



DEPARTMENT OF TECHNOLOGY

FIRST YEAR M.TECH

FOOD TECHNOLOGY

Syllabus w.e.f from Academic year 2016-2017

Scheme of Teaching and Examination

Semester – I

Subject Code	Subject	Teaching Scheme (Hours / Week)			
		L	T	P	Credits
FT10	Research Methodology (Audit)	2	-	-	-
FT 10	Advances in Food Engg. and Technology	4	-	-	04
FT 11	Advances in Food Science and Nutrition	4	-	-	04
FT 12	Novel Techniques in Food Packaging	4	-	-	04
FTE 1	Elective-I	3	-	-	03
FTE 2	Elective-II (Open Elective*)	3	-	-	03
FT 14	Laboratory- I Advances in Food Engg. And Technology	-	-	2	01
FT 15	Laboratory- II Advances in Food Science and Nutrition	-	-	2	01
FT 16	Laboratory- III Novel Techniques in Food Packaging	-	-	2	01
FTS 1	Seminar –I	-	-	2	02
	Total	20	-	08	23

Elective I	Elective II
FTE-11 : Advances in meat, fish and poultry processing	Elective II: choose from list on next page
FTE-12: Modern techniques in fruits and vegetable processing	
FTE-13 : Waste utilization of food processing industries	

* Students from M.Tech any branch of Department of Technology Can opt for this Elective.

Semester -I Open Elective*)

Sr.No.	Elective-II (Open Elective*)	Branch
1	E15(V) Digital System And Testing	Electronics Technology
2	E 15 (V)Mixed Signal ASIC Design	
3	E 15 (E) Automotive Embedded Systems	
4	FTE-21: Advances in processing of dairy Technology	Food Technology
5	FTE-22: Food rheology and texture	
6	FTE-23: Advances in cereals and pulses processing technology	
7	ETE 2 Fuel and Combustion Technology	Energy Technology
8	ETE 2Solar Passive Architecture	
9	ETE 2Energy storage systems	
10	ESTE-21 Optimization Techniques	Environmental Science and Technology
11	ESTE-22 Design of Energy Efficient Building	
12	ESTE-23 Operational Health and Safety Management	
13	CS515 Advanced Operating Systems	Computer Sci. &Technology
14	CS515 Real Time Systems	
15	CS515 Web Engineering	

Minimum number of students for selection of Elective - 8

Maximum number of students for selection of Elective - 36 *

***Preference will be given to core branch**



DEPARTMENT OF TECHNOLOGY

FIRST YEAR M.TECH

FOOD TECHNOLOGY

Scheme of Teaching and Examination

Semester – II

Subject Code	Subject	Teaching Scheme (Hours / Week)			
		L	T	P	Credits
FT 20	Advances in Food Biotechnology	4	-	-	4
FT 21	Chemical and instrumental analysis of food components	4	-	-	4
FT 22	Food Quality, Safety and Toxicology	4	-	-	4
FTE 3	Elective-III	3	-	-	3
FTE 4	Elective-IV (Open Elective*)	3	-	-	3
FT 23	Laboratory- I Advances in Food Biotechnology	-	-	2	1
FT 24	Laboratory-II Chemical and instrumental analysis of food components	-	-	2	1
FT 25	Laboratory-III Food Quality, Safety and Toxicology	-	-	2	1
FTE 2	Seminar –II	-	-	2	2
	Total	18	-	8	23

Elective III	Elective IV
FTE-31 : Newer developments in bakery and confectionery	Elective IV: choose from list on next page
FTE-32: Nutraceutical and functional foods	
FTE-33 : Food color and flavor technology	

***: Students from M. Tech. any branch of Department of Technology can opt for this Elective.**

Semester -II (Open Elective*)

Sr.No.	Elective-IV (Open Elective*)	Branch
1	E 25 (V) VLSI in Signal Processing	Electronics Technology
2	E25(E) High Performance Networks	
3	E 25 (E) High speed digital design	
4	FTE-41: Recent developments in processing of plantation crops	Food Technology
5	FTE-42: Simulation and modeling in food processing	
6	FTE-43: Project management for food processing industries	
7	ETE 4-1 Power Co-generation	Energy Technology
8	ETE 4-2 Energy modeling and project Management	
9	ETE 4-3 The New Energy Technologies	
10	ESTE-41 Operation and Maintenance of Environmental Facilities	Environmental Science and Technology
11	ESTE-42 Rural Water Supply and Sanitation	
12	ESTE-43 Environmental Biotechnology	
13	CS525 Geographical Information Systems	Computer Sci. &Technology
14	CS525 Artificial Intelligence and Natural Language Processing	
15	CS525 System modeling and simulation	

Minimum number of students for selection of Elective - 8

Maximum number of students for selection of Elective - 36 *

***Preference will be given to core branch**



DEPARTMENT OF TECHNOLOGY

SECOND YEAR M.TECH

FOOD TECHNOLOGY

Scheme of Teaching and Examination
Semester – III

Course Code	Course	Teaching Scheme			
		L	T	P	Credits
T 31	* Industrial Training	-	-	**2	4
S 32	Dissertation Phase-I	-	-	**5	10
	Total	-	-	7	14
	**Total Contact hours per week/students = 2 & 5 respectively for T31 & S32				

*8 weeks at the end of first year

OR

Industrial Training will be split in two slots of four weeks during semester III

Semester-IV

Course Code	Course	Teaching Scheme			
		L	T	P	Credits
D 42	Dissertation Phase-II	-	-	5	20
	Total	-	-	5	20
	Total Contact hours per week = 5				

SYLLABUS OF M. TECH (FOOD TECHNOLOGY)

SEMESTER-I

(FT-10) Research Methodology (Audit Course)

Teaching Scheme: L: 2 T: -- Credits: --

Unit I :

Research Methodology: An Introduction

Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in Defining a Problem **Hrs**
4

Unit II :

Research Design

Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps In Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling **6**

Unit III :

Measurement and Scaling Techniques

Measurement in Research, Measurement Scales, Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques **4**

Unit IV :

Methods of Data Collection and Analysis

Collection of Primary and Secondary Data, Selection of appropriate method, Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation **4**

Unit V :

Techniques of Hypotheses, Parametric or Standard Tests

Basic concepts, Tests for Hypotheses I and II, Important parameters, Limitations of the tests of Hypotheses, Chi-square Test, Comparing Variance, as a non-parametric Test, Conversion of Chi to Phi, Caution in Using Chi- square test **4**

Unit VI :

Analysis of Variance and Co-variance

ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA, Assumptions in ANOCOVA, Multivariate Analysis Technique, Classification of Multivariate Analysis, factor Analysis, R-type Q Type Factor Analysis, Path Analysis **4**

Interpretation and Report**1****(FT-11) Advances in Food Engg. and Technology****Teaching Scheme: L: 4 T: -- Credits: 4****Unit I :**

Material and energy balance, Transport Phenomena for food systems, Flow behaviour of non Newtonian fluids, Rheology of dough, Unsteady state Heat Transfer with phase change, Heat transfer during drying and freezing. (8 Hrs)

Unit II:

Equipment design aspect of evaporators, dryers, freezers. Form Fill Seal, Vacuum and other packaging machines. Materials used for food processing equipment and corrosion control. (6 Hrs)

Unit III :

Newer techniques in thermal food processing - Retort processing, UHT, Extrusion - hot and cold. (6 Hrs)

Unit IV :

Radio-frequency heating Microwave for food cooking and dehydration, Ohmic heating. Advances in Freezing and refrigeration techniques. (6 Hrs)

Unit V :

Pulsed electric field, high-intensity light pulses, irradiation technique , thermo-sonication, High hydrostatic processing of foods, super critical CO₂ technique. (8 Hrs)

Unit VI :

Modified atmosphere, enzymatic processing and hurdle technology. Advanced Membrane Technology for water and liquid foods and effluent treatment. (6 Hrs)

Books Recommended

1. Food Engineering Operations by Brennan J.G, 1976
2. Fundamentals of food process engineering by Romeo Toledo, 1999
3. Engineering Properties of Foods by Rao MA and Rizvi SSH, 1986
4. Elements of Food Engineering by Watson EL and Harper JC, 1989,
5. Food Process Engineering by Heldman DR and Singh RP, 1984,
6. Food Engg. Fundamentals by J. Clair Batty, 1983
7. Handbook of food and bioprocess modeling by Sablani S., Rahman M, 2007
8. Advances in food processing and technology by Peter Fellows
9. Food processing and technology: Principle and practice by P Fellows 2009

(FT 12) Advances in Food Science and Nutrition

Teaching Scheme: L: 4 T: -- Credits: 4

Unit I :

Chemistry of Carbohydrates: Nomenclature Classification & structure of carbohydrates, Chemical reactions of carbohydrates. Physical & chemical properties of sugars. Chemistry, properties and preparation of Pectic substances, gums & polysaccharides, Starch and its hydrolytic products, maltodextrins, Cellulose, Cyclodextrins (7Hrs)

Unit II :

Chemistry of Proteins: Importance of Proteins. Nomenclature, classification, structure and chemistry of amino acids, peptides & Proteins. Sources and distribution of Proteins. Isolation, identification & purity of Proteins. Denaturation. Physical & chemical characteristics of Proteins. (6Hrs)

Unit III :

Chemistry of Lipids: Definition & classification of lipids. Basic Structures, Chemistry of fatty acids & glycerides. Components of Fatty acids, Phospholipids, and unsaponifiables, Auto oxidation and hydrolysis, Physical & chemical characteristics of fats & oils, hydrogenated fats, shortening agents, confectionary fats etc. Rancidity of fats & oils, and its prevention, antioxidants. (7Hrs)

Unit IV :

Chemistry water, vitamins and minerals : Importance of water in foods. Structure of water & ice. Concept of bound & free water & their implications. Sorption Phenomena and Sorption isotherms. Vitamin stability, Toxicity and sources of vitamins, Bioavailability of vitamins, Reasons for the loss of vitamins in foods. Classification, functional properties and uses of minerals. (6Hrs)

Unit V :

Physiological importance of nutrients : Recent advances in biochemistry of food metabolism and nutritional aspects of foods; Nutritional requirements of special group of people such as aged, infants, pregnant & lactating mothers, patients etc. Therapeutic nutrition & formulation of special dietary foods; Relation of food and diseases; Deficiencies of essential nutrients; Assessment of nutritional status & RDA; Effect of processing on nutrients; (8Hrs)

Unit VI :

Nutraceutical aspects of food : Functional foods and nutraceuticals with attributes to control cardiovascular diseases, cancer, obesity, ageing etc. Food components and nutrients affecting immune systems, behaviour and performance; Functional aspects of dietary fibre, amino acids & peptides, lactic acid bacteria, antioxidants, vitamins, fatty acids etc. (6Hrs)

Books Recommended

1. "Food Chemistry" Marcel Dekker, Inc., New York, O.R.Fennema
2. "Food Chemistry" Springer Berlin, Heidelberg, New York. Belitz, H.D.. Grosch
3. Introductory foods, Bennion M. and Hughes, D. (1975), Macmillan publishing Co., New York.
4. Advances in food and nutrition research by Steve L. Taylor
5. Human nutrition by Burton, BT, 1976,
6. Food, Nutrition and Diet Therapy by Krause and Mahan 1996,

(FT 13) Novel Techniques in Food Packaging

Teaching Scheme: L: 4 T: -- Credits: 4

Unit – I

Active and intelligent packaging: Active Packaging Techniques and intelligent Packaging Techniques, current use of novel Packaging Techniques, consumers and novel Packaging

Oxygen, ethylene and other scavengers: Oxygen scavenging technology, selecting right types of oxygen scavenger, ethylene scavenging technology, carbon dioxide and other scavengers. (7Hrs)

Unit II :

Antimicrobial food packaging: Antimicrobial agents, constructing antimicrobial packaging systems, factors affecting the effectiveness of antimicrobial packaging.

Shelf life study of packaged foods.

Non-migratory bioactive polymers (NMBP) in food packaging: Advantages of NMBP, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds and their applications. (7Hrs)

Unit III :

Packaging-flavour interaction: Factors affecting flavour absorption, role of food matrix, role of differing packaging materials, flavour modification and sensory quality.

Developments in modified atmosphere packaging (MAP): Novel MAP gas, testing novel MAP applications, applying high oxygen MAP (07 Hrs)

Unit IV :

Recycling of packaging materials: Recyclability of packaging plastics, improving the recyclability of plastics packaging, testing safety and quality of recycled materials, using recycled plastics in packaging. Biodegradable packaging materials. (7Hrs)

Unit V :

Packaging materials for newer techniques like radiation processing, microwave and radiowave processing, high pressure processing, thermal processing as retortable pouches and special purpose foods like space food, defence food etc. Role of packaging in the supply chain of perishable and frozen foods. (7Hrs)

Unit VI :

Safety and legislative aspects of packaging: Regulatory considerations, plastic, metal, paper and glass packaging, bar coding and labeling. (5Hrs)

Books Recommended

1. Modern food packaging, Indian Institute of Packaging, 1998
2. Novel Food Packaging Techniques, Ahvenainen .
3. Food packaging and preservation by M.Malthlouthi, 1994
4. Food and Packaging Interactions by Risch.S.H. 1991
5. Handbook of Food Packaging by F.A. Paine and H.Y. Paine 1983
6. Food Packaging Technology (Vol.1 & 2) by G. Bureau and J.L.Multon, 1996
7. Handbook of Package Engineering by Hanlon, Kelsey & Forcinio

(FTS-1) Seminar

Teaching Scheme: P: 2
Contact hrs : 2 Hrs./Week/student

Credits: 2

The topic of seminar shall be based on area of Food Technology; preferably considering new ideas, concepts, technologies & developments in the field of Food Technology. At least two oral presentations and submission of report in soft & hard copies is expected. Students shall deliver Seminar on the State-of-the-Art topic in front of Examiners and Student-colleagues. Prior to presentation, he/she shall carry out the detailed literature survey from Standard References such as International Journals and Periodicals, recently published reference Books etc. and submit a report on the same along with computer based presentation copy to the concerned examiner/guide at the end of the seminar. The assessment shall be based on selection of topic, its relevance to the present context, report documentation and presentation skills. Guide should spare for 2hrs /week/student for seminar

(FT-14) Laboratory- I

Advances in Food Engg. and Technology

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report.

(FT-15) Laboratory- II

Advances in Food Science and Nutrition

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report

(FT-16) Laboratory- III

Novel Techniques in Food Packaging

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report.

SEMESTER-II

(FT 20) Advances in Food Biotechnology

Teaching Scheme: L: 4 T: -- Credits: 4

Unit I :

Microbiology and Biochemistry of fermented foods, Production of bakers yeast, starter cultures, algae, mushrooms and single cell proteins from different substrates. Fermented cereal /legume products, including bread, Traditional fermented foods. Soya based Oriental fermented foods.

(8Hrs)

Unit II :

Production of Wine, Beer, and other alcoholic beverages. Production of lactic acid, citric acid, vinegar. Fermented dairy products such as cheese, yoghurt, sweet curd, paneer, shreekhand, Fermented pickles.

(6Hrs)

Unit III :

Production of amino acids, fatty acids, vitamins, polysaccharides, flavours and colours. (6Hrs)

Unit IV :

Enzyme applications in industry. Advantages and constraints of immobilized enzymes and microbial cells. Types of enzyme reactors. Aerobic and anaerobic treatment of effluents from food processing industry. Activated sludge process, biomethanation.

(6Hrs)

Unit V :

Concept and problems of plant and animal tissue culture. Technology for cultivation of callus and suspension cultures from explant. Synthesis of natural products by plant tissue culture. Microcarrier cultivation of animal cells. Production of monoclonal antibodies.

(6Hrs)

Unit VI :

Chemical structure of nucleic acid proteins; introduction to Genetics, DNA replication, transcription and translation.; cell division, cell cycle, DNA repair mechanism, modifying enzymes, recombinant DNA technology, mutation and polymorphism and their detection. PCR, RT-PCR, electrophoresis, electro blotting and capillary blotting. Application to produce genetically modified foods.

(8Hrs)

Books Recommended

1. Fundamentals of food biotechnology by Byong H.Lee, 1996
2. Food biotechnology by Kalidas Shetty, 2006
3. Brock Biology of microorganisms, 12th ed., by M.Madigan, J.Martinko, J.Parkar,2009
4. Principles of genetics by R. H. Tamarin, 2004
5. Fundamental bacterial genetics by Nancy Trun and Janine Trempy, 2004
6. Basic molecular and Cell Biology 3rd edition Ed. by David Latchman. 2006.

(FT 21) Chemical and instrumental analysis of food components

Teaching Scheme: L: 4 T: -- Credits: 4

Unit I :

Preparation & Standardization of solutions, sample preparation and sampling, Buffer Methods & principle for determinations of Proximate composition: Moisture, Fat, Protein, Fiber, Carbohydrate, Ash. (6Hrs)

Unit II :

Analysis of Starch, Reducing and Non reducing sugars in foods. Determination of Minerals: Iron, Calcium, Phosphorus, Vitamin-A, Vitamin- B, Vitamin- C. Plant pigments (carotene, lycopene, chlorophyll, anthocyanins). (6Hrs)

Unit III :

Blanching adequacy, non enzymatic browning. Analysis of fats and oil (FFA, PV, RM value) Sensory evaluation – different scales, training, skills and importance for consumer acceptance. Quantification of sensory attributes - Artificial Tongue, Artificial Nose. Texture analysis. (8Hrs)

Unit IV :

Enzymes in food analysis; Supercritical fluid extraction in food analysis; Rapid methods for detection of food pathogens, biosensors, automation and use of computers in food analysis. (6Hrs)

Unit V :

Application of modern techniques including spectroscopy (atomic absorption. Measurement), flame photometry. X-ray analysis of foods and its applications, electrophoresis- applications, principle and different types. Mass spectroscopy, IR, Nuclear magnetic resonance (NMR). (8Hrs)

Unit VI :

Chromatography :GC, GC –MS, HPLC, HPTLC, gel permeation, ion-exchange, etc., their principles and applications. Refractometry – its applications and methods. Rheology measurements. DSC, SEM, rapid methods of thermal analysis. (6Hrs)

ReferenceBooks :

1. Food Analysis Theory and Practice Y.Pomeranz
2. The Chemical Analysis of Foods and Food Products Morris B.Jacobs
3. Food Analysis: Separation Techniques W.Graenwedel
4. Handbook of Analysis and Quality Control for Fruits and Vegetables S.Ranganna
5. Food Analysis Nielson
6. Handbook of Food Analysis Nollel

(FT 22) Food Quality, Safety and Toxicology

Teaching Scheme: L: 4 T: -- Credits: 4

Unit I :

Objectives, importance and functions of quality control. Quality of raw materials and finished products, statistical quality control. Good Hygienic Practices (GHP), Good Manufacturing Practices (GMP), ISO 9001 (Quality Management System). Food regulations, grades and standards, Licensing and registration. (6Hrs)

Unit II :

Types of food hazards: biological, chemical and physical; Risk assessment; Existing and emerging pathogens due to globalisation of food trade; Newer systems of safety evaluation such as HACCP. Salient features of Food Safety & Standards Act, 2006, Structure of FSSAI, ISO 22000 (Food Safety Management System), Traceability, Food Recall. (6Hrs)

Unit III :

Testing of food ingredients & additives; Animal studies including LD50; Ames test for teratogenicity; Natural toxic constituents in plant foods; Shellfish poisoning; Chemicals from processing such as fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked foods and pyrolysis, pesticides and herbicides. (6Hrs)

Unit IV :

Intentional and unintentional additives; Toxicity due to microbial toxins including botulinum and staphylococcal toxins, mycotoxin and due to other food pathogens; Food allergy and intolerance; Detoxication strategy. (6Hrs)

Unit V :

Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labelling (Packaging types, understanding labelling rules & Regulations, Nutritional labelling, labelling requirements for pre-packaged food as per CODEX). (6Hrs)

Unit VI :

Organic food, Identifying Organic foods, Advantages, The Organic Certification Process, Organic Food labeling, GM food, Why are GM food produced, Main issues of concern for Human Health, How are GM Food regulated Internationally, Regulation in India. (6Hrs)

Books Recommended

1. Environmental regulation and food safety by Veena Jha.
2. Microbiological safety of food by Hobbs, 1973
3. Emerging technologies; food process by Da-wen, 2005
4. Food safety by Laura K Egendorf, 2000
5. International standards of food safety by Naomi Rees, David Watson, 2000
6. Codex alimentarius by FAO & WHO, 2007

(FTS-2) Seminar II

Teaching Scheme: P: 2
Contact hrs : 2 Hrs./Week/student

Credits: 2

The topic of seminar shall be based on area of Food Technology; preferably considering new ideas, concepts, technologies & developments in the field of Food Technology. At least two oral presentations and submission of report in soft & hard copies is expected. Students shall deliver Seminar on the State-of-the-Art topic in front of Examiners and Student-colleagues. Prior to presentation, he/she shall carry out the detailed literature survey from Standard References such as International Journals and Periodicals, recently published reference Books etc. and submit a report on the same along with computer based presentation copy to the concerned examiner/guide at the end of the seminar. The assessment shall be based on selection of topic, its relevance to the present context, report documentation and presentation skills. Guide should spare for 2hrs /week/student for seminar

(FT-23) Laboratory- I

Advances in Food Biotechnology

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report.

(FT-24) Laboratory- II

Chemical and instrument analysis of food components

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report.

(FT-25) Laboratory- III

Food Quality, Safety and Toxicology

Teaching Scheme: P: 2

Credits: 1

A performance based on Experiments, or assignment or Visit report.

SEMESTER-III

T 31 Industrial Training:
Teaching Scheme Examination Scheme
Contact hrs : 2 Hrs./Week/student
Credit: 4

8 Weeks at the end of First Year or **OR Industrial Training will be split in two slots of four weeks during semester III. Evaluation** at end of III semester on the basis given report and Presentation to concern Guide.

Semester-III & IV

S 32 and D 42 Dissertation Project Phase I & II

The student shall be allowed to submit the dissertation phase I report only after the completion of minimum 50% work of the total project with intermediate /partial results of the dissertation project to the concern guide and the dissertation phase II report only after the full-fledge demonstration of his /her work to the concerned guide. Assessment of the dissertation shall be based on design & implementation aspects, documentation & presentation skills, utility of the dissertation work & publications based on the same.

For the dissertation phase I and phase II concern guide should guide to each student minimum for 2 hrs per week till the final submission of the dissertation of the concern student.