

Mata Gujri College

(An Autonomous College)

Sri Fatehgarh Sahib

Affiliated to Punjabi University Patiala

Syllabi

For

M.Sc. (Hons.) Food Technology - First Year

(Ist & IInd Semester)

SYLLABUS OF COURSES TO BE OFFERED

(C-Core Courses, DSE-Discipline Elective Courses & AEEC-Ability Enhancement Elective Courses)



Academic Session 2018-2019 & 2019-2020

M.Sc. (Hons.) Food Technology First Year

Subjects and Distribution of Marks

Semester-I

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MFT-101 (C-1)	Paper I	Food Biochemistry and Nutrition	4	70	30	100	4
MFT-102 (C-2)	Paper II	General Microbiology	4	70	30	100	4
MFT-103 (C-3)	Paper III	Principles of Food Processing	4	70	30	100	4
MFT-104 (C-4)	Paper IV	Food Additives	3	70	30	100	3
MFT-105 (C-5)	Paper V	Research Methodology	2	70	30	100	2
MFT-106	LC-1	Food Biochemistry and Nutrition Lab	4			50	2
MFT-107	LC-2	General Microbiology Lab	4			50	2
MFT-108	LC-3	Principles of Food Processing Lab	4			50	2
MFT-109	LC-4	Food Additives Lab	2			50	1
MFT-409		Research Project (Induction of students towards research)			100		2
Total							26

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

M.Sc. (Hons.) Food Technology First Year

Subjects and Distribution of Marks

Semester – II

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MFT-201 (C-6)	Paper VI	Fruits and Vegetable Technology	3	70	30	100	3
MFT-202 (C-7)	Paper VII	Food & Industrial Microbiology	4	70	30	100	4
MFT-203 (C-8)	Paper VIII	Milk and Milk Processing Technology	3	70	30	100	3
MFT-204 (DSE-1)	Paper IX-a	Sugar and Confectionery Technology	3	70	30	100	3
	Paper IX-b	Fermentation Technology-I	3	70	30	100	
MFT-205 (DSE-2)	Paper X-a	Enzymes in Food Industry	3	70	30	100	3
	Paper X-b	Fermentation Technology-II	3	70	30	100	
MFT-206	LC-5	Fruits and Vegetable Technology Lab	4			50	2
MFT-207	LC-6	Food & Industrial Microbiology Lab	4			50	2
MFT-208	LC-7	Milk & Milk processing Technology Lab	4			50	2
MFT-209	LC-8a	Sugar and Confectionery Technology Lab	2			50	1
	LC-8b	Fermentation Technology-I Lab	2			50	
MFT-210	LC-9a	Enzymes in Food Industry Lab	2			50	1
	LC-9b	Fermentation Technology-II Lab	2			50	
MFT-409		Research Project (synopsis submission)			100		3
		Total					27

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

M.Sc. (Hons.) Food Technology Second Year**Subjects and Distribution of Marks****Semester III**

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MFT-301 (C-9)	Paper XI	Egg, Meat & Fish Technology	3	70	30	100	3
MFT-302 (C-10)	Paper XII	Food Engineering	4	70	30	100	4
MFT-303 (C-11)	Paper XIII	Biostatistics	3	70	30	100	3
MFT-304 (AEEC-1)	Paper XIV-a	Milk Product Technology-I	2	70	30	100	2
	Paper XIV-b	Pseudocereals and Millet Technology	2	70	30	100	
MFT-305 (AEEC-2)	Paper XV-a	Food Plant Layout	2	70	30	100	2
	Paper XV-b	Bakery Technology	2	70	30	100	
MFT-306	LC-10	Egg, Meat & Fish Technology Lab	4			50	2
MFT-307	LC-11	Food Engineering Lab	4			50	2
MFT-308		Industrial Training				50	2
MFT-409		Research project (Experimental work)			100		7
		Total					27

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

M.Sc. (Hons.) Food Technology Second Year

Subjects and Distribution of Marks

Semester – IV

Paper code	Paper No.	Name of paper	Period/ Week	External Marks	Internal Marks*	Total Marks	Credits
MFT-401 (C-12)	Paper XVI	Cereals, Pulses and Legume Technology	4	70	30	100	4
MFT-402 (C-13)	Paper XVII	Food Packaging	3	70	30	100	3
MFT-403 (AECC)	Paper XVIII	Food Quality and Regulations	3	70	30	100	3
MFT-404 (DSE-3)	Paper XIX-a	Nutraceutical & Functional Foods	3	70	30	100	3
	Paper XIX-b	Food Product Development	3	70	30	100	
MFT-405 (AEEC)	Paper XX-a	Milk Product Technology-II	2	70	30	100	2
	Paper XX-b	Beverage Technology	2	70	30	100	
MFT-406	LC-12	Cereals, Pulses and Legume Technology Lab	4			50	2
MFT-407	LC-13	Food Packaging Lab	4			50	2
MFT-408	LC-14a	Nutraceutical & Functional Foods Lab	2			50	1
	LC-14b	Food Product Development Lab	2			50	
MFT-409		Research project & seminar (Experimental work & Thesis writing)			100		8
		Total					28

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

C-Core course, DSE-Discipline Specific Elective Course, AEEC- Ability Enhancement Elective Course, AECC- Ability Enhancement Compulsory course

Assessment Parameters

Weightage (%)

- | | |
|-------------------------------|----|
| 1. Quality of thesis | 40 |
| 2. Quantitative data analysis | 20 |
| 3. Significance of work | 20 |
| 4. Presentation and defense | 20 |

**M.Sc. (Hons.) Food Technology (Semester-I)
Paper I – Food Biochemistry and Nutrition (MFT-101)**

Lectures to be delivered: 60 (Credit Hours-4)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Food chemistry, application and scope

Carbohydrates: Monosaccharide, Disaccharide, Oligosaccharides, Polysaccharides, Occurrence, Classification and properties

Proteins: Sources, amino acids, peptides, protein classification, structure & their properties, protein denaturation, Food proteins

Lipids, Oils and Fats: Classification and uses of lipids in food, physical and chemical properties, Sources of oils and fat, classification of lipids, Fatty acids (Saturated, Unsaturated and essential fatty acids) ALA, EPA & DHA (omega fatty acids), Physical characteristics of fats, Reactions of fats (rancidity and polymerization), Processing of oils and fats Functions of oils and fats in food

Unit II

Vitamins and Minerals: Classification, Sources, functions, deficiency symptoms

Dietary Fibre: Complex carbohydrates as functional food ingredient. Soluble, insoluble dietary fibre, sources, functions and benefits

Enzymes: Introduction, Nomenclature and classification, Factors affecting the rate of enzyme catalyzed reactions, Enzyme Immobilization, enzymes in food processing, enzymatic browning

Plant Pigments: Occurrence, structure, functions and changes during processing in plant pigments (Chlorophyll, Carotenoids, Anthocyanins and Flavonoids)

Books recommended:

- ❖ Damodaran, S. P and Fennema, O. R. *Fennema's food chemistry*. CRC press. 5th Edition
- ❖ Cox, M. M and David L. N. *Lehninger principles of biochemistry*. WH Freeman, Recent Edition
- ❖ Plummer, D. T. *Introduction to practical biochemistry*. Tata McGraw-Hill, Recent Edition
- ❖ Chopra, H. K Anupama P and Panesar S. P. *Bio-organic Chemistry*. Alpha International (2013)
- ❖ Kent, N. L. *Kent's Tech of Cereals: An introduction for students of food sc and agriculture*. Elsevier (1994)

M.Sc. (Hons.) Food Technology (Semester-I)

Paper II – General Microbiology (MFT-102)

Lectures to be delivered: 60 (Credit Hours-4)

Max. Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Introduction to Microbiology: Historical developments of microbiology, brief account of classification of microorganisms, Hackel's three kingdom concept, Whittaker's five kingdom concept, three domain concept. Prokaryotic and eukaryotic cell, Brief account of major groups of microorganisms: Bacteria, algae, fungi, protozoa and viruses

Methods of Microbiology: Microscopy: bright field & dark field microscopy, fluorescence and immuno-fluorescence microscopy, phase contrast and electron (transmission and scanning) microscopy, Staining techniques; simple, negative, gram, acid fast, spore and capsule, Flagella staining of microorganisms, Isolation and maintenance of microbial cultures from different sources

Unit-II

Nutrition Types and Growth of Microorganisms: Nutritional types (Concept of litho/organo, photo/chemo and auto/ heterotrophs), types of media (selective media, differential media, assay and enrichment media), choice of media, Growth of microorganisms: Population growth and growth kinetics, Methods of growth determination, effect of environmental conditions (pH, temperature, aeration, etc.) continuous culture, diauxic growth, synchronous cultures

Control of Microorganisms: Control of microbes by physical (dry and moist heat, pasteurization, tyndalization, radiation and filtration) techniques, Control of microbes by chemical agents (disinfection sanitization, antiseptics, sterilants and fumigation), Determination of phenol coefficient of disinfectant, antibacterial agents, Mechanism of resistance to antimicrobial agents, Susceptibility testing of fastidious and anaerobic bacteria

Books Recommended:

- ❖ Alcamo, I.E. (2011) Fundamentals of Microbiology, John and Barlett Publishers
- ❖ Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. (2010). Microbiology, Mc. Graw Hill Publishers
- ❖ Prescott. L.M. Harley J.P. and L. Kleig D.A. (2013). Microbiology, Mc. Graw Hill Publishers
- ❖ Stanier, R. Y. Adelberg, E.A. and Ingraham, J.L. (2004). General Microbiology, Mac Millan Press .

**M.Sc. (Hons.) Food Technology (Semester-I)
Paper III– Principles of Food Processing (MFT-103)**

Lectures to be delivered: 60 (Credit Hours-4)

Max Marks: 70
Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction of Food Processing: Introduction to food technology, Status of Food processing sectors in India, Properties of foods, Food spoilage (safety and shelf-life), Concept of water activity (Brining and Syruping)

Ambient-Temperature Processing: Raw material preparation, cooling crops and carcasses, cleaning, sorting and grading and peeling

Thermal Processing –I: Introduction to thermal processing, Effect of heat on microorganisms, enzymes and nutritional quality of food. Theory and equipment used for heat processing using steam or water (Blanching, Pasteurization, Heat sterilization, Ultra high-temperature (UHT)

Thermal Processing -II: Drying process, types of dryers, dehydration effect in food. Technology and effect on food during concentration

Unit II

Low Temperature Processing: Chilling and Freezing: theory, equipments, applications and its effect on food and micro-organisms. Freeze drying and freeze concentration.

Pressure Processing (Non-thermal technologies-I): High-pressure processing; theory, equipment, effect on micro-organisms, spores and enzymes

Irradiation Processing (Non-thermal technologies-II): Irradiation and Microwave: Introduction, Principle, Microwave heating of foods, source of radiation, mechanism of preservation, dose determination.

Hurdle Technology: Concept of hurdle technology, Types of Hurdles (physical, physicochemical and microbial). Preservation by hurdle technology

Books recommended:

- ❖ Desrosier, N. W. and James N. D. *The technology of food preservation*. Ed. 4. A VI Publishing Co
- ❖ Potter, N.N. and Joseph H. H. *Food science*. Springer Science & Business Media, 2012
- ❖ Stewart, G. F. and Maynard A. A. *Introduction to food science and technology*. Elsevier, 2012
- ❖ Salunkhe, D. K, and Kadam, S.S. *Handbook of fruit science & tech: production, composition, storage & processing*. CRC press, 1995

M.Sc. (Hons.) Food Technology (Semester-I)

Paper IV– Food Additives (MFT-104)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Additives in food processing and preservation, Functions, safety and quality evaluation of additives.

Additives Type-I: Various additives such as preservatives, antioxidants, Sequestrants and humectants, food uses and functions in formulations

Additives Type-II: Colours, Acidulants, Anticaking agents, Thickeners, Flour bleaching agents, Bread improvers with respect to chemistry, Food uses and functions in formulations

Unit-II

Emulsifier and Stabilizer: Definition (Emulsion and Emulsifier), types, Application, Emulsion stabilization.

Flavors and Sweeteners: Definition and basic tastes, Chemical structure and taste, Description of food flavors, Flavors enhancers. Sweeteners; Natural and Artificial

Antioxidants and other Phytochemicals: Natural & synthetic antioxidants, iso-flavones, lycopene role as nutraceuticals and functional foods

Books recommended:

- ❖ Branen, A. Larry, P. Michael D, Seppo S. and John T. *Food additives*. CRC Press, 2001
- ❖ Saltmarsh, M. and Mike S. *Essential guide to food additives*. Royal Society of Chemistry, 2013
- ❖ Pomeranz, Y. *Functional properties of food components*. Academic Press, 2012
- ❖ Joint FAO/WHO Expert Committee on Food Additives. Meeting, and World Health Organization. *Safety evaluation of certain food additives*. No. 56. World Health Organization, 2006.
- ❖ Furia, Thomas E. *CRC handbook of food additives*. Vol. 1. CRC press, (Recent Edition)

M.Sc. (Hons.) Food Technology (Semester-I)

Paper V – Research Methodology (MFT-105)

Lectures to be delivered: 30 (Credit Hours-2)

Max. Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Foundations of Research: Meaning/Definition, Objectives, deductive and inductive research. Characteristics of scientific method, Understanding research language: Concept.

Problem Identification & Formulation: Research Question, Investigation Question, Measurement Issues and Hypothesis.

Research Design: Concept, Importance of Research Design, Exploratory Research Design, Descriptive Research Design and Experimental Design. Variable types (Independent and Dependent).

Qualitative and Quantitative Research: Concept of measurement, causality, generalization and replication. Merging the two approaches

Unit-II

Sampling: Introduction to Sample, Types, Sampling Frame, Sampling Error, Determining size of the sample – Practical considerations in sampling

Interpretation of Data and Paper Writing – Layout of a Research Paper, Search for Journals, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism, plagiarism detection

Use of Tools/Techniques for Research: Methods to search required information effectively, Software for paper formatting; MS Office

Books Recommended:-

- ❖ Kumar, S and Promma P. *Research methodology*. Springer US, 2005.
- ❖ Marczyk, G. David D and David F. *Essentials of research design & methodology*. John Wiley & Sons, 2005
- ❖ Kothari, C. R. *Research methodology: Methods and techniques*. New Age International, 2004.
- ❖ Taylor, S. J. Robert B and Marjorie D. *Introduction to qualitative research methods: A guidebook & resource*. John Wiley & Sons, 2015.

M.Sc. (Hons.) Food Technology (Semester-I)

LC I – Food Biochemistry and Nutrition Lab (MFT-106)

Lectures to be delivered: 60 (Credit Hours-2)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Preparation and standardization of solution
2. Quantitative tests for proteins estimation
3. Quantitative tests for carbohydrates by DNSA and Anthrone methods
4. Paper chromatography/TLC of pigments
5. Estimation of vitamin C in citrus fruits
6. To perform various Quantitative/Qualitative tests for lipids
7. To determine %crude fibre content in given food sample
8. Proximate calculation for different flour
9. To determine acid value of fat
10. Estimation of Na, Ca and Mg content in given food sample

**M.Sc. (Hons.) Food Technology (Semester-I)
LC-II – General Microbiology Lab (MFT-107)**

Lectures to be delivered: 60 (Credit Hours-2)

Max. Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Introduction to GLP (Good Laboratory Practices)
2. Introduction to general equipments (autoclave, BOD incubator, hot air oven, laminar air flow, pH meter, colony counter) used in microbiology lab
3. Introduction to microscopes (Simple, compound and phase contrast).
4. Staining Techniques (Simple staining, Gram's staining)
5. Media preparation and its sterilization
6. Isolation and enumeration of bacteria from soil by serial dilution and agar plating method
7. To study morphology of bacteria isolated from soil sample
8. Determination of cell size of different microorganisms
9. Determination of cell count by SPC method and DMC method
10. To isolate fungi and yeast and study their morphology
11. Calculation of generation time and growth rate of bacterial culture

**M.Sc. (Hons.) Food Technology (Semester-IV)
LC III– Principles of Food Processing Lab (MFT-108)**

Lectures to be delivered: 60 (Credit Hours-2)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. % moisture determination by **a.** Drying method (using hot air oven) **b.** Moisture meters
2. To study the effect of chilling injury on perishable products
3. To study the effect of chilling injury on perishable products
4. To study the effect of pasteurization on food quality
5. To study the effect of sterilization on food quality
6. To study the effect of thermization on food quality
7. To study the effect of drying on food quality
8. To study drying kinetics of food
9. Preparation of syrup and brine and determination of its strength
10. To estimate water activity (**a_w**) of foods using saturated salt solution
11. To study osmotic dehydration of fruits
12. Visit to food processing industry

**M.Sc. (Hons.) Food Technology (Semester-I)
LC IV– Food Additives Lab (MFT-109)**

Lectures to be delivered: 30 (Credit Hours-1)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. To detect various adulterants in foods (Milk & milk products and Spices)
2. Application of stabilizers in beverage formulation
3. Application of thickeners in soup preparation
4. Use of various chemical preservatives in food preservation
5. Application of emulsifiers in emulsion preparation
6. Application of various colorants in acceptability determination of beverages
7. Use of humectants in confectionary products to arrest water activity by glycerol
8. Effect of flour improver on dough quality
9. To prepare flavoured drink using synthetic flavour
10. Sensory evaluation practice for additive utilized food preparation in lieu of control sample

**M.Sc. (Hons.) Food Technology (Semester-II)
Paper VI– Fruits and Vegetable Technology (MFT-201)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Nutritive value of Fruits & Vegetables, Fundamentals of Harvesting; Maturity indices, Post Harvest technology of Fruits & Vegetables, Climacteric and non-climacteric fruits.

Handling and Storage of Fruits & Vegetables: Ambient, Refrigerated, Modified and Controlled atmosphere, evaporative cold storage, minimally processed foods.

Preparatory Operations for Fruits and Vegetables: Washing, Cleaning, Grading (Size, Color and Shape), Sorting, Peeling, Size reduction

Processing Effects on Quality (F&V): Texture, color and flavour of fruits and vegetables, nutritive value of processed fruits

Canning of Fruits & Vegetables: General process & equipment. Canning of Fruits & Vegetables: Process & Equipment, UHT. Containers for conventional & aseptic canning

Unit II

Fermented fruits & Vegetable: Technology of production for pickles and sauerkraut

Fruit Juice: Method of juice extraction, clarifications of fruit juices, preservation of fruit juices. Problems related to concentration & storage

Fruit and Vegetable based products and their Specifications: Squash, RTS, Syrup, Tomato puree, paste, ketchup, soup, veg sauces. Jam, Jellies & Marmalade, role of pectin in products

Fruit Preserves: Legal standards of processed fruits and vegetables, FSSAI, BIS, Codex Alimentarius Commission (CAC).

Books Recommended:

- ❖ Lal, G. *Preservation of fruits and vegetables*. ICAR New Delhi, (Recent Edition).
- ❖ Bhutani, R. C. *Fruit and vegetable preservation*. Daya Books, 2003.
- ❖ Ranganna, S. *Handbook of analysis and quality control for f & v products*. Tata McGraw-Hill, 1986.
- ❖ Fellows, P. J. *Food processing technology: principles and practice*. Elsevier, 2009.

**M.Sc. (Hons.) Food Technology (Semester-II)
Paper-VII Food and Industrial Microbiology (MFT-202)**

Lectures to be delivered: 60 (Credit Hours-4)

Max. Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit-I

Introduction to Food Microbiology: Food as substrate for microorganisms, microorganisms in food (moulds, yeast and bacteria) and their importance, principles of food preservation, aseptic control of microorganisms (modified environments, physical methods and chemical preservatives), factors influencing microbial growth in food- extrinsic and intrinsic factors

Contamination and Spoilage: Cereals, vegetables, fruits, milk and milk products, fish and sea foods, poultry, sugar products, spoilage of canned food

Food Borne Infection and Intoxications: Infection and intoxication caused by: *Clostridium*, *Staphylococcus*, *Escherichia*, *Salmonella*, *Shigella* and *Vibrio*.

Fermented Cereal Products: Raw materials & fermentative process for production of fermented plant foods (Bread, soya), Oriental fermented foods: soya sauce, meso, tempeh, idli and dosa.

Fermented Milk Products: Kefir, Kumis, Yogurt, Bulgarian milk, Acidophilus milk

Unit-II

Introduction to Industrial Microbiology: Importance of industrial microbiology, industrially important microorganisms, selection of raw materials

Process Technology: fermentation system: upstream and downstream processing

Important Industrial Products: Non- distilled (beer and wine) and distilled alcoholic beverages (Whisky, rum, brandy), bio-ethanol, organic acids (vinegar, citric acid and itanoic acid), lactam antibiotics (Pencillin and streptomycin)

Industrial Enzymes and Amino Acids: Production & applications: industrial enzymes (amylases, proteinases and cellulases); amino acid (glutamic acid and lysine), steroids microbial transformation.

Industrial Waste: Types of industrial waste (solid & liquid), Treatments & disposal methods

Books Recommended:

- ❖ Adams MR and Moss MO. *Food Microbiology*, RSC Publishers, UK
- ❖ Frazier W C and Westhoff D C. *Food Microbiology*, Tata McGraw-Hill Publishers, New York
- ❖ James, MJ. *Modern Food Microbiology*, Aspan Publication, Gaithersburg, Maryland
- ❖ Moo-Young M. *Comprehensive Biotechnology*, Pergamon Press, Oxford, UK

M.Sc. (Hons.) Food Technology (Semester-II)

Paper VIII– Milk and Milk Processing Technology (MFT-203)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Definition, Status of milk production and industries in India, composition, factors affecting composition

Sources of Milk: Human, Cow (Indian and Exotic breeds), Goat, Buffalo and Camel milk

Properties: Food and nutritive value, physicochemical properties of milk.

Pre-processing: Clean milk production, buying and collection, cooling and transportation, receiving, judging and grading. Microbiology of milk

Processing: Preheating, Filtration, Clarification, Cream separation and standardization, Working of clarifier, Pasteurization (LTLT/HTST/UHT); Working principle. Homogenization (working principle), Re-constitution and recombination process

Unit II

Market Milk and Special Milk: Sterilized milk, homogenized milk, soft curd milk, flavoured milk, vitaminized milk, standardized milk, full fat, toned, double toned, skim milk and humanized milk.

Fermented Milk Products: Natural buttermilk, cultured buttermilk, acidophilus milk, Bulgarian buttermilk, kumiss, kefir, yoghurt, dahi and lassi, probiotic dairy foods

Traditional Indian Dairy Products: Khoa and khoa based sweets, channa based sweets, milk and cereal (composite) based foods; kheer and raabadi etc.

Fat Rich Dairy Products: Technology of preparation for Cream, Butter, Butteroil and Ghee

Books recommended:

- ❖ De, Suku mar. *Outlines of dairy technology*. Oxford university press, 2008.
- ❖ BOOKS, BIOTECH. "Dairy and Food Product Technology." (2016).
- ❖ Walstra, P. Pieter W., Jan TM Wouters, and Tom J. Geurts. *Dairy science and technology*. CRC press, 2005.
- ❖ Aneja, R. P., B. N. Mathur, R. C. Chandan, and A. K. Banerjee. *Tech of indian milk products: hand book on process tech modernization for professionals, entrepreneurs & scientists*. Dairy India Yearbook, 2002.

M.Sc. (Hons.) Food Technology (Semester-II)

Paper IX a– Sugar and Confectionery Technology (MFT-204)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction to Confectionery: Trends in confectionery, types of confectionery (sugar, chocolate, bakery confectionery), crystalline and non crystalline confectionery, nutritional facts.

Manufacturing of Sugar: Composition of cane juice, refining process, carbonation, filtration, evaporation, crystallization, curing and finishing, drying, storage, deterioration of sugar, by products

Raw materials for Confectionery: Flour, functions of water in confectionary, invert sugar and milk, leavening agents, milk protein, soya protein, oils, and fats, gelling and whipping agents, Flavours and Colours

Manufacture of Sugar Confections: Hard boiled candies, Toffees, Caramel, Chewing gums and marshmallow.

Unit II

Chocolate Confectionery: cocoa processing, chocolate manufacture, bars and enrobed chocolate, emulsifiers in chocolate, cocoa butter substitutes

Packaging: Packaging requirements, forms and materials for confectionary

Sensory Evaluation: Sensory evaluation of confectionary products

Defects in Confectionery: Preparation and quality evaluation Fat bloom, sugar bloom, microbiological problems and rancidity

Books recommended:

- ❖ Minifie, B. *Chocolate, cocoa & confectionery: science & technology*. Springer Science & Business Media, 2012.
- ❖ Talbot, G. *Science & tech of enrobed and filled chocolate, confectionery & bakery products*. Elsevier, 2009.
- ❖ Edwards, W. P. *The science of sugar confectionery*. Royal Society of Chemistry, 2007.
- ❖ Woloson, W. A. *Refined Tastes: Sugar, Confectionery & Consumers in 19th Century America*. JHU Press, 2002.
- ❖ Lees, R. *Sugar confectionery & chocolate manufacture*. Springer Science & Business Media, 2012.

**M.Sc. (Hons.) Food Technology (Semester-II)
Paper IX b– Fermentation Technology-I (MFT-204)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Origin, scope and developments of fermented food and beverage industry

Raw Materials for Microbial Production: Conventional and non conventional medium, storage and transportation and homogenization of medium

Inoculum Development: Techniques for the development of inoculum for bacteria, fungus and yeast in industrial fermentation process

Unit II

Fermentation Types: Batch, Fed batch, Continuous, Submerged, surface, solid substrate fermentation, design of fermenter/bioreactors and its parts

Fermented Beverages: Fermentative production and quality analysis of undistilled (red and white wine, beer (ale and lager)) and distilled (whiskey and rum)

Microbial Biomass for Food and Feed: Single cell protein, industrial scale Fermentative production and characterization of Algal, bacterial, fungal and yeast biomass as single cell protein

Books recommended:

- ❖ Prescott S. C and Cecil G. D. "Industrial microbiology." *Industrial microbiology*. (Recent Edition).
- ❖ Stanbury P. F, Allan W and Stephen J. H. *Principles of fermentation technology*. Elsevier, 2013.
- ❖ Montville, T. J., and Karl R. M. *Food microbiology: an introduction*. 2nd Edition. ASM Press, 2007.
- ❖ Hui, Y. H, Lisbeth M. G, Jytte J, Wai-Kit N, and Peggy S. S. *Handbook of food & beverage fermentation technology*. Vol. 134. CRC Press, 2004.
- ❖ Ray, Bibek, and Arun Bhunia. *Fundamental food microbiology*. CRC press, 2007.

**M.Sc. (Hons.) Food Technology (Semester-II)
Paper X a– Enzymes in Food Industry (MFT-205)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70
Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction to Enzymes: Introduction and properties of enzyme, classification of enzymes into six major groups, enzyme activity, units of enzyme activity, specific activity, cofactors, coenzymes and prosthetic group, turn over number

Mechanism of Enzyme Catalysis: Enzyme structure, Factors responsible for catalytic efficiency of enzymes (proximity and orientation effects, acid base catalysis, distortion, covalent catalysis, pH and temperature). Single substrate (Michaelis-Menten) & double substrate rex (Ping-pong mechanism)

Industrial Enzyme Production: Microbial sources of enzymes, criteria for the selection of microbes for enzyme production, Microbial production of amylase, pectinase and cellulase

Immobilization of Enzymes: Methods of enzyme immobilization (ionic bonding, adsorption, covalent bonding, microencapsulation and gel entrapment). Comparison of free and immobilized enzyme systems, Co immobilization

Enzymes in Starch Industry: production of modified starches and corn syrups (HFCS)

Unit II

Application of Enzymes in Fruits and Vegetables Products: Distribution of pectic substances & pectinases in fruits, Specific applications of enzymes in juice technology like clarification, debittering.

Application of Enzymes in Dairy and Meat Industry: Rennin and Proteases application.

Application of Enzymes in Brewing Industry: Production and post processing technology of beer formation, role of enzymes in mashing and finishing operation

Recent Advances in Enzyme Technology: Enzymic reactions in biphasic liquid systems, stabilization of enzymes in biphasic aqueous-organic systems, Equilibria in biphasic aqueous-organic systems, Enzyme based biosensor for food analysis.

Books recommended:

- ❖ Copeland, R. A. *Enzymes: a practical introduction to structure, mechanism & data analysis*. John Wiley & Sons, 2004.
- ❖ Reed, G. *Enzymes in food processing*. Elsevier, 2012.
- ❖ Damodaran, S. Kirk L. P and Owen R. Fennema. *Fennema's food chemistry*. CRC press, 2007.
- ❖ Whitehurst, R. J and Maarten V. O. *Enzymes in food technology*. John Wiley & Sons, 2009.
- ❖ Palmer, T. *Enzymes*. Horwood Publishing, Chichester (Recent Edition)

**M.Sc. (Hons.) Food Technology (Semester-II)
Paper X b– Fermentation Technology-II (MFT-205)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Production of Food Additives: Raw material, culture, fermentative production process and application of amino acids (L- glutamic acid and L-aspartic acid)

Microbial Polysaccharide: Raw materials, fermentative production and application of Xanthan Gums and Dextrins.

Microbial Production of Vitamins: Raw materials, culture, fermentative production process and application of Thiamin (B-1), riboflavin (B-2), vitamin (B-12)

Unit II

Microbial Production of Organic Acids: Raw materials, culture, fermentative production process and application of citric and lactic acids

Microbial Production of Enzymes: Upstream and downstream processing for industrial production and application of microbial enzymes (Lipase and cellulase) in food technology

Books recommended:

- ❖ Prescott and Dunn's industrial microbiology by B. Reed
- ❖ Principles of fermentation technology by P. F. Stanbury, A. Whitaker and Hall
- ❖ Comprehensive Biotechnology by Moo Young (Vol. 3 and 4)
- ❖ Yeast Biotechnology by D. R. Berry, I. Russel and G.G. Stewart.
- ❖ Microbial Biotechnology, Fundamentals of Applied Microbiology by A. N. Glazer and H. Nikaido
- ❖ Biotechnology: Food Fermentation Technology by V. K. Joshi and A. Pandey

**M.Sc. (Hons.) Food Technology (Semester-II)
LC V– Fruits and Vegetable Technology Lab (MFT-206)**

Lectures to be delivered: 60 (Credit Hours-2)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Extraction of juice and its clarification
2. Preparation of RTS, Nectar and Cordial
3. Cold and Hot extraction of tomato pulp
4. Estimation of pectin content
5. Preparation of jelly
6. Check the ascorbic acid content and antioxidant activity of given sample
7. Check the lycopene content of given sample
8. Preparation of pickle
9. Drying of carrot pomace and its uses as dietary fiber
10. Perform the blanching process and check efficiency
11. Estimation of pectin content

M.Sc. (Hons.) Food Technology (Semester-II)

LC VI– Food and Industrial Microbiology Lab (MFT-207)

Lectures to be delivered: 60 (Credit Hours-2)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. To study the impact of physical and chemical preservatives on shelf life of given food sample
2. Microbiological analysis of fresh food samples
3. To check the standard plate count of spoiled food sample
4. Isolation and characterization of spoilage microorganisms from spoiled food
5. Study the microbial succession in sauerkraut production
6. To check the quality of milk sample using MBRT test
7. Estimation of alcohol contents produced in wine production
8. To study amylase production and its estimation
9. To study cellulase production and its estimation
10. Immobilization of whole cells and enzymes using sodium alginate

M.Sc. (Hons.) Food Technology (Semester-II)

LC VII– Milk and Milk processing Technology Lab (MFT-208)

Lectures to be delivered: 60 (Credit Hours-2)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. To perform platform tests: temperature, % acidity, pH, COB and alcohol.
2. Determine fat content by Gerber method
3. A lab practice for the determination of specific gravity of given milk sample
4. To check SNF and TS content of milk
5. To perform cream separation and standardization of milk
6. To check the efficiency of pasteurization by *Phosphatase* test
7. Preparation of value added foods using millets and milk
8. To determine the moisture content, ash content and protein content of milk
9. Preparation of butter and check fat, curd and moisture content of butter
10. Prepare various fermented dairy products
11. Determination of homogenization efficiency in different layers of homogenized milk

M.Sc. (Hons.) Food Technology (Semester-II)

LC VIII a– Sugar and Confectionery Technology Lab (MFT-209)

Lectures to be delivered: 30 (Credit Hours-1)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Determine the composition of cane juice.
2. To perform cookery stages of sugar syrup (soft ball, firm ball, hard ball, soft crack & hard crack)
3. A lab activity for the preparation of confections: Milk cake
4. Sensory evaluation of various confectionery products.
5. A practice for chocolate preparation
6. Preparation of invert sugar
7. Preparation of caramel and Toffee
8. Preparation of marshmallow
9. Visit to confectionery industry

**M.Sc. (Hons.) Food Technology (Semester-II)
LC VIII b- Fermentation Technology-I Lab (MFT-209)**

Lectures to be delivered: 30 (Credit Hours-1)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Understanding the working and principle of fermenters (Open & Closed controlled fermentation)
2. Preparation of bacterial and fungal inoculum
3. Production of wine
4. Production of Indian traditional fermented cereal based products (Idli/Dosa)
5. Production of ethanol by SSF and submerged fermentation
6. Production and evaluation of SCP
7. To study Growth Kinetics of given microbes
8. Visit to beverage industry (alcoholic)

**M.Sc. (Hons.) Food Technology (Semester-II)
LC X a– Enzymes in Food Industry Lab (MFT-210)**

Lectures to be delivered: 30 (Credit Hours-1)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Microbial Production of *amylase*
2. Microbial production of *cellulases/pectinases*
3. Effect of various parameters on the enzyme activity
4. Immobilization of enzyme by various methods
5. Study of enzyme kinetics
6. Comparison of enzyme kinetics of free and immobilized enzyme
7. Study of bore well method (Kerby bore) using modified media
8. Effect of dextrinization in given flour samples
9. To deactivate enzyme in fruits (Apple/Pineapple) through various methods

M.Sc. (Hons.) Food Technology (Semester-II)

Paper X b– Fermentation Technology-II Lab (MFT-210)

Lectures to be delivered: 30 (Credit Hours-1)

Max Marks: 50

Pass Marks: 40%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Microbial production of amino acids Aspartic acid
2. Microbial production of antibiotic Penicillin
3. Microbial production of *Amylase*
4. Microbial production of *Cellulase*
5. Microbial production of *Pectinase*
6. Production of Fermented milk products-Kefir
7. Production of Fermented milk products-Kumis
8. Production of Fermented milk product-Yoghurt
9. Microbial production of citric acids

M.Sc. Food Technology Second Year

Subjects and Distribution of Marks

Semester III

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
MFT-301 (C-9)	Paper XI	Egg, Meat & Fish Technology	3	70	30	100	3
MFT-302 (C-10)	Paper XII	Food Engineering	4	70	30	100	4
MFT-303 (C-11)	Paper XIII	Biostatistics	3	70	30	100	3
MFT-304 (AEEC-1)	Paper XIV-a	Milk Product Technology-I	2	70	30	100	2
	Paper XIV-b	Pseudocereals and Millet Technology	2	70	30	100	
MFT-305 (AEEC-2)	Paper XV-a	Food Plant Layout	2	70	30	100	2
	Paper XV-b	Bakery Technology	2	70	30	100	
MFT-306	LC-10	Egg, Meat & Fish Technology Lab	4			50	2
MFT-307	LC-11	Food engineering Lab	4			50	2
MFT-308		Industrial Training				50	2
MFT-309		Research project (Experimental work)	14	100			7
		Total					27

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

M.Sc. Food Technology Second Year

Subjects and Distribution of Marks

Semester – IV

Paper code	Paper No.	Name of paper	Period/ week	External Marks	Internal Marks*	Total Marks	Credits
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M.Sc. (Hons.) Food Technology, 2018-19 & 2019-20 (Ist and IInd Semester)

MFT-401 (C-12)	Paper XVI	Cereal, Pulses and Legume Technology	4	70	30	100	4
MFT-402 (C-13)	Paper XVII	Food Packaging	3	70	30	100	3
MFT-403 (AECC)	Paper XVIII	Food Quality and Regulations	3	70	30	100	3
MFT-404 (DSE-3)	Paper XIX-a	Nutraceuticals & Functional Foods	3	70	30	100	3
	Paper XIX-b	Food Product Development	3	70	30	100	
MFT-405 (AEEC)	Paper XX-a	Milk Product Technology-II	2	70	30	100	2
	Paper XX-b	Beverage Technology	2	70	30	100	
MFT-406	LC-12	Cereal, Pulses & Legume Technology Lab	4			50	2
MFT-407	LC-13	Food Packaging Lab	4			50	2
MFT-408	LC-14a	Nutraceuticals & Functional Foods Lab	2			50	1
	LC-14b	Food Product Development Lab	2			50	
MFT-409		Research & seminar (Experimental work cum thesis)	16	100			8
Total							28

*Internal assessment (30): Seminar (5 Marks) MST (15 Marks), Assignment (5), Attendance/report for the seminar/symposium/industrial/Educational visit (5 marks)

C-Core course, DSE-Discipline Specific Elective Course, AEEC- Ability Enhancement Elective Course, AECC- Ability Enhancement Compulsory course

Assessment Parameters	Weightage (%)
5. Quality of thesis	40
6. Quantitative data analysis	20
7. Significance of work	20
8. Presentation and defense	20

**M.Sc. Food Technology (Semester III)
Paper-XI, Egg, Meat & Fish Technology (MFT-301)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short

answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Meat: Introduction, Types, Status and scope of meat industry in India.

Composition and nutritive value, conversion of muscle into meat, environmental and animal production factors that affect meat quality, post mortem changes in meat, rigor mortis, cold shortening.

Meat tenderization: Meat Cuts, Ageing of meat, natural and artificial methods, Properties of fresh meat-water holding capacity, color, palatability, Cooking methods for meat

Storage and preservation of meat: Chilling, Freezing, Curing, Smoking, Dehydration, Canning. Spoilage of meat, Meat analogs

Unit II

Fish: Factors affecting quality of fresh fish, fish dressing, chilling, freezing, salting and canning of fish
Manufacturing of fish oil, fish protein concentrate

Surimi processing and fish pickel

Poultry: Types, chemical and nutritive value of poultry meat, poultry dressing and slaughtering methods, preservation, grading and packaging of poultry meat.

Egg: Structure, composition, nutritive and functional properties, Quality of egg: Internal quality evaluation, egg candling, egg grading, microbial spoilage of eggs, preservation and storage methods for eggs, Egg powder, Egg allergens

Books recommended:

Egg Science & Technology by Staddelman.

Poultry Products Technology by G.J. Mountney.

Principles of Meat Science by Forrest et al.

Developments in meat science by Lawrie–Vol.1, 2, 3, 4.

Processed meats by Pearson.

Fish processing Technology by George M. Hall.

Foods: Facts and Principles by N. Shakuntala Manay

Handbook of Meat and Meat Processing by Y. H. Hui.

**M.Sc. Food Technology (Semester-III)
Paper-XII, Food Engineering (MFT-302)**

Lectures to be delivered: 60 (Credit Hours-4)

Max. Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Units and Dimensions: Terms, definitions, measurement systems, SI systems, unit conversion, intensive and extensive properties, equilibrium state, density, specific volume, specific weight, specific heat, enthalpy, entropy, pressure, temperature scales.

Material balances: Basic principles, process flow diagrams, Material Balance Problems, concentration and dehydration

Energy balances: Thermodynamic systems (closed, open and isolated) Basic principles, energy terms, specific heat of solids and liquids, properties of saturated and superheated steam, heat balances.

Heat transfer: Modes of heat transfer, conductive, convective and radiative heat transfer, conductive heat transfer in a rectangular slab, estimation of convective heat transfer coefficient, forced convection and free convection, Kirchoff's Law, Stefan Boltzman law, Wien displacement law of heat transfer

Heat exchangers: plate, tubular, scraped surface and steam infusion.

Thermal process calculations: Commercially sterile concept, concept of D, F and Z values, thermal process calculation for canned foods.

Unit II

Fluid flow: Types of fluids and fluid flows, Concept of Viscosity and Viscometer, Fluid statics and dynamics, Bernoulli's equation, Newtonian and non Newtonian fluids,

Psychrometrics: Psychrometric chart, Properties of dry air: composition of air, specific heat of dry air, enthalpy of dry air and dry bulb temperature.

Properties of water vapor: specific volume of water vapor, specific heat of water vapour, Gibbs-Dalton law, Dew point temperature, relative humidity, humidity ratio, wet bulb temperature.

Size reduction: Size reduction in solids, Kick's law, Size reduction in liquids (homogenization and emulsifications)

Books Recommended:

Introduction to Food Engineering by R.P. Singh and D.R. Heldman.

Heat Transfer by J.P. Holman

Fundamentals of Food Process Engineering by R.T. Toledo.

Frozen Food Technology by C.P. Mallett.

Transport Processes and Unit Operations by C.J. Geankoplis

Food Engineering Operations by J.G. Brennan, J.R. Butters, N.D. Cowell & A.E.V. Lille

Unit Operations of Chemical Engineering by W.L. McCabe, J.C. Smith & P. Harriott

Transport Processes and Unit Operations by C.J. Geankoplis

**M.Sc. Food Technology (Semester III)
Paper-XIII–Biostatistics (MFT-303)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction to biostatistics: Basic definitions and applications, sampling (representative sample, sample size, sampling bias), sampling techniques

Data collection and presentation: Types of data, collection of primary and secondary data

Methods of data presentation: histogram, polygon and pie diagram

Measures of central tendency: Mean, Mode and Median

Measures of variability: Standard deviation, standard error, range, mean deviation and coefficient of variation

Correlation and regression: Positive and negative correlation, Karl- Pearsons co-efficient of correlation, Linear regression and regression equation and multiple linear regressions

Unit-II

Tests of significance: Small sample test (Chi-square test, t- test, F- test), large sample test (Z test)

Introduction to probability theory and distributions: concept of theory and distribution without derivation, binomial, Poisson and normal (only definitions and problems)

Analysis of variance-I: Analysis of variance with linear models

Analysis of variance-II: Analysis of variance for one-way classified data, analysis of variance for two-way classified data with one observation for cell

Analysis of variance-III: Analysis of variance for two-way classified data with multiple but equal number of observations per cell (data analysis only)

Books Recommended:

Bailey N T J. Statistical Methods in Biology, English University Press, London.

Banerjee PK. Introduction to biostatistics, S. Chand Publishers, New Delhi.

Bliss, C I.K. Statistics in biology, Mac-Graw Hill Publishers, New York.

Singh S, Bansal ML, Singh TP and Kumar R. Statistical Methods for Research Workers, Kalyani Publishers, New Delhi.

M.Sc. Food Technology (Semester III)

Paper -XIVa– Milk Product Technology-I (MFT- 304)

Lectures to be delivered: 30 (Credit Hours-2)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Heat desiccated products: Technology of khoa preparation and its types, Technology of Ghee preparation.

Acid coagulated Products: Technology of Paneer and channa preparation, Types and Characteristics,

Fermented Dairy products: Yoghurt and Curd preparation & its Defect, Composite dairy cereal products. Butter churning and its specifications, Technology of Cheese Preparation

Unit-II

Technology of SMP & WMP Preparation: Skim Milk Powder (Roller Dried & Spray Dried), WMP technology, RTE Dairy instant mixes.

Frozen desserts: Technology of Ice cream Mix preparation, Role of Ingredients and Freezing characteristics, Slow & fast freezing

Dairy by-product and their utilization: Whey and Whey proteins, whey utilization, Ghee residue utilization and Butter milk utilization

Standards and Legislations: Standards and Legislations of different milk and milk products

Books recommended:

1. Sukumar, De (1994). Outlines of Dairy Technology. Oxford University Press.
2. Smith G. (2003). Dairy processing improving quality. Woodhead Publishers.
3. Andrews, A.T. (1994). Biochemistry of Milk Products. Woodhead Publishers.
Technology of Dairy Products by Early, R.

M.Sc. Food Technology (Semester-III)

Paper -XIV b – Pseudocereals and Millet Technology (MFT-304)

Lectures to be delivered: 30 (Credit Hours-2)

Max. Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Introduction to Pseudocereal: Geographical distribution, Nutritional richness, Directorate and Research Centres, Antinutrients and Minimal pre-processing steps for their minimization, Comparison to staple cereal of Indian concern, Commercially available pseudocereal

Buckwheat: Nutritional composition, Buckwheat fortified foods

Amaranth: Introduction to Amaranth, Nutritional Composition, Amino acids of Amaranth, Bioactive components of amaranth

Unit-II

Millet Technology: Millet and its types, Nutritional enrichment, Milling, Antinutrients and their home scale minimization pre-processing sequential steps

Sorghum: Nutritional significance, Sorghum utilization, Bioactive components, Post harvest processing techniques, Composite Foods

Quinoa: Introduction, Nutritional Composition, Omega Fatty Acid of Quinoa, latest trends in preparation of multigrain flour, bread, biscuits and breakfast cereal

Books Recommended:-

Samuel, A.M. (1996) "The Chemistry and Technology of Cereals as Food and Feed", CBS Publisher & Distribution, New Delhi.

Blanshard J.M.V., Frazier, P.J. and Galliard, T. Ed. 1986. Chemistry and Physics of Baking. Royal Society of Chemistry, London.

Chakraverty, A. 1988. Postharvest Tech. of Cereals, Pulses and oilseeds. Oxford & IBH, N. Delhi.

Durbey, S.C. 1979. Basic Baking: Science and Craft. Gujarat Agricultural University, Anand (Gj).

Kent, N.L. 1983. Technology of Cereals. 3rd Edn. Pergamon Press, Oxford, UK.

Salunkhe, D.K., Kadam, S.S. Ed. 1989. Handbook of World Food Legumes: Chemistry, Processing and Utilization, (3 vol. set). CRC Press, Florida.

M.Sc. Food Technology (Semester III)

(Paper- XV a) Food Plant Layout (MFT-305)

Lectures to be delivered: 30 (Credit Hours-2)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Introduction: Food Plant Organization and management Organization Chart, Factors to be considered in plant location and site selection

Food plant layout and facilities: Design, layout, equipment machinery (Bakery Industry, Beverage Industry, Dairy Industry and Meat industry) and building

Good Laboratory Practices: Foreign Material, Pest Control and Management, Quality Circles and Quality Culture Concept, Six Sigma Concept. Good Manufacturing Practices to be considered in designing food plant.

Unit-II

Mechanized operations: CIP (Cleaning in place/cleaning in plant), Conveyors, Canning and retorting machines.

Corrosion and Corrosive foods: Types of Corrosion, mildly and highly corrosive food, Corrosion by service fluids. Preventive measures of corrosion (Lacquering, Oiling, Painting, Galvanic series order, Alloying)

Hygiene and Sanitation: Cleaning and Sanitation Procedure, Fumigation Practices, ETP (Effluent Treatment Plant) sanitizing agents

Recommended Books:

Plant Layout and Design–James M Moore.

Industrial Engineering and Management–O P Khanna,

Food Processing Operations and Scale Up–Leon Leuine and Peter Clerk.

M.Sc. Food Technology (Semester III) (Paper- XV b) Bakery Technology (MFT-305)

Lectures to be delivered: 30 (Credit Hours-2)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Wheat: Types of wheat, Classification, Physico-chemical basis of wheat grain softness or hardness

Wheat Flour: Milling of wheat, Types and quality of different types of flour, Proteins (Gluten) and Enzymes (Amylases) of wheat concern

Ingredients: Functions of different ingredients of bakery concern, *Sugar* – sources, types, functions of sugar and role in baking. *Shortening* – Nature of fat, types, functions, *Leavening agents* – Definition, physical, chemical and biological leavening agents, role of leavening agents in baking, *Eggs* – egg foams and their role in bakery.

Unit-II

Technology of baking: basic concepts, batch/continuous dough mixing, dividing, moulding, panning, proofing, baking, Qualitative changes during different unit operations

Bakery products: Bread making technology, Cookies, Biscuits & crackers technology, cake technology

Quality & Defects: Sensory evaluation of baked products, Staleness and ropiness in bread, appearance of Sugar bloom and fat bloom in baked goods.

Suggested Readings:

Samuel, A.M. (1996). "The Chemistry and Technology of Cereal as Food and Feed", CBS Publishers & Distribution, New Delhi.

Pomeranz, Y. (1998). "Wheat : Chemistry and Technology", Vol. I, 3rd Ed., Am. Assoc. Cereal Chemists, St. Paul, MN, USA.

Eliasson, A.C. and Larsson, K. (1993). "Cereals in Breadmaking", Marcel Dekker, Inc. New York.

Honey, R.C. (1986). "Principles of Cereal Science and Technology", Am. Assoc. Cereal Chemists, St. Paul, MN, USA.

Pomeranz, Y. (1976). "Advances in Cereal Science and Technology", Am. Assoc. Cereal Chemists, St. Paul, MN, USA.

M.Sc Food Technology (Semester-III) (LC-10 Practical) Egg, Meat & Fish Technology Lab (MFT-306)

(Credit Hours-2)

Max. Marks: 50

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Quality determination and grading of egg through candling and floating test
2. Effect of high temperature on coagulation time of egg contents
3. Find out effect of different time and temp. combination on formation of iron sulphide in egg
4. Determine specific gravity of eggs
5. To determine protein in meat sample through Lowry method

6. Determination of egg constituents such as ash, Total solid, moisture
7. To determine % fraction of egg and express as (Haugh unit, A & Y Index)
8. Microbiological test for egg and meat in special reference to *E.coli*
9. Grading of egg on size basis from jumbo to pee wee
10. Comparative test to judge efficacy of heat in controlling total viable count in a given sample of raw and processed market meat sample

**M.Sc. Food Technology (Semester-III)
(LC-11 Practical) – Food Engineering Lab (MFT-307)**

(Credit Hours-2)

Max. Marks: 50
Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A comprises of write up (12 Marks) from the list of practical pertaining to lab course. Section B comprises of practical to be perform in examination (25 Marks). Section C meant to evaluate practical note Book Evaluation and Viva Voce (13 Marks).

1. To study the working principle and operation of various types of grinders
2. To study thee distillation operation
3. Determination of Viscosity of liquid foods.
4. Determination of Reynolds number and nature of fluid flow in pipe
5. Determination of freezing time of selected food material
6. Study of an evaporator

7. Determination of heat transfer coefficient in free and forced convection

**M. Sc Food Technology (III Semester)
Industrial Training (MFT-308)**

(Credit Hours-7)

Max Marks: 50

INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES

Students have to undergone a compulsory 6 weeks industrial training (Food industry/ NABL lab/ Research institute) after IInd Semester, they have to submit a copy of training report alongwith issued certificate attested from the head of training organization as per the format provided. Students will be evaluated on the basis of **Seminar / Presentation / Viva-voce** to be conducted in IIIrd Semester and evaluated on marks basis (Out of 50).

**M.Sc Food Technology (III Semester)
Research Project (Experimental work) (MFT- 409)**

(Credit Hours-7)

Max Marks: 100

INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES

This is performance based activity. Research project undertaken by student as per their induction and literature survey during first semester is still ongoing as wet lab activities for data collection. All the findings have to be communicated by researcher to the concerned mentor which is evaluated on marks basis (Out of 100).

**M.Sc. Food Technology Semester – IV
Paper - XVI Cereal, Pulses and Legume Technology (MFT-401)**

Lectures to be delivered: 60 (Credit Hours-4)

Max. Marks: 70
Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS / CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Introduction: Cereals (wheat, rice, barley) and coarse cereals (millets, sorghum, amaranth and quinoa). Structure and composition of cereal grains and legumes

Wheat Technology: conditioning and milling, different grades of flour, improvers, process of manufacturing for biscuit, bread, cakes & pasta

Rice processing: Rice quality and grading standards, Methods parboiling & their methods, Changes during aging of rice, enrichment of rice with vitamins and mineral. Rice milling, degree of Milling, Factors affecting yield and quality of rice

Processing of Corn: Wet and Dry corn milling, corn types, functional properties of corn starch, products of wet milling, Syrups, HFCS, alkaline cooked products

Unit II

Barley Technology: Malting, milling of barley, functional characteristics of barley

Oats Technology: Structure of oat grains, composition, and applications of technology.

Legumes: Production, varieties and structure, chemical composition, Antinutrients, processing and cooking methods, utilization of legumes,

Extraction and refining of oils : Solvent extraction, refining and hydrogenation of oils, significance of omega-3 and omega-6 fatty acids in edible oils. CANOLA (GMF), antinutrients in oilseeds

Suggested readings:

Samuel, A.M. (1996). "The Chemistry and Technology of Cereal as Food and Feed", CBS Publishers & Distribution, New Delhi.

Pomeranz, Y. (1998). "Wheat : Chemistry and Technology", Vol. I, 3rd Ed., Am. Assoc. Cereal Chemists, St. Paul, MN, USA.

Eliasson, A.C. and Larsson, K. (1993). "Cereals in Breadmaking", Marcel Dekker, Inc. New York.

Honey, R.C. (1986). "Principles of Cereal Science and Technology", Am. Assoc. Cereal Chemists, St. Paul, MN, USA

Pomeranz, Y. (1976). "Advances in Cereal Science and Technology", Am. Assoc. Cereal Chemists, St. Paul, MN, USA.

M.Sc. Food Technology (Semester-IV)

Paper XVII– Food Packaging (MFT-402)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Introduction: Packaging and packaging material. Designing of packaging materials, Determination of shelf life of packaged products

Paper and plastic technology: Paper manufacturing processes viz; mechanical and chemical, (rigid & flexible) PET bottle, Laminates

Metal and Glass technology: Tin free steel, ECCS (Electroplating/Galvanization), Two piece & three piece can manufacture, Lacquering & Enamelling, glass bottle and glass jar formation technology (Parison/ Gob/ LAbeling of bottle)

Packaging methods: Vacuum, gas packaging, shrink packaging, Retortable pouch technology. Edible films and coatings, Active and Intelligent packaging techniques, Aseptic Packaging, Nano composites in food packaging, CAS & MAP

Packaging machinery: Form, Fill and seal, thermoform, shrink wrap,

Unit-II

Introduction to Human Resource Management: Definition, Functions of HRM and its relation to other Managerial functions, Importance of human resource management in Industry, EDP programme, Human Resource Planning, Methods of Recruitment, Psychological tests and Interviewing

Market: Introduction, scope, types of markets, marketing functions, marketing of food produce in India. Storage and Warehousing, Four P's of market (Market Mix), management problems to improve productivity in food industry

Meaning and Importance of Placement: Induction, Job satisfaction and its importance Motivation, Grievances and Grievance Handling Procedure, Discipline and Disciplinary action. Differences between Human Relations and Industrial Relations

Books Recommended:

1. Personnel Management: CB Mamoria.
2. Principles of Personnel Managements: Dawin B Filppo.
3. New Food Product Development : Gordon W Fuller
4. Principle and Practice of Marketing in India: CB Mamoria and RC Joshi.

M.Sc. Food Technology (Semester-IV)

Paper XVIII– Food Quality and Regulations (MFT-403)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit I

ISO: ISO:9000 (Quality Management System), ISO:14000, ISO:22000. Introduction, Features, Principles and Elements

Total Quality Management: Introduction and concept, cost and economics of quality, tools and techniques for analyzing the quality process, six-sigma.

HACCP: Hazard Analysis & Critical Control Points, CCP's, GMP and GHP

Technology Commercialization: Technology commercialization policy initiatives in India, Business Planning and Development Units, Women Entrepreneurship Development Programme, Skill Development Programmes

Unit II

Intellectual Property Rights: Intellectual property, types and related Indian legislations; WIPO, international conventions: TRIPs agreement, PCT, Paris convention, Budapest treaty; trade secret protection.

Patents: Novelty, inventiveness and industrial application; prior art; provisional and complete specifications; patent claims,

Patenting systems: Types of patent applications, national (India) and international patent filing, patent infringement; patentability of food technology processes and products in India; patent search: databases

Suggested Readings:

McLaughlin GC. Total quality in research and development, CRC press USA

Early R. Guide to total quality management systems for the food industry, blackie academic NY

Singh K C. Intellectual property rights on biotechnology, BCIL Publishers, New Delhi

Cornish WR. Intellectual property : patents, Trade marks and allied Rights, universal law publishing, New Delhi

M.Sc. Food Technology (Semester-IV)

Paper XIX a– Nutraceutical and Functional Foods (MFT-404)

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Functional Foods and Nutraceuticals: Introduction - Defining the concept –Classification, Significance of nutraceutical and functional foods in management of disease and disorder

Therapeutic role of nutraceuticals Classifying Nutraceuticals Food Source: Plant: Soya, olive oil, tea, grape wine, garlic, dietary fibre and other fruits and its Mechanism of Action – on Anticancer, Blood Lipid Profile, Anti oxidation.

Animal source: CLA (Conjugated Linolenic Acid), Omega Fatty Acids in special reference to Omega-3 (ω -3), Milk and other dairy products

Unit-II

Herbs as nutraceutical: Wild variety of plants as food remedies

Microflora as functional food: *Latobacillus* and *Streptococcus*, Probiotic, Prebiotic and Synbiotic terms, their usefulness in gastrointestinal health and other health benefits

Development of nutraceutical and functional food: Enrichment, Fortification and Supplementation, Composite Foods, Infant formula

Suggested Readings :

Mary, K. Schmidl and Theodore, P. Labuza , Essentials of Functional Foods, 2000.

Mazza, G , Functional Foods- Biochemical and processing aspects, 1998.
Israel Goldberg , Functional foods, Pharma foods, Nutraceuticals, 2001.
Robert easy Wildman , Handbook of Nutraceuticals and Functional Foods, 2001.

**M.Sc. Food Technology (Semester IVth)
Paper XIX b– Food Product Development (MFT-404)**

Lectures to be delivered: 45 (Credit Hours-3)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section - C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

Unit-I

Food needs and consumer preference: Market survey and its importance in, designing a questionnaire to find consumer needs for a product or a concept, advantages of processed foods in urbanized modern society; why people buy processed foods. Developing a product to meet the requirements

Designing new products new food product development (NPD) process and activities: recipe development, use of traditional recipe and its modification, recent development in food ingredients\additives, modifications for production on large Scale, cost effectiveness, nutritional needs or uniqueness

Unit-II

Standardization & large scale production: process design, equipment needed and design, Designing process parameters for optimum quality, statistical analysis, application in product development and comparison with market samples

Quality , safety and regulatory aspects: product stability, evaluation of shelf life, changes in sensory attributes and effects of environmental conditions; accelerated shelf life determination; developing packaging systems for maximum stability and cost effectiveness; interaction of package with food, regulatory aspects;

Suggested Readings:

Lyon, D.H.; Francombe, M.A.; Hasdell, T.A.; Lawson, K. (eds) (2002): Guidelines for Sensory Analysis in Food Products Development and Quality Control. Chapman and Hall, London.

2. Lawless, H.T. and Klein, B.P. (2001): Sensory Science Theory and Applications in Foods. Marcel Dekker Inc. New York.
3. Piggott, J.R. (ed) (2008): Sensory Analysis of Foods. Elsevier Applied Science, London.
4. Ranganna S. 2006. HandBook of Analysis and Quality Control for Fruits and Vegetables Products 2nd Ed. Tata McGraw- Hill Publishing company Limited. New Delhi.

M.Sc. Food Technology (Semester IV)

Paper –XX a– Milk Product Technology-II (MFT- 405)

Lectures to be delivered: 30 (Credit Hours-2)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit I

Indian dairy industry: Development and statistics (State co-operative societies and national body), Milk consumption growth, Cost reduction techniques

Advances in dairy industry: Adulterants detection in milk and milk products, Novel technologies at a glance in dairy; PEF (Pulse Electric Field) and HHP /HPP (High Hydrostatic Pressure/High Pressure Processing) and membrane processing of milk

Indian Milk Confections: Dairy based sweets (Gulabjamun and Kalakand, Rosogolla, Sandesh, Chakka and Srikhand)

Unit-II

Butter oil preparation (Ghee): Definition, standards and Composition, Methods of ghee preparation, Continuous ghee making machine, Packaging regulation

Functional dairy ingredients: Casein derived bioactive peptides, probiotics and health safety

Dairy Microbiology: Starter culture; maintenance and propagation (DVS /Freeze dried) Flavor influence by microflora (Acetaldehyde, Diacetyl, cheese ripening)

Books recommended:

1. Sukumar, De (1994). Outlines of Dairy Technology. Oxford University Press.

2. Smith G. (2003). Dairy processing improving quality. Woodhead Publishers.
3. Andrews, A.T. (1994). Biochemistry of Milk Products. Woodhead Publishers.
Technology of Dairy Products by Early, R.

M.Sc. Food Technology (Semester-IV)

Paper XX b– Beverage Technology (MFT-405)

Lectures to be delivered: 30 (Credit Hours-2)

Max Marks: 70

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 12 marks each. Section C will consist of 11 short answer type questions which will cover the entire syllabus uniformly and will carry 22 marks in all. Candidates are required to attempt two questions each from sections A and B of the question paper and entire section C.

Unit-I

Beverages: Definition, types, importance of beverages in our diets, Manufacturing of carbonated beverages and technology of carbonation, Technology of soft drinks, ingredients and additives used in production of soft drinks

Whey: beverages and utilization of whey in development of fortified drink, use of low calorie sweeteners in beverages.

Technology of alcoholic beverages: Distilled: Brandy, Vodka, Rum, Gin, tequila, whisky & scotch
Un Distilled: Wine, cider, beer

Unit-II

Tea: Production, processing and chemistry of tea manufacturing and types

Coffee: Production, processing, roasting and brewing of coffee, soluble coffee, decaffeinated coffee, monsoon coffee, coffee brew concentrate and chicory.

Cocoa processing: Cocoa beverages and chocolate.

Packaged drinking water: manufacturing processes, quality evaluation of raw and processed water, methods of water treatment, BIS quality standards of bottled water

Suggested Readings:

Tressler, Donald K. and Joslyn, Maynard A. 1971 Fruit and Vegetable Juice Processing Technology, Second Edition. The AVI Pub. Com., Inc. USA.

Manay Shakuntala N and Shadaksharaswamy, M. Foods : Facts and Principles.
2nd edition New Age Inter. Publishers, New Delhi.

Haard, N.F. and Salunkhe, D.K. 1975. Postharvest Biology and Handling of Fruits and Vegetables. AVI, Westport.

Kader, A. A. 1992. Postharvest Technology of Horticultural Crops, 2nd Ed. University of California, Division of Agriculture and National Resources, California.

**M.Sc. Food Technology (Semester IVth)
LC-12– Cereal, Pulses and Legume Technology Lab (MFT-406)**

(Credit Hours-2)

Max Marks: 50

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Milling of wheat and rice and calculate % bran and flour recovery.
2. Physical characterization of wheat and rice kernel.
3. Determination of quality characteristics of flours.
4. Parboiling and evaluation of quality of parboiled rice.
5. Milling of rice and assessment of per cent of head, broken, immature kernels degree of polish.
6. Determination and conditioning of moisture in given sample of kernels/flours
7. Baking practice for the preparation of bread, cookies and cakes
8. Sensory changes and ant- nutrient minimization in millets using minimal pre-processing treatments.
9. Lab demonstration of dried and cake yeast application for bread formation

**M.Sc. Food Technology (Semester-IV)
LC-13– Food Packaging Lab (MFT-407)**

(Credit Hours-2)

Max Marks: 50

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Symbolic identification and collection of plastic packaging material.
2. Physico-chemical identification of different plastics (Density & flame test)
3. To determine grease proof resistance test for different plastic packaging material
4. To determine autoclavable heat stability for the given plastic samples
5. To determine the total moisture available in given paper (cardboard/corrugated fibre) sample
6. To determine the WVTR of given plastic sample
7. Comparative evaluation of glass package (amber and transparent) on free radical antioxidants
8. To determine the total amount of wax loaded in a given sample of wax paper
9. Visit to nearby industry to have a demonstration for thermoform (form, fill & seal) blow moulding machine

M.Sc. Food Technology (Semester IVth)

LC-14a– Nutraceutical and Functional Food Lab (MFT-408)

(Credit Hours-1)

Max Marks: 50

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Perform composite dairy Food preparation with enhanced health attributes (Bajra Lassi)
2. Development of Gluten free products and compare with its equivalent market sample
3. A lab practice for the demonstration of functional paneer preparation
4. Whey Fruit blend preparation
5. Preparation of calorie free cookies in lab
6. Production of traditional sweetened Misti dahi with sugar and fat replacer
7. Assigned a lab activity to students as per their efficiency for any of new food preparation

**M.Sc. Food Technology (Semester IV)
LC-14b– Food Product Development Lab (MFT-408)**

(Credit Hours-1)

Max Marks: 50

Pass Marks: 35%

INSTRUCTIONS FOR THE PAPER SETTERS/ CANDIDATES

The Final practical paper will consist of three sections A, B and C. Section A will contain write up (12 Marks) from the list of practical pertaining to lab course. Section B will contain practical to perform in examination (25 Marks). Section C will contain practical note Book Evaluation and Viva Voce (13 Marks).

1. Perform composite dairy Food preparation
2. A gluten free approach with hydrocolloids
3. A calorie free approach using non nutritive sweeteners
4. A comparative study for skimmed and standardized milk set curd
5. Any of baked preparation utilizing wheat or oat bran
6. Caramel preparation in lab
7. Food preserve preparation (Carrot, Aamwla or any seasonal fruit)
8. Pickle preparation with blend of honey

**M.Sc Food Technology (Semester-IV)
Research project & Seminar (Experimental work & Thesis Writing) (MFT- 409)**

(Credit Hours-8)

Max Marks: 100

INSTRUCTIONS FOR THE PAPER SETTERS /CANDIDATES

Ongoing project work (Introduced from first semester) is meant for thesis writing, its compilation and deliverables at the end of semester. Compiled project report sent to the external examiner and evaluated on the day of result seminar. Satisfactory viva-voce and corrected thesis resubmission thereafter will only be the criteria to successfully award of degree on marks basis (Out of 100).