



SCHEME OF INSTRUCTIONS

and

SYLLABI OF

MASTER OF SCIENCE

IN

FOOD TECHNOLOGY

Choice Based Credit System (CBCS)

(w.e.f. Academic Session 2021-2022)

Department of Agriculture

INVERTIS UNIVERSITY, BAREILLY

Invertis Village, NH-24, Bareilly

U.P.-243123

Program Outcomes of M.Sc. Food Technology

After completion of the program of M.Sc. in Food Technology, students will have the following attributes:

- PO1** Understand and demonstrate comprehensive knowledge of food science and technology branch.
- PO2** Conduct scientific experiments and document scientific investigations in the area of food science and technology.
- PO3** Design solutions for food quality and safety issues.
- PO4** Apply various food processing, preservation and packaging technologies.
- PO5** Analyse and explain with illustrations chemical, biochemical and microbiological phenomenon as applied to food processing and preservation.
- PO6** Evaluate food quality and safety using advanced instrumentation.
- PO7** Create leadership qualities for realization of various goals and manifest the innovative business plans.
- PO8** Contextual knowledge to assess societal and cultural issues in food technology and suggest viable solutions.
- PO9** Ability to use appropriate research methodology in Food Technology.
- PO10** Awareness about ethical conduct in professional and personal context.
- PO11** Manage information, develop scientific reports and make presentations.
- PO12** Engage independent and life-long learning about the changes and developments taking place in agricultural scenario in the country.

SCHEME OF EVALUATION
M.Sc. –FOOD TECHNOLOGY
I-YEAR, SEMESTER-I
(w.e.f. academic session 2021-22)

S. No.	Category	Course Code	SUBJECT	PERIODS			CREDIT	MARKS		
				L	T	P		DISTRIBUTION		
								IAM	ESM	TOTAL
THEORY										
1	Core Course(CC)	MFT-101	Principle of Food Processing and Preservation	3	1	0	4	30	70	100
2	Core Course(CC)	MFT-102	Food Chemistry	3	1	0	4	30	70	100
3	Core Course(CC)	MFT-103	Food Analysis and Instrumentation	3	1	0	4	30	70	100
4	Core Course(CC)	MFT-104	Food Microbiology	3	1	0	4	30	70	100
5	AECC	MFT-105	Communication Skills and technical writing	2	0	0	2	15	35	50
6	Non Credit	MFT-106	Human Values and Ethics	2	0	0	0	15	35	50
PRACTICAL / TRAINING / PROJECT / SEMINAR										
7	Lab. Courses	MFT-151	Food Processing and Preservation Lab	0	0	4	2	15	35	50
8	Lab. Courses	MFT-152	Food Chemistry Lab	0	0	4	2	15	35	50
9	Lab. Courses	MFT-153	Food Analysis and Instrumentation Lab	0	0	4	2	15	35	50
Total				16	4	12	24	295	455	650
Abbreviations Used	L – Lecture; T – Tutorial; P – Practical; C – Credit; IAM – Internal Assessment Marks; ESM – End Semester Marks CC= Core Course, DSE=Discipline Specific Electives, GE-Generic Elective, AECC-Ability Enhancement Compulsory Core Courses, SEC=Skill Enhancement Course									

SCHEME OF EVALUATION
M.Sc. – FOOD TECHNOLOGY
1st-YEAR, SEMESTER-II
(w.e.f. academic session 2021-22)

S. No.	Category	Course Code	SUBJECTS	PERIODS			CREDIT	MARKS		
				L	T	P		DISTRIBUTION		
								IAM	ESM	TOTAL
THEORY										
1	CC	MFT-201	Technology of Fruits and Vegetables	3	1	0	4	30	70	100
2	CC	MFT-202	Unit operations in Food Engineering	3	1	0	4	30	70	100
3	CC	MFT-203	Research Methodology, Statistics and Computer Applications	3	1	0	4	30	70	100
4	DSE(1*)	MFT-204	Technology of legumes and oilseeds	3	1	0	4	30	70	100
		MFT-205	Technology of meat, poultry and Fish Products							
5	GE(1*)	MFT-206	Intellectual Property Rights	2	0	0	2	15	35	50
		MFT-207	Quality Control and Food Laws							
PRACTICAL / TRAINING / PROJECT / SEMINAR										
6	Lab Course	MFT-251	Technology of Fruits and Vegetables Lab	0	0	4	2	15	35	50
7	SEC	MFT-252	Seminar	0	0	2	1	50	0	50
8	SEC	MFT-253	Industrial Training**	0	0	0	4	0	100	100
Total				14	4	06	25	200	450	650
Abbreviations Used	L – Lecture; T – Tutorial; P – Practical; C – Credit; IAM – Internal Assessment Marks; ESM – End Semester Marks CC= Core Course, DSE=Discipline Specific Electives, GE=Generic Elective, AECC=Ability Enhancement Compulsory Core Courses, SEC=Skill Enhancement Course									

(*) Students will have choice to opt only one out of the two courses.

(**)The students will have to undergo for internship during the winter break for maximum of 4 weeks after 1st semester, however, the viva voce will be conducted in the 2nd semester and hence the credits will be given to the students in the 2nd semester.

MFT-101 Principles of Food Processing and Preservation

Teaching Scheme

Lectures: 3 hrs/week

Tutorials: 1 hr/week

Credits: 4

Examination Scheme

Internal Assessment Marks[IAM]:30

[Class Test: 12, Teachers assessment: 6, Attendance: 12]

End Semester Marks[ESM]: 70

Course Objectives:

1. To give knowledge of historical development of food processing and preservation.
2. To give knowledge of general aspects of methods of food processing and preservation.
3. Gives knowledge of effect of processing on different foods.
4. To impart knowledge on technology behind various food processings.
5. To impart knowledge about food preservation and its various techniques.

Detailed Syllabus

Module I

Scope and importance of food processing; historical developments in food processing; food spoilage: microbial, physical, chemical & miscellaneous. Water activity: role of water activity in food preservation, intermediate moisture foods (IMF) principles, characteristics, advantages and problems of IM foods. Thermal and Non thermal Food preservation techniques.

MODULE 2

Heat preservation and processing: heat resistance of microorganisms, thermal death curve, types of heat treatments and effects on foods, canning of foods, cans and container types, spoilage of canned foods, heat penetration, brief concept of different heat processing methods: blanching, roasting, frying, baking, extrusion cooking etc. Dehydration: drying, dehydration and concentration, drying curves, drying methods and type of dryers; food concentration, methods of concentration of fruit juices, liquid food concentrates, changes in food during dehydration and concentration.

MODULE 3

Refrigeration storage: requirements of refrigeration storage, changes of foods during refrigeration storage, refrigeration load, chilling and refrigeration, cold storage.

Freezing and frozen storage: freezing curves, slow and quick freezing, factors determining freezing rate, freezing methods, changes in food during freezing, frozen food storage, Lyophilisation, Cryogenic Freezing, Dehydro freezing, Freeze Concentration, IQF.

MODULE 4

. Novel Food Processing, – mushrooms, algae, leaf protein concentrates, protein from petroleum yeast, food analogues, edible insects.

MODULE 5

Natural and Chemical Food Preservatives – types, permissible limits, safety aspects .Chemical preservation: types, uses and effects of class I and class II preservatives in foods.

Non thermal preservation techniques. Advanced food preservation methods – food irradiation - safety and quality of irradiated foods. microwave and Ohmic processing of foods- principles, procedure and applications. Application of nanotechnology in food preservation.

Suggested Readings

1. Norman, N.P and Joseph, H.H.(1997). Food Science, Fifth edition, CBS Publication,New Delhi .
2. Frazier, W.C and Westhoff, D.C (1996). Food Microbiology, 4 th edition, Tata Mc Graw Hill Publication, New Delhi.
3. Kalia M. and Sangita, S. (1996). Food Preservation and Processing, First edition, Kalyani Publishers, New Delhi.
4. Desrosier & Desrosier, Technology of Food Preservation. Avi Publishing Co Inc.4edtn.2004.
5. Fellows, Food process technology: Principles and Technology, CRC publications,2000.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the historical development of food science and technology.
2. Understand the various food processing methods.
3. Understand about the different terminology related to low temperature food processing.
4. Understand the novel food processings and food analogues.
5. Understand the different types of preservatives and preservation technology involved.

MFT-102 Food Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs./ week	Internal Assessment Marks[IAM]:30
Tutorials: 1 hr/week	[Class Test: 12, Teachers assessment: 6,Attendance: 12]
Credits: 4	End Semester Marks[ESM]: 70

Course Objectives:

1. To give knowledge of carbohydrate food molecules and types of starches in food chemistry.
2. To give knowledge about protein molecules and various protein systems, isolates and concentrates within food.
3. Gives knowledge of dietary requirements of lipids and its refining.
4. To impart knowledge on role of vitamins in food.
5. To understand plant based pigments and emulsions in food.

Detailed Syllabus

MODULE 1
Water: properties, bonding and chemistry. Carbohydrates: Classification, structure and properties of carbohydrates. Role of carbohydrates in food industry. Sugar, starch, cellulose, glucans, hemicelluloses, gums, pectic substances, polysaccharides. Resistant Starches and Dietary Fibre – Definition, Sources and Functions. Modified starches.
MODULE 2
Proteins: Classification, structure, properties, purification and denaturation of proteins. Browning reaction in foods: Enzymatic and non-enzymatic browning in foods of vegetable and animal origin during storage and processing of foods. Egg proteins, meat proteins, fish muscle proteins, oil seed proteins and cereal proteins. Concept of protein quality, dietary requirements, deficiency symptoms. Single cell proteins, Stress and Anti-freeze Proteins; Protein Isolates and Concentrates.
MODULE 3
Lipids: Classification and physico-chemical properties of food lipids. Refining of crude oils, hydrogenation and winterization. Vegetable and animal fat, margarine, lard, butter. Frying and shortening. Flavor changes in fats and oils, lipid oxidation, factors affecting lipid oxidation, autooxidation, biological significance of auto-oxidation of lipids.
MODULE 4
Vitamins: Role of vitamins in food industry, effect of various processing treatments and fortification of foods. Food sources, effects of deficiency Minerals: Role of minerals in food industry, effects of various processing treatments. Effects of excess, if any, and deficiency.

MODULE 5

Biological changes in foods: Plant pigments and their roles in food industry. Bitter substance and tannins. Flavor Composition of Foods and beverages

Emulsion: Definition, Theory, Emulsifiers: Properties, role & action in stabilizing an emulsion.

Suggested Readings

1. Fennema, O.R. Ed. 2008, 4th Ed. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
2. Meyer, L.H. 2004. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.
3. Potter, N.N. 1995. Food Science. 3rd Ed. AVI, Westport.
4. De Man., J.M.2018. Principles of Food Chemistry. AVI, Springer International Publishing.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the role of water carbohydrates and starches in food.
2. Understand about the different protein molecules present in food, their structure and function.
3. Understand about the different lipid molecules present in food, their structure and function and refining.
4. Understand about the different vitamins in food and their function.
5. Understand about the different biological changes in foods: Plant pigments and their roles in food industry. Emulsions and its uses.

MFT-103 Food Analysis and Instrumentation

Teaching Scheme Lectures:3 hrs./ week Tutorials:1 hr/week Credits: 4	Internal Assessment Marks[IAM]:30 [Class Test: 12, Teachers assessment: 6,Attendance: 12] End Semester Marks[ESM]: 70
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Course Objectives:

- 1.To give knowledge about preparation of chemical solutions and food sample preparations.
- 2.To give knowledge about proximate composition of food.
- 3.To impart knowledge of colorimetry,spectroscopy,electrophoresis and atomic absorption spectrophotometry.
- 4.To impart knowledge on instrumentation in food analysis.
5. To impart knowledge on refractometry , ultrasonics ,texture analysis and immunoassays methods in food.

Detailed Syllabus

MODULE I
Preparation of chemical solutions: Concept of molar, molal, and normal solutions. pH and Buffers: Importance and measurement of pH. Introduction to food analysis, types of samples and sampling techniques, storage and preservation of samples, expression of results.
MODULE II
Proximate analysis of foods: Principles of moisture, fat, protein, carbohydrates, crude fiber and vitamins in foods.
MODULE III
Instrumentation in food analysis: principles, types and applications of colorimetry and raman spectroscopy, photometry, electrophoresis; High Pressure Liquid chromatography, Gas chromatography and atomic absorption spectrophotometry.
Module IV
Instrumentation in food analysis: color measurement in foods; X-ray analysis of foods and its applications; mass spectroscopy; nuclear magnetic resonance (NMR); differential scanning calorimetry (DSC).

Module V

Refractometry and ultrasonics in food analysis; texture analysis in foods, sensory versus instrumental analysis of texture, rapid methods of microbial analysis; immunoassays methods.
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Suggested Readings

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| 1. Chatwal, G.R. , ." Instrumental methods of chemical analysis"', Mumbai, Himalaya Pub. Pvt. Ltd, 2011. |
| 2. R G. Moreira, T.P Coultate "Automatic Control for Food Processing System"' . 2001. |
| 3. D. Patranabis, "Industrial Instrumentation"', McGraw Hill, 1990. |
| 4. B.G.Liptak,. Instrument Engineers Handbook: Process Measurement and Analysis"', 1995 |
| 5. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, Cambridge University. |

Course Outcomes:

After completing the course, students will be able to:

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| 1. Understand the method of preparation of chemical solutions and food samples. |
| 2. Understand the principles of proximate analysis in food. |
| 3. Understand about the different instrumentation involved in food analysis. |
| 4. Understand about advanced instrumentation in food analysis. |
| 5. Understand the refractometry, ultrasonics ,texture analysis and immunoassays methods in food. |

MFT-104 Food Microbiology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs./ week Tutorials: 1 hr/week Credits: 4	Internal Assessment Marks[IAM]:30 [Class Test: 12, Teachers assessment: 6,Attendance: 12] End Semester Marks[ESM]: 70

Course Objectives:

- 1.To give knowledge of general characteristics ,classification of microorganisms and their uses and source of contamination in food industry.
- 2.To give knowledge about factors affecting harmful microbes growth and lethal effects of various food processing techniques.
- 3.Gives knowledge of food microbiology, associated health risks and HACCP system.
- 4.To impart knowledge about food spoiling pathogens and their investigation methods.
- 5.To impart knowledge about food fermentation and associated starter cultures.

Detailed Syllabus

MODULE 1

Microbiology: Introduction, historical developments in food microbiology; prokaryotes and eukaryotes; classification of microorganisms- a brief account; sources of microorganisms in foods; microbial growth, growth curve; factors affecting growth-intrinsic and extrinsic factors controlling growth of microorganisms, microbiological criteria of foods and their significance.

MODULE 2

Effect of food preservatives, heating process, irradiation, low temperature storage, chemical preservatives and high-pressure processing on the microbiology of foods; control of water activity and microbial growth, applications of hurdle technology for controlling microbial growth.

MODULE 3

Foods microbiology and public health: food poisoning, types of food poisonings, important features etc; bacterial agents of food borne illness, food poisoning by clostridium, salmonella, E. coli, bacillus, staphylococcus etc.; non-bacterial agents of food borne illness: poisonous algae, and fungi - a brief account, the HACCP system and food safety used in controlling microbiological hazards.

MODULE 4

Food spoilage and microbes of milk, meats, fish and various plant products, spoilage of canned foods; Indicators microorganisms, methods of isolation and detection of microorganisms or their products in food; conventional methods; rapid methods (newer techniques) - immunological methods; fluorescent, antibody, radio immunoassay, principles of ELISA, PCR (Polymerized chain reactions).

MODULE 5

Food fermentations: Bacterial, yeast and mold cultures; single and mixed cultures, propagation, maintenance and evaluation of cultures; factors affecting activity of cultures, bacteriophages, residual antibiotics and chemicals.

Suggested Readings

1.	Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New york.
2.	Microbiology by Pelczar, Smith & Chan.
3.	Food Microbiology by Frazier, 5 th edtn ,2017. Mc.Graw Hill Education.
4.	Food microbiology by V. Ramesh, MJP publishing.2007.

Course Outcomes:

After completing the course, students will be able to:

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| 1. Understand the different types of microorganisms and their structure. |
| 2. Understand the effect of various processing on food microbes. |
| 3. Understand about the food microbiology, associated health risks and HACCP system. |
| 4. Understand the different food spoilage and its causes with detection techniques too. |
| 5. Understand the microbiology of fermentation and starter cultures. |

MFT-105 Communication Skills and Technical Writing

Teaching Scheme	Examination Scheme
Lectures: 2 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Class Test: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35

Course Objectives:

1. To give knowledge about vocabulary and word fluency.
2. To give knowledge about technical writing.
3. To give knowledge about effective communication skills.
4. To encourage students about interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview.
5. To give knowledge about concept of community nutrition.

Detailed Syllabus

MODULE 1
Grammar: Expressions, Modals & Moods, Word Stress, Fluency, Voice, Enhancing Vocabulary Punctuations
MODULE 2
Introduction to Technical writing – Definition, types, characteristics, Report Writing, CV & Resume making, Research paper
MODULE 3
Effective Communication Skills: Power Point Presentations (Subject-Oriented), Soft Skills - Proper Body Postures, Right/Positive Body Language, Eye Contact, Public speaking, Interactive Communication Skills -Group Discussions, Debates, Conversations, Telephonic Etiquettes, Facing an interview
MODULE 4
Communication Skills: How to make Delivery of Content Effective, Proper Articulation, Modulation, Voice Throw, Proper Stress on Words, Presenting PPT's, Confidence Building, Motivation, Writing Covering Letters , Filling Application Forms.
MODULE 5
Technical Writing : Documentation of Academic credentials, Writing of Introduction, Acknowledgement, Abstract & Conclusion, Commonly used Abbreviations in the Thesis & Research Communication, Structuring the Presentation, Learning how to make PPT's, number of Slides, font, font size, Table Insertions, Picture, Clip Art, Chart, Grammatical Accuracy.

Suggested Readings

1.	Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
2.	Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.
3.	Wren PC & Martin H.2006. High School English Grammar and Composition. S. Chand, New Delhi.
4.	

Course Outcomes:

1.	Understand and apply knowledge of english communication in various contexts like interpersonal, intrapersonal, small group, organizational
2.	Find and write different academic writing more efficiently.
3.	Able to communicate effectively in interview as well as work place.
4.	Develop their personality and confidence
5.	Able to perform well in different competitive exams

MFT-106 Human Values and Ethics

Teaching Scheme	Examination Scheme
Lectures: 2 hrs./ week Credits: 0	Internal Assessment Marks[IAM]:15 [Class Test: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35

Course Objectives:

1. To give knowledge about needs of ethics and related practices.
2. To give knowledge about fair trade practices.
3. To give knowledge about property, rights, duties and their correlation
4. To encourage students about Patent rights/protection and procedure.
5. To give knowledge about International Registration systems and national policies on food security.

Detailed Syllabus

MODULE 1
The importance and the needs of ethics; Ethical business practices; Laws and ethics; Environmental protection;
MODULE 2
Creating awareness and safeguarding health of consumers; Fair trade practices.
MODULE 3
Concept of property, rights, duties and their correlation; History and evaluation of IPR; Copyrights and related rights. Distinction among various forms of IPR.
MODULE 4
Patent rights/protection and procedure; Infringement or violation; Remedies against infringement; Indian Patent Act 1970 and TRIPS; Geographical indication and Industrial design.
MODULE 5
International Registration systems; WIPO treaties; Unfair competition; Protection of new plant varieties; Legal implications and public concerns in genetic modification of foods; National policies on food security.

Suggested Readings

1. Daniel and Selvamony - Value Education Today, (Madras Christian College, Tambaram and ALACHE, New Delhi, 1990)
2. S. Ignacimuthu - Values for Life - Better Yourself Books, Mumbai, 1991.
3. M.M.M.Mascaronhas Centre for Research Education Science and Training for Family Life Promotion - Family Life Education, Bangalore, 1993.
4. Agochiya D. 2002. Every Trainer's Handbook. Sage Publ.

Course Outcomes:

After completing the course, students will be able to:

1.	Understand the sensitivity of human values.
2.	Understand the outweigh of commitment and responsibility.
3.	Understand and realize the professional ethics for a healthy and hassle free professional life.
4.	Develop some significant qualities to contribute for the organization as well as the entire society.
5.	Bring the peace and harmony to the society.

MFT 151-Food Processing and Preservation Laboratory

Teaching Scheme	Examination Scheme
Practicals:4 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Record: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35 [Practical: 20 marks Viva:10, Record: 05 Marks]

Course Objectives:

1. To give practical knowledge of fruits and vegetables processing and preservation methods.
2. Provides practical knowledge of various food groups like frozen food,emulsions.
3. Gives knowledge of various adulteration tests and their principles.

Detailed Syllabus

1. Fruit & Vegetable Processing; Use of Chemical Additives for Preservation; Thermal Processing of Foods – Preparation of Jams, Jellies, Squashes, Pickles, Chutneys, Sauces.
2. Dehydration & Evaporation – Preparation of Condensed Milk
3. Emulsions-Preparation of Mayonnaise
4. Frozen Foods – Preparation of Ice Cream & Fruit/ Vegetable Pulp
5. Determination of gelatinization.
6. Stages of sugar cookery.
7. Estimation of gluten content.
8. Adulteration tests in various food samples.
9. Amylose and amylopectin content in rice.
10. Parboiling of rice.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the different fruits and vegetables processing methods and preservation.
2. Understand the preparation of emulsions and frozen foods.
3. Understand about various adulteration tests and their principles.

MFT 152-Food Chemistry Laboratory	
Teaching Scheme	Examination Scheme
Practicals:4 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Record: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35 [Practical: 20 marks Viva:10, Record: 05 Marks]

Course Objectives:

- 1.To give practical knowledge of food chemistry.
- 2.Provides practical knowledge of various food proximate analysis.
- 3.Gives knowledge of use of many lipid test and calorific value of food.

Detailed Syllabus

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| <ol style="list-style-type: none"> 1. Qualitative analysis of carbohydrates 2. Qualitative analysis of proteins 3. Estimation of carbohydrates in food materials 4. Estimation of proteins in food materials 5. Estimation of crude fibre in food materials 6. Estimation of ascorbic acid in food materials 7. Estimation of calorific value of foods 8. Analysis of Lipids: Free fatty acid, Peroxide value, Saponification value, RM Number, TBA test, Iodine value 9. Determination of NaCl content in food products. |
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Course Outcomes:

After completing the course, students will be able to:

1. Understand the different concepts behind food proximate analysis.
2. Understand the qualitative test of carbohydrates and proteins.
3. Understand about the different lipid analysis tests.
4. Understand the working of food analysis equipments.

MFT 153-Food Analysis and Instrumentation Laboratory	
Teaching Scheme	Examination Scheme
Practicals:4 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Record: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35 [Practical: 20 marks Viva:10, Record: 05 Marks]

Course Objectives:

- 1.To give practical knowledge of food equipments testing and their instrumentation.
- 2.Provides practical knowledge of various food analysis methods.
- 3.Gives knowledge about use of many equipments.

Detailed Syllabus

<ol style="list-style-type: none"> 1. Mathematical calculations in analysis- Concentration calculations, Ppm, Ppb, mg/1, Kg/ha, % normal, Molar Ug/100 gm calculations. 2. Qualitative and quantitative estimation of proteins by spectrophotometer. 3. Estimation of lactose in milk. 4. Estimation of Beta-Carotene in Foods. 5. Spectrophotometric estimation of carbohydrate. 6. Determination of microbial count. 7. Determination of yeast and mould count. 8. Instrumentation –Operation and Working of (Demo only) G.C.-Gas Chromatograph H.P.L.C.-High Pressure Liquid Chromatography A.A.S.- Atomic Absorption Spectrophotometer.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the different mathematical calculations for food analysis.
2. Understand the basics of analysis using spectrophotometer.

MFT-201 Technology of Fruits and Vegetables

Teaching Scheme	Examination Scheme
Lectures: 3 hrs./ week	Internal Assessment Marks[IAM]:30
Tutorials:1 hr./ week	[Class Test: 12, Teachers assessment: 6,Attendance: 12]
Credits: 4	End Semester Marks[ESM]: 70

Course Objectives:

- 1.To give knowledge of chemical composition of fruits and vegetables,their pre processing operations.
- 2.To give knowledge about technology of fruits and vegetable products processing in various forms.
- 3.Gives knowledge of technology of tomato and its products preparation.
- 4.To impart knowledge on technology for new product formulation and utilization of food industry wastes.
- 5.To give knowledge of tea, coffee, cocoa, vinegar processing and pectin production.

Detailed Syllabus

MODULE 1
Classification and composition of fruits and vegetables and their nutritional significance; climacteric and non-climacteric fruits; post harvest treatments, edible coatings. Physical and chemical indices of fruit maturity, crop maturity and ripening, bio-chemical changes during maturation, ripening, processing and storage. Pre-processing operations: washing, blanching, peeling, sorting and grading of fruits and vegetables; minimal processing of fruits and vegetables; quality factors for processing, export standards, fruit product order (FPO).
MODULE 2
Technology of jam, jellies, marmalades, specifications, role of pectin and theories of gel formation. Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, physiological and enzymological aspects of fruit juice production, fruit juice concentrates and powders- preparation and specifications, packaging. Fruit juice beverages, squash, cordial, crush, RTS, nectar, syrups, blending of juices.
MODULE 3
Technology of tomato products: sauce, puree, ketchup and tomato paste.Fruit preserves and candied fruits, dehydrated fruits & vegetables, spoilage of processed products. Canning of fruits and vegetables, preparation of syrups and brines, spoilage of canned fruits and vegetables.
MODULE 4

Stages of new product development, by products from fruit and vegetable wastes, utilization and disposal of fruit industry wastes. Production of mushroom and its processed products; Cashew and coconut: chemical composition, processing technology and their processed products.

MODULE 5

Vinegar: Method of preparation and quality control.

Raw material processes and uses of pectin, products based on pectin, manufacturing and quality.

Suggested Readings

1. Haard, N.F. and Salunkhe, D.K. 1975. Postharvest Biology and Handling of Fruits and Vegetables. AVI, Westport.
2. Preservation of Fruits and Vegetables–Girdhari Lal, Siddhapa and Tondon, ICAR, New Delhi.
3. Salunkhe, D.K. and Kadam, S.S. Ed. 1998. Handbook of Vegetable Science and Technology. Marcel Dekker, New York, USA.
4. Wills, R.B.H., McGlasson, W.B., graham, D., Lee, T.H. and Hall, E.G. 2016. Postharvest: An Introduction to the Physiology and Handling of Fruits and Vegetables. BSP Professional Books, Oxford.
5. Hand Book of Analysis and Quality Control of Fruits & Vegetable Products–S. Ranganna Tata McGraw Hill, New Delhi.

Course Outcomes

After completing the course, students will be able to:

1. Understand the different fruits and vegetables chemical composition. and their pre processing operations.
2. Gives knowledge about fruit and vegetables products preparation methods and technology involved.
3. Imparts knowledge about tomato products preparation methods and technology involved.
4. Understand the stages of new product formulation and food industry waste utilization .
5. Technology of vinegar, tea, cocoa and pectin production.

MFT-202 Unit operations in Food Engineering

Teaching Scheme	Examination Scheme
Lectures: 3 hrs./ week	Internal Assessment Marks[IAM]:30
Tutorials: 1 hr./week	[Class Test: 12, Teachers assessment: 6,Attendance: 12]
Credits: 4	End Semester Marks[ESM]: 70

Course Objectives:

- 1.To give knowledge of preliminary unit operations ,material handling, cleaning,sorting and grading in food industry.
- 2.To give knowledge about engineering principles of various unit operations in food industry.
- 3.Gives knowledge of engineering of unit operations associated with preservation, pasteurization evaporation and dehydration techniques.
- 4.To impart knowledge about refrigeration,freezing engineering.
- 5.To impart knowledge about technological principles of freezing operations, freezing systems.

Detailed Syllabus

MODULE 1

Preliminary unit operations – material handling, cleaning, sorting and grading.

Material handling–theory, classification of various material handling equipments, conveyors and elevators .

Cleaning – types of contaminants found on raw foods, aims of cleaning, methods of cleaning dry, wet and combination methods; dry cleaning methods - screening, aspiration, magnetic cleaning and abrasive cleaning; wet cleaning methods- soaking, spray washing, flotation washing and ultrasonic washing.

Sorting and grading – advantages of sorting and grading, grading factors, methods of sorting and grading.

Engineering properties of food materials

MODULE 2

Conversion unit operations – size reduction, mixing and filtration.

Size reduction- benefits of size reduction, nature of forces used in size reduction, criteria of size reduction, equipment selection (hardness of feed, mechanical structure of feed, moisture content and temperature sensitivity of feed); mode of operation of size reduction equipment – open circuit and closed circuit grinding, free crushing, choke feeding and wet milling; size reduction of solid foods, fibrous foods and liquid foods; effects of size reduction on solid and liquid foods.

Mixing – mixing terminology (agitating, kneading, blending, and homogenizing), mixing equipments – mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators), mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer & vertical screw mixer); effects of mixing on foods.

Filtration – filtration terminology (feed slurry, filtrate, filter medium, filter cake and filter), filtration methods/equipments – pressure filtration, vacuum filtration, & centrifugal filtration.

MODULE 3
Preservation unit operations (high temperature operations)- pasteurization, evaporation and dehydration. Pasteurization– basic concept, effects of pasteurization on foods. Evaporation – main functions of evaporation, factors affecting the rate of heat transfer, factors influencing the economics of evaporation, evaporation equipments –horizontal tube evaporators, vertical tube evaporator and plate evaporator; single and multiple effect evaporators. Dehydration – objectives of dehydration, dehydration terminology, basic dehydration theory; drying curves, dehydration systems – tray drier, tunnel drier, drying time calculations.
MODULE 4
Preservation unit operation (low temperature operations) - refrigeration, freezing and freeze drying. Refrigeration – introduction, components of refrigeration systems – compressor, condenser and expansion valve; mechanical refrigeration system. Mechanical separations-Centrifugation and Sedimentation.
MODULE 5
Freezing – technological principles of freezing operations, freezing systems- direct contact and indirect contact system; influence of freezing rate on food system; freezing time calculations. Freeze drying – conventional drying vs freeze drying; equipments used and effects of freeze drying on food quality.

Suggested readings
1. S. K. Sharma, S.J.Mulvaney, and S.S.H.Rizvi, Food Process Engineering: Theory and Laboratory Experiments, Wiley and Sons, 2000.
2. H. Pandey, H.K. Sharma, R.C. Chauhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004.
3. M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.

Course Outcomes:

After completing the course, students will be able to:

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|---|
| 1. Understand the preliminary unit operations in food industry. |
| 2. Understand engineering principles of various unit operations in food industry. |
| 3. Understand engineering of unit operations associated with preservation, pasteurization evaporation and dehydration techniques. |
| 4. Understand the refrigeration,freezing engineering. |
| 5. Understand about freezing systems in food. |

MFT203: Research Methodology, Statistics and Computer Applications

Teaching Scheme

Lectures: 3 hrs./ week
Tutorials: 1 hr./week
Credits:4

Examination Scheme

Internal Assessment Marks[IAM]:30
[Class Test: 12, Teachers assessment: 6,Attendance: 12]
End Semester Marks[ESM]: 70

Course Objectives:

1. To give scientific approach to research and its types.
2. To give knowledge about sampling design, measurements and their central tendency.
3. To impart knowledge about experimental designs, measures of variability, correlation and various statistical tests.
4. To impart knowledge about introduction of computer science and technology, application softwares.

Detailed Syllabus

MODULE I

Research: significance, conceptualization of problem – hypothesis, Types of research – Research designs, fundamental, applied – action, exploratory, discipline, experimental, survey, case study and ex post facto. Longitudinal, cross sectional and correlational research.

MODULE 2

Theory of probability – population sample. Sampling techniques: Research methods – Interview schedule, important methods and data collection, interpretation of results, observation, social mapping, participatory rapid assessment. Writing up research reports and proposal.

MODULE 3

Statistics – meaning, role of statistics in research- descriptive research – classification, tabulation of data – graphic and diagrammatic representation of data. Measurement of central tendency , variation, dispersion, normal distribution – Mean, median, testing levels of significance – ‘T’ test, F test and X^2 test.

MODULE 4

Correlation, coefficient of correlation – rank correlation, analysis of variance, types, regression and forecasting–Fitting regression curves, discrimination analysis.

MODULE 5

Computer applications: MS office-word, excel, power point, internet, photoshop. Statistical software packages used in research. Software controlled food processing operations, application part in food industry. Software applications for quality control.

Suggested Readings

1. Elhance, D.L. (2008). Fundamentals of Statistics. Kitab Mahal, Patna.

2. Garret H.P. (2004). Statistics in Psychology and Education. Vallies Fotter and Simons Ltd. Bombay.
3. Kothari, C.R. (2008) Research Methodology. Wishwa Prakashan. New Delhi, India. Rao, K.V. (2007) Biostatistics. Jaypee Brothers medical publishers, New Delhi.
4. Sundar, R.P. & Richard, J. (2003). An Introduction to Biostatistics. Prentice Hall, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

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| 1. Understand the methods and role of scientific approach to research. |
| 2. Understand the various experimental designs, methods of sampling their analysis and data collection. |
| 3. Understand about the different terminology related to measurements, correlation, regression central tendency. |
| 4. Knowledge about test of significance of difference between means like t test, z test, chi square test, ANOVA. |
| 5. Knowledge of correlation and regression. |
| 6. Computer applications in food technology like response surface methodology and MS office applications: MS Office |

MFT204: Technology of Oil Seeds and Legumes

Teaching Scheme	Examination Scheme
Lectures: 3 hrs./ week Tutorials: 1 hr./ week Credits:4	Internal Assessment Marks[IAM]:30 [Class Test: 12, Teachers assessment: 6,Attendance: 12] End Semester Marks[ESM]: 70

Course Objectives:

1. To give knowledge about legumes and oilseeds production and processing in world.
2. To give knowledge about soyabean processing and value addition.
3. To impart knowledge about various edible oil sources and their processing technology.
4. To impart knowledge about oil based food emulsions preparation.

Detailed Syllabus

MODULE I
Status, production and major growing areas of legumes and oilseeds in India and world; structure and chemical composition of pulses and oilseeds; nutritional and antinutritional factors. Milling scenario of pulses in India, milling techniques: dry milling and wet milling; processing of legumes: soaking, germination, decortication, cooking, fermentation; puffing, roasting and parching; utilization of pulses; protein isolates and concentrates; role of legumes in human nutrition.
MODULE 2
Processing and utilization of soyabean for value added products; soy based fermented products; innovative products from pulses and oilseeds; future developments in products and processes; products from legumes and uses: starch, flour, protein concentrates and isolates.
MODULE 3
Sources of edible oils (groundnut, mustard, soyabean, sunflower, safflower, coconut, sesame and oil from other sources); physio-chemical properties; processing of oilseeds: rendering, pressing, solvent extraction, refining, hydrogenation; factors affecting extraction; packing and storage of fats and oils, changes during storage.
MODULE 4
Oil specialty products: margarine, mayonnaise, salad dressing, fat substitutes etc; chemical adjuncts: lecithins and GMS.

MODULE 5

Nutritional food mixes from oilseeds: processing of oilseeds for food use, protein rich foods, protein enriched cereal food.
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Suggested readings

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| 1. Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology. Applied Science, London. |
| 2. Salunkhe, O.K. Chavan, J.K, Adsule, R.N. and Kadam, S.S. 1992. World |
| 3. Mathews, R.H. Ed. 1989. Legumes: Chemistry, Technology and Human Nutrition. Marcel Dekker, New York. |

Course Outcomes:

After completing the course, students will be able to:

1. Understand the legumes and oilseeds production and processing in world.
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2. Understand the soyabean and its various products processing and value addition.
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3. Understand about the different edible oil sources and their processing

4. Knowledge about oil based food emulsions preparation.
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5. Understand the preparation of nutritional food mixes from oilseeds.
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MFT 205: Technology of Meat ,Fish and Poultry Products

Teaching Scheme	Examination Scheme
Lectures: 3hrs./ week Tutorials: 1 hr./ week Credits: 4	Internal Assessment Marks[IAM]:30 [Class Test: 12, Teachers assessment: 6,Attendance: 12] End Semester Marks[ESM]: 70

Course Objectives:

- 1.To give an overview about meat and poultry products industry,its composition,its aging and related phenomena.
- 2.To give knowledge about eating quality and meat analogues.
- 3.To impart knowledge about egg and its preservation methods.
- 4.To impart knowledge poultry meat.
- 5.To impart knowledge about fish and its processing.

Detailed Syllabus

MODULE 1

Status and scope of meat industry in India; Structure and physico-chemical properties of Muscle meat: composition and nutritive value, conversion of muscle into meat, post mortem changes in meat, rigor mortis, cold shortening, pre-rigor processing; stunning and slaughtering methods.

Aging of meat, meat tenderization- natural and artificial methods; cooking methods for meat: roasting, frying and braising; storage and preservation of meat: chilling, freezing, curing, smoking, dehydration, freeze-drying, irradiation, canning.

MODULE 2

Cooking, palatability and eating quality of meat, microbial spoilage of meat; restructured meat products (sausages), meat analogs; meat industry by products: importance and applications; intermediate moisture and dried meat products; meat plant hygiene and good manufacturing practices; packaging of meat products.

MODULE 3

Egg: Structure, composition and nutritive value of eggs, Storage and shelf life problems
Quality evaluation of eggs: international and external quality evaluation, candling, albumen index, Haugh unit, yolk index etc.

Egg preservation: grading of eggs, whole egg preservation, pasteurization, dehydration, freezing, egg products: egg powder, value added egg products (e.g., Meringues and Foams etc.), packaging of egg and egg products.

MODULE 4

Poultry products: types, chemical and nutritive value of poultry meat, slaughtering and evaluation of poultry carcasses; poultry cut-up parts and meat/bone ratio; preservation, grading and packaging of poultry meat.

MODULE 5

Fish processing: factors affecting quality of fresh fish, fish dressing, chilling, freezing, glazing, salting and canning of fish; manufacturing of fish paste, fish oil, fish protein concentrate and fish meal; by-products of fish industry and their utilization. Shell fish processing.

Suggested readings

1.	BD Sharma. Meat and Meat Products Technology, Jaypee Brothers Medical Publishers. 1999.
2.	Kerry J. et al. 2002. Meat Processing. Woodhead Publ. CRC Press.
3.	Pearson AM & Gillett, TA. 1996. Processed Meat. 3rd Ed. Chapman & Hall.
4.	Hui YH. 2001. Meat Science and Applications. Marcel Dekker. 32

Course Outcomes:

After completing the course, students will be able to:

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|---|
| 1. Understand about meat and poultry products industry, its composition, its aging and related phenomena. |
| 2. Understand the various eating quality and meat industry products. |
| 3. Understand about the egg and its preservation methods. |
| 4. Understand the poultry and its products preservation. |
| 5. Understand the basic of fish processing. |

MFT206: Intellectual Property Rights

Teaching Scheme	Examination Scheme
Lectures: 2 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Class Test: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35

Course Objectives:

- 1.To give an overview of IPR and its regime in India
- 2.To give knowledge about IPR benefits,patents and copyrights,trademarks .
- 3.To impart knowledge about protection laws for plant varieties and farmers.
- 4.To impart knowledge about International treaties on plant genetics,technologies and research collaborations.

Detailed Syllabus

MODULE 1
Need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.
MODULE 2
Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties.
MODULE 3
Fundamentals of patents, copyrights, geographical indications, designs and layout, trademarks.
MODULE 4
Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.
MODULE 5
International Treaty on Plant Genetic; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement

Suggested readings

1.	Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
2.	Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

1. Understand about Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.
2. Understand the IPR and its benefits.
3. Understand the basics of patents, copyrights, geographical indications, design and layout, trademarks
4. Understand the protection laws related to plant varieties and farmers.
5. Understand the International Treaties.

MFT207: Quality Control and Food Laws

Teaching Scheme	Examination Scheme
Lectures: 2 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Class Test: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35

Course Objectives:

1. To give an overview about meat and poultry products industry, its composition and nutritive value in India.
2. To give knowledge about mechanism of rigor mortis, postmortem changes. factors affecting meat quality.
3. To impart knowledge about preservation methods of meat and poultry and meat tenderization techniques.
4. To impart knowledge about utilization of meat, poultry and fish industry by products.
5. .To impart knowledge about egg, its composition, processing, properties and poultry processing industry.

Detailed Syllabus

MODULE 1
Quality Assurance: Introduction, Importance and Difference. Food Quality and Food Safety: Scope and difference.
MODULE 2
Raw materials & Finished product quality: Quality parameters and evaluation procedures: Appearance, color, texture, viscosity, consistency, flavor. Sensory evaluation: Selection of panel of judges, sensory characteristics of foods, types of tests.
MODULE 3
Food standards and laws: International – Concept of Codex alimentarius, HACCP, GMP, GHP, USFDA, ISO 9000, ISO 22000, ISO 14000. National – Introduction of BIS/IS, Food Safety and standards – 2006, Food Safety and standard regulation 2010, FPO, MPO, MMPO, Agmark. Prevention of food adulteration Act: Food Adulteration: definition, common adulterants in different foods, contamination, methods of detection. Food additives and legislation; coloring matter, preservatives, poisonous metals, antioxidants and emulsifying and stabilizing agents, insecticides and pesticides. PFA specification for food products, Nutritional labeling
MODULE 4
Quality Certification & Accrediation: Introduction and procedure.
MODULE 5

Water Quality: Water standards and Analysis physical, chemical and microbiological characteristics of water analysis. Waste treatment: Fundamentals of Physical, Biological & Chemical waste treatments.

Suggested readings

1. Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI Wallingford.
2. Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

1. Understand about Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement.
2. Understand the IPR and its benefits.
Understand the basics of patents, copyrights, geographical indications, design and layout, trademarks.
3. Understand the protection laws related to plant varieties and farmers.
4. Understand the International Treaties.

MFT-251 Technology of Fruits and Vegetable Laboratory	
Teaching Scheme	Examination Scheme
Practicals:4 hrs./ week Credits: 2	Internal Assessment Marks[IAM]:15 [Record: 06, Teachers assessment: 03,Attendance: 06] End Semester Marks[ESM]: 35 [Practical: 20 marks Viva:10, Record: 05 Marks]

Course Objectives:

- 1.To give practical knowledge about processing of fruits and vegetables products.
2. To attain expertise in Vegetable and Fruit Maturity Index Determination and Calculation.

Detailed Syllabus

<ol style="list-style-type: none"> 1.Preparation of Vegetable Products. 2.Preparation of Fruit Products. 3.Preparation of Dehydrated Fruits and Vegetables. 4.Preparation of Dried Figs and Raisins. 5. Vegetable and Fruit Maturity Index Determination and Calculation. 6. Quality Standard Measurements of Vegetable and Fruit Products.

Course Outcomes:

After completing the course, students will be able to:

<ol style="list-style-type: none"> 1. Understand the different methods of preparation of Fruits and vegetables various products. 2. Understand the techniques to be employed in determining the activity Vegetable and Fruit Maturity Index Determination and Calculation.
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MFT-252 SEMINAR

Teaching Scheme	Examination Scheme
Practical:2 hrs./week Credits: 1	Internal Assessment Marks:50

Course Objectives:

1. To prepare the students for compiling the knowledge and giving the presentation on any curriculum related topic so as to equip them with recent trends related to topic and also its effective delivery.

It's compulsory for all the students to give a seminar on the topic assigned by the Department of food technology in the starting of the semester, in the supervision of the assigned supervisor. If the discussion session of seminar / presentation is not found satisfactory then the next date for the said presentation will be given immediately.

Presentation Time duration : 30 - 45 minutes

Discussion duration : 15 - 20 minutes

Course Outcomes:

After completing the course, students will be able to:

Compile the essence of any given topic in the form of presentation and ensure its further effective delivery also by using recent technology in the teaching field.

MFT-253 Industrial training	
Teaching Scheme	Examination Scheme
Credits: 4	End Semester Marks[ESM]: 100 [Presentation: 50 marks, Viva:10, Report: 40 Marks]

Course Objectives

1. To attain expertise in hands on training in food technology.
2. To enable students observe, first hand, work flow and processes in food industries and associated enterprises.

It is compulsory for all the students to have 4 weeks internship in industry during winter break after 1st semester.

Course Outcomes:

After completing the course, students will be able to:

1. The student will be exposed to the diverse setting in food industries.
2. The student will be able to appreciate different processing and production technologies in various industrial settings

