

**DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY, MURTHAL
(SONEPAT)**

**SCHEME OF STUDIES & EXAMINATIONS
M. TECH. 1st YEAR (SEMESTER – II) (FOOD TECHNOLOGY)**

Credit Based Scheme w.e.f. 2013-14

S. No.	Course No.	Course Title	Teaching Schedule			Marks of Class work	Examination Marks		Total	Credit	Duration of Exam
			L	P	Total		Theory	Practical			
1.	FT502	UNIT OPERATIONS IN FOOD ENGINEERING	4	-	4	25	75	-	100	4	3
2.	FT504	PROCESS TECHNOLOGY OF CEREALS AND BAKERY PRODUCTS	4	-	4	25	75	-	100	4	3
3.	FT506	PROCESS TECHNOLOGY OF FRUITS AND VEGETABLES	4	-	4	25	75	-	100	4	3
4.	FT508	NUTRACEUTICALS AND FUNCTIONAL FOODS	4	-	4	25	75	-	100	4	3
5.	FT	ELECTIVE-1	4	-	4	25	75	-	100	4	3
6.	FT510	FOOD PROCESSING LAB-I	-	4	4	20	-	30	50	2	3
7.	FT512	FOOD PROCESSING LAB- II	-	4	4	20	-	30	50	2	3
TOTAL			20	8	28	165	375	60	600	24	

ELECTIVE - I:

1. FT522: FOOD ADDITIVES
2. FT524: BEVERAGE TECHNOLOGY
3. FT526: PROCESS TECHNOLOGY OF LEGUMES, OILSEEDS AND PLANTATION CROPS

NOTE:

1. The students will be allowed to use non-programmable scientific calculator. However, sharing/exchange of calculator is prohibited in the examination.
2. Electronic gadgets including cellular phones are not allowed in the examination.
3. The choice of students for any elective shall not be a binding on the department to offer, if the department does not have expertise.

FT502: UNIT OPERATIONS IN FOOD ENGINEERING
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)

L P Credits
4 -- 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

OBJECTIVES:

1. To review various unit operations in food engineering.
2. To develop an understanding of material handling- theory and equipments involved (conveyors and elevators etc.)
3. To identify various kinds of contaminants found on raw foods and methods of cleaning, sorting and grading.
4. To analyze the importance and effect of conversion unit operations (size reduction, mixing and filtration) on foods.
5. To know the technology and equipments of agitating, kneading, blending, and homogenizing for liquids of low and moderate viscosity.
6. To develop an understanding of mixers for high viscosity pastes ((Pan mixer, horizontal mixer and dough mixer) and mixers for dry solids (tumbler mixer & vertical screw mixer).
7. To study the methodology of filtration and equipments involved in pressure filtration, vacuum filtration and centrifugal filtration.
8. To understand the technology involved in the pasteurization of packaged and unpackaged foods and to study the effect of pasteurization on foods.
9. To study the main functions of evaporation in food technology and narrate factors affecting the rate of heat transfer, factors influencing the economics of evaporation, evaporation equipments – open pans, horizontal tube evaporators, vertical tube evaporator and plate evaporator; single and multiple effect evaporators.
10. To enumerate objectives of dehydration in food processing, dehydration terminology, basic dehydration theory; drying curves, dehydration systems – tray drier, tunnel drier, drying time calculations.
11. To elaborate Refrigeration system – components of refrigeration systems – compressor, condenser and expansion valve and mechanical refrigeration system.
12. To narrate technological principles of freezing operations, freezing systems- direct contact and indirect contact system; influence of freezing rate on food system; freezing time calculations.
13. To discuss the concept of conventional drying vs. freeze drying; equipments used in freeze drying and effects of freeze drying on food quality.

OUTCOME:

1. Able to interpret the role and importance of various preliminary unit operations on the quality of foods.
2. Able to know various kinds of mixers and technology of mixing used for different kinds of food commodities.
3. Able to find the effect of high temperature preservation unit operations (dehydration, evaporation and pasteurization) on overall quality of various foods.
4. Able to understand the concept and significance of refrigeration and freezing (low temperature preservation unit operations) on food quality.
5. Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

TEXT /REFERENCE BOOKS:

1. Earle, R.L. (1983) Unit Operations in Food Processing, 2nd Edition, Pergamon Press, Oxford, U.K.
2. Singh, R. P. and Heldman, D. R. (1984). Introduction to Food Engg., Academic Press, INC, London.
3. Harper, J.C. (1976) Elements of Food Engg., AVI Publ. Co., Westport, Connecticut.
4. Toledo, R.T. (1980). Fundamentals of Food Process Engg., AVI. Publ. Co., Westport, Connecticut.
5. Brennan, J.G., Buffers, J.R., Cowell N.D., Lilly, A.E.V. (1976). Food Engg. Operations, 2nd Ed., Elsevier, New York.
6. Lewis, M.J. (1987). Physical Properties of Foods & Foods Processing Systems, Ellis Horwood, England.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)	1
UNIT – I (09.01.18 to 01.02.18)	
Preliminary Unit Operations: Material handling, cleaning, sorting and grading.	2
Material handling–theory, classification of various material handling equipments, conveyors and elevators.	2
Cleaning – types of contaminants found on raw foods, methods of cleaning.	2
Sorting and grading – method and advantages.	1
Conversion unit operations – size reduction, mixing and filtration.	2
Size reduction- benefits criteria of size reduction, equipment selection mode of operation of size reduction equipment –effects of size reduction on foods.	2
UNIT – II (02.02.18 to 26.02.18)	
Mixing: Mixing technology (agitating, kneading, blending, and homogenizing)	2
Mixing equipments – mixers for liquids of low or moderate viscosity (Paddle agitators, turbine agitators and propeller agitators)	3
Mixers for high viscosity pastes (Pan mixer, horizontal mixer and dough mixer), mixers for dry solids (tumbler mixer & vertical screw mixer)	3
Effects of mixing on foods.	1
Filtration – filtration terminology (feed slurry, filtrate, filter medium, filter cake and filter)	2
Filtration methods/equipments – pressure filtration, vacuum filtration, & centrifugal filtration.	3
UNIT – III (27.02.18 to 19.03.18)	
Preservation Unit Operations (high temperature operations): Pasteurization, evaporation and dehydration	2
Pasteurization– basic concept, pasteurization of unpackaged and packaged foods.	2
Effects of pasteurization on foods.	1
Evaporation – main functions of evaporation, factors affecting the rate of heat transfer.	2
Factors influencing the economics of evaporation.	1
Evaporation equipments – open pans, horizontal tube evaporators, vertical tube evaporator and plate evaporator; single and multiple effect evaporators.	3
(20.03.18 to 31.03.18)	
Dehydration – objectives of dehydration, dehydration terminology.	1
Basic dehydration theory, drying curves.	3
Dehydration systems – tray drier, tunnel drier, drying time calculations.	3
UNIT – IV (02.04.18 to 16.04.18)	
Preservation unit operation (low temperature operations):	
Introduction to Refrigeration, freezing and freeze drying.	2
Components of refrigeration systems – compressor, condenser and expansion valve, mechanical refrigeration system.	3
Freezing – technological principles of freezing operations.	3
(17.04.18 to 27.04.18)	
Freezing systems- direct contact and indirect contact system.	1
Influence of freezing rate on food system.	1
Freezing time calculations.	1
Freeze drying – conventional drying vs freeze drying.	1
Equipments used and effects of freeze drying on food quality.	2

Home Assignments :4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
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2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

FT504: PROCESS TECHNOLOGY OF CEREALS AND BAKERY PRODUCTS
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)

L P Credits
4 -- 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

OBJECTIVES:

1. To enumerate the scope and importance of production and processing of cereals in India.
2. To study the structure and chemical composition of corn, wheat and rice grains.
3. To discuss the general principals and operations underlying milling of corn (wet and dry) , wheat and rice.
4. To know the criteria of flour quality.
5. To narrate various measurement techniques of dough rheology .
6. To study various technologies and unit operations involved in bread making .
7. To analyze the functionality of wheat proteins, carbohydrates lipids and enzymes in bread making.
8. To know the technology implicated in the formulation of biscuits, cookies, crackers, cakes, noodles and pasta products.
9. To elaborate the technology of parboiling of rice.
10. To study the cooking characteristics of rice and factors affecting cooking behavior of rice grains.
11. To know the detailed methodology of barley malting.
12. To study the formulation of High Fructose Corn Syrup and its food application.

OUTCOME:

1. Able to know the overall contribution of processed cereal and bakery products to Indian food industry.
2. Able to find structure and chemical composition of different cereal grains (corn, rice,wheat) and also able to know various wheat flour grades and types based on chemical composition and structure of wheat grains.
3. Able to narrate the functions of ingredients/additives such as fat, emulsifiers, oxidants, reducing agents in formulation of bread, rice convenience foods and other cereal based bakery products.
4. Able to enumerate various types of malts and their uses in food processing.
5. Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

TEXT/ REFERENCE BOOKS:

1. Samuel, A.M.(1996) “ The Chemistry and Technology of Cereals as Food and Feed “, CBS Publisher & Distribution.
- 2.Pomeranz, Y. (1998) “Wheat: Chemistry and Technology”, Vol 1,3” Am. Assoc.Cereal Chemists. St. Paul, MN.
3. Eliasson, A.C. and Larsson, K. (1993) “Cereals in Breadmaking”, Marcel Dekker. NewYork.
4. Honeney, R.C. (1986) “Principles of Cereal Science and Technology”, Am. Assoc. Cereal Chemists, St. Paul, MN.
- 5.Pomeranz, Y. (1976) “Advances in Cereal Science and Technology”, Am. Assoc. Cereal Chemists St.Paul, MN,
6. Juliano, B.O. (1985). “Rice Chemistry and Technology”, Am. Assoc. Cereal Chemists, St. Paul, MN, USA.
7. Blanshard J.M.V., Frazier, P.J. and Galliard, T. Ed. 1986. Chemistry and Physics of Baking. Royal Society of Chemistry, London.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)

UNIT – I (09.01.18 to 31.01.18)

Structure, quality and chemical composition of wheat grain.	2
Wheat milling – general principles and operations.	2
Flour extraction rates and various flour grades and types.	3
Criteria of flour quality.	1
Dough rheology and its measurement.	3

UNIT – II (02.02.18 to 28.02.18)

Bread making processes.	2
Importance of critical unit operations in bread making.	2

Development in bread making methods.	2
Functions of ingredients/additives such as fat, emulsifiers, oxidants, reducing agents and conditioners.	3
Bread faults and staling.	1
Functionality of wheat proteins, carbohydrates, lipids and enzymes in bread making.	3

UNIT – III (01.03.18. to 26.03.18)

Technology of biscuit, cookies, crackers and cakes manufacturing.	5
Leavening agents in bakery products; baking powders as leavening agents in bakery products.	
Technology of noodles and pasta products.	4

UNIT – IV (27.03.18 to 17.04.18)

Structure and chemical composition of rice grain.	1
Milling of rice, factors affecting rice yield during milling.	2
Rice bran as rice milling by products.	1
Rice parboiling technology.	2
Cooking characteristics of rice and factors affecting cooking behaviour of rice grains.	2
Rice convenience foods.	1

(18.04.18 to 27.04.18)

Structure types, composition of corn grain.	1
Wet and dry milling of corn.	2
Corn sweeteners (high fructose corn syrups) and their uses.	1
Barley malting process: different types of malts and their food applications.	2

Home Assignments :4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

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A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

FT506: PROCESS TECHNOLOGY OF FRUITS AND VEGETABLES
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)

L P Credits
4 -- 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

OBJECTIVES:

1. To elaborate the scope and importance of processing of fruits and vegetables in India.
2. To evaluate the effect of various pre-harvest factors on post – harvest physiology of different fruits and vegetables.
3. To study the role of precooling methods, edible coatings, crop maturity and ripening to extend the shelf life of horticultural crops.
4. To analyze the importance and effect of different methods of storage (Controlled atmospheric storage, Modified atmospheric storage, Hypobaric storage, Refrigerated storage) on quality of fruits and vegetables.
5. To know the technology involved in the formulation of various processed products from different fruits and vegetables (jams, jellies, marmalades, juices, squashes, cordials, crushes, nectars, RTS etc.) along with specifications.
6. To study methodologies involved in the production and packaging of fruit juice concentrates and fruit juice powders.
7. To evaluate the techniques implicated in the preparation of different Tomato products, fruit preserves, candied fruits, dehydrated fruits and vegetables.
8. To narrate the method of formulation of various syrups and brines for canning of fruits and vegetables.
9. To study various reasons involved in the spoilage of processed canned fruit and vegetables.
10. To enumerate the development of various new products from fruit and vegetable waste.
11. To discuss various processed products from mushrooms, cashew and coconut along with their chemical composition and processing technology.

OUTCOME:

1. Able to find the overall contribution of fruit and vegetable processing sector to food industry in India.
2. Able to know the chemical composition, nutritional significance and health benefits of various raw fruits and vegetables and their processed products.
3. Able to find the effect of various packaging techniques, different gaseous atmospheres . on post harvest handling of horticultural crops.
4. Able to know the technology and benefits involved in the production of various processed fruit and vegetable products e.g. able to find the role of pectin in gel formation, technology for juice pressing, juice extraction and enzymatic clarification , debittering and blending of juices.
5. Able to find the utilization and disposal of fruit industry waste.
6. Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

TEXT/ REFERENCE BOOKS:

1. R.P.Srivastava and Sanjeev Kumar (2001): Fruit and Vegetable Preservation – Principles and Practices, Third edition, International Book distributing Co. Lucknow(India)
2. A.K.Thompson (2003): Fruit and Vegetables – Harvesting, handling and storage. 2nd edition Blackwell Publishing.
3. Er. B. Pantastico: Post harvest Physiology, handling and utilization of tropical and subtropical fruits and vegetables. AVI Publishing Company, Inc.
4. W.V Cruess (1997): Commerical Fruit and Vegetable Products. Allied Scientific Publishers. Bikaner (India)
5. Girdharilal (1996) Preservation of Fruits and Vegetables. ICAR, New Delhi
6. Dauthy, M.E. 1997. Fruit and Vegetable Processing. International Book Distributin Co. Lucknow, India.
7. Hamson, L.P. 1975. Commercial Processing of Vegetables. Noyes Data Corporation, New Jersey.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)

1

UNIT – I (09.01.18 to 31.01.18)

Classification and Composition of Fruits and Vegetables and their Nutritional Significance: Climacteric and non-climacteric fruits.	3
Preharvest factors influencing post-harvest physiology.	2
Post harvest handling, precooling methods, post harvest treatments and edible coatings.	2
Crop maturity and ripening.	1
Methods of storage, refrigerated, CA, MA and hypobaric storage.	2
MAP recent developments, advances, role of gases, influence of MAP on microorganisms, advantages disadvantages.	2
Pre-processing operations.	1

UNIT – II (01.02. 18 to 26.02.18)

Technology of Jam, Jellies and Marmalades: Specifications, role of pectin and various theories of gel formation.	2
Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices.	2
Physiological and enzymological aspects of fruit juice production.	1
Fruit juice concentrates and powders- preparation and specifications, packaging.	2
Fruit juice beverages, squash, cordial, crush, RTS, nectar, syrups,	4
Blending of juices.	1

UNIT – III (27.02.18 to 31.03.18)

Technology of Tomato Products: Sauce, puree, ketchup and tomato paste.	3
Fruit preserves and candied fruits, dehydrated fruits & vegetables.	3
Spoilage of processed products.	2
Canning of fruits and vegetables.	2
Preparation of syrups and brines.	2
Spoilage of canned fruits and vegetables.	2

UNIT – IV (01.04.18 to 27.04.18)

New Product Development: By- products from fruit and vegetable wastes .	3
Utilization and disposal of fruit industry wastes.	3
Production of mushroom and its processed products.	2
Cashew and coconut: chemical composition, processing technology and their processed products.	4

Home Assignments : 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

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For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

**FT508 : NUTRACEUTICALS AND FUNCTIONAL FOODS
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)**

L	P	Credits	Class Work:	25 Marks
4	--	4	Examination	:75 Marks
			Total	:100 Marks
			Duration of Examination:	3 Hours

OBJECTIVES :

- To review the concept of nutraceutical and functional foods.
- To narrate the regulatory issues associated with nutraceuticals.
- To discuss the role of nutraceuticals / functional foods in prevention of angiogenesis, cardiovascular diseases, cancer, diabetes, cholesterol management, obesity and inflammation.
- To study the health benefits of natural plant pigments (chlorophyll, chlorophyllin, carotenoids, anthocyanins).
- To know the physical and chemical properties and health significance of glucosinolates, isoflavonoids, phytoestrogens, omega-3 and omega-6 fatty acids, antioxidants phytosterols.
- To enumerate various types of prebiotics and probiotics viz. resistant starch and fructo-oligosaccharides.
- To analyze the usefulness of prebiotics and probiotics in the maintenance of gastrointestinal health.
- To know the technology involved in the development of functional foods.
- To study the detailed methodology of isolation, storage and stability of phytochemicals/ bioactive compounds.
- To enumerate the concept of nutrigenomics and interpret its relation to nutraceuticals.

OUTCOME:

- Able to interpret the nutraceuticals as new dietary ingredients/ dietary supplements.
- Able to learn the biological significance of various types of nutraceuticals and functional foods and their role in disease prevention.
- Able to know the methodology of production of nutraceuticals and world market for nutraceuticals.
- Able to find the dosages of nutraceuticals and functional foods for effective control of disease or health benefit with adequate safety.
- Able to learn health benefits of prebiotics & probiotics and relation of nutrigenomics to nutraceuticals.
- Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

TEXT/ REFERENCE BOOKS:

- Brigelius-Flohé, J & Joost HG. (2006). Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
- Cupp J & Tracy TS. (2003). Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
- Gibson GR & William CM. (2000). Functional Foods - Concept to Products.
- Goldberg I. (1994). Functional Foods: Designer Foods, Pharma Foods.
- Losso JN. (2007). Anti-angiogenic Functional and Medicinal Foods. CRC Press
- Neeser JR & German BJ. (2004). Bioprocesses and Biotechnology for Nutraceuticals. Chapman & Hall.
- Robert EC. (2006). Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman.
- Shi J. (2006). Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
- Webb GP. (2006). Dietary Supplements and Functional Foods. Blackwell Publ.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)

UNIT – I (09.01.18 to 07.02.18)

Concept of Nutraceuticals : Nutraceutical and functional foods.	2
Nutraceuticals as new dietary ingredients, biological significance of nutraceuticals.	3
World market for nutraceuticals, regulatory issues.	4
The role of nutraceuticals / functional foods in disease prevention : angiogenesis and cardiovascular diseases, cancer, diabetes, cholesterol management, obesity and inflammation dosage levels.	5

UNIT – II (08.02.18 to 01.03.18)

Health Benefits of Nutraceuticals:

Natural pigments (chlorophyll, chlorophyllin, carotenoids) anthocyanins.	3
Glucosinolates, isoflavonoids, phytoestrogens.	2
omega-3 and omega-6 fatty acids.	2
Antioxidants and phytosterols.	2
Dosage for effective control of disease or health benefit with adequate safety.	3

UNIT – III (05.03.18 to 03.04.18)

Prebiotics and Probiotics: Usefulness of probiotics and prebiotics in gastro intestinal health and other benefits.	3
Beneficial microbes.	2
Prebiotic ingredients in foods.	3
Types of prebiotics and their effects on gut microbes. Resistant starch and Fructo-oligosaccharides as probiotic food components.	4

UNIT – IV (04.04.18 to 27.04.18)

Functional Foods: Definition, development of functional foods.	3
Isolation, storage, processing and stability of phytochemicals/bioactive compounds.	2
Nutrigenomics: nutrigenomics an introduction and its relation to nutraceuticals.	4

Home Assignments :4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

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For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

**FT524: BEVERAGE TECHNOLOGY (ELECTIVE-I)
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)**

L	P	Credits	Class Work	: 25 Marks
4	--	4	Examination	: 75 Marks
			Total	: 100 Marks
			Duration of Examination	: 3 Hours

OBJECTIVES:

1. To review the scope and importance of beverage industry in India.
2. To study the manufacturing technology for juice based and synthetic beverages.
3. To know detailed methodology implicated in the production of still, carbonated, low-calorie and dry beverages,
4. isotonic and sports drinks.
5. To study the role of various ingredients in the formulation of soft drinks and technology of carbonation of soft drinks.
6. To elaborate the manufacturing of beverages from different plant products (tea, coffee, cocoa, spices, herbs, nuts etc.) and animal based products (dairy).
7. To study the role of yeast in the manufacturing of beer and other alcoholic beverages.
8. To narrate various types of beers (ale and lager) and methodology of brewing process.
9. To enumerate different equipments used for brewing and distillation of wine, distilled spirits and related beverages.
10. To study the manufacturing and process quality evaluation and raw and processed water.
11. To enumerate various methods of water treatment.
12. To discuss BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, and carbonated water.

OUTCOME:

1. Able to find the overall contribution of beverage industry to food processing sector in India.
2. Able to know about various types of natural and synthetic beverages and their nutritional and health significance.
3. Able to narrate the benefits of consumption and technology of production of speciality beverages.
4. Able to find the manufacturing and quality evaluation of various types of alcoholic beverages.
5. Able to know various types of packaged water drinks, technology involved in their production and quality evaluation.
6. Able to imbue the motivation in students for continuous learning and improvement of technical advancement & skills.

TEXT / REFERENCE BOOKS:

1. Hardwick WA. 1995. Handbook of Brewing. Marcel Dekker.
2. Hui YH. et al 2004. Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.
3. Priest FG & Stewart GG. 2006. Handbook of Brewing. 2nd Ed. CRC.
4. Richard P Vine. 1981. Commercial Wine Making - Processing and Controls. AVI Publ.
5. Varnam AH & Sutherland JP. 1994. Beverages: Technology, Chemistry and Microbiology. Chapman & Hall.
6. Woodroof JG & Phillips GF. 1974. Beverages: Carbonated and Non Carbonated. AVI Publ.

LECTUREWISE PROGRAMME : (from 08.01.18 to 27.04.18)

Introduction of the subject (08.01.18)

UNIT – I (09.01.18 to 02.02.18)

Types of Beverages and their Importance	1
Status of beverage industry in India.	1
Manufacturing technology for juice-based beverages and synthetic beverages.	4
Technology of still, carbonated, low-calorie and dry beverages.	3
Isotonic and sports drinks.	1

Role of various ingredients of soft drinks, carbonation of soft drinks. 3

UNIT – II (05.02.18 to 28.02.18)

Speciality beverages based on :

Tea, coffee, cocoa. 4

Spices, plant extracts, herbs. 4

Nuts 1

Dairy and imitation dairy-based beverages. 3

UNIT – III (01.03.18 to 06.04.18)

Alcoholic Beverages: Introduction to types, manufacturing and quality evaluation. 2

The role of yeast in beer and other alcoholic beverages. 3

Ale type beer, lager type beer. 2

Technology of brewing process. 3

Equipments used for brewing and distillation. 2

Wine and related beverages. 2

Distilled spirits.

UNIT – IV (09.04.18 to 27.04.18)

Packaged Drinks: Definition, types, manufacturing processes. 2

Quality evaluation of raw and processed water. 2

Methods of water treatment. 3

BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

Home Assignments : 4 –5 assignments are given during the semester.

Evaluation Procedure

1.	Surprise Quiz/ Tutorial Test	5 Marks
2.	Assignment / Project / Performance in the Class	5 Marks
3.	Minor Tests (Two tests having equal weightage) Minor Test I : 14-16 Feb, 2018 Minor Test II : 4 -6 April, 2018	15 Marks
4.	Major test (University Examination)	75 Marks

Award of Grades Based on Absolute Marks: The University is following the system of grading based on absolute marks (after applying moderation if any). Following grading will be done based on the % of marks obtained in all the components of evaluation part of the subject.

A+ (90% - 100 %), A (80% - 89%), B+ (70% - 79%) , B(62% - 69%), C+ (55% - 61%), C (46% - 54%), D (40% - 45), F (Less than 40 %)

For F grade, a candidate shall be required to appear in the major test of concerned course only in the subsequent examination(s) to obtain the requisite marks/grade.

Attendance Record – Candidate should attend at least 75% attendance of the total classes held of the subject

Chamber consultation hour: Any vacant period.

Note: In the semester examination, the examiner will set 08 questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all, selecting at least one from each unit. All questions will carry equal marks.

FT510: FOOD PROCESSING LAB-I
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)

L	P	Credits	Class Work	:	20 Marks
--	4	2	Examination	:	30 Marks
			Total	:	50 Marks
			Duration of Examination	:	3 Hours

OBJECTIVES:

1. To evaluate the quality of wheat and rice grains e.g. gluten content in wheat flour and amylose content of rice.
2. To visit bakery and confectionary industries.
3. To know the technology involved in the formulation of different cereal and confectionary based products e.g. biscuits, cakes, chocolate and cookies etc. and their quality evaluation.
4. To study the role of milling and mixing time on the crispness of biscuits.

OUTCOME:

1. Able to know about various processing techniques used in the development of cereal based products.

List of Experiments/ Exercises:

(08.01.18 to 31.01.18 (every Monday))

- | | |
|---|-----|
| 1. To check the physicochemical and rheological properties of wheat and rice. | 4 |
| 2. Determination of gluten content in wheat flour. | 4 |
| 3. Milling of wheat and rice by laboratory mill. | 4+4 |

(01.02.18 to 28.02.18)

- | | |
|--|-----|
| 4. Quality tests of rice. | 4 |
| 5. Determination of amylose content in rice. | 4 |
| 6. Malting of barley; puffing and popping of grains. | 4+4 |

(01.03.18 to 31.03.18)

- | | |
|---|-----|
| 7. Preparation of protein concentrates and evaluation for protein content and solubility. | 4 |
| 8. Extraction of oil using expeller and solvent extraction methods. | 4 |
| 9. To visit related processing industries and bakery and confectionery industries. | 4+4 |

(01.04. 18- 27.04.18)

- | | |
|--|-----|
| 10. Effect of mixing time on the crispness and firmness of biscuits. | 4 |
| 11. Preparation and quality evaluation of cakes and chocolate. | 4+4 |

TEXT /REFERENCE BOOKS:

1. Lorenz KL.1991. Handbook of Cereal Science and Technology. Marcel Dekker.
2. Marshall WE & Wadsworth JI. 1994. Rice Science and Technology. Marcel Dekker.
3. Mathews RH. 1989. Legumes Chemistry, Technology and Human Nutrition. Marcel Dekker.
4. Matz SA. 1969. Cereal Science. AVI Publ.
5. Paquot C. 1979. Standard Methods of Analysis of Oils, Fats and Derivatives. Pergamon Press.
6. Pomeranz Y. 1987. Modern Cereal Science & Technology.VCH Publ.
7. Salunkhe DK.1992. World Oilseeds: Chemistry, Technology and Utilization. VNR.
8. Swern D. 1964. Bailey's Industrial Oil and Fat Products. InterSci. Publ. 28
9. Watson SA & Ramstad PE.1987. Corn; Chemistry and Technology. AACC.

FT512: FOOD PROCESSING LAB-II
M. TECH. SEMESTER - II (FOOD TECHNOLOGY)

L	P	Credits		Class Work	:	20 Marks
--	4	2		Examination	:	30 Marks
				Total	:	50 Marks
				Duration of Examination	:	3 Hours

OBJECTIVES:

1. To know the detailed technology involved in the development of various processed products from different fruits and vegetables e.g. Jams, jellies, marmalades, fruit cheese, pickles, tomato paste, puree and ketchup etc.
2. To evaluate the quality of processed products developed from fruits and vegetables.
3. To study the role of drying and dehydration in the shelf life of fruits and vegetables viz. grapes, figs, banana, onion, garlic and potato etc.

OUTCOME:

1. Able to know about various processing techniques for preservation of fruits and vegetables.

List of Experiments/ Exercises :

- (08.01.18 to 31.01.18 (every Tuesday))**
1. Evaluation of pectin grade for the formulation of jellies and marmalades. 4
 2. Canning of mango/guava/papaya. 4
 3. Preparation and quality evaluation of fruit jam: apple/ mango/ guava. 4
 4. Preparation of grape raisin, dried fig and dried banana. 4
- (01.02.18 to 28.02.18)**
5. Processing of tomato products. 4+4
 6. Preparation of anardana. 4
 7. Preparation of papain /guava cheese. 4
- (01.03.18 to 31.03.18)**
8. Preparation of pickle, mixed pickle. 4+4
 9. Preparation of dried ginger. 4
 10. Preparation of amchur. 4
- (01.04.18- 27.04.18)**
11. Preparation of dried onion and garlic. 4
 12. Preparation of banana and potato wafers. 4
 13. Preparation of dehydrated vegetables. 4

TEXT /REFERENCE BOOKS:

1. Barret DM, Somogyi LP&Ramaswamy H. 2005. Processing of Fruits. CRC Press
2. FAO. 2007. Handling and Preservation of Fruits and Vegetables by Combined Methods for Rural Areas- Technical Manual.FAO Agr. Ser. Bull., 149.
3. Fellows P. 2007. Guidelines for Small-Scale Fruit and Vegetables Processors. FAO Agr. Ser. Bull., 127.
4. Lal G, Siddappa GS & Tandon GL. 1998. Preservation of Fruits and Vegetables. ICAR.
5. Salunkhe DK & Kadam SS.1995. Handbook of Fruit Science & Technology: Production, Composition and Processing. Marcel Dekker.
6. Salunkhe DK & Kadam SS. 1995. Handbook of Vegetables Science & Technology: Production, Composition, Storage and Processing. Marcel Dekker.