 3 |
| | FPT-515 | Food Processing Engineering | 3 | | 3 |
| **Skill Enhancement** | | | | | **4** |
| | FPT-591 | Advances in Food Chemistry and Microbiology | | 4 | 2 |
| | FPT-593 | Industrial Visit | | | 2 |
| **Open Elective (Select any 1)** | | | | | **4*1=4** |
| | MS-101 | Management Process and Organisational Behaviour (USMS) | 4 | | 4 |
| | GEN 101 | Research Methods and Legal Writing (USLLS) | 4 | | 4 |
| | IPR-107 | Nature, Emergence and Development of IPR (USLLS) | 4 | | 4 |
| | EM -609 | Energy Resource and Technology (USEM) | 4 | | 4 |
| | EM-701 | EIA & Risk Analysis (USEM) | 4 | | 4 |
| | MBT-519 | Industrial Biotechnology (USBT) | 4 | | 4 |
| | MBT-521 | Industrial Safety (USBT) | 4 | | 4 |
| | FPT-517 | Traditional Indian & Ethnic Foods (USBT) | 4 | | 4 |
| | FPT-519 | Advances in Cereal and Pulses Processing Technology (USBT) | 4 | | 4 |
| **Total** | | | | | **26** |

## Semester 2

| Course type | Course code | Course name | L | P | Credits |
|---|---|---|---|---|---|
| **Discipline Core** | | | | | **4*3=12** |
| | FPT-502 | Advance Techniques in Food Processing | 3 | | 3 |
| | FPT-504 | Advances in Food Packaging | 3 | | 3 |
| | FPT-506 | Advances in Food Analysis | 3 | | 3 |
| | FPT-508 | Post Harvest Food Technology and Management | 3 | | 3 |
| **Discipline Elective (Select any 2)** | | | | | **3*2=6** |
| | FPT-510 | Food Product Development and Entrepreneurship | 3 | | 3 |
| | FPT-512 | Nutrition and Dietetics | 3 | | 3 |
| | FPT-514 | Oils and Fat Technology | 3 | | 3 |
| | FPT -516 | Fermentation Technology | 3 | | 3 |
| **Skill Enhancement** | | | | | **4** |
| | FT-592 | Advances in Food Analysis Lab | | 4 | 2 |
| | FT-594 | Seminar | | | 2 |
| **Open Elective (Select any 1)** | | | | | **4*1=4** |
| | IPR-102 | Law of Patents (USLLS) | 4 | | 4 |
| | MS-102 | Management of Technology, Innovation and Change (USMS) | 4 | | 4 |
| | IPR-106 | Law of Designs, Layout Designs and Geographical Indications (USLLS) | 4 | | 4 |
| | EM-602 | Air Pollution , Meteorology and Control (USEM) | 4 | | 4 |
| | MBT-526 | Biotic and Abiotic Stress Biology (USBT) | 4 | | 4 |
| | MBT-528 | Biosafety, Bioethics and IPR (USBT) | 4 | | 4 |
| | FPT-518 | Food Biotechnology (USBT) | 4 | | 4 |
| | FPT-520 | Bakery and Confectionary Technology (USBT) | 4 | | 4 |
| **Total** | | | | | **26** |

## Semester 3

| Course type | Course code | Course name | L | P | Credits |
|---|---|---|---|---|---|
| Project Work | FPT-691 | Seminar* | | | 2 |
| | FPT-693 | Minor Project | | | 10 |
| Total | | | | | 12 |

* NUES

## Semester 4

| Course type | Course code | Course name | L | P | Credits |
|---|---|---|---|---|---|
| Project Work | FPT-692 | Major Project | | | 14 |
| Total | | | | | 14 |

**Credits distribution**

| Course Type | Sem 1 | Sem 2 | Sem 3 | Sem 4 | Credits |
|---|---|---|---|---|---|
| Discipline Core | 12 | 12 | | | 24 |
| Discipline Elective | 6 | 6 | | | 12 |
| Project | | | 12 | 14 | 26 |
| Skill Enhancement | 4 | 4 | | | 8 |
| Open Elective | 4 | 4 | | | 8 |
| Total | 26 | 26 | 12 | 14 | 78 |

**Note:**

- **The minimum number of credits required to obtain the M.Tech. Degree in Food Processing Technology is (70 credits) must include all of the core subjects (Theory & Lab), Seminar and Dissertation.**
- **Credits and Subjects code needs to be updated.**
- **The credits included in the Syllabi and Scheme of Teaching and Examination of a programme shall generally be 5 – 10% more than such minimum specified credits, subject to prescribed guidelines of the concerned statutory or regulatory authority, if any.**

M.Tech.

# Syllabus for
# M. Tech (Food Processing Technology)
# [As per NEP]


**AUGUST 2025 ONWARDS**

**UNIVERSITY SCHOOL OF BIOTECHNOLOGY**
**GGS INDRAPRASTHA UNIVERSITY**
**DWARKA, DELHI – 110078**

| FPT-501 | Technology of Functional Foods and Nutraceuticals | 3-1-0 |
|---|---|---|

**Course Objectives:**

- Aims to provide students with a comprehensive understanding of these products, their health benefits, and the technologies used in their production.
- The course will typically cover topics like the concept of functional foods and nutraceuticals, their chemical nature, and the role they play in health and disease prevention.

**Course Outcomes:**

Students will be able to understand:

- Knowledge of developing and applying processing techniques in nutraceutical production, as well as understanding the concepts of nutraceuticals and functional foods.
- Role of nutraceuticals and functional foods in managing chronic diseases, the sources of these foods, and the marketing and regulatory aspects of the industry.

**SYLLABUS**

1. Biotechnology for the production of plant based functional foods (Biofortification with essential micronutrients, phytochemicals, modification of macronutrients); production of hypoallergenic foods; reduction of antinutrients. Biotechnology for the production of animal based functional foods (meat products, dairy foods).

2. Improving the bioavailability of polyphenols (bioavailability of flavanoid, factors affecting bioavailability, statergy to improve bioavailability of flavnoids). Function of next generation polyphenol "Oligonol".

3. Increased production of nutriments by genetically engineered bacteria (glutathione, Ala-Gln, Hydroxyproline, Hyaluronic Acid, N-Acitileglucosaamine, cystidine 5-Diphosphate Choline). Improved and enhancement of phyto ingredients using new technology of genetic re-combination.

4. Pro-biotics & Pre-biotics Health benefits, Efficacy & Safety. Designers food, specialty foods, substitutes (e.g. Milk replacers, low sodium slat, sugarless sweet meats, food for sports, geriatric). Nutraceuticals with reference to Indian Context and Ayurveda.

5. Solubility and Product Recovery in super critical fluid separation process. Super fluid technology for extraction of bio active components.

6. Dehydration technologies to retain bio-active components (artificial drying, drug drying, spray

drying, freeze drying, vacuum drying, micro-wave vacuum drying, membrane seperation technology in processing bioactive components (preconcentration, fractionation, hybrid process, new membrane processes).

7. Packaging technologies for functional foods: fruits & vegetables (processed plant products, flesh plant products), probiotics (yogurt, dried cultures), intermediate moisture products, oils and fats, choice of packaging materials. Active packaging.Microencapsulation and nano emulsion technology for delivery of nutraceuticals and functional foods.

8. Application of nanotechnology to functional foods and nutraceuticals to enhance their bioactivities: nanonisation of functional foods and nutraceuticals (functional foods, nutraceuticals, medicines). improvements in the bioactivity of functional foods and nutraceuticals (hepatoprotective, antioxidant), nanotechnology functional foods and drug delivery systems.

9. Microalgal biotechnology in the production of nutraceuticals: microalgal in food chain, scale of microalgal nutraceutical production, health concerns with microalgal products, lipid, carotenoids, production with microalgal.

10. Future strategies for the development of biotechnology- enhanced functional food and their contribution to human nutrition.

**References:**


1. Advances in food research by G F.Stewart, 1966
2. Functional foods: Designer foods, pharma foods and neutraceuticals by Goldberg. 1994
3. Advances in food and nutrition research by Steve L. Taylor, 2007
4. Functional food Ingredients & Nutraceuticals by John Shi, Taylor & Francis 2007
5. Biotechnology in functional foods & nutraceuticals by Debasis Bagchi, Francis C. Lau and Dilip K. Ghosh, CRC Press. Boca Raton, 2010

| FPT-503 | Food Safety and Quality Assurance | 3-1-0 |
|---|---|---|

**Course Objectives:**

- This course will equip individuals with the knowledge and skills necessary to ensure the safety and quality of food products from farm to fork.
- This includes understanding food safety principles, regulations, hazard analysis, quality control, and auditing procedures.
- The course also aims to foster a positive food safety culture and potentially promote self-employment in the food industry.

**Course Outcomes:**

Students will be able to understand:

- Assess and mitigate food safety hazards, implement quality assurance and control practices, prepare for and participate in audits, understand global food systems, and embrace technological advancements in food safety and quality.

## SYLLABUS

1. Food safety, Food Quality Attributes, Risk assessment, Hazards: Types of food Hazards. Fundamentals of Food Quality Assurance and Quality Control.

2. Food Adulteration and Contamination, Food Toxicants, Food Allergens, Food additives Pesticide Residue, Impact of Globalization of Food Trade in Food Safety.

3. Good Agricultural Practices (GAP), Good Hygienic Practices (GHP), Good Laboratory practices (GLP), Good Manufacturing Practices (GMP). Generally recognized as safe (GRAS).

4. Hazard Analysis Critical Control Point (HACCP): Steps and Principles, Critical Control Point (CCP) Prerequisite Program (PRP), Operational Prerequisite Program (OPRP), Implementation of HACCP in Food Industry.

5. International Organization for Standards (ISO), ISO: 22000 & Food Safety System Certification (FSSC 22000). British Standards Institution (BSI), Publicly Available Specification (PAS 220), Publicly Available Specification (PAS 223).

6. Total Quality management (TQM); ISO-9001, Global Food Safety Initiative (GFSI)

7. Safe Quality Food (SQF), British Retail Consortium (BRC), International Feature Standards (IFS), Food and Drug Administration Act (FDA), European Council (EU), Codex Alimentarius Commission (CAC).

8. Halal certification, Kosher certification, Organic Certifications, Agricultural and Processed Food Products Export Development Authority (APEDA).

9. Food Safety Standard Act of India (FSSAI), Bureau of Indian Standards (BIS), Food Quality regulations and guidelines in India Agricultural Grading and Marketing (AGMARK).

10. Food Safety Surveillance

**References:**


1. Handbook of food toxicology by S. S. Deshpande
2. Nutritional and safety aspects of food processing by Tannenbaum SR
3. Microbiological safety of food by Hobbs BC, 1973,
4. Chemical toxicology of food by Galli, C.L, 1978
5. Principle method of toxicology by Andrew Wallace Hayes, 2001
6. Food toxicology by William Helferich, ICarl Winter, 2001
7. The food safety information handbook by Cynthia A. Robert, 2009Food safety: a reference handbook 2nd Ed. by Nina Redman (2007) ABC-CLIO publishers, USA
8. Food Safety Culture by Frank Yiannas (2009) Springer
9. Make It Safe: A Guide to Food Safety by CSIRO Food and Nutritional Sciences (2010) CSIRO Publishing
10. Food Quality Assurance: Principles and Practices. 2004.Inteaz Alli

| FPT-505 | Advances in Food Chemistry and Microbiology | 3-1-0 |
|---|---|---|

**Course Objectives:**

- Advances in Food Chemistry and Microbiology course is to provide students with a comprehensive understanding of the chemical and microbiological aspects of food, encompassing both the science and the applications in food processing, safety, and quality.
- It will also help students to equip with knowledge and skills to address challenges in food production and ensure food safety and quality.

**Course Outcomes:**

Students will be able to understand

- Chemical and microbiological aspects of food, including food spoilage, preservation, and safety.
- It delves into the roles of microorganisms in food, focusing on both beneficial and harmful organisms.
- Additionally, the course explores food processing techniques, quality control, and the application of microbiology in developing novel food products and technologies.

## SYLLABUS

1. Laboratory design & equipments. Standards for design & construction. The building. Internal structure, fittings & services, work flow & equipments. Laboratory operation and Practice. Standard operating procedures, laboratory staff & personnel practices.

2. Microorganisms associated with foods: Bacteria, fungi, viruses, protozoa, toxic algae. Bacterial classification, Microbial grouping in practice. Total colony counts, indicator Organisms.

3. Factors affecting the growth, survival & death of microorganisms. Important characteristics of food contaminant microorganisms. Characteristics of microbial growth & factors affecting microbial growth.

4. Food spoilage & food-borne illness. Microbial contamination — sources, routes & control. Fate of microorganisms in food. Consequences of microbial growth in food, food spoilage, food-borne illness.

5. Food preservation and fermentation. Controlling shelf life by preservation systems. Temperature of processing & storage. Microbial fermentations and biotechnology.

6. Application of microbiology in food industry. HACCP- based systems. Microbial risk assessment of raw food materials / ingredients. Hygiene monitoring.

7. Food Biochemistry: Introduction, biochemical changes in carbohydrates, proteins & amino acids, lipids & plant pigments in foods. Selected biochemical changes important in handling & processing of foods. Browning reactions, Maillard reaction, cararnelization, ascorbic acid browsing, lipid browning, and aminophospholipids browning Structures crystallinity and chemical degradation of fats in foods, Chemical modification and functional role of fat and fat replacements.

8. Protein cross-linking in foods. disulfide cross-links, from tyrosine, melanoidins. Manipulation of protein cross-linking during food processing (chemical & enzymatic methods) & applications.

9. Biochemistry of milk constituents. Lactose, milk lipids, proteins, milk salts & vitamins. Thermal processing of milk, cheese & fermented milks, whey processing.

10. Biochemistry of fruit & vegetable processing. Chemical composition, Harvesting & processing, warming, enzyme application. Biochemical composition & nutritional value of processed products.

**References:**


1. Adams. M.R. & Moss. M 0. (2000). Food Microbiology 2nd edn. Royal Society of Chemistry London.
2. Jay J.M. (2007). Modern Food Microbiology, 7th Edition. Aspen Publishers Inc. Maryland. USA.
3. Food Microbiology & Laboratory Practice by (2005) Chris Bell, Paul Neaves and Anthony P. Williams, Blackwell Science, USA.
4. Food Biochemistry & Food Processing (2006), Y.H. Hui editor, W.K. Nip. Leo. M.L. Nollet. Gopinath Paliyath & B.H. Simpson, Blackwell Publishing, Iowa. USA.

| FPT-507 | Utilization of Food Industry Waste | 3-1-0 |
|---|---|---|

**Course** Objectives:

- This course will equip students with the knowledge and skills to effectively manage and utilize food industry waste, minimizing environmental impact and promoting resource recovery.
- Also they will understand different waste streams, exploring various treatments and recycling techniques, and identifying opportunities for converting waste into valuable products like bio fuels, fertilizers, or food ingredients.

**Course Outcomes:**

Students will be able to understand:

- About various methods for repurposing food waste into valuable resources.
- These methods range from composting and creating animal feed to producing bio fuels or biopolymers, ultimately promoting sustainability and reducing environmental impact.

## SYLLABUS

1. Waste and its consequences in pollution and global warming. Types of food processing waste and their present disposal methods.

2. Treatment methods of solid wastes: Biological composting, drying, Incineration; Design of solid waste management system; Landfill digester, Vermicomposting Pit.

3. Treatment methods for solid waste from food process industries: Design of Activated Sludge process, Rotating Biological Contractors, Trickling filters, USAB, Biogas Plant.

4. Fruits and vegetables: Production of Citrus oils from Citrus fruits, Production of Single Cell Protein by utilizing fruits and vegetable waste, Use of potato waste.

5. Dairy Industry: Status and utilization of Dairy by-products i.e. Whey, buttermilk and ghee residues.

6. Meat Industry: Availability and Utilization of by-products of meat industry: Utilization of organs and glands of animal as human food. Production of Human food from animal blood and blood protein.

7. Fish and poultry industry: Availability and utilization of by-products of Fish and poultry industry, production of fish meal, Fish meal concentrate, Texturized fish protein concentrate, Marketable products like chitin, chitosan and fertilizers and shells.

8. Cereals waste utilization, Extraction of oil and wax from rice bran, Puffed cereals from broken rice; Starch, modified starch and industrial alcohol from usable cereals.
9. Drinking water treatment: Types of treatments: Flocculation/Sedimentation, Filtration, Ion-Exchange, Absorption, Disinfection (Chlorination/ozonation)
10. Utilization of Food Packaging Waste: Glass, Plastic, Aluminum, Paper/Carton, Polymers.

**References:**


1. Utilisation of By- products and treatment of waste in the food industry ed. By Vasso Orepoulou, Winfried Russ (2007) Springer.
2. Waste Management for food industries by loannis S. Arvanitoyannis (2008) Academic Press.
3. Water and waste water Tech. 5th Ed. By Mark & Hammer, PHI.
4. Industrial microbiology by L.E.Casida, New Age Publication.
5. Environmental pollution control engireering by C.S. Rao.
6. Food processing waste management by green and Kramer (AVI)
7. By- products from food industries: utilization and disposal by AFSI(I)
8. Environment (protection) act, 1986

| FPT-509 | Advances in Animal Based Food Products | 3-1-0 |
|---|---|---|

**Course Objectives:**

- Understand recent technological advancements in the processing, preservation, and packaging of animal-based food products (meat, milk, eggs, fish, etc.).
- Explore functional, nutraceutical, and value-added animal products with health benefits and market potential.
- Examine quality control measures, food safety standards, and regulatory requirements for animal-based foods.
- Learn about sustainable and ethical practices in animal food product development.

**Course Outcomes:**

Students will be able to:

- Analyze and interpret emerging trends and technologies in animal-based food processing and product development.
- Evaluate the nutritional, sensory, and microbiological quality of various animal-derived food products.
- Apply food safety and regulatory principles in the production of hygienic and high-quality animal-based foods.
- Develop prototypes of value-added animal products using modern techniques.
- Demonstrate understanding of ethical, environmental, and economic considerations in the animal-based food industry.

## SYLLABUS

1. Milk composition; structure and properties. General Aspects of Processing of milk-standardization, tonning of milk, homogenization, pasteurization, sterilization, storage, transportation and distribution of milk.

2. Processing of milk products; condensed milk, evaporated milk, whole (WMP) and skimmed milk (SMP), butter, cheese, khoa, paneer, ice cream, fermented milk products.

3. Grading and Quality testing of milk and milk products. In plant cleaning system.

4. Meat; Effect of feed, breed and management on meat production and quality. Pre slaughter care. Ante mortem and post mortem examination.

5. Manufacturing of sausages, comminuted meat products. Slaughtering of animals. Evaluation, Inspection and grading of meat. Conversion of muscle to meat. Hygiene in meat processing. Naturally occurring toxicants.

6. Smoking, drying, curing, chilling, freezing, canning of meat. Tenderization of meat. Ageing of meat. Meat analogues.

7. Poultry: classification, composition, Slaughtering and processing. Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Processing of egg products. Grading, quality spoilage, storage and transportation of whole eggs.

8. Fish, types of fish, structure and composition. Catching, handling and examination and transportation of fish.

9. Canning, smoking, freezing and dehydration of fish. Autolytic changes, bacteriological changes, rancidity, physical changes.

10. Seafood intoxication; Treatment and prevention. safety precautions for handling of sea food.

**References:**


1. Outlines of Dairy Technology by Sukumar De (1994), Oxford University Press, New Delhi.
2. Rosenthal, I. (1991). Milk and Milk Products. VCH, New York.
3. Macrae, B., Robinson, R.IN and Sadler, M.J. (1993). Encyclopedia of Food -Sciences,
4. Principles of Dairy Processing by James N. Warner, Wiley Eastern Ltd.
5. Milk and Milk Products by Eckles, Combs; and Macy, Tata McGraw Hill.
6. Meat Science by R.A. Lawrie, Pergamon Press.
7. Poultry Products Technology by G.J. Mountney.
8. Meat, Poultry & Sea Food Technology by R.L.Henricksons.
9. Poultry Meat and Egg Production by Parkhurst & Mountney.

| FPT-502 | Advance Techniques in Food Processing | 3-1-0 |
|---|---|---|

**Course Objective:**

- To equip students with in-depth knowledge, skills, and practical experience in various advanced food processing techniques, including innovative technologies and methods for food preservation, quality control, and product development.
- The course typically focuses on the application of these techniques to ensure food safety, extend shelf life, and improve the overall quality and appeal of food product.

**Course Outcome:**

Students will be able to:

- Gain knowledge and skills to understand and apply various innovative food processing techniques.
- Understand about techniques which can improve food safety, extend shelf life, enhance quality, and contribute to sustainable practice.

## SYLLABUS

1. Scope of food processing; historical developments; principles of food processing and preservation. Unit operations in food processing.
2. Raw material preparation; size reduction, mixing and forming, separation and concentration of food components.
3. Processing and preservation by heat, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric and ohmic heating, microwave heating, baking roasting and frying, etc.
4. Processing and preservation by low-temperature- freezing, freeze drying and freeze concentration, chilling.
5. Processing and preservation by drying: concentration and evaporation-types of dryers and their suitability for different food products; ultra- filtration, reverse osmosis, dehydration
6. Processing and preservation by non-thermal methods: irradiation, high hydrostatic pressure, pulsed electric field, hurdle technology
7. Use and application of enzymes and microorganisms in processing and preservation of foods; food fermentations, pickling, smoking etc.
8. Controlled and Modified Storage and packaging
9. Food additives: definition, types and functions, permissible limits and safety aspects
10. Post Processing Operations; Coating or enrobing, Packaging, Filling and sealing of containers, material handling, Storage and distribution.

**References:**


1. Fellows PJ. 2005. Food Processing Technology. Principle and Practice. 2nd Ed. CRC.
2. Potter NN & Hotchkiss 1997. Food Science. 5th Ed. CBS.
3. Jelen P. 1985. Introduction to Food Processing. Prentice Hall.
4. Ramaswamy H & Marcotte M. 2006. Food Processing: Principles and Applications. Taylor& Francis.

| FPT-504 | Advances in Food Packaging | 3-1-0 |
|---|---|---|

**Course Objective:**

The purpose of this course is to educate:

- Characteristics of food packaging materials and how they affect food quality and shelf life. To understand different kinds of advance packing techniques and equipments used.
- Learning the most recent developments in food packaging.

**Course Outcome:**

On the successful completion of the course, students will be able to:

- Recognize the principles of packaging and the characteristics of the materials used in packaging.
- Examine the qualities of the materials used in packing.
- Recognize the economics of packaging and use your understanding to create different food packaging designs.
- Recognize innovative food packaging.
- Recognize the legal requirements for food package labeling.

## SYLLABUS

1. Introduction to Food packaging: Benefits and Requirements of packaging, Types of packaging. Current status and trends.
2. Packaging materials and forms; Types, properties advantages and disadvantages of packaging materials, Rigid, Semi- rigid and flexible packaging.
3. Plastic Paper and Woods: Rigid and flexible Plastics, Thermosetting and Thermoplastics Plastic films, Laminated plastic materials, Polyethylene (PVC, PET, polycarbonates, HDPE, LDPE) and their mechanical sealing and barrier properties. Paper, cellulosic papers, card board, corrugated paper boxes and Wood.
4. Glass and Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminium containers, Protective lacquers and coatings for metal containers. Manufacturing of glass, advantages and disadvantages.
5. Analysis of packaging materials: WVTR, GTR, GSM, bursting strength, tensile strength, tearing strength, drop test, puncture test, impact test etc.
6. Novel Packaging; Smart packaging, Active and Intelligent packaging. Types and roles; Scavenging technology, heating and Self cooling packaging, Time temperature indicators (TTIs), freshness indicators, Pathogen indicators, RFID indicators, Bio-sensors in food packaging.
7. Controlled atmosphere packaging (CAP), Modified atmosphere packaging (MAP), Biodegradable packaging, Aseptic packaging, Retortable pouches, Tetra pack, Vacuum packaging
8. Minimal packaging technology. Introduction to Non-migratory bioactive polymers (NMBP) in food packaging, Types and Advantages of NMBP.
9. Packaging for different types of food commodities (eggs, meat, fish, fresh fruits and vegetable etc.)

10. Packaging laws and regulations. General Requirements and labeling of packaged foods, Declaration, Importance of nutritional labelling.

**References:**


1. Principal of Food Packaging by Sacharow & Griffin, Van Nastrand Rainhold Company, New York.
2. Food Packaging Materials by Mahadeviah & Growramma
3. Canning and Aseptic Packaging by Ranganna, TMH.
4. Food Science and Processing Technology Vol. II by Mridula Mirajkar and Sreelata Menon.
5. Technology of Food Preservation by Norman W. Desrosier & James N. Desrosier.
6. Food Science by Norman N. Potter.
7. Food Technology, Processing and Laboratory Control by F. Aylward.
8. Novel Food Packaging Techniques, 2001,Ahvenainen R, CRC Press.
9. Food Packaging 2012, Robertson GL, CRC Press.
10. Handbook of Package Engineering, 1998, Hanlon, J F, Kelsey R J & Forcinio H. CRC Press.
11. Innovations in Food Packaging, 2005, Han J and Han J. Academic Press.
12. Emerging Food Packaging Technologies, 2012, Yam K & Lee D, Woodhead Publishing.
13. Handbook of Food Packaging Technology Frank. Albert Paine, Heather Y. Paine.

| FPT-506 | Advances in Food Analysis | 3-1-0 |
|---|---|---|

**Course Objectives:**

- This course aims to provide students with a comprehensive understanding of advanced food analysis techniques and their applications.
- The course focuses on equipping students with the knowledge and skills necessary to conduct thorough food analysis, ensuring product quality, safety, and consumer well-being.

**Course Outcomes:**

Students should be able to:

- Understand and apply various analytical techniques for food composition, quality, and safety assessment;
- Analyze and interpret data obtained from food analysis experiments;
- Critically evaluate and select appropriate analytical methods for specific food matrices; and
- Communicate analytical results effectively, including written reports and presentations.

## SYLLABUS

1. Estimation of proximate constituent of food sample (moisture, ash, fat, fibre, carbohydrates, protein etc.). Principle, theory & experimental methods. Acidity and pH estimation.
2. Determination of moisture by direct & indirect methods like GC, IR, NIR, Microwave & Mass Spectroscopy). Ash content of food, dry & wet-ashing. Drying & factors affecting rate of drying, methods.
3. Sensory Evaluation: Panel selection and Training, Judging Quality, Test Methods (Different test Rating Test, Sensitivity-threshold Test) using sensory attributes.
4. Analysis of Quality Attributes colour, viscosity, consistency, rhelogy and texture using instruments. Test for Rancidity, Putrification and Adulteration in different food products.
5. Use of Supercritical fluid extraction, biosensors, automation and computers in food analysis.
6. Determinate of fat soluble and water soluble vitamin in food. Sample preparation and estimation, determination of multiple vitamins by HPLC.
7. Application of modern techniques including spectroscopy, chromatography including GC-MS, gel permeation, ion-exchange, HPTLC, GG-FTIR.
8. Estimation of, minerals by AAS and ICPMS; Principle, sample preparation methods and

procedures and its importance.

9. Advanced Microbial methods in Food analysis; Bacterial Count (Staining, TPC, Air flora), Coliform count. Yeast and Mould Count. Microbial standards for different food samples, Rapid methods for detection of food pathogens, Analysis of food toxicity.
10. Identification tests. DNA methods, PCR based diagnostic techniques, Kit based detections electrophoresis in food analysis.

**References:**


1. Analysis of Fruits and vegetables by Ranganna. TMH.
2. Quality control in the food industry by Herschfoerfer S. M.
3. Quality control for the food industry by Kramer A. and Twigg B.A.
4. Principles of sensory evaluation of Foods by Amerine M. A.
5. Rheology and Texture in Food Quality by DeMan, J. M. and. Vowsy P. W
6. Spectral method in food analysis by Magdi Mossoba, 1999
7. Sensory evaluation technique by Morton C. Meilgaard, 2007
8. Flavours in food by Voilley, Andre, 2006,
9. Food Chemistry by W. Grosch by Belitz, H.D., Grosch, W.2nd ed., 1999
10. Handbook of Food Analysis (Vol I & II) 1996 by Leo M.L. Nollet Marcel Dekker, USA.

| FPT-508 | Post Harvest Food Technology and Management | 3-1-0 |
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**Course Objectives:**

- Post Harvest Food Technology and Management course aims to equip students with knowledge and skills to minimize food losses, improve food quality, and add value to agricultural produce after harvest.
- The course covers various aspects of post-harvest handling, processing, and preservation techniques, including topics like storage, packaging, and value add

**Course Outcomes:**

Students will be able to learn:

- About principles of post-harvest management, processing, preservation, packaging, and storage techniques for fruits, vegetables, and other agricultural products.
- The course will also help to understand concepts on extending shelf life, adding value, and understanding the impact of various factors on food quality.

## SYLLABUS

1. Scope and importance of post harvest management of fruits and vegetables in Indian economy. Nature of post harvest losses in fruits and vegetables, Classification of fruits and vegetables, structure and cellular components, factors affecting post harvest losses.
2. Maturity criteria; Maturity indices-computational, physical, chemical and physiological methods; methods for maturity determination, types of maturity indices and their components, harvesting of fruits and vegetables: harvesting tools, containers and methods.
3. Post harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non- climacteric fruits, control of ripening; ethylene generation and regulation; sources of ethylene; standards and specifications for fresh fruits and vegetables.
4. Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level: Methods of pre-cooling (Room cooling, Hydro cooling, Forced air cooling, Vacuum cooling. Package icing), alternate methods (Radiant cooling. High altitude cooling).
5. Storage practices for fruits and vegetables: Controlled atmosphere storage, Modified atmosphere storage, Cold storage, Hypobaric storage, Zero energy cool chamber
6. Commodity pre-treatments: Chemicals, wax-coating, inhibition of sprouting, pre- packaging, vapour heat treatment and irradiation.
7. Post harvest handling systems: systems for fruits and vegetables of regional importance such as citrus fruits, mango, banana, pomegranate, tomato, papaya and carrot.
8. Physiological post harvest disorders: Chilling injury and diseases; Mechanical injury- types;

Technologies to control post harvest losses; Respiration and transpiration loss; methods to measure respiration and transpiration losses; Spoilage of fruit and vegetable; Enzymatic browning and its control.

9. Packing house operations: Types of packaging for fruits and vegetables, materials used for packaging and their properties, principles of transport and commercial transport operations.
10. Minimal processing concept; Processing methods and equipments for fruit and vegetable products. Processing of traditional fermented foods. Quality, safety, nutritive value and public health aspects of the traditional foods.

**References:**


1. Kadar AA. 1992 Post-harvest Technology of Horticulture Crops. 2nd Ed. University of California.
2. Verma LR. & Joshi VK 2006. Volume I and Volume I. Post harvest Technology of Fruits and Vegetables Indus Publication.
3. R.B.H Wills, W.B. Mc Glasson, D. Graham, T.H. Lee and E.G. Hall. "Post Harvest. An Introduction to physiology and Handling of Fruits and Vegetables." CBS Publishers and distributors. New Delhi 1996.
4. Lal G, Siddapa GS & Tandon GL. 1986. Preservation of Fruits and Vegetables ICAR.
5. Pantastico B. 1975. Post harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. A VI Publication.
6. Salunkhe DK, Bolia HR & Reddy NR 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. 1, Fruits and Vegetables CRC.
7. Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.

| FPT-510 | Food Product Development and Entrepreneurship | 3-1-0 |
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**Course Objectives:**

- This course aims to equip students with the knowledge and skills to develop innovative and marketable food products while also fostering entrepreneurial mindset and skills.

**Course Outcomes:**

- Students will learn about food science principles, product development processes, market research, and the basics of product development, while also fostering an entrepreneurial mindset for starting and running a food-related business.

## SYLLABUS

1. New Food Products; New food product: Definition, Characteristics, Need for New food product development. Classification of new food products: Line extensions - Repositioning of existing products - New form of existing product - Reformulation - New packaging -Innovative products - Creative products and Value added products.
2. The new product success equation: strategic planning; innovation as science. Commercial viability and sustainability of raw materials, food waste and energy efficiency of the whole process. Trends monitoring: sorting fad from long-lasting.
3. New Food product development in Food Industry Ideation/Idea generation, Consumer research and meeting customer needs: beyond hearing the voice of the consumer Product design and Formulation.
4. Process development: Prototype development and scale up. Quality assessment of new developed products: Evaluation-Shelf Life Testing. Packaging and labeling. Quality and Safety of the products.
5. Food Product Commercialization and Marketing Costing and Pricing, Test Market, Advertising and promotions, Product launching, Product life cycle.
6. Entrepreneurship, concept, Types, qualities and functions of an entrepreneur. Ethics and Intellectual property/ Patents in food product development
7. The importance of product innovation; research for creativity, constraints to innovation. communication & phases of new product development.
8. Sources of new product ideas; general techniques, criteria for screening ideas; how to work with uncertainty, factors shaping future product and process development and new food for the future.
9. Food Products with reference to Health foods, Medical foods, Therapeutic foods, Herbal foods, Fortified foods. Infant foods, Geriatric foods, Sports drink. Functional foods, Designer foods and Nutraceuticals with attributes to control diseases. Probiotics, Prebiotic and Symbiotics.
10. Case studies: product development in bakery, confectionary industry, breweries, fruits, Meat & fish, snack foods, dietary & health foods and nutraceuticals.

**References:**


1. New Food Product Development: From Concept to Marketplace by Gordon W. Fuller (20J 1) CRC Press. Taylor & Francis Group
2. An Integrated Approach to New Food Product Development ed. By Howard R. Moskovitz. Israel Saguy, Tim Straus (2009) CRC Press. Taylor & Francis Group
3. Product and process innovation in the food industry ed. By Bruce Traill. Klaus G. Grunert (1997) Springer
4. The new cultures of food: marketing opportunities from ethnic, religious and cultural diversity ed. By Adam Lindgreen, Martin K. Hingley (2009) Gower Publishing, Ltd
5. Food, Nutrition and diet Therapy by Krause and Mahan 1996.
6. Modern Nutrition in Health & Disease by Young & Shils.
7. Gordon W.Fuller (2011), New Food Product development, 3rd edition, CRC press, Newyork.
8. Graf, E. and Saguy, I.S. (1991).Food Product Development: From Concept to the Market Place, Van Nostrand Reinhold New York.
9. Oickle, J.G. (1990).New Product Development and Value Added, Food Development Division Agriculture, Canada
10. .Latest research and industry innovations published in journals and news.