



आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश
IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

SCHOOL OF BIOTECHNOLOGY

**MASTER OF SCIENCE
(FOOD TECHNOLOGY)**

[II YEAR PROGRAM]

**CHOICE BASED CREDIT SYSTEM (CBCS)
COURSE STRUCTURE AND SYLLABUS**

**[Applicable w.e.f. Academic Session: 2022-23]
[As per CBCS guidelines given by UGC]**

IFTM UNIVERSITY

**N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244001
Website: www.iftmuniversity.ac.in**



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SCHOOL OF BIOTECHNOLOGY

Study and Evaluation Scheme

of

Master of Science

(Food Technology)

Choice Based Credit System (CBCS)

[Applicable w.e.f. Academic Session: 2022-23]

[As per CBCS guidelines given by UGC]

Summary

Programme:	Master of Science (Food Technology)
Programme Level:	Degree (Post Graduation)
Duration:	Two years (Four semesters) Fulltime
Medium of Instruction:	English
Minimum Required Attendance:	75%
Maximum Credits:	86

IFTM University, Moradabad
MASTER OF SCIENCE (FOOD TECHNOLOGY)

Preamble

Completion of graduation course in Food Technology simply provides a platform for basic understanding of the subject. Inventions, innovations and technology have revolutionized and enriched the Food Technology subject. Food Technology is a branch that deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. The field also involves techniques and processes that are used to transform raw materials into food. Extensive research goes behind making food items edible as well as nutritious.

School of Biotechnology, IFTM University offers the M.Sc. (Food Technology) program with an aim to professionally train students with an undergraduate degree to provide services majorly in educational & research institutions, quality control divisions of industries, food processing units and other related settings. These postgraduates are expected to be equipped to pursue research and to contribute to the knowledge building process in the same field.

Considering this, M.Sc. (Food Technology) CBCS (2021-2022) program is designed to provide through and updated knowledge of the subject which makes easy entry of the students in public private sector. Uniqueness of the course is of having 6 months mandatory dissertation work along with Core Courses (CC), Generic Elective (GE), Ability Enhancement Compulsory Course (AECC), Discipline Specific Elective (DSE) and Skill Enhancement Course (SEC).

Programme Outcomes (POs)

Students completing this program will be able to:

- Become a highly skilled professional in food technology, equipped with the theoretical, technical and managerial knowledge to contribute to solving problems related to food industry.
- The program particularly focuses on key requirement of food industry like production, processing, preservation, packaging, labeling, quality management, and distribution of food products.
- Utilize technical skill to transform raw materials into food product.
- Explore in different domains such as food processing, soft drink manufacturing; spice, cereal and rice mills; food packaging and pharmaceutical industry etc.
- Gain position as research scientist' position and will able to design research projects/experiments to improve the yield, flavor, nutrition quality and general acceptability of the packaged food.
- Established start-up, and entrepreneurship venture such as consultancy and training centers.

PROGRAM OUTCOMES (PO):

Following Program Outcomes will be achieved:

PO1- Scientific and Technical Knowledge: Acquire in –depth theoretical and practical knowledge of food science and technology.

PO2- Problem Analysis: Acquire proficiency in solving technical as well other problems related to food sector/ industry and focus on the importance of safe processed nutritious food.

PO3- Design/ Development of solution: Work in food industries, research organizations and academia; develop ability to design or process food products as per needs and specifications.

PO4- Utilization of contemporary technologies: Apply fundamental knowledge related to pure science in interdisciplinary manner for applying the use of modern tools and equipments to analyze food born infection, food spoilage, post-harvest losses and maintain the quality and standards from farm to fork.

PO5- Food professionals and society: Critically analyze data, knowledge of professional and ethical responsibilities, develop understanding of economic importance of food products, food laws and packaging technology and materials.

PO6- Environment and sustainability: Recognize the influence of professional engineering solutions in social and environmental contexts, and exhibit understanding of, and need for, sustainable development.

PO7- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO8- Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary setting.

PO9- Communication: Communicate well with the engineering community and society at large on complex engineering operations, such as comprehending and writing effective reports and design documentation, making successful presentations and giving and receiving clear directions.

PO10- Life-long learning: Gain domain knowledge and know-how for successful career in academia, industry and research. Promoting life-long learning to meet the ever evolving professional and team skills.

1. Eligibility

- a. **Admission Criteria:** Admission to this course shall be carried out through merit.
- b. **Qualifying Examination:** Undergraduate level with any discipline of life Science/ home science.
- c. Marks 45% aggregate for general and OBC category and 40 % aggregate for SC/ST category.

2. Curriculum: M.Sc. courses shall be based on semester system which will be of two years duration, divided into two sessions and four semesters. Each session shall be of two semesters, Session- I shall comprise of two semesters i.e., semester-I and semester-II; Session-II shall comprise of two semesters i.e., semester-III and semester-IV. The academic will follow the pattern as mentioned below:

Academic Calendar	Classes
I and III Semester	August to December
II and IV Semester	January to May
Summer Vacation	June and July

3. Cancellation of Admission: If a student at any stage is found to have concealed any information or have furnished false documents or found to be indulged in gross indiscipline/ misconduct, his/ her admission shall be cancelled and fee deposited by the student shall not be refunded in any case.

Evaluation of Performance

1. Programme: Evaluation of performance of the students in a programme shall be a continuous process based on their performance in the class test, quizzes, assignments and the end semester examinations.

a. Theory papers in semester system (Maximum Marks: 100)

The evaluation will be done through two class test and one end semester examination. This will be in addition to quizzes, assignments, attendance, etc. Each class test will carry a weightage of 10 marks, and the end semester examination will carry a weightage of 70 marks. The remaining 10 marks will be awarded on the basis of attendance and performance in quizzes and assignments.

b. Practical in semester system (Maximum Marks: 100)

In each practical, the student will be required to carry out the number of experiments as specified in the syllabus. Each practical conducted will be assessed by the teacher based on the experiment done during the lab, submission of the practical file, and understanding of the experiment done, which will carry a weightage of 30 marks. There shall be an end semester practical examination with or without an external examiner which will carry a weightage of 70 marks.

2. Project, Dissertation, Seminar etc.: Project, Seminar, Dissertation, and other learning-oriented activities shall have associated maximum marks and credits, as stated in the syllabus.

3. Examination:

- a.** The minimum Grade required to pass in each Theory & Practical paper is 'GRADE D'.
- b.** A candidate, in order to pass, minimum CGPA of 4.50 is required in a particular academic year inclusive of both semesters of that academic. And maximum number of Carryover paper permissible for promotion to next academic year are 06 theory/ practical / project papers.
- c.** There shall be no minimum Grade required to pass in General Proficiency (GP). However, Grade obtained in General Proficiency (GP) shall be included in SGPA.
- d.** In case of audit paper, the minimum Grade required to pass is Grade D. However, the Grade obtained in audit paper shall not be included in SGPA.

Groups of CBCS:

The 07 groups of courses have been identified to provide student comprehensive exposure to a large number of areas, leading to the holistic development of an individual. These groups / clusters are as follows:

1. Core Courses- Theory (CC-T)
2. Core Courses- Practical (CC-P)
3. Discipline Specific Elective (DSE)
4. Generic Elective (GE)
5. Ability Enhancement Compulsory Courses (AECC)
6. Skill Enhancement Courses (SEC)
7. Project/Dissertation/Seminar

1. Core Courses- Theory (CC-T):

Core courses of M.Sc. Program will provide a holistic approach to food technology graduates, giving them an overview of the field, a basis to build and specialize upon. These core courses are the strong foundation to establish technical knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase.

The core courses will provide more practical-based knowledge. It will train the students to analyze, decide, and lead-rather than merely know-while creating a common student experience that can foster deep understanding of the subject. A wide range of core courses provides groundwork in the field of Food Fermentation, Food Microbiology, Food Engineering etc.

We offer core courses in semester I, II, III during the M.Sc. Food Technology. There will be 4 credits for each core course offered depending upon the course content.

2. Core Courses- Practical (CC-P):

These courses include various laboratories designed to provide the student solid foundation to the domain of Food Technology. These courses are of 1 credit each.

3. Discipline Specific Elective (DSE):

Elective courses may be offered by the main discipline of study is referred to as Discipline Specific Elective. The University offer discipline related Elective courses of interdisciplinary nature like

Fundamentals of Food Technology, Food and Nutritional Chemistry, Food Quality System & Management etc. There will be 4 credits for each Discipline Specific Elective course offered depending upon the course content.

4. Generic Elective (GE):

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. This can be a core course offered in a discipline/subject which may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective. This course includes Entrepreneurship and Business Management. This course is of 4 credits.

5. Ability Enhancement Compulsory Course (AECC):

These courses are actually Ability Enhancement Course (AEC) which is designed to develop the ability of students in Food Packaging Technology and Food Processing and other related courses where they might find it difficult to communicate at a higher level in their prospective job at a later stage due to lack of practice and exposure in the language etc. Students are motivated to learn the theories, fundamentals and technological aspects which can help them develop and sustain in the corporate environment and culture. These courses are of 4 credits each.

6. Skill Enhancement Courses (SEC):

These courses are designed to provide value-based and/or skill-based knowledge. Courses like Bioinstrumentation, Enzymology and Enzyme Technology will provide skill based technical knowledge for working in special units in industries and to develop them as entrepreneur. These courses are of 4 credits each.

7. Project/Dissertation/Seminar:

- i. Project with a department faculty or in Government recognized research lab/ Institute(s)/ Research based industry. It is the exploration of a specific topic within a field by a post graduate student that makes an original contribution to the discipline.
- ii. The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other than their regular classes.

Summary of Credits

M.Sc. Food Technology: Two-Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	Type of Course	Credit	Total Credits
1.	Core Course-Theory (CC-T)	6 Courses of 4 Credits each (Total Credit 6X4)	24
2.	Core Course-Practical (CC-P)	6 Courses of 1 Credits each (Total Credit 6X1)	06
3.	Discipline Specific Elective(DSE)	3 Courses of 4 Credits each (Total Credit 3X4)	12
4.	Generic Elective (GE)	1 Course of 4 Credit (Total Credit 1X4)	04
5.	Ability Enhancement Compulsory Course (AECC)	3 Courses of 4 Credits each (Total Credit3X4)	12
6.	Skill Enhancement Courses (SEC)	2 Courses of 4 Credits each (Total Credit 2X4)	08
7.	Project/Dissertation	1 Course of 20 Credits (Total credit 1x20)	20
Total			86

School of Biotechnology
Programme: Master of Science (Food Technology)
CHOICE BASED CREDIT SYSTEM
Effective from Session 2022-23

Course Code		CBCS BASKET	Credits			
Core Courses- Theory (CC-T)			L	T	P	C
MSB101T	Biochemistry		3	1	0	4
MSB102T	Microbiology		3	1	0	4
MFT201T	Food Microbiology		3	1	0	4
MFT202T	Food Fermentation		3	1	0	4
MFT301T	Post-Harvest Management of Fruits and Vegetables		3	1	0	4
MFT302T	Food Engineering		3	1	0	4
Core Courses-Practical (CC-P)			L	T	P	C
MSB101P	Biochemistry Lab		0	0	2	1
MSB102P	Microbiology Lab		0	0	2	1
MFT201P	Food Microbiology Lab		0	0	2	1
MFT202P	Food Fermentation Lab		0	0	2	1
MFT301P	Post-Harvest Management of Fruits and Vegetables Lab		0	0	2	1
MFT302P	Food Engineering Lab		0	0	2	1
Discipline Specific Elective (DSE)			L	T	P	C
MFT101T	Fundamentals of Food Technology		3	1	0	4
MFT203T	Food and Nutritional Chemistry		3	1	0	4
MFT303T	Food Quality Systems and Management		3	1	0	4
Generic Elective (GE)			L	T	P	C
MFT304T	Entrepreneurship and Business Management		3	1	0	4
Ability Enhancement Compulsory Course (AECC)			L	T	P	C
MFT102T	Principles of Food Processing		3	1	0	4
MFT204T	Food Packaging Technology		3	1	0	4
Elective	MFT305T	Meat, Poultry and Fish Processing Technology	3	1	0	4
	MFT306T	Nutraceuticals and Functional Foods				
	MFT307T	Milk and Milk Product Technology				
Skill Enhancement Courses (SEC)			L	T	P	C
MSB104T	Bioinstrumentation		3	1	0	4
MSB205T	Enzymology and Enzyme Technology		3	1	0	4
Project/Dissertation			L	T	P	C
MFT481P	Dissertation		0	0	20	20

IFTM UNIVERSITY, MORADABAD
COURSE STRUCTURE
(CHOICE BASED CREDIT SYSTEM)
M.Sc. (FOOD TECHNOLOGY)
EFFECTIVE FROM 2022-23
SEMESTER: I

S.No.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
THEORY												
1.	CC-T	MSB101T	Biochemistry	3	1	0	20	10	30	70	100	4
2.	CC-T	MSB102T	Microbiology	3	1	0	20	10	30	70	100	4
3.	DSE	MFT101T	Fundamentals of Food Technology	3	1	0	20	10	30	70	100	4
4.	AECC	MFT102T	Principles of Food Processing	3	1	0	20	10	30	70	100	4
5.	SEC	MSB104T	Bioinstrumentation	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT												
6.	CC-P	MSB101P	Biochemistry Lab	0	0	2	-	-	30	70	100	1
7.	CC-P	MSB102P	Microbiology Lab	0	0	2	-	-	30	70	100	1
TOTAL				15	05	04	-	-	210	490	700	22

SEMESTER: II

S.No.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
							Mid Term Exam			External Exam		
				L	T	P	CT	AS +AT	Total			
THEORY												
1.	CC-T	MFT201T	Food Microbiology	3	1	0	20	10	30	70	100	4
2.	CC-T	MFT202T	Food Fermentation	3	1	0	20	10	30	70	100	4
3.	DSE	MFT203T	Food and Nutritional Chemistry	3	1	0	20	10	30	70	100	4
4.	AECC	MFT204T	Food Packaging Technology	3	1	0	20	10	30	70	100	4
5.	SEC	MSB205T	Enzymology and Enzyme Technology	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT												
6.	CC-P	MFT201P	Food Microbiology Lab	0	0	2	-	-	30	70	100	1
7.	CC-P	MFT202P	Food Fermentation Lab	0	0	2	-	-	30	70	100	1
TOTAL				15	05	04	-	-	210	490	700	22

IFTM UNIVERSITY, MORADABAD
COURSE STRUCTURE
(CHOICE BASED CREDIT SYSTEM)
M.Sc. (FOOD TECHNOLOGY)
EFFECTIVE FROM 2022-23
SEMESTER: III

S.No.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
				L	T	P	Mid Term Exam			External Exam		
							CT	AS +AT	Total			
THEORY												
1.	CC-T	MFT301T	Post-Harvest Management of Fruits and Vegetables	3	1	0	20	10	30	70	100	4
2.	CC-T	MFT302T	Food Engineering	3	1	0	20	10	30	70	100	4
3.	DSE	MFT303T	Food Quality Systems and Management	3	1	0	20	10	30	70	100	4
4.	GE	MFT304T	Entrepreneurship and Business Management	3	1	0	20	10	30	70	100	4
5.	AECC	Departmental Elective*	*Only 01 paper is to be chosen from the basket of the departmental electives having 03 papers, provided by the school	3	1	0	20	10	30	70	100	4
PRACTICALS / PROJECT												
6.	CC-P	MFT301P	Post-Harvest Management Lab	0	0	2	-	-	30	70	100	1
7.	CC-P	MFT302P	Food Engineering Lab	0	0	2	-	-	30	70	100	1
TOTAL				15	05	04	-	-	210	490	700	22

LIST OF DEPARTMENTAL ELECTIVES*

Sr. no.	Course Code	Course Name
1.	MFT305T/ MFT306T/ MFT307T	Meat, Poultry and Fish Processing Technology /Nutraceuticals and Functional Foods/ Milk and Milk Product Technology

IFTM UNIVERSITY, MORADABAD
COURSE STRUCTURE
(CHOICE BASED CREDIT SYSTEM)
M.Sc. (FOOD TECHNOLOGY)
EFFECTIVE FROM 2022-23
SEMESTER: IV

S.No.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
				L	T	P	Mid Term Exam		External Exam			
							CT	AS +AT		Total		
THEORY												
1.	CC-P	MFT481P	Dissertation	0	0	20	-	-	150	250	400	20
TOTAL				0	0	20	-	-	150	250	400	20

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Microbiology/Food Technology) I Year (I Semester)

MSB101T BIOCHEMISTRY

Objective(s): The objectives of this course:

- Is designed to introduce the students to the study of biological phenomena at the molecular level.
- Aims to make the students understand the fundamental chemical principles that govern complex biological systems.
- Have major focuses on disciplines within biology and chemistry to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis.
- Enable students to acquire a specialized knowledge of the biological molecules and their structure.

UNIT I: (8 Sessions)

Carbohydrates: Composition; basic structure and function of carbohydrates, Mono-, di-, oligo-saccharides, Glycosidic bonds; glycoproteins (O- linked and N- linked), glycolipids; Polysaccharides- Classification, Homopolysaccharides; Heteropolysaccharides; Metabolism- Glycolysis, TCA cycle, Gluconeogenesis, HMP pathway, Glycogenesis, Glycogenolysis.

UNIT II: (8 Sessions)

Proteins: Primary, Secondary, Tertiary and Quaternary structure of Proteins; Globular protein- Hemoglobin and Myoglobin; Fibrous protein- Collagen and Membrane Protein; ATP synthetase; Protein sequencing; Evolutionary divergence of organisms and its relationship to protein structure and function; Ramachandran plot; Protein folding.

UNIT III: (8 Sessions)

Fatty acids: General formula, nomenclature and chemical properties; Lipid classification- simple, complex; General structure and functions of major lipid subclasses - acyl glycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins & free fatty acids; Fatty acid oxidation (β oxidation of fatty acid); Regulation of fatty acid metabolism; Ketone bodies; Circulating lipids - chylomicrons. LDL, HDL and VLDL.

UNIT IV: (8 Sessions)

Nucleic Acids: Structure of purines, pyrimidines, nucleosides and nucleotides; Physical & biochemical properties of DNA; Types of DNA- A, B and Z DNA, their structure and significance; Physical & biochemical properties of RNA- tRNA, rRNA, mRNA and hnRNA; Primary, secondary, and tertiary structures of RNA; metabolism of Purines and Pyrimidines (*De-novo* and Salvage pathway).

UNIT V: (8 Sessions)

Fat soluble and water soluble vitamins: structure and function, Cofactors and coenzymes: structure and function; Coenzymes and their functions - NAD, NADP⁺, FAD, FMN, lipoic acid, TPP, pyridoxal phosphate, biotin and cyanocobalamin; Hormones: Classification; site of formation, target organs; Mechanism of action of peptide and steroid hormones: Insulin, Glucagon, Epinephrine, Norepinephrin, Thyroid hormones, Testosterone, Estrogen, Progesterone, Pheromones; Hormonal regulation of metabolism by mineralocorticoids.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand in detail the structure and physicochemical properties and metabolism of carbohydrates for skill development.

CO2: Understand in detail the structure, type and classification of protein for skill development.

CO3: Understand the nomenclature and chemical properties of Fatty acids and Lipids along with their metabolic pathways like β oxidation for skill development.

CO4: Understand the structure of Purines and Pyrimidines and their metabolism, types of DNA and properties of RNA for skill development.

CO5: Understand the difference between the water-soluble and fat-soluble vitamins and their key role in metabolism for skill development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	1	1	1	1	1	1	3
CO2	1	3	1	1	1	1	1	1	1	3
CO3	3	1	2	1	1	1	1	1	1	3
CO4	2	1	1	1	1	1	3	1	1	2
CO5	3	3	1	3	1	1	1	1	1	3

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. D. Papachristodoulou, A. Snape, W. H. Elliott, Daphne C. Elliott. Biochemistry and Molecular Biology, V Ed., Oxford University Press, 2014.
2. K. Trehan. Biochemistry, II Edition, New Age International, 2007.
3. D.L. Nelson, M. M. Cox. Lehninger Principles of Biochemistry, V Ed., CBS Publication, 2016.
4. D. Voet, C. W. Pratt, J.G. Voet, Principles of Biochemistry: International StudentVersion, IV Ed., Wiley, New York.
5. J.M. Berg, J.L., Tymoczko, L. Stryer. Biochemistry: VII Ed., W.H. Freeman Int. Edition, 2010.

Website Sources:

- <https://onlinecourses.nptel.ac.in/>

- <https://www.wikipedia.org/>
- <https://www.ncbi.nlm.nih.gov/books>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Microbiology/Food Technology) I Year (I Semester)

MSB102T MICROBIOLOGY

Objective: The objective of this course:

- Is to provide knowledge about the microbial world their morphology, difference from other living organisms, distribution and their specific roles in various fields of human life and industry.

UNIT I: (8 Sessions)

Introduction to Microbiology: Definition, Historical background & scope; Prokaryotes and eukaryotes, Difference between prokaryotic and eukaryotic organisms; Method of Microbiology- Pure culture techniques, sterilization techniques, Culture media and its types; microbial nutrition; Microbial growth and kinetics.

UNIT II: (8 Sessions)

Bacteria: General characteristics; Morphology and structure of bacteria; Gram positive and gram negative bacteria; Basic principle and techniques used in bacterial Classification; Types of vegetative, asexual and sexual reproduction in bacteria.

UNIT III: (8 Sessions)

Viruses: General characteristics; Morphology, Classification and structure of plant, animal and bacterial viruses; Cultivation of viruses, a brief account of Adenoviruses, Herpes, Retrovirus, Viroids and prions; Reproductive cycles: lytic and lysogenic.

UNIT IV: (8 Sessions)

Control of Microorganism: Antimicrobial Agents; Sulfa drugs, Antibiotics (penicillin and cephalosporin); Broad Spectrum Antibiotics; Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance of antibiotics.

UNIT V: (8 Sessions)

Microbial Ecology: Microbial flora of soil; Interaction among soil microorganisms; Nitrogen fixation; Symbiotic association-types, functions and establishment of symbiosis; *A. niger*, yeast, *Pseudomonades putida*.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the historical concept of microbiology, various sterilization techniques, microbial nutrition, and microbial growth for skill development and employability.

CO2: Learn about the structure and the classification of bacteria for skill development.

CO3: Learn about the structure and classification of the virus for skill development.

CO4: Understand the mechanism of sterilization, use and mode of action of various antibiotics for skill development.

CO5: Understand the microbial ecology including interaction among soil microbes, symbiosis, and nitrogen fixation for skill development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	1	1	1	1	1	1	1
CO2	3	3	1	1	1	1	1	1	1	1
CO3	3	3	1	1	1	1	1	1	1	1
CO4	2	1	2	2	1	3	2	1	1	1
CO5	2	1	1	3	1	3	1	1	1	3

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	2	1	1

Suggested Readings:

1. Pelczar Jr. M.J., Chan E.C.S. and Krieg R., Microbiology, McGraw Hill (1998).
2. Stainer R.Y., Ingraham J.L., Wheelis M.L. and Pamler P.R., General Microbiology, MacMillan (2003).
3. Powar & Dagniwala. Microbiology, Volume 1, Himalaya Publishing House Pvt. Ltd, 2012.
4. Tortora G.J., Funke B.R., and Case C.L., Microbiology, An Introduction, Pearson Education (2009).
5. Madigan, M., Martinko, J., Dunlap, P. and Clark, D., Biology of Microorganisms, Pearson Education (2015).

Website Sources:

- <https://www.khanacademy.org/>
- <https://www.britannica.com/>
- <https://www.wikipedia.org/>
- <https://www.researchgate.net>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (I Semester)

MFT101T FUNDAMENTALS OF FOOD TECHNOLOGY

Objective(s): The objectives of this course are to:

- To understand the history and evolution of food processing.
- To study the structure, composition, nutritional quality of various plant and animal foods.
- To study the structure and composition of various animal foods

UNIT I: **(8 Sessions)**

Introduction: Historical development of food science and technology. Evolution of Food Processing from prehistoric times till date. Introduction to various branches of Food Science and Technology

UNIT II: **(8 Sessions)**

Technology of Cereals and Pulses

I. Cereals and Millets: Introduction, composition, uses and by-products of cereals and coarse cereals. Wheat- Types (hard, soft/ strong, weak), process of malting, Gelatinization of starch. Rice- Different dehusking methods, Parboiling of rice- advantages and disadvantages. Millets -Varieties and uses of maize, sorghum, barley and oats.

II. Pulses: Chemical composition of pulses, processing of pulses- soaking, germination, decortications, cooking and fermentation. Toxic constituents in pulses and its detoxification processes.

UNIT III: **(8 Sessions)**

Nutritional and Technological aspects of foods

I. Fats and Oils: Introduction of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Refining of oils. Rancidity - hydrolytic and oxidative rancidity and its prevention. Different types of fats and oils-Margarine, butter, hydrogenated vegetable oil, lard.

II. Fruits and Vegetables: Classification of fruits and vegetables, Types of browning enzymatic and non-enzymatic browning, Dietary fiber.

UNIT IV: **(8 Sessions)**

Flesh Foods: Meat - Definition of carcass, concept of red meat and white meat, composition of meat, marbling, tenderization of meat, ageing of meat. **Fish** - Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish. **Poultry** - Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

UNIT V: **(8 Sessions)**

Milk and Milk Products: PFA definition of milk, Composition of milk, its constituents, various steps in processing of milk. An overview of types of market milk and milk products- cheese, paneer, ice cream, ghee, butter, butter oil, flavoured milk, imitation milk.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the history and evolution of food processing and learn the various branches of Food

Science and Technology for skill development, employability and entrepreneurship development.

CO2: Understand the structure, composition, nutritional quality, and processing of different cereals and pulses for skill development, employability and entrepreneurship development.

CO3: Enumerate the importance of different types of fats and oils; Rancidity and Refining of oils. The students will be able to learn the classification of fruits and vegetables and types of browning for skill development, employability and entrepreneurship development.

CO4: Understand the composition, classification, characteristics, and nutritive value of various flesh foods for skill development, employability and entrepreneurship development.

CO5: Understand the composition of milk and the technology of manufacturing various products like butter, ghee, butter, ice cream and cheese. Acquire knowledge of milk constituents and steps involved in the processing of milk for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	2	1	1	1	1	1	1
CO2	3	1	2	3	1	1	1	1	1	3
CO3	2	1	1	1	1	1	1	1	1	3
CO4	2	3	1	1	1	1	1	1	1	3
CO5	2	1	1	3	1	1	1	1	1	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	2
CO2	3	2	2
CO3	3	3	3
CO4	2	2	3
CO5	3	3	2

Suggested Readings:

1. Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, NewAge Publishers, 2004.
2. B. Srilakshmi, Food science, New Age Publishers, 2002.
3. Meyer, Food Chemistry, New Age, 2004.
4. Potter, Norman. M., Food Science, CBS Publication, 1996.
5. Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004.

Website Sources:

- <https://onlinecourses.nptel.ac.in/>
- <https://www.wikipedia.org/>
- <https://www.ncbi.nlm.nih.gov/books>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (I Semester)

MFT102T PRINCIPLES OF FOOD PROCESSING

Objective(s): The objectives of this course:

- Enables the students to understand the basic principles of food processing used to achieve preservation and to learn about the principles of equipment for processing of food with heat addition or removal.
- List and define the unit operations and understand how they are used in the processing of foods.

UNIT I: (8 Sessions)

Introduction: Definition and scope of food Science and Technology; historical development of food processing and preservation; Effect of processing on sensory characteristics of foods- color, texture, and taste; Effect of processing on nutritional properties.

UNIT II: (8 Sessions)

Processing and preservation by heat: Blanching, Pasteurization, Heat sterilization, UHT processing, Evaporation and distillation, Extrusion, dielectric heating, Drying and Dehydration, microwave heating, baking and roasting.

UNIT III: (8 Sessions)

Processing and preservation by low temperature: Chilling, freezing, freeze drying and freeze concentration, Controlled and Modified atmosphere storage.

UNIT IV: (6 Sessions)

Processing and preservation by non-thermal methods: Principles and applications in foods-Irradiation, Hurdle technology, high pressure processing, pulsed electric field, Membrane technology, Nanotechnology.

UNIT V: (10 Sessions)

Food Process Economics: Various stages in plant design, financial analysis, Cost of Production, Break Even Analysis, Project Economics: Fixed Capital, Working Capital, Growth Capital. Depreciation, General Process Economics for clarified Fruit Juices.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the historical development of food processing for skill development, employability and entrepreneurship development.

CO2: Understand the different processing and preservation methods for skill development, employability and entrepreneurship development.

CO3: Discuss various processing and preservation techniques for skill development, employability and entrepreneurship development.

CO4: Identify novel technologies in the processing of fleshy foods for skill development, employability and entrepreneurship development.

CO5: Understand the Food Process Economics and Various stages in plant design for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	1	1	1	1	1	1	1
CO2	3	3	1	3	1	1	1	2	1	1
CO3	3	3	1	3	1	1	1	1	1	2
CO4	3	3	3	2	2	1	1	1	1	1
CO5	1	1	3	1	2	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	3
CO2	3	2	3
CO3	3	3	2
CO4	3	3	3
CO5	2	3	3

Suggested Readings:

1. D. G. Rao. Fundamentals of Food Engineering. PHI Learning Pvt. Ltd., 2010.
2. B Sivasankar. Food Processing and Preservation. PHI Learning Private Limited (2013).
3. D.R. Heldman and R.W. Hartel, Principles of Food Processing; Aspen Publication, 2nd ed., 1999.
4. P.J. Fellows; Food Processing Technology: Principles and Practice Wood head publishing; 3rd ed. 2009.
5. Stephanie Clark, Stephanie Jung, Buddhi Lamsal, Food processing: Principles and Application, 2014.

Website Sources:

- <https://onlinecourses.nptel.ac.in/>
- <https://www.wikipedia.org/>
- <https://library.nitrkl.ac.in/>
- ecoursesonline.iasri.res.in

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Microbiology/Food Technology) I Year (I Semester)

MSB104T BIOINSTRUMENTATION

Objective(s): The objectives of this course:

- Is to provide principle of the various analytical techniques, which will be helpful in various applications in the field of life science like Molecular Genetics, Cell Biology, Genetic Engineering, Environmental Science and other fields.
- The student will learn to technical aspect of functioning of these bio instruments.

UNIT I: **(8 Sessions)**

Microscopic Techniques: Principles and Applications of Light, Phase Contrast, Fluorescence Microscopy; Scanning and Transmission Electron Microscopy; Confocal Microscopy; Advances of microscopy.

UNIT II: **(8 Sessions)**

Chromatography Techniques & Centrifugation Techniques: Theory and Application of Paper Chromatography, TLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, GLC and HPLC; Density & Ultra Centrifugation.

UNIT III: **(8 Sessions)**

Electrophoresis Techniques: Theory and Application of PAGE, Agarose Gel Electrophoresis, Iso-electric Focusing, Immuno diffusion, Southern, Northern and Western Blotting.

UNIT IV: **(8 Sessions)**

Spectroscopic Techniques: Theory and Application of UV and Visible Spectroscopy, Fluorescence Spectroscopy, NMR, Atomic Absorption Spectroscopy, Raman Spectroscopy

UNIT V: **(8 Sessions)**

Radio-isotopic Techniques: Introduction to Radioisotopes and their Biological Applications; Radioactive Decay – Types and Measurement; Principles and Applications of GM Counter, Solid and Liquid Scintillation Counter; Autoradiography, Radiation Dosimetry.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the principle and working of microscope for skill development, employability and entrepreneurship development.

CO2: Understand the concept of separation and purification techniques and their application for skill development, employability and entrepreneurship development.

CO3: Acquire knowledge of the various applications of electrophoresis for skill development, employability and entrepreneurship development.

CO4: Explain the principle, instrumentation, and application of spectroscopic instruments for skill development, employability and entrepreneurship development.

CO5: Understand the various radioisotopic techniques and their application in biology and medicine for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	3	1	1	1	1	1	3
CO2	2	3	1	2	3	1	1	1	1	
CO3	3	3	2	2	3	1	1	1	1	3
CO4	2	2	2	1	1	1	1	1	1	
CO5	2	2	3	3	2	1	1	3	1	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	3
CO2	3	2	3
CO3	3	2	2
CO4	3	2	3
CO5	3	3	3

Suggested Readings:

1. Skoog & West Principle of Instrumental Analysis 4th Edn 1992.
2. Freilder. Physical Biochemistry: Application to Biochemistry and Molecular Biology, 2nd Edn 1983.
3. Keith Wilson & John Walker Principles and Techniques of Biochemistry and Molecular Biology:, 7th Edn., Cambridge University Press.
4. S. K. Sawhney & Randhir Singh., Introductory Practical Biochemistry 5th Edn, 2014.
5. G. R. Chatwal & S. K. Anand, Instrumental Methods of Chemical Analysis, Oscar publication, 2015.

Website Sources:

- <https://onlinecourses.nptel.ac.in/>
- <https://www.wikipedia.org/>
- <https://library.nitrkl.ac.in/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Microbiology/Food Technology) I Year (I Semester)

MSB101P BIOCHEMISTRY LAB

1.	Introduction of Laboratory Practices	
2.	Safety Measures	
3.	Do and Don'ts	
4.	About Equipment and Accessories and Working	
5.	To study of the properties of carbohydrates. Experiment: I A Molish Test Experiment: 1 B. Benedict's Test;	Experiment 1
6.	2A: To estimate given amount of protein by Folin-Lowry method. 2B: To estimate the protein content in the given sample by Biuret methods.	Experiment 2
7.	3A: Qualitative test for the presence of fatty acid by titrametric methods. 3B: Estimation of cholesterol by Liebermann-Buchard reaction.	Experiment 3
8.	To learn technique SDS-PAGE and to separate protein according to their molecular size.	Experiment 4
9.	Estimation of total carbohydrates by Anthrone's methods.	Experiment 5
10.	To detect whether given sample is protein or non-protein.	Experiment 6
11.	To detect the presence of amino acid from a given sample by Ninhydrin Test or Xanthoproteic acid Test.	Experiment 7
12.	Test to distinguish ketoses from aldoses sugars (Seliwanoff's test)	Experiment 8

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Microbiology/Food Technology) I Year (I Semester)

MSB102P MICROBIOLOGY LAB

1.	Introduction of Laboratory Practices	
2.	Safety Measures	
3.	Do and Don't	
4.	About Equipment and Accessories and Working	
5.	Working Principle and structural components of simple microscope.	Experiment 1
6.	Working Principle and structural components of compound microscope.	Experiment 2
7.	Basics Working and Principle of Autoclave	Experiment 3
8.	Basics Working and Principle of Biological Safety Cabinet (Laminar Air Flow Chamber)	Experiment 4
9.	Study of Sterilization methods and equipments.	Experiment 5
10.	To prepare and sterilize the nutrient broth media.	Experiment 6
11.	To prepare and sterilize the nutrient agar media (NAM) and to prepare nutrient agar slants.	Experiment 7
12.	To isolate and enumerate microorganisms from soil sample by spread and streak plate methods.	Experiment 8
13.	To isolate and enumerate microorganisms from soil sample by serial dilution method.	Experiment 9
14.	To isolate the microorganisms from mixed culture by sub-culturing technique.	Experiment 10
15.	To stain bacterial cell by simple staining method.	Experiment 11

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (II Semester)

MFT201T FOOD MICROBIOLOGY

Objective(s): The objectives of the course:

- To provide instruction in the general principles of food microbiology.
- It is assumed that students will have received adequate introduction to microbiology.
- The course covers the biology and epidemiology of food borne microorganisms of public health significance, including bacteria, yeasts, fungi, protozoa and viruses, and food spoilage microorganisms; the microbiology of food preservation and food commodities; fermented and microbial foods.
- Principles and methods for the microbiological examination of foods; micro biological quality control, and quality schemes.

UNIT I: **(8 Sessions)**

History of Microorganisms in food: Historical Developments and scope of food microbiology; Classification and identification of yeasts, molds and groups of bacteria important in food industry; Intrinsic and extrinsic parameters of foods that affect microbial growth.

UNIT II: **(8 Sessions)**

Microorganisms in food: Role and significance of microorganisms in food-Fresh meat and poultry, processed meat, seafoods, fruits and vegetable products, cereals products, dairy food products, fermented food products; starter cultures; production process of SCP, cheese, beer, wine and distilled spirits.

UNIT III: **(8 Sessions)**

Food hygiene and sanitation: Importance and principles of food hygiene and sanitation; Contamination during handling and processing and its control; indicator organisms; Rapid methods in detection of microorganisms; Microbiological Examination of surfaces, air sampling.

UNIT IV: **(8 Sessions)**

Food preservation: Methods and principles of food preservation- Physical: Low temperature; High temperature (pasteurization, canning); Irradiation (UV, microwave, ionization); Drying; High pressure processing; Chemical preservatives and natural antimicrobial compounds; Biobased preservation systems- LAB and bacteriocins.

UNIT V: **(8 Sessions)**

Food Born Diseases: Diseases (Botulism, Cholera, Gastroenteritis, Hepatitis, Poliomyelitis, Amoebiasis), their causative agents, symptoms and preventions; Mycotoxins in food with reference to Aspergillus species.

Course Outcomes:

At the end of the course students will be able to:

CO 1: Acquaint with historical developments and scope of food microbiology, Classification, and identification of microorganisms and different parameters of foods that affect microbial growth for skill development, employability and entrepreneurship development.

CO 2: Understand the role and significance of microorganisms in various foods for skill development, employability and entrepreneurship development.

CO 3: Understand the importance and principles of food hygiene and sanitation. Also learn the rapid

methods in detection of microorganisms for skill development, employability and entrepreneurship development.

CO 4: Understand the different methods and principles of food preservation for skill development, employability and entrepreneurship development.

CO 5: Predict the causative agent and pathogenesis of disease caused by foodborne pathogens and their toxins for skill development and employability.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	1	1	1	1	1	1	1
CO2	3	3	3	3	3	3	1	1	1	1
CO3	3	3	3	2	3	3	2	2	2	3
CO4	2	2	3	2	2	2	2	2	2	3
CO5	3	3	1	1	1	2	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	2
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	3	2	1

Suggested Readings:

1. Frazier, W.S. and Weshoff, D.C. Food Microbiology, 4th Ed., McGraw Hill Book Co., New York, 1988.
2. Mann & Trusswell. Essentials of human nutrition. 3rd edition. oxford university press, 2007.
3. Lindsay. Applied Science Biotechnology. Challenges for the flavour and Food Industry. Willis Elsevier, 1988.
4. Roger, A., Gordon, B. and John, T Food Biotechnology, 1989.
5. Jay, J.M., Modern Food Microbiology, CBS Publications, New Delhi, 1987.

Website Sources:

- <http://www.fda.gov/Food/ScienceResearch/ResearchAreas/SafePracticesforFoodProcesses/default.htm>
- Codex – Food hygiene www.fao.org/docrep/W4982E/w4982e09.html
- www.europa.eu.int/comm/dg24/health/sc/scv/out26_en.html
- CAC – Principles www.who.int/fsf/mbriskassess/pdf/draftpr.pdf
- International commission on Microbiological Specifications for Foods (ICMSF) www.ICMSF.org
- Ozfoodnet.org.au www.cdc.gov/foodnet
- Food Standards Australia New Zealand www.foodstandards.gov.au

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (II Semester)

MFT202T FOOD FERMENTATION

Objective(s): The objectives of this course:

- Is to introduce the learners with food processing technology that utilizes the growth and metabolic activity of microorganisms for the stabilization and transformation of food materials.
- Designed so that a food technology student can get knowledge about several fermented food and food related products and can discuss the technologies of some popular traditional foods of fermentation origin.
- Discusses the potential microbiologic risks associated with their consumption and the food safety challenges that they raise.

UNIT I: (8 Sessions)

Preparation and Maintenance: Preparation and Maintenance of Bacterial, Yeast and Mold; cultures for food fermentations; Indian traditional sweet, savory and snack food products: Sweetmeats, Idli and Dosa.

UNIT II: (8 Sessions)

Production of organic acid and amino acid: Organic Acid- Acetic Acid, Lactic Acid, Citric Acid
Amino acid- Glutamic acid, Tryptophan
Production of Vitamins: Vitamin B12.

UNIT III: (8 Sessions)

Fermented Animal Products: Cheeses, Curd and Yoghurt, Butter milk and the fermented milks; Spoilages and defects of fermented dairy products and their control; Fermented meat and fish products.

UNIT IV: (8 Sessions)

Fermented Beverages and vegetables: Fermentative Production of Beer, Wines, Cider and Vinegar.
Fermented Vegetables (Pickles)- sauerkraut, olives, kimchi; Oriental fermented foods.

UNIT V: (8 Sessions)

Food processing Aids: Production of Baker's Yeast, Microbial Proteins and fats, Food enzymes, Food additives- food color, flavor enhancers, emulsifier and food preservatives.

Course Outcomes:

At the end of the course students will be able to:

CO 1: Understand the preparation and maintenance of bacterial, yeast, and mold cultures for food fermentation; preparation of Indian traditional sweet, savory, and snack food products such as idli, dosa, and sweet meal for skill development, employability and entrepreneurship development.

CO 2: Acquaint with knowledge of organic acids and amino acids preparation for skill development, employability and entrepreneurship development.

CO 3: Understand the manufacturing and processing of meat and poultry products for skill development, employability and entrepreneurship development.

CO 4: Understand the manufacturing and processing of fermented beverages, vegetables, and oriental fermented foods for skill development, employability and entrepreneurship development.

CO 5: Understand the basics of production of several industrially important food processing aids such as baker's yeast, emulsifiers, enzymes, food color, flavour enhancers, etc for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	1	1	1	1	1	1	3
CO2	3	2	3	2	1	1	1	1	1	1
CO3	2	1	2	3	3	3	1	1	1	1
CO4	2	1	2	2	3	3	1	3	1	3
CO5	2	1	2	2	2	3	1	3	1	3

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	3
CO2	3	2	3
CO3	3	3	2
CO4	2	3	2
CO5	3	3	2

Suggested Readings:

1. P.F. Stanbury, A. Whitaker, S.J. Hall, Principles of Fermentation Technology, Third revised ed., Butterworth-Heinemann Ltd, 2016
2. J.E. Bailey, F. David, Biochemical Engineering fundamentals, Second ed., 2010.
3. A.H. Patel, Industrial Microbiology. MacMillan Publishers. 2015.
4. K.H. Steinkrus: Handbook of Indigenous Fermented Foods
5. Samuel Cate Prescott; Cecil Gordon Dunn; Gerald Reed. Prescott & Dunn's industrial microbiology. Publisher: Westport, Conn(1982).
6. L.E. Casida. Industrial Microbiology. 1st edition. John Wiley & Sons Inc; (December 1968)
7. William C. Frazier, Dennis C. Westhoff. Food Microbiology. Edition:3, Tata McGraw-Hill Publishing Company.

Website Sources:

- <https://www.wikipedia.org/>
- <https://www.ncbi.nlm.nih.gov/books>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (II Semester)

MFT203T FOOD AND NUTRITIONAL CHEMISTRY

Objective(s): The objectives of this course:

- Provides knowledge about the analytical, biochemical, chemical, physical, nutritional, and toxicological aspects of food and food ingredients.
- This will enable students to understand the properties and role of various constituents in foods, interaction and changes during processing.

UNIT I: (8 Sessions)

Food chemistry Water and carbohydrates: Definition and importance, Major food constituents and their physico-chemical properties; Carbohydrates- Structure, Classification, chemical reactions, functional properties of sugars and polysaccharides in foods; Effect of processing on nutritional quality of carbohydrates; Water in foods- Types of water in foods, Water activity-Definition, measurement of water activity, role and importance of water activity in foods.

UNIT II: (10 Sessions)

Proteins and lipids: Definition and importance, classification, structure, sources, functions, physico-chemical properties and functional properties of proteins; Browning reactions in foods; Protein concentrates, isolates and hydrolysates and their applications. Lipids: classification, and use of lipids in foods, physical and chemical properties, effects of processing on functional properties, auto-oxidation and rancidity of lipids.

UNIT III: (6 Sessions)

Vitamins and Minerals: Classification, properties, Effect of processing on vitamins and minerals, antioxidants, deficiency and diseases; Enrichment and fortification.

UNIT IV: (8 Sessions)

Enzymes, Flavors and pigments: Chemistry, classification, mode of action, specificity, enzymatic browning and their control, Applications of enzymes in food industry. Natural food flavors, extraction methods and characterization; Pigments in food and their industrial applications.

UNIT V: (8 Sessions)

Metabolic rate and caloric needs: Requirements and role of nutrients in human health, RDAs. Nutrition of dietary fibers; Biological value of proteins; Energy value of foods; Techniques of diet and health surveys; Formulation of diets and food products for specific needs.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the structure, classification, chemical reactions, functional properties of sugars and polysaccharides in foods. Also understand the types of water in foods, the role, and importance of water activity in foods for skill development and employability.

CO2: Understand the classification, structure, sources, functions, physicochemical properties, and functional properties of proteins. Also learn the classification, use of lipids in foods, physical and chemical properties, effects of processing on functional properties, auto-oxidation, and rancidity of lipids

for skill development, employability and entrepreneurship development.

CO3: Acquire in-depth knowledge about the classification, properties, Effect of processing on vitamins and minerals, enrichment, and fortification for skill development, employability and entrepreneurship development.

CO4: Understand the chemistry, classification, mode of action, specificity, enzymatic Browning, and their control, Applications of enzymes in the food industry. Also, identify natural food flavors and pigments in foods for skill development, employability and entrepreneurship development.

CO5: Understand the requirements and role of nutrients in human health, Techniques of diet and health surveys, Formulation of diets and food products for specific needs for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	1	1	1	1	1	1	3
CO2	3	1	1	1	1	1	1	1	1	3
CO3	3	2	1	1	1	1	1	1	1	3
CO4	2	2	2	2	1	1	1	1	1	3
CO5	1	1	2	2	1	1	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	
CO2	3	3	3
CO3	3	2	2
CO4	3	2	2
CO5	3	2	3

Suggested Readings:

1. Aurand, L.W. and Woods, A.E. Food Chemistry. AVI, Westport, 1973.
2. Birch, G.G., Cameron, A.G. and Spencer, M. Food Science, 3rd Ed. Pergamon Press, New York, 1986.
3. Fennema, O.R. Ed. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York. 1976.
4. Meyer, L.H. Food Chemistry. East-West Press Pvt. Ltd., New Delhi. 1973.
5. Potter, N.N. Food Science. 3rd Ed. AVI, Westport. 1978.

Website Sources:

- <https://onlinecourses.nptel.ac.in/>
- <https://www.wikipedia.org/>
- <http://ecoursesonline.iasri.res.in/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (II Semester)

MFT204T FOOD PACKAGING TECHNOLOGY

Objective(s): The objectives of this course:

- Focuses on the packaging to minimize product losses (waste) throughout the food handling and distribution chain.
- Food packaging is to hold the food quality – ideally in the condition in which it was prepared by the food manufacturer – until it is ready to be consumed.
- The quality of food is to be retained as much as possible during the time between period of release and time of use.
- It requires a combination of properties and/or characteristics and although each recognized packaging material possesses some of these, sadly no one material possesses them all.

UNIT I: **(8 Sessions)**

Materials Used For Food Packaging: Packaging requirements and selection of packaging materials; Types of packaging materials: Paper: pulping, fibrillation and beating, types of papers and their testing methods; Glass: composition, properties, types of closures, methods of bottle making; Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminum containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.

UNIT II: **(8 Sessions)**

Properties of Packaging materials: Such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation.

UNIT III: **(8 Sessions)**

Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapor transmission rate (WVTR) and its measurement, prediction of shelf life of foods, selection and design of packaging material for different foods.

UNIT IV: **(8 Sessions)**

Food packaging systems: Different forms of packaging such as rigid, semirigid, flexible forms and different packaging system for (a) dehydrated foods (b) frozen foods (c) dairy products (d) fresh fruits and vegetables (e) meat, poultry and sea foods.

UNIT V: **(8 Sessions)**

Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink-packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines; carton making machines.

Course Outcomes:

At the end of the course students will be able to:

CO1: Acquaint with the principles, methods, and materials used for safe packaging of foods for skill development, employability and entrepreneurship development.

CO2: Understand the properties of packaging material with their testing and evaluation methods for skill development, employability and entrepreneurship development.

CO3: Understand the barrier properties of packaging materials and will be able to predict the shelf life of food and select and design the packaging material based on its barrier properties for skill development, employability and entrepreneurship development.

CO4: Understand the different packaging systems used for different kinds of foods for skill development, employability and entrepreneurship development.

CO5: Understand the packaging equipment and machinery based on the properties of packaging material for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	1	3	3	3	1	1	1
CO2	3	2	2	1	2	2	3	1	1	1
CO3	3	1	3	3	1	1	1	1	1	1
CO4	3	2	1	3	3	1	1	1	1	1
CO5	3	2	3	2	1	2	1	1	1	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	3
CO2	3	3	3
CO3	2	2	3
CO4	2	2	3
CO5	2	2	3

Suggested Readings:

1. Food packaging – Principles & Practice Gordon L Robertson
2. Ranganna, Handbook of Analysis and Quality Control for Fruit and Vegetable Products
3. N Shakuntalamany & M Shadaksharaswamy Foods: Facts and principles
4. Food Packaging Technology Hand book NIIR New Delhi

Website Sources:

- http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/food_technology/food_packaging_technology/01.introduction_to_food_packaging/et/2643_et_m1.pdf
- <http://ecoursesonline.iasri.res.in/course/view.php?id=28>
- <https://www.kaznau.kz/page/GPIIR/UMCDzarubej/Rosnita%20Binti%20A%20Talib.pdf>
- <https://www.sanfoundry.com/food-engineering-questions-answers-food-packaging-labelling/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. (Biotechnology/Food Technology) I Year (II Semester)

MSB205T ENZYMOLOGY & ENZYME TECHNOLOGY

Objective(s): The objectives of the course:

- Provide a deeper insight into the fundamentals of enzyme structure, function and kinetics of enzymes and techniques employed in enzymes purification and characterizations are also emphasized in this course.
- Will introduce students to the theory as well as applications of enzyme technology in various industries.
- Serves to provide an awareness of the current and possible future applications of enzyme technologies.

UNIT I: (8 Sessions)

Introduction to Enzymes: Holoenzyme, apoenzyme, prosthetic group. Interaction between enzyme and substrate – lock and key model, induced fit model; Features of active site, activation energy, enzyme specificity and types. IUB system of classification and nomenclature of enzymes. Isolation and purification of enzymes from plants, animals and microbes; Enzyme activity; Unit of enzyme activity-definition and importance.

UNIT II: (8 Sessions)

Enzyme Kinetics: Kinetics of single substrate reactions; Derivation of Michaelis-Menten equation, turnover number; Determination of K_m and V_{max} (LB plot, ED plot), Importance of K_m & V_{max} ; Multi-Substrate reaction mechanisms. Deactivation Kinetics. Specific activity.

UNIT III: (8 Sessions)

Factor Affecting Enzyme Activity, Catalysis and Regulation: Factors affecting the velocity of enzyme catalyzed reaction: enzyme concentration, temperature, pH, substrate concentration, inhibitors and activators, Acid-base and nucleophilic catalysis, Role of metal ions in enzyme catalysis; Enzyme Inhibition: irreversible; reversible (competitive, uncompetitive and non-competitive inhibition); Allosteric regulation of enzymes, concerted and sequential model.

UNIT IV: (8 Sessions)

Structure and Function of Enzymes: Lysozyme, chymotrypsin, DNA polymerase, RNase, proteases; Lipases, papain, ribonuclease, trypsin, carboxypeptidase, phosphorylase; Multi enzyme complexes-pyruvate dehydrogenase and fatty acid synthetase.

UNIT V: (8 Sessions)

Enzyme Immobilization, Reactors and Biosensors: Adsorption, Matrix entrapment, Cross linking, Encapsulation, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques; Enzyme Reactors – Stirred tank reactors (STR), Continuous Flow Stirred Tank Reactors (CSTR), Packed-bed reactors (PBR), Fluidized-bed Reactor (FBR); Membrane reactors. Biosensors – glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the concept of enzymes and their support groups, along with the different theories that support the working of enzymes, classification as well as how enzymes could be purified from different sources for skill development and employability.

CO2: Understand the working mechanism of enzymes by different mathematical equations for skill development.

CO3: Understand the physical factors that affect the activity and catalysis of enzymes and how the working of enzymes is regulated (inhibitions) for skill development.

CO4: Understand the structure and function of different enzymes involved in replication and other metabolic activities for skill development, employability and entrepreneurship development.

CO5: Understand the commercial applicability of enzymes, the process of immobilization, enzymes as biosensors, and their bioprocessing in enzyme reactors for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	3	3	3	3	3	2
CO2	3	1	1	3	3	1	1	3	3	3
CO3	3	2	2	3	3	1	1	3	2	3
CO4	3	2	2	3	3	1	1	3	2	3
CO5	3	1	2	3	3	3	1	3	2	3

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	1
CO2	3	1	1
CO3	3	1	1
CO4	3	3	3
CO5	3	2	2

Suggested Readings:

1. Alan Fersht: Structure and Mechanism in Protein Science, 2nd ed. W.H. Freeman & Co.
2. Nicolas Price & Lewis Stevens: Fundamentals of Enzymology, 2nd edition, Oxford Univ. Press, New York, NY.
3. Trevor Palmer: Understanding Enzymes, Second Edition, J. Wiley & Sons, New York.
4. Donald Voet & Judith Voet: Biochemistry, J. Wiley & Sons, New York
5. Geoffrey Zubay (1993): Biochemistry, 3rd edition, Wm. C. Brown, Oxford
6. Berg, Tymoczko and Stryer: Biochemistry, 7th Edition., W.H.Freeman,2010
7. Nicolas Price & Lewis Stevens: Fundamentals of Enymology, 2nd edition, Oxford Univ. Press, New York, NY.

Website Sources:

- <https://www.omicsonline.org/scholarly/enzyme-technology-journals-articles-ppts-list.php>
- <https://www.britannica.com/science/enzyme>
- <https://www.sciencedirect.com/book/9780444641144/advances-in-enzyme-technology>
- <http://www.biologydiscussion.com/enzymes/enzyme-technology/enzyme-technology-application-and-commercial-production-of-enzymes/10185>
- <http://www.biologymad.com/studentswork/12%20-%20etnotes.pdf>
- <https://www.kth.se/dib/enzyme-technology-1.783173>
- <http://www1.lsbu.ac.uk/water/enztech/whither.html>
- <https://bmcbiotechnol.biomedcentral.com/articles/sections/protein-and-enzyme-technology>
- <http://www.odofin.com/enzyme%20technology.htm>
- <https://www.thesciencenotes.com/enzyme-technology/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (II Semester)

MFT201P FOOD MICROBIOLOGY LAB

1	Introduction of Laboratory Practices	
2	Safety Measures	
3	Do and Don'ts	
4	About Equipment and Accessories and Working	
5	Preparation of special culture media	Experiment 1
6	Assessment of surface sanitation by SWAB RINSE METHOD	Experiment 2
7	Assessment of personal hygiene by swab method	Experiment 3
8	To study proteolytic bacteria using skim milk agar media	Experiment 4
9	To study yeast and mold growth using potato dextrose agar medium (PDA)	Experiment 5
10	To study starch hydrolyzing microorganisms using starch agar medium	Experiment 6
11	To study the growth of coliform on EMB agar medium	Experiment 7
12	To perform mounting of fungi using Lacto phenol cotton blue	Experiment 8

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology I Year (II Semester)

MFT202P FOOD FERMENTATION LAB

1	Introduction of Laboratory Practices	
2	Safety Measures	
3	Do and Don'ts	
4	About Equipment and Accessories and Working	
5	Introduction to Food Fermentation Lab	Experiment 1
6	To produce ethanol under submerged conditions using <i>Saccharomyces cerevisiae</i>	Experiment 2
7	To extract and purify ethanol produced under submerged conditions	Experiment 3
8	To study the Baker's yeast production under submerged conditions.	Experiment 4
9	To study the production of sauerkraut.	Experiment 5
10	To study the production of single cell proteins.	Experiment 6
11	To study the production of lactic acid from whey.	Experiment 7
12	To study the production of Cheese making from whole milk	Experiment 8
13	To study the production Citric acid from whey with sugars and additives by <i>Aspergillus niger</i> .	Experiment 9

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (III Semester)

MFT301T POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES

Objective(s): The objective of this course:

- Aims to provide knowledge about the fruit and vegetable structure, post-harvest physiology and its spoilage.
- To understand the concepts of physiological characteristics of fruits and vegetables.
- To provide an insight about fruit losses during storage and ways to prevent it.

UNIT I: (8 Sessions)

Introduction: Importance & scope of post-harvest management of fruits and vegetables in Indian economy; Postharvest losses; type and extent of losses, causes, loss assessment, methods of loss reduction; Principles and methods of fruits and vegetables preservation, Types of storage – Natural, Ventilated, Low temperature.

UNIT II: (8 Sessions)

Fruits and Vegetables: Morphology, structure and composition of fruits and vegetables: Biochemical constituents; Maturity indices and standards for selected fruits and vegetables; Methods of maturity determinations.

UNIT III: (8 Sessions)

Harvesting and Handling: Importance of harvesting and handling of fruits and vegetables; Harvesting tools and their design aspects; Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level; Post Harvest handling system for fruits and vegetables of regional importance such as citrus, mango, banana, pomegranate, tomato, papaya and carrot etc.; factors affecting post-harvest losses; Commodity pretreatments - chemicals, wax coating, prepackaging, VHT and irradiation.

UNIT IV: (8 Sessions)

Post-harvest physiological and biochemical changes: Ripening of climacteric and non-climacteric fruits; regulations, methods; Physiological post-harvest disorders- Chilling injury and disease; prevention of post-harvest diseases and infestation.

UNIT V: (8 Sessions)

Packaging and Transportation: Packaging of fruits and vegetables; Storage practices- CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; packaging house operations; principles of transport and commercial transport operations.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the production status and post-harvest preservation methods of fruits and vegetables for skill development, employability and entrepreneurship development.

CO2: Understand the structure and composition of fruits and vegetables for skill development and employability.

CO3: Acquire knowledge on post-harvest management tools and handling methods of fruits and vegetables for skill development, employability and entrepreneurship development.

CO4: Understand the basic post-harvest biological, chemical, physiological, and metabolic processes and changes in fruits and vegetables for skill development.

CO5: Gain an overview of cold chain management supply of fruits and vegetables for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	3	2	1	3	2	1	3
CO2	2	3	3	3	3	1	2	3	3	3
CO3	3	2	2	3	2	2	2	2	3	3
CO4	2	3	3	3	1	3	3	1	2	3
CO5	3	3	2	1	3	3	1	2	2	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	3
CO2	3	3	2
CO3	3	3	2
CO4	2	3	2
CO5	2	3	3

Suggested Readings:

1. Amalendu Chakraverty , Arun S. Mujumdar Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices,2003.
2. AA Kadar, Post harvest technology. of Horticulture crops ,Third Edition: University of California, 2002
3. D K Salunkhe Handbook of vegetable science,1998.
4. TK Bose, Fruits of India: Tropical and subtropical, Publisher-Naya prakash, 1991.
5. R. Wills et al. Postharvest of fruit, vegetables & ornamentals; CAB International, (2007).

Website Sources:

- <https://onlinecourses.nptel.ac.in/>
- <https://www.wikipedia.org/>
- <http://ecoursesonline.iasri.res.in/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (III Semester)

MFT302T FOOD ENGINEERING

Objective: The main objective of this course:

- Is designed to emphasis on the various properties of the raw material used in food processing, different processing technologies required in transforming them into quality food products and material handling equipment involved in food processing operations.

UNIT I: (6 Sessions)

Thermodynamics and Heat Transfer: Principles of thermodynamics and heat transfer applied to food engineering; Mass Transfer; Modes of Heat Transfer – in solids and liquids; radiative heat transfer; Steady and Unsteady State Heat Transfer; Microwave Heating Fourier's Law; Stefan Boltzmann Law.

UNIT II: (6 Sessions)

Kinetics of biological reactions: kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods; application of Arrhenius equation to biological reactions.

UNIT III: (10 Sessions)

Method for thermal process evaluation: Commercial sterility, pasteurization and sterilization methods based on slowest heating region; determination of the process time based on region of greatest temperature lag; the process equivalence in terms of minutes at 121.1°C; calculation of process time for fluids on stream line flow and turbulent flow heated in heat exchangers; general introduction to aseptic canning process, hydrostatic sterilizer and aseptic packaging practices and design problems.

UNIT IV: (8 Sessions)

Food chilling and freezing: Properties of frozen foods; freezing point depression; general introduction to enthalpy changes during freezing; Plank's equation for predicting rates of product freezing; Cryogenic freezing and IQF; design of food freezing equipment such as air blast freezers, plate freezers and immersion freezers.

UNIT V: (10 Sessions)

Mechanical Operations in Food Processing: Size Reduction and Related Laws; Methods of Size Reduction – crushing, grinding; Equipment used for Size Reduction; Applications in a Food Processing Industry.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the concept of thermodynamics in food engineering for skill development.

CO2: Identify the chemical changes in food, types of reactions, and order of the reaction for skill development.

CO3: Develop the concept of aseptic operation of food processing and familiarize techniques like pasteurization, blanching, and sterilization for skill development, employability and entrepreneurship

development.

CO4: Understand the techniques of food preservation at low temperatures and freezing for skill development, employability and entrepreneurship development.

CO5: Understand the concept of heat transfer and working of instruments like heat exchanges for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	1	1	1	1	1	2	1
CO2	2	2	3	3	1	1	2	1	2	1
CO3	3	2	3	3	1	1	1	2	1	2
CO4	2	3	3	3	3	3	3	2	1	1
CO5	3	3	2	2	1	3	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	2
CO2	3	1	2
CO3	3	3	2
CO4	2	3	2
CO5	2	3	3

Suggested Readings:

1. H. Pandey, H.K. Sharma, R.C.Chouhan, B.C. Sarkar and M.C. Bera, Experiments in Food Process Engineering, CBS Publishers and Distributors, 2004.
2. M.A. Rao, S.S. H.Rizvi and A.K.Dutta, Engineering properties of Foods, 3rd ed., Marcel Dekker, 2005.
3. Zeki Berk, Food process engineering and technology, first edition, 2009.
4. Aiba, Humphrey & Miller, Biochemical Engg., Academic Press, 1973.
5. Rao DG. Fundamentals of food engineering. PHI Learning Private Ltd, 2010.

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- <https://www.wikipedia.org/>
- <http://ecoursesonline.iasri.res.in/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (III Semester)

MFT303T FOOD QUALITY SYSTEMS AND MANAGEMENT

Objective: The main objective of this course:

- Emphasis on introducing the students to the principles of food safety and sanitation. It focuses on the important areas of foodborne diseases, food safety hazards and the effective management of food safety through the application of the risk management system Hazards Analysis Critical Control Point (HACCP).

UNIT I: (8 Sessions)

Concept of quality: Quality control; Importance and function of Quality control; Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory *vis-à-vis* instrumental methods for testing quality, Methods of quality assessment of food materials- Fruits, Vegetables, Dairy products, cereals, Meat, Poultry and egg.

UNIT II: (8 Sessions)

Quality management: Objectives of quality management, Sampling procedures and plans; Quality management systems in India- Food Safety and Standards Act, 2006; Global Food safety Initiative; HACCP; Quality manuals, documentation and audits.

UNIT III: (8 Sessions)

Various organizations: Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); International scenario, international food standards- ISO and Food Codex.

UNIT IV: (8 Sessions)

Quality assurance: Total Quality Management; Food adulteration and food safety; Export import policy- WTO (SPS, TBT); export documentation; IPR and Patent; Labeling issues.

UNIT V: (8 Sessions)

Quality procedures and applications: Sanitary and hygiene practices (GMP, GHP, GLP); Sampling and specification of raw material and finish products; Applications in different food industries.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the principles and methods of sensory evaluation. Acquire in-depth knowledge about the Quality assessment of food materials for skill development and employability.

CO2: Gain knowledge of the Quality Management System in India, understand the importance of FSSAI and to know about sampling procedures and plans for food products for skill development, employability and entrepreneurship development.

CO3: Understand National Food standards and Regulations, comprehend the need for hygiene and sanitation for ensuring food safety for skill development.

CO4: Understand the principle and importance of Indian and International standards like HACCP, ISO, and Food Codex for skill development and employability.

CO5: Understand the concept of food adulteration and food safety. Gain an overview of IPR and patent for skill development and employability.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	2	2	1	1	1	1	1	1
CO2	2	1	3	3	2	2	1	3	1	1
CO3	3	2	3	3	3	2	2	2	3	3
CO4	2	3	3	3	3	3	3	2	2	3
CO5	3	3	2	2	2	3	2	2	3	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	2
CO2	3	2	3
CO3	2	1	2
CO4	2	3	1
CO5	3	3	1

Suggested Readings:

1. Amerine MA, Pangborn RM & Rosslos EB. Principles of Sensory Evaluation of Food. Academic Press, 2013.
2. Early R. Guide to Quality Management Systems for Food Industries, Blackie Academic, 2012.
3. Furia TE. Regulatory status of Direct Food Additives, CRC Press, 2018.
4. Jellinek G. Sensory Evaluation of Food - Theory and Practice, Ellis Horwood, 1985.
5. Krammer A & Twigg BA. Quality Control in Food Industry. Vol. I, II. AVI Publication, 1970.
6. Ranganna S. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, Tata-McGraw-Hill, 1986.

Website Sources:

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- <https://www.wikipedia.org/>
- <https://www.ncbi.nlm.nih.gov/books>
- <http://ecoursesonline.iasri.res.in/>

IFTM University, Moradabad
Master of Science M.Sc.), Programme
M.Sc. Food Technology I Year (III Semester)

MFT304T ENTREPRENEURSHIP AND BUSINESS MANAGEMENT

Objective(s): The objectives of this course are to:

- Familiarize students with business models and their planning and development.
- Acquaint students with the principles and intricacies of managing an enterprise.

UNIT I: (8 Sessions)

Being An Entrepreneur: Definition and Qualities of an Entrepreneur, Types of Industry – cottage and small scale industry, Market Structure – macro and micro business, Creating a Business Model, Brand Creation.

UNIT II: (8 Sessions)

Food Processing Plant: Product and Process Designs, General and Specific Design and Layout Considerations, Selection of Equipment.

UNIT III: (8 Sessions)

Human Resource Management: Recruitment, Training, Performance Appraisals, Worker's Safety and Welfare. Employee's Union.

UNIT IV: (8 Sessions)

Marketing Management: Functions of Marketing, Market Intelligence - survey techniques, demand & supply, Market Forecasting – consumer behaviour and trends, Segmentation, Targeting and Positioning; Marketing Network, E-Marketing and E-Procuring.

UNIT V: (8 Sessions)

Advertising And Commercialization: Objectives of Advertising, Advertising Message, Budgeting; Media Selection, Personal Selling and Publicity, Sales Promotion.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the fundamentals of entrepreneurship, identify entrepreneurial personality traits, skills, competencies; understand the value proposition and business model for skill development, employability and entrepreneurship development.

CO2: Understand the selection of appropriate locations for establishing industrial plants by applying the concepts of location selection, able to design plant and production layouts through basic strategies for skill development, employability and entrepreneurship development.

CO3: Understand and build a strong foundation for creativity and innovation management, encourage diversity including attitude towards the job (job satisfaction and work engagement), attitude towards the organization (e.g., organizational commitment); job security, employee union, and other concepts for skill development.

CO4: Understand the concepts of marketing management; relevant functional areas of marketing management and its application; identifying and resolving problems pertaining to marketing management for skill development, employability and entrepreneurship development.

CO5: Understand and realize the relevant research in advertising and marketing communication,

design effective visual communication for advertising approaches that combine the use of print, online/ digital, other multimedia communication, develop advertising media buying and planning strategies for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	1	3	1	1	2	2	2	2
CO2	2	3	1	1	2	1	2	3	3	3
CO3	2	2	3	2	3	1	3	2	3	2
CO4	2	3	3	1	1	3	3	2	2	1
CO5	3	2	2	2	1	1	1	1	1	3

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	2	2
CO3	2	1	1
CO4	2	3	3
CO5	3	3	2

Suggested Readings:

1. Chhabra TN and Suria RK. 2001. Management Process and Perspectives. Kitab Mahal.
2. Jhingan ML. 2005. International Economics. 5th Ed. Virnda Publ.
3. Kotler P. 2000. Marketing Management. Prentice Hall.
4. Reddy SS, Ram PR, Sastry TVN and Bhavani ID. 2004. Agricultural Economics. Oxford & IBH.

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- <https://www.ediindia.org/>

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (III Semester)

MFT305T MEAT, POULTRY AND FISH PROCESSING TECHNOLOGY

Objective: The main objective of this course:

- To provide an understanding of the technology for handling, processing, preservation and by-product utilization of meat, poultry and fish products processing.

UNIT I: (8 Sessions)

Introduction: Status and scope of meat and poultry industry in India; Muscle- structure, chemical composition and physico-chemical properties of meat muscle, Effect of feed, breed and management on meat production and quality; nutritive value, conversion of muscle into meat.

UNIT II: (8 Sessions)

Slaughter process: Slaughtering of animals and poultry, post-mortem inspection and ante- mortem inspection; grading of meat; Factors affecting post-mortem changes, properties and shelf life of meat; Meat tenderization - natural and artificial methods; Modern abattoirs and design of facilities - typical layout and features.

UNIT III: (8 Sessions)

Processing and preservation of meat: Mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat; Thermal processing- canning of meat, retort pouch, dehydration and irradiation; Meat Products -kebabs, mince, salami, sausages, meat emulsions, dried meat, meat extracts, ready to eat (RTE) meat products; Meat plant sanitation and waste disposal; by-product Utilization.

UNIT IV: (8 Sessions)

Poultry: Poultry industry in India, measuring the yields and quality characteristics of poultry products, microbiology of poultry meat, spoilage factors; Lay-out and design of poultry processing plant; Poultry meat processing operations, equipment used – Defeathering, bleeding, scalding etc.; Packaging of poultry products, refrigerated storage of poultry meat, by products – eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage.

UNIT V: (8 Sessions)

Fish: Commercially important marine products from India; product export and its sustenance; basic biochemistry and microbiology; preservation of postharvest fish freshness; transportation in refrigerated vehicles; deodorization of transport systems; design of refrigerated and insulated trucks; grading and preservation of shell fish; pickling and preparation of fish protein concentrate, fish oil and other by products

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the scope of the meat and poultry industry in India; muscle structure, composition, physicochemical properties, effect of feed, breed, and management on meat production and quality for skill development and employability.

CO2: Understand the slaughtering process of animals, inspection, and meat tenderization for skill

development, employability and entrepreneurship development.

CO3: Acquire detailed knowledge about the various processing and preservation techniques for meat; meat plant sanitation and waste disposal for skill development, employability and entrepreneurship development.

CO4: Understand the quality characteristics of poultry products, the microbiology of poultry meat, layout and design of poultry processing plant, poultry meat processing operations, packaging of poultry products for skill development, employability and entrepreneurship development.

CO5: Gain knowledge about the important marine products from India, basic biochemistry and microbiology, preservation of postharvest fish freshness, grading and preservation of shellfish, pickling and preparation of fish protein concentrate, fish oil, and other by-products for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	1	2	2	1	1	1
CO2	2	1	3	3	1	1	2	1	1	1
CO3	3	2	3	3	1	1	1	1	1	2
CO4	2	3	1	3	2	3	1	1	1	1
CO5	3	3	2	1	1	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	1
CO2	2	3	2
CO3	3	2	2
CO4	2	3	3
CO5	3	2	2

Suggested readings:

1. Forrest JC. 1975. *Principles of Meat Science*. Freeman.
2. Govindan TK. 1985. *Fish Processing Technology*. Oxford & IBH.
3. Hui YH. 2001. *Meat Science and Applications*. Marcel Dekker.
4. Pearson AM & Gillett TA. 1996. *Processed Meat*. 3rd Ed. Chapman & Hall.
5. Stadelman WJ & Cotterill OJ. 2002. *Egg Science and Technology*. 4th Ed. CBS.

Website sources:

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- ecoursesonline.iasri.res.in

IFTM University, Moradabad
Master of Science (M.Sc.), Programme
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MFT306T NUTRACEUTICAL AND FUNCTIONAL FOODS

Objective: The main objective of this course:

- To cater to the newly emerging area of nutraceuticals with respect to the types, mechanisms of action, manufacture of selected nutraceuticals, product development, clinical testing and toxicity aspects.

UNIT I: (8 Sessions)

Concept of Nutraceuticals and Functional Foods: Definition and importance of nutraceuticals and functional foods. Nature, type and scope of nutraceutical and functional foods; Nutraceutical and functional food applications and their health benefits; Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions.

UNIT II: (8 Sessions)

Metabolic aspects of Bioactive ingredients and Risk Reduction of diseases: Nutraceuticals for specific situations such as-cancer, heart disease, stress, osteoarthritis, hypertension etc.; Antioxidants and other phytochemicals (isoflavones, lycopenes) their role as nutraceuticals and functional foods; Dietary fibers and complex carbohydrates as functional food ingredients; Protein as a functional food ingredient; Probiotic foods and their functional role; Herbs as functional, health promoting activity of common herbs.

UNIT III: (8 Sessions)

Food products as functional foods: Cereal products – oats, wheat bran, rice bran etc.; Functional vegetables products, oil seeds and sea foods; Coffee, tea and other beverages as functional foods/drinks and their protective effects.

UNIT IV: (8 Sessions)

Clinical testing of nutraceuticals and health foods: Interactions of prescription drugs and nutraceuticals; adverse effects and toxicity of nutraceuticals; nutrigenomics – an introduction and its relation to nutraceuticals.

UNIT V: (8 Sessions)

Regulatory status and laws governing Functional foods and Nutraceuticals: Marketing and regulatory issues for functional foods; Health Claims: Disease Risk Reduction Claims, regulatory issues for nutraceuticals including CODEX; Recent developments and advances in the area of nutraceuticals and functional foods.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the field of functional foods and nutraceuticals, differentiate between different classes of nutraceuticals, apply the knowledge of nutraceuticals and functional foods in food industries for skill development, employability and entrepreneurship development.

CO2: Understand the new trends of bioactive compounds of food and their role in the prevention and treatment of various diseases for skill development, employability and entrepreneurship development.

CO3: Understand the different fields of product technology such as vegetable products, dairy products, fish products, cereal derived products, and fermented products as functional foods including aspects of

their protective behavior for skill development, employability and entrepreneurship development.

CO 4: Understand the clinical testing of nutraceuticals and health foods, interaction of prescription drugs and nutraceuticals, adverse effects and toxicity of nutraceuticals for skill development and employability.

CO 5: Understand and apply the guidelines of national and international regulatory bodies for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	1	2	1	1	3	1	1	1
CO2	2	1	3	3	1	1	1	1	1	1
CO3	2	2	2	3	1	1	1	1	1	1
CO4	2	3	3	2	1	2	3	1	2	3
CO5	2	3	2	3	3	3	3	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	3
CO2	2	3	2
CO3	3	2	3
CO4	3	2	3
CO5	3	2	2

Suggested readings:

1. Brigelius-Flohé, J & Joost HG. 2006. Nutritional Genomics: Impact on Health and Disease. Wiley VCH.
2. Cupp J & Tracy TS. 2003. Dietary Supplements: Toxicology and Clinical Pharmacology. Humana Press.
3. Gibson GR & William CM. 2000. Functional Foods - Concept to Product.
4. Goldberg I. 1994. Functional Foods: Designer Foods, Pharma Foods.

Website sources:

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IFTM University, Moradabad
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MFT307T MILK AND MILK PRODUCT TECHNOLOGY

Objective: The main objective of this course:

- To acquaint with techniques and technologies of testing and processing of milk into various products and by products.

UNIT I: (8 Sessions)

Present status of milk & milk products in India and abroad: Market milk-Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equipments. Special milks such as flavoured, sterilized, recombined & reconstituted toned & double toned.

UNIT II: (8 Sessions)

Cream and Butter: Definition, classification, composition, cream separation, sampling, neutralization, sterilization, pasteurization & cooling of cream, evaluation, defects in cream; Butter-Definition, composition, classification, methods of manufacture, theories of churning, evaluation, defects in butter.

UNIT III: (8 Sessions)

Condensed and Dried milk: Definition, methods of manufacture, evaluation of condensed & evaporated milk; Dried milk- Definition, methods of manufacture of skim & whole milk powder, instantiation, physiochemical properties, evaluation, defects in dried milk powder.

UNIT IV: (8 Sessions)

Ice cream and cheese: Definition, composition and standards, nutritive value, classification, methods of manufacture, evaluation, defects in ice cream, and technology aspects of softy manufacture; Cheese-Definition, composition, classification, methods of manufacture, cheddar, Gouda, cottage and processed cheese, evaluation, defects in cheese.

UNIT V: (8 Sessions)

Indigenous milk products: Present status, method of manufacture of yoghurt, dahi, khoa, burfi, kalakand, gulabjamun, rasogulla, shrikhand, chhana, paneer, ghee, lassi etc; probiotic milk products.

Course Outcomes:

At the end of the course students will be able to:

CO1: Understand the composition of milk, quality evaluation and testing of milk, processing of milk, cleaning and sanitization of milk equipments. Also, they will learn about the concept of special kinds of milk for skill development, employability and entrepreneurship development.

CO2: Understand the composition, classification, methods of manufacture, and defects of cream and butter for skill development, employability and entrepreneurship development.

CO3: Understand the definition, methods of manufacture and defects of condensed and dried milk for skill development, employability and entrepreneurship development.

CO4: Learn about the composition, classification, nutritive value, methods of manufacture, and defects of ice cream and cheese for skill development, employability and entrepreneurship development.

CO5: Understand the method of manufacture of yogurt, dahi, khoa, buri, kalakand, rasogulla, chhana, paneer, ghee, lassi, probiotic milk etc for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading for the achievement of Programme Outcomes

Please write 3,2,1 wherever required

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	3	1	1	2	1	1	3
CO2	2	2	2	2	1	1	1	1	1	2
CO3	3	3	2	3	1	2	1	1	1	3
CO4	3	2	2	3	1	1	1	2	1	2
CO5	3	2	3	3	1	1	1	2	1	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	3	3
CO3	2	2	3
CO4	3	3	2
CO5	2	2	3

Suggested readings:

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. Technology of Indian Milk Products. Dairy India Publ.
2. Rathore NS et al. 2008. Fundamentals of Dairy Technology - Theory & Practices. Himanshu Publ.
3. De Sukumar, Outlines of Dairy Technology, Oxford University Press, 1991.
4. P.Walstra, Dairy Technology: Principles of Milk Properties and Processes, First ed., CRC Press, 1999.
5. Web BH, Johnson AH & Lford JA. 1987. Fundamental of Dairy Chemistry. 3rd Ed. AVI Publ.

Website sources:

- <https://onlinecourses.nptel.ac.in/>
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**Master of Science (M.Sc.), Programme
M.Sc. Food Technology II Year (III Semester)**

MFT301P POST HARVEST TECHNOLOGY LAB

1.	Introduction of Laboratory Practices	
2.	Safety Measures	
3.	Do and Don'ts	
4.	About Equipment and Accessories and Working	
5.	To study the maturity and maturity indices of fruits and vegetables	Experiment 1
6.	Determination of soluble solids and acidity of a given samples.	Experiment 2
7.	To study the effect of pretreatment on fruits and vegetables	Experiment 3
8.	Determination of reducing sugar and total sugar of given samples	Experiment 4
9.	Preparation of fruit preserve	Experiment 5
10.	To study the effect of drying on various fruits and vegetables	Experiment 6
11.	Preparation of Santra Marmalade	Experiment 7
12.	To study the nature and cause of deterioration in fruits and vegetables	Experiment 8

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MFT302P FOOD ENGINEERING LAB

1	Introduction of Laboratory Practices	
2	Safety Measures	
3	Do and Don't	
4	About Equipment and Accessories and Working	
5	To prepare a plant layout for a sample food plant or for the laboratory	Experiment 1
6	To study drying and drying characteristics of a given food materials	Experiment 2
7	To study the process of elevation of boiling points	Experiment 3
8	study the different types of dryers in food engineering	Experiment 4
9	To carry out the freezing of given fruit and vegetable samples	Experiment 5
10	To study the various types of heat exchanger used in food industry	Experiment 6
11	To study the freezing characteristics (freezing point depression in solution)	Experiment 7
12	To compare conventional processing methods with microwave processing of foods	Experiment 8