

FACULTY OF FOOD SCIENCE & TECHNOLOGY

SYLLABUS FOR THE BATCH FROM THE YEAR 2024 TO YEAR 2026

Programme Code: MSFT

**Programme Name: M.Sc. Food Technology
(Semester I-IV)**

Examination: 2024-2025



**P.G. Department of Food Science and Technology
Khalsa College, Amritsar**

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(c) Please visit the College website time to time.

S.No.	PROGRAMME OBJECTIVES
1.	To prepare students for evaluating thinking and analytical skills to broaden their knowledge of food and its preservation.
2.	Students will be able to recognize the main world problems and their root causes and to develop an ability to resolve these problems
3.	To develop ability to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools to investigate the complex problem.
4.	To prepare students for understand the societal needs related to nutritional and hygienic foods and to apply reasoning to solve social health, safety, culture and legal issue.
5.	To provide skills of food manufacturing and processing. The knowledge of various processes of food makes this as an ideal choice for a successful career.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	To disseminate knowledge of food technology and allied discipline among students which enable them to understand the emerging techniques and advanced methods of food processing and preservation.
PSO-2	To make students understand, evaluate and develop food products, their handling, processing and packaging.
PSO-3	Identification and analysis to solve problems for the development of products, processes, techniques to meet the demands of the society.
PSO-4	To enhance the ability of students in food processing industries to design and process food products as per the needs and specifications or can also emerge as an entrepreneur.
PSO-5	To make them aware of various challenges involved in food processing and their possible solution with best of knowledge attained

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EXAMINATION 2024-25
COURSE SCHEME FOR BATCH 2024-2026

COURSE SCHEME FOR BATCH 2024-2026											
SEMESTER-I											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Marks				Page No.
			L	T	P		Th	P	Int A.	Total	
MSFT51-101	Principles of Food Processing and Preservation	3	2	1	-	3	55	-	20	75	13
MSFT51-102	Lab: Principles of Food Processing and Preservation	2	-	-	1	1	-	18	07	25	14
MSFT51-103	Food Microbiology	3	2	1	-	3	55	-	20	75	15
MSFT51-104	Lab: Food Microbiology	2	-	-	1	1	-	18	07	25	16
MSFT51-105	Dairy Technology-I Fluid Milk Processing	3	2	1	-	3	55	-	20	75	17
MSFT51-106	Lab: Dairy Technology-I Fluid Milk Processing	4	-	-	2	2	-	37	13	50	18
MSFT51-107	Technology of Cereal Processing	3	2	1	-	3	55	-	20	75	19
MSFT51-108	Lab: Technology of Cereal Processing	4	-	-	2	2	-	37	13	50	20
MSFT51-109	Technology of Fruits and Vegetable Processing	3	2	1	-	3	55	-	20	75	21
MSFT51-110	Lab: Technology of Fruits and Vegetable Processing	4	-	-	2	2	-	37	13	50	22
	Current Affairs*	-		1		-	-	-	-	-	-

***Non-Credit**

SEMESTER-II											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Marks				Page No.
			L	T	P		Th	P	Int A.	Total	
MSFT52-201	Food Chemistry	3	2	1	-	3	55	-	20	75	23
MSFT52-202	Lab: Food Chemistry	2	-	-	1	1	-	18	07	25	24
MSFT52-203	Food Engineering-I	3	2	1	-	3	55	-	20	75	25
MSFT52-204	Lab: Food Engineering-I	2	-	-	1	1	-	18	07	25	27
MSFT52-205	Dairy Technology – II (Milk Products Processing)	3	2	1	-	3	55	-	20	75	28
MSFT52-206	Lab: Dairy Technology –II (Milk Products Processing)	4	-	-	2	2	-	37	13	50	29
MSFT52-207	Technology of Legumes & Oilseeds Processing	3	2	1	-	3	55	-	20	75	30
MSFT52-208	Lab: Technology of Legumes & Oilseeds Processing	4	-	-	2	2	-	37	13	50	31
MSFT52-209	Technology of Egg & Poultry Processing	3	2	1	-	3	55	-	20	75	32
MSFT52-210	Lab: Technology of Egg & Poultry Processing	4	-	-	2	2	-	37	13	50	33
MSFT52-211	In Plant Training	4	--	--	2	2	-	-	-	Satisfactory/ Unsatisfactory	34
	Current Affairs*	-		1		-	-	-	-	-	-

MSFT52-206 In-plant Training of 4 weeks duration in Food Processing Industry after the completion of 2nd Semester. In-plant Training will be graded as Satisfactory/Unsatisfactory.

***Non-Credit**

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EXAMINATION 2024-25
COURSE SCHEME FOR BATCH 2023-2025

COURSE SCHEME FOR BATCH 2023-25											
SEMESTER-III											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Marks				Page No.
			L	T	P		Th	P	Int A.	Total	
MSFT61-301	Food Packaging Technology	6	3	2	1	6	75	35	40	150	35
MSFT61-302	Food Engineering-II	4	2	1	1	4	50	25	25	100	37
MSFT61-303	Technology of Fish & Meat Processing	4	2	1	1	4	50	25	25	100	39
MSFT61-304	Applied Research Methodology	4	2	1	1	4	50	25	25	100	41
MSFT61-305	Advanced Instrumentation in Food Technology	4	2	1	1	4	50	25	25	100	43
MSFT61-306	Master's Seminar	4	-	-	4	4	-	100	-	100	45

COURSE SCHEME											
SEMESTER-IV											
Course Code	Course Name	Hours/Week	Credits			Total Credits	Marks				Page No.
			L	T	P		Th	P	Int A.	Total	
MSFT62-401	Food Quality Assurance & Management	4	2	1	1	4	50	25	25	100	46
MSFT62-402	Industrial Microbiology and Fermented Foods	4	2	1	1	4	50	25	25	100	48
MSFT62-403	Advances in Food Nutrition	4	2	1	1	4	50	25	25	100	50
MSFT62-404	Application of Enzymes in Food Industry	4	2	1	1	4	50	25	25	100	52
MSFT62-405	Nutraceutical and Functional Foods	4	2	1	1	4	50	25	25	100	54
MSFT62-406	M.Sc. Dissertation	4	-	-	4	4	-	100	-	100	56

M. Sc. FOOD TECHNOLOGY - SEMESTER –I -IV

ORDINANCES FOR MASTER OF FOOD TECHNOLOGY 2 YEAR DEGREE PROGRAMME IN THE DEPARTMENT OF FOOD TECHNOLOGY AS PER NEP

1. Duration:

The duration of the course shall be four semester after graduation.

2. Eligibility

A candidate who has passed any one of the following examination is eligible for admission in M.Sc. Food Technology Course

- I. Bachelor in Food Science & Technology (Honours)
- II. B.Sc. Agriculture (Honours)
- III. B.Sc. Food Science & Quality Control
- IV. B.Sc. Medical
- V. B.Sc. Non-Medical

5. B.Sc. Clinical Nutrition

6. B.Sc. Home Science

7. B.Voc. Food Processing

8. Other Food Science related graduate degrees

With 50% marks or any equivalent examination recognized by UGC

1. Fee

Every candidate shall pay such fee as the College may prescribe from time to time.

2. Scheme of Instructions-Examination

For each examination, every student admitted to the courses under the semester system must be on the rolls of the institution, and shall send his/her admission form and fees for the examination through the Principal/Head of the Institution, accompanied by the following certificates:

- a) Of having attended at least 75% of the total number of lectures delivered in each theory and practical course separately. Deficiency in lectures may be condoned as per ordinances of college/University. If in a particular semester, a student falls short of attendance in a maximum of two courses, he/she would be permitted to appear in the semester examination of the papers in which he/she fulfils the attendance requirements. The course/s in which the student does not fulfill the minimum attendance requirements, he/she shall not be permitted to appear in the semester examination of such course/s, and shall be declared as having failed in such course/s. A student who is falling short of attendance in maximum of two courses, he/she shall be required to attend the minimum number of lectures which were falling short, during next year when the course/s is/are offered.

- b) Of having good moral character.

- c) The syllabi, courses of reading and regulations for the courses shall be notified by the College from time to time, and shall be deemed to constitute integral part of the ordinances. Course evaluation under the semester system of evaluation shall be done on marks basis. If a course has both the theory and practical components, the student will be required to pass both the components, separately. However, if the student fails in theory, but is passing in practical of that course, he/she will be required to clear the theory paper only, and vice-versa.

3. Carry on system for various semester examinations.

I. Courses having two semester duration:

- a. There shall be no condition for promoting a student from first semester to second semester.
- b. **For certificate courses/UG/PG Diploma** - In case a student fails to pass all the courses/papers within a period of two semesters (One Year), he/she shall be given two consecutive semesters (one year) more to pass.
- c. **For one year degree course-** In case a student fails to pass all the courses/papers within a period of two semesters (One Year), he/she shall be given two year more to pass.

II. Courses having four semester duration:

- a. There shall be no condition for promoting a student from first semester to second semester.
- b. However the student shall be promoted to the third semester only if he/she has passed at least 50% courses/papers of the first two semesters.
- c. There shall be no condition for promoting a student from third semester to fourth semester.
- d. In case a student fails to pass all the courses/papers within a period of four semesters (Two Years), he/ she shall be given four consecutive semesters (Two Years) more to pass.

III. Courses having six semester duration:

- a. There shall be no condition for promoting a student from first semester to second semester
- b. However, the student shall be promoted to the third semester only if he/she has passed at least 50% courses/papers of the first two semesters.
- c. There shall be no condition for promoting a student from third semester to fourth semester.
- d. However a student shall be promoted to fifth semester only if he/she has passed at least 50% courses/ papers of the first four semesters.
- e. There shall be no condition for promoting a student from fifth semester to sixth semester. After a period of six semesters the student shall be given a period of two consecutive years to pass.

IV. Courses having eight semester duration:

- a. There shall be no condition for promoting a student from first semester to second semester.
- b. A student shall be promoted to the third semester only if he/she has passed atleast 50% courses/papers of the first two semesters, but there will be no condition for promoting a student from third semester to fourth semester.
- c. A student shall be promoted to fifth semester only if he/she has passed at least 50% courses/papers of the first four semesters.
- d. There shall be no condition for promoting a student from fifth semester to sixth semester.
- e. A student shall be promoted to seventh semester only if he/she has passed at least 50% courses/ papers of the first six semesters.
- f. There will be no condition for promoting a student from seventh semester to eight semester and after a period of eight semesters, the student shall be given a period of two consecutive years to pass.

V. Courses having ten semester duration:

- a. There shall be no condition for promoting a student from first semester to second semester
- b. A student shall be promoted to the third semester only if he/she has passed atleast 50% courses/papers of the first two semesters, but there will be no condition for promoting a student from third semester to fourth semester.
- c. A student shall be promoted to fifth semester only if he/she has passed at least 50% courses/papers of the first four semesters.
- d. There shall be no condition for promoting a student from fifth semester to sixth semester.
- e. A student shall be promoted to seventh semester only if he/she has passed at least 50% courses/ papers of the first six semesters.
- f. There will be no condition for promoting the student from seventh semester to eighth semester.
However, a student shall be promoted to ninth semester only if he/she has passed at least 50% courses/papers of the first eight semesters.
- g. There will be no condition for promoting the student from ninth semester to tenth semester.
- h. After a period of ten semesters, the student will be given a period of two consecutive years more to pass.

Note:1. No special chance or exemption shall be allowed beyond what is stated in the above Ordinances.

Note:2. Failing students shall appear in the examination in the regular semester examinations next year i.e., reappear of examination for an odd semester shall be conducted along with the next odd semester, and even semester along with the next even semester and there shall be no special supplementary examinations.

Note:3. If 50% of the courses/papers required to pass involve a fraction, the fraction of the course/paper will be treated as a full course. For example, if in a year there are 13 courses in two semesters, the candidate will be required to pass minimum of 7 courses/papers.

VI. The medium of instructions shall be English.

VII. Maximum time allowed to pass a degree is given in the table below *:

<i>Programme duration</i>	<i>Maximum time to complete a degree</i>
Five years	Seven years
Four years	Six years
Three years	Five years
Two years	Four years
One year*	Three years

*For certificate course/UG/PG Diploma maximum time limit is N+1.

VIII. The candidate shall be treated to be failing in the courses offered in the semester in which he has not sought admission/ dropped the semester and such courses/papers in which the candidate has failed shall be taken into account while deciding the promotion of the candidate in subsequent semesters as per the condition. The candidate shall be required to seek admission into the dropped/ gap semester examination as a regular candidate at the end of the prescribed duration of the course, but within the maximum time allowed to pass a course as given above table VII of the ordinances, provided that he fulfills all other requirements under the prevailing ordinances. Regular students admitted to a programme shall register/enroll themselves with the college in the very first semester of their admission and pay prescribed fee to the college/University. Direct admission to second semester is not allowed. The above shall also apply to all such courses in which admission to a college is a prerequisite as a regular student.

The above provision is extended to all the Under Graduate, Post Graduate Courses & Diplomas. This provision shall also be extended for subsequent semesters.

4.

Course Credit

Each course shall have a certain number of credits assigned to it depending upon the academic load of the course assessed on the basis of weekly contact hours of lecture, tutorial and laboratory classes, assignments or field study and/or self-study.

Generally, each course shall have an integer number of credits reflecting its weightage. The number of credits of a course in a semester shall ordinarily be calculated as under:

- (1) **Lectures/Tutorials:** One lecture hour per week shall normally be assigned one credit. One hour of tutorial per week shall be assigned one credit. Theory courses shall be generally two to four credits, and tutorials one credit each. For determining the credits of a theory course, lectures and tutorials shall be added.

- (2) **Practicals:** Two laboratory hours per week shall be assigned one credit.

Courses other than Lectures /Tutorials shall be treated as practical courses.

The Course credits for each course shall be given as L-T-P. For example, 3-1-0 will mean that it is a lecture based course and has 3 lectures, 1 tutorial, and no practical assigned to it. Similarly, a course with 0-0-2 means that it is a practical course with 4 hours of class work. Credit will be assigned to seminar, dissertation, project etc. under the practical component.

Generally the course work per semester will be 20 to 30 credits. A student shall register for a minimum of 20 credits in a semester. Syllabi will be designed with minimum credits required to complete a degree as follows:

Duration of Degree Programme	Minimum Credits
One year	45
Two year	90
Three year	135
Four year	180
Five year	225

5. Grading System

The Grading will follow Credit-Based System, the details of which are given below:

While undertaking the course work, the following terms are defined:

'Course' means a paper.

'Credit' means weightage assigned to a course

'Grade' means a letter grade assigned to a student on a 10 point scale.

'Grade point' means points assigned to a letter grade.

'Semester Grade Point Average' (SGPA) means weighted average of grades in a semester.

$$SGPA = \frac{\sum_{i=1}^m (G_i \times C_i)}{\sum_{i=1}^m C_i},$$

Where G_i are the grade points obtained by a student in the i^{th} registered course and C_i are the credits of the i^{th} registered course and 'm' is the number of courses registered by a student in a particular semester.

$$\sum_{i=1}^m (G_i \times C_i) = \text{Total grade points obtained by a student in a semester,}$$

$$\sum_{i=1}^m C_i = \text{Total credits registered by the student in that semester.}$$

Or

$$SGPA = [(G_1 \times C_1) + (G_2 \times C_2) + \dots + (G_m \times C_m)] / [C_1 + C_2 + \dots + C_m]$$

'Cumulative Grade Point Average' (CGPA) means weighted average of grades in all the semesters computed at the end of any semester or at the end of the course completion.

$$CGPA = \frac{\sum_{i=1}^n (G_i \times C_i)}{\sum_{i=1}^n C_i} \\ = [(G_1 \times C_1) + (G_2 \times C_2) + \dots + (G_n \times C_n)] / [C_1 + C_2 + \dots + C_n],$$

where G_i are the grade points obtained by a student in the i^{th} registered course and C_i are the credits of the i^{th} registered course, 'n' is the number of courses registered in all the semesters.

SGPA and CGPA shall be calculated up to two decimal places, after rounding off the third decimal to the nearest second place integer decimal, hence 0.005 to be increased to 0.01.

The student would be awarded a letter grade on a 10 point scale on the basis of his/her performance. Grades shall be awarded as per the following table:

Common Grading Table		
Percentage Marks	Letter Grade	Grade Points
>90 to ≤100	O (Outstanding)	10
>80 to ≤90	A+ (Excellent)	9
>70 to ≤80	A (Very Good)	8
>60 to ≤70	B+ (Good)	7
>50 to ≤60	B (Above Average)	6
>40 to ≤50	C (Average)	5
≥35 to ≤40	P (Pass)	4
Below 35	F (Fail)	0
Absent (Ab)	F (Fail)	0

6. Assignments

In courses involving project report/ dissertation/thesis/case study/ status report/training report/term report or any other such assignment, the candidate shall be required to submit any such assignment, required in the partial fulfillment of the degree, by the 31st July of the last semester of the course, in which he/ she is registered. The Principal may, however, give an extension of one month after this date i.e., up to 31st August. Grant of further Extension/Condonation of delay in receipt of such an assignment will be made and governed as per the college rules. Assignments /dissertation/Thesis shall be evaluated by an examiner deputed by Head of department / Chairman Board of Studies/Principal of the college.

7. Discipline

Each student shall be under the control and discipline of the college. In case of any misconduct on the part of a student, the college shall have a power to take disciplinary action against the defaulter, to the extent of cancellation of admission of the defaulting student from the rolls of the institution.

8. Minimum Credits and Minimum CGPA required for a degree

The credits for the courses in which a student has obtained 'P' (minimum passing grade for a course) grade or higher shall be counted as Credits earned by him/her. A student shall have to earn a minimum of such number of Credits as may be required for the award of a degree in a particular course/discipline. A student, who has obtained a minimum CGPA of 4 and earned a minimum number of Credits as per scheme as specified for the programme, shall be eligible for the award of the respective degree.

- a) A student shall be required to maintain a minimum of 4 CGPA at the end of the final semester of his/her degree programme. If his/her CGPA falls below 4 at the end of final semester, the student will be declared as having failed in that particular year and will have to seek readmission in the odd semester of the particular year. For Example: In three year UG programme, the candidate having failed in the (final) 6th semester will have to seek readmission in the 5th semester.
- b) A student getting 'F' grade in any course will be treated as having failed in that course. If he/she fails in a course, he/she will have to repeat the course and will have to obtain at least 'P' grade in that course within the maximum period defined above in Table VII to complete the degree for that programme.
- c) A student who does not complete the programme of study within the minimum duration of the course of his/her study, or gets 'F' grade in any course shall not be eligible for any merit position/medal/award of the College.

Notes:

1. All such students who were admitted under the non-credit based system before the implementation of credit based evaluation and grading system will be governed under the prevalent respective Ordinances of non-credit based System of examination till they pass such classes/courses.
2. The clauses which are not covered under these Common Ordinances be read with their respective Ordinances and other general rules.
3. Clauses relating to medium of instructions, duration of courses, eligibility, re-appear etc. which have not been mentioned under the new Common Ordinances will remain the same as per the previous ordinances.

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-101

COURSE TITLE: PRINCIPLES OF FOOD PROCESSING & PRESERVATION

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Students shall learn principles of different techniques used in processing and preservation of foods, identification and selection of preservation methods appropriate for specific foods, recent food preservation methods.

COURSE CONTENTS:

Theory:

UNIT-I

Principles of Preservation methods, Microbial, Physical, and chemical preservation of foods.
 Food preservation by low-temp: Refrigeration, changes in food during refrigeration storage; freezing, types of freezer, freezing process, thawing, changes in Food during freezing; and freeze-drying.

UNIT-II

Preservation and processing methods by high temp: Blanching, canning, pasteurization, sterilization, extrusion cooking; Drying, Types of dryers, Dehydration effect in foods. Non-thermal preservation: Microwave processing, ionizing irradiation, membrane technology, Aseptic processing,
 Intermediate Moisture Foods: Principles, Characteristics, Advantages, and Problems in developing new IM foods.

UNIT-III

Recent methods in food preservation: Pulse electric field technology, Infrared, High Pressure, Ohmic heating, Hurdle technology.

PRESCRIBED BOOKS:

- Arsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 vol.Set). AVI, Westport.
- Bender, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
- Fellows, P. and Ellis H. 1990. Food Processing Technology: Principles and Practice, NY.
- Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

COURSE OUTCOMES:

On completing the course, the students will be able to:
 CO1: Understand principles of different techniques used in processing and preservation of foods.
 CO2: Identify and select preservation methods appropriate for specific foods.
 CO3: Learn the effects of preservation methods on the quality of food.
 CO4: Learn about the recent food preservation methods.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-102

COURSE TITLE: LAB: PRINCIPLES OF FOOD PROCESSING & PRESERVATION

Credit hours (per week): 01
(P=1 TOTAL=1)
Total Hours: 15
Time: 3 Hours

Max. Marks: 25
Practical Marks: 18
Internal Assessment: 07

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students shall learn principles of different techniques used in processing and preservation of foods, identification and selection of preservation methods appropriate for specific foods, recent food preservation methods.

Practicals:

1. Determination of thermal inactivation time of enzymes.
2. Adequacy of blanching
3. Dehydration of foods.
4. Preservation of food products by low temperature.
5. Preservation of food products by concentration method.
6. Use of chemicals in preservation of foods.
7. Cut out examination of canned foods.
8. Visit to a food processing plant.

PRESCRIBED BOOKS:

- Arsdel W.B., Copley, M.J. and Morgen, A.I. 1973. Food Dehydration, 2nd Edn. (2 vol.Set). AVI, Westport.
- Bender, A.E. 1978. Food Processing and Nutrition. Academic Press, London.
- Fellows, P. and Ellis H. 1990. Food Processing Technology: Principles and Practice, NY.
- Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport.

COURSE OUTCOMES:

On completing the course, the students will be able to:

- CO1: Understand principles of different techniques used in processing and preservation of foods.
CO2: Identify and select preservation methods appropriate for specific foods.
CO3: Learn the effects of preservation methods on the quality of food.
CO4: Learn about the recent food preservation methods.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-103
COURSE TITLE: FOOD MICROBIOLOGY

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Student will be able to understand the importance of microorganisms in food., role and significance of intrinsic and extrinsic factors microbial growth in foods, spoilage of food by microbes and their prevention, ability to identify the characteristics of important pathogens and spoilage microorganisms in foods.

COURSE CONTENTS:

Theory:

UNIT-I

Introduction, Bacteria, yeasts and molds important in foods, food viruses, extrinsic and intrinsic factors affecting growth of microorganisms in foods

Growth and Destruction of Microorganisms: Physical and chemical factors affecting the destruction of microorganisms, TDT, Z, F, D values.

UNIT-II

Microorganism in Natural Products and Their Control: Microbiology of milk and milk products, cereals and cereal products; meat and meat products, fruits and vegetables, fish or fish products: poultry and eggs; sugars and syrups, spices and salt, canned foods.

UNIT-III

Food infections, food intoxications, mycotoxins, non-bacterial food poisoning.

Food plant sanitation. Methods of detection of microorganisms in foods. Concept of HACCP.

PRESCRIBED BOOKS:

- Banwart, G.J. 1989, Basic Good Microbiology. 2nd Edition. Van Nostrand Reinhold.
- Frazier, W.C. and Westener, D.C., 1988. Food Microbiology. 4th edition. McGraw Hill Inc., New York.
- Jay, J.M., 1986. Modern Food Microbiology 3rd Edition, Van Nostrand Reinhold.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Get knowledge on importance of microbes of different categories and factors affecting microbial growth in food.

CO2: Recognize important microorganisms affecting food quality and safety.

CO3: Identify methods of microorganism control to preserve food and make food consumption safe.

CO4: Get knowledge on food plant sanitation.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-104
COURSE TITLE: LAB: FOOD MICROBIOLOGY

Credit hours (per week): 01
(P=1 TOTAL=1)
Total Hours: 15
Time: 3 Hours

Max. Marks: 25
Practical Marks: 18
Internal Assessment: 07

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Student will be able to understand the importance of microorganisms in food., role and significance of intrinsic and extrinsic factors microbial growth in foods, spoilage of food by microbes and their prevention, ability to identify the characteristics of important pathogens and spoilage microorganisms in foods.

COURSE CONTENTS:

Practicals:

1. To study the spoilage of microorganisms present in spoiled Bread, Dry Milk, Raw Milk, Condensed Milk, Jam, Butter etc.
2. The enumeration and identification of micro flora involved in spoilage through SPC and microscopic method.
3. To study microbiological quality of raw milk, pasteurized milk and dry milk.
4. To compare the percentage acidity of milk and curd.
5. To check the quality of pasteurization by phosphate test.
6. To determine to ascorbic acid content of given food material by 2, 6-dichlorophenol indophenol method.

PRESCRIBED BOOKS:

- Banwart, G.J. 1989, Basic Good Microbiology. 2nd Edition. Van NostrandReinnold.
- Frazier, W.C. and Westener, D.C., 1988. Food Microbiology. 4th edition. McGraw Hill Inc., New York.
- Jay, J.M., 1986. Modern Food Microbiology 3rd Edition, Van Nostrand Reinhold.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Get knowledge on importance of microbes of different categories and factors affecting microbial growth in food.

CO2: Recognize important microorganisms affecting food quality and safety.

CO3: Identify methods of microorganism control to preserve food and make food consumption safe.

CO4: Get knowledge on food plant sanitation.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-105
COURSE TITLE: DAIRY TECHNOLOGY-I (Fluid Milk Processing)

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Students will acquire knowledge about composition, processing and preservation of milk, Organization and operations involved in milk processing Unit, Legislation for the quality control of milk, Adulteration of milk and its detection.

COURSE CONTENTS:

Theory:

UNIT-I

Milk: Present status of milk production and availability in India and Abroad, sources of milk, Definition, Composition of milk of various species, important characteristics of major constituents of milk viz. milk fat, milk proteins, lactose and minerals. Minor constituents of milk. Factors affecting the quality and quantity of milk produced by milk animals. Physical, chemical and Nutritive properties of milk.

Market Milk : Brief introduction to Standard milk, Toned milk, Double toned milk, Flavoured milk, Vitamin enriched milk, Reconstituted milk and recombined milk. Legal and ISI standards of milk. Adulterations of milk and its detection. Common preservatives used in milk and their detection. Collection, transportation and distribution of milk. Clean milk production.

UNIT-II

Milk Processing : Processes of straining, Filtration and clarification.

Standardization : Definition of standardization, purpose and uses of standardization process. Use of Pearson's square method to solve the standardization problems in dairy industry.

Homogenization: Definition, Effect of homogenization on milk. Uses of homogenization. Checking the effectiveness of homogenization.

UNIT-III

Pasteurization : Definition, purposes and objects of pasteurization–LTLT and HTST processes of pasteurization.

Sterilization: Definition, Method for manufacturing of sterilized flavoured milk. UHT process.

PRESCRIBED BOOKS:

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, New Delhi.
- Milk & Milk Products by Eckles, CH, Combs WB, Macy H, 1997, McGraw Hill Book, New Delhi
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers USA.

COURSE OUTCOMES:

On completing the course, the students will be able to:

- CO1: Know about composition of milk and important characteristics of milk constituents.
 CO2: Study about legislation for the quality control of milk.
 CO3: Learn about the adulterations of milk and its detection.
 CO4: Learning the processing of milk and working of a few dairy equipment.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-106
COURSE TITLE: LAB: DAIRY TECHNOLOGY-I (Fluid Milk Processing)

Credit hours (per week): 02
(P=2 TOTAL=2)
Total Hours: 30
Time: 3 Hours

Max. Marks: 50
Practical Marks: 37
Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students will acquire knowledge about composition, processing and preservation of milk, Organization and operations involved in milk processing Unit, Legislation for the quality control of milk, Adulteration of milk and its detection.

Practicals:

1. Sampling equipment and sampling of milk. Different types of milk samples.
2. Platform tests (Acidity, COB and Alcohol test).
3. Organoleptic Tests: (Physical examination of milk).
4. Determination of milk fat percentage by Gerber's method.
5. Determination of specific gravity by lactometer.
6. Determination of SNF percentage and TS percentage of milk with lactometer.
7. Detection of common adulterants and preservatives of milk.
8. Reporting on the suitability of milk for heat processing.
9. Reporting on the quality of given sample of milk.
10. Visit to milk processing plants.
11. Visit to N.D.R.I Karnal.

PRESCRIBED BOOKS:

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, New Delhi.
- Milk & Milk Products by Eckles, CH, Combs WB, Macy H, 1997, McGraw Hill Book, New Delhi
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers USA.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Know about composition of milk and important characteristics of milk constituents.

CO2: Study about legislation for the quality control of milk.

CO3: Learn about the adulterations of milk and its detection.

CO4: Learning the processing of milk and working of a few dairy equipment.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-107
COURSE TITLE: TECHNOLOGY OF CEREAL PROCESSING

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Students will acquire the knowledge about composition and milling of various cereal grains, different equipments involved, role of ingredient in baking of different products, manufacture of different cereal products.

COURSE CONTENTS:

Theory:

UNIT-I

General introduction to cereals, Structure and nutrient distribution in cereals.

Wheat: Wheat types, cleaning, conditioning and milling of wheat. Wheat flour quality tests, Physical tests of dough. Flour fortification and treatments. Role of different ingredients in baking. Technology of baking bread and biscuits. Straight-Dough method and Sponge-Dough method.

UNIT-II

Rice: Structure and composition of rice; Rice milling. Parboiling of rice, advantages and disadvantages of parboiling, Rice bran processing into oil. Rice products- puffed rice and rice flakes.

UNIT-III

Corn: Structure and composition of corn. Wet milling and dry milling of corn, corn sweeteners and syrups. Corn flakes.

Oats: Milling of Oats, Preparation of porridge, Ready-cooked porridge .

PRESCRIBED BOOKS:

1. Wheat Chemistry and Technology by K. Khan & P.R. Shewry, 4th Ed. 2009, AACC International, St. Paul, Minn.
2. Kent's Technology of Cereals by K.A. Rosentrater and A.D. Evers, 5th Ed., 2018, Woodhead Publishing Ltd., UK.
3. Principle of Cereal Science & Technology by J.A. Delcour and R.C. Hosney, 3rd Edition., 2010, AACC International, St. Paul, Minn.
4. Corn Chemistry and Technology by S.O. Serna-Saldivar, 2019, AACC International, St. Paul, Minn.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand composition and structure of different cereals.

CO2: Know about technology for cereal Milling & their Products along with equipments.

CO3: Evaluate quality of wheat.

CO4: Become aware of the role of different Bakery ingredients.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-108
COURSE TITLE: LAB: TECHNOLOGY OF CEREAL PROCESSING

Credit hours (per week): 02
(P=2 TOTAL=2)
Total Hours: 30
Time: 3 Hours

Max. Marks: 50
Practical Marks: 37
Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students will acquire the knowledge about composition and milling of various cereal grains, different equipments involved, role of ingredient in baking of different products, manufacture of different cereal products

Practicals:

1. Milling of wheat, Physico–chemical testing of wheat and rice.
2. Parboiling and evaluation of quality of parboiled rice.
3. Evaluation of cooking quality of rice.
4. Determination of gluten
5. Preparation of chapattis
6. Determination of crude fiber, ash, protein and fat
7. Determination of FFA of wheat flour
8. Baking of bread, cookies and cakes.
9. Visit to wheat and rice processing plants.

PRESCRIBED BOOKS:

5. Wheat Chemistry and Technology by K. Khan & P.R. Shewry, 4th Ed. 2009, AACC International, St. Paul, Minn.
6. Kent's Technology of Cereals by K.A. Rosentrater and A.D. Evers, 5th Ed., 2018, Woodhead Publishing Ltd., UK.
7. Principle of Cereal Science & Technology by J.A. Delcour and R.C. Hosney, 3rd Edition., 2010, AACC International, St. Paul, Minn.
8. Corn Chemistry and Technology by S.O. Serna-Saldivar, 2019, AACC International, St. Paul, Minn.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand composition and structure of different cereals.

CO2: Know about technology for cereal Milling & their Products along with equipments.

CO3: Evaluate quality of wheat.

CO4: Become aware of the role of different Bakery ingredients.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-109

COURSE TITLE: TECHNOLOGY OF FRUITS & VEGETABLE PROCESSING

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

The students shall be able to understand various Post-harvest physiological and biochemical changes occurs in fruits and vegetables, Desirable characteristics of fruits & vegetables for processing., different technologies involved in Processing, Preservation & Value- Addition of Fruits & Vegetables.

COURSE CONTENTS:

Theory

UNIT-I

Post-harvest physiological and biochemical changes in fruits and vegetables; ripening of climacteric and non-climacteric fruits.

Principles and methods of fruits and vegetables preservation, Desirable characteristics of fruits & vegetables for processing. Preparing fruits & vegetables for processing, washing, sorting, grading, peeling, blanching, cutting, de-stoning and pitting. Canning & Bottling of fruits & vegetables products.

UNIT-II

Definition, Formulation, Preparation & FPO standards of Fruit juices , Method of juice extraction, Equipment, preservation and clarification. Squashes & Cordials, Fruit syrups, Nectar. Fruit juice concentrates. Jams, jellies & Marmalades. Fermented and non-fermented pickles, Tomato Juice, Tomato Puree, Paste, Chutney, Sauce, Soup & Ketchup. Preserves and candied products.

UNIT-III

Freezing: General Methods of Freezing of Fruits & Vegetables: their Packaging & Storage. Dehydration of Fruits & Vegetables.

PRESCRIBED BOOKS:

- Preservation of Fruits and Vegetables–GirdhariLal, Siddhapa and Tondon, ICAR, New Delhi.
- Hand Book of Analysis and Quality Control of Fruits & Vegetable Products–S. RangannaTata McGraw Hill, New Delhi.
- Commercial Vegetable Processing–Wood Roof &Lue.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand basic processes and changes in fruits and vegetables.

CO2: Know about different techniques used in processing and preservation of fruits and vegetables.

CO3: Become aware of different technologies and methods to reduce their post-harvest losses in fresh produce.

CO4: Get knowledge on making commercial products like Jams, Jellies, Marmalade etc.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –I
COURSE CODE: MSFT51-110

COURSE TITLE: LAB: TECHNOLOGY OF FRUITS & VEGETABLE PROCESSING

Credit hours (per week): 02
(P=2 TOTAL=2)
Total Hours: 30
Time: 3 Hours

Max. Marks: 50
Practical Marks: 37
Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

The students shall be able to understand various Post-harvest physiological and biochemical changes occurs in fruits and vegetables, Desirable characteristics of fruits & vegetables for processing., different technologies involved in Processing, Preservation & Value- Addition of Fruits & Vegetables.

Practicals:

1. Preparation of fruit and vegetable juices.
2. Concentration of fruit and vegetable juices
3. Preparation of squashes, RTS
4. Preparation of Jams, Jellies, Marmalades.
5. Preserve & Candied Fruit
6. Preparation of potato chips.
7. Preparation of pickles
8. Preparation of tomato puree, paste & ketchup.
9. Dehydration and sun drying of fruits & vegetables.
10. Visit to canning industry

PRESCRIBED BOOKS:

- Preservation of Fruits and Vegetables–GirdhariLal, Siddhapa and Tondon, ICAR,New Delhi.
- Hand Book of Analysis and Quality Control of Fruits & Vegetable Products–S. RangannaTata McGraw Hill, New Delhi.
- Commercial Vegetable Processing–Wood Roof &Lue.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand basic processes and changes in fruits and vegetables.

CO2: Know about different techniques used in processing and preservation of fruits and vegetables.

CO3: Become aware of different technologies and methods to reduce their post-harvest losses in fresh produce.

CO4: Get knowledge on making commercial products like Jams, Jellies, Marmalade etc.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II
COURSE CODE: MSFT52-201
COURSE TITLE: FOOD CHEMISTRY

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

- Students shall be aware of the underlying chemistry, properties and effects of processing on food components.
- Understanding of food components reactions and their impact on sensory, nutritional, and functional properties of foods.
- Ability to identify the structure of food constituents and relate the structure to the constituents function and importance in foods with respect to food quality, nutrition, safety, processing, etc.
- Ability to explain influence of factors such as temperature, pH, ionic characteristic and strength, bonding, etc. on chemical changes in food systems and judge how to adjust these conditions to improve or minimize chemical and biochemical deterioration of food systems.

COURSE CONTENTS:

Theory:

UNIT-I

Definition and importance; major food constituents and their physico-chemical properties; role of water in food. Water activity Carbohydrates- chemical reactions, functional properties of sugars and polysaccharides in foods. Important carbohydrates and their applications in foods.

UNIT-II

Protein and amino acids: structure, classifications, sources, denaturation and functional properties of proteins.

Lipids: classification, and use of lipids in foods, physical and chemical properties, effects of processing on functional properties. Oxidative and hydrolytic rancidity, reversion, Tests to check purity of fats and oils.

UNIT-III

Vitamins and Minerals: Different types and their effect of processing on vitamins and minerals. Deficiency diseases.

PRESCRIBED BOOKS:

- Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon Press, New York.
- Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
- Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know about the chemistry of foods, role of each component and their interaction.

CO2: Understand the functional aspects of food components and their role in food processing.

CO3: Knowledge about various reactions involved in food

CO4: Evaluate quality of fats and oils.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II
COURSE CODE: MSFT52-202
COURSE TITLE: LAB: FOOD CHEMISTRY

Credit hours (per week): 01
(P=1 TOTAL=1)
Total Hours: 15
Time: 3 Hours

Max. Marks: 25
Practical Marks: 18
Internal Assessment: 07

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- Students shall be aware of the underlying chemistry, properties and effects of processing on food components.
- Understanding of food components reactions and their impact on sensory, nutritional, and functional properties of foods.
- Ability to identify the structure of food constituents and relate the structure to the constituents function and importance in foods with respect to food quality, nutrition, safety, processing, etc.
- Ability to explain influence of factors such as temperature, pH, ionic characteristic and strength, bonding, etc. on chemical changes in food systems and judge how to adjust these conditions to improve or minimize chemical and biochemical deterioration of food systems.

Practicals:

1. Preparation and standardization of solution.
2. Moisture content by Drying method and Moisture meters
3. Total ash, acid soluble and insoluble ash.
4. Protein content by Biuret method/ Lowry's method and Kjeldhal method
5. Estimation of reducing & non-reducing sugars, total sugars.
6. Lipid estimation by Soxhlet method, Peroxide value and Free fatty acid.

PRESCRIBED BOOKS:

- Birch, G.G., Cameron, A.G. and Spencer, M. 1986. Food Science, 3rd Ed. Pergamon Press, New York.
- Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
- Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.

COURSE OUTCOMES: On completing the course, the students will be able to:

- CO1: Know about the chemistry of foods, role of each component and their interaction.
CO2: Understand the functional aspects of food components and their role in food processing.
CO3: Knowledge about various reactions involved in food
CO4: Evaluate quality of fats and oils.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II
COURSE CODE: MSFT52-203
COURSE TITLE: FOOD ENGINEERING-I

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Students will understand

- Basics of Fundamentals of Food Processing Operations, principles of heat and mass transfer.
- Working of equipments in Food Industry related to transport of Fluids, Thermal Processing and Material Handling along with basics as applied to Food Processing Operations.
- Basics of Psychometrics & its applications.
- Mathematical Calculations related to above Engineering Applications.

COURSE CONTENTS:

Theory

UNIT-I: Basics of Food Engineering

- **Units and Dimensions:** Fundamental and derived units, system of measurement, brief introduction to dimensions, Application of mathematical techniques in process calculation.
- **Material and Energy Balance Calculations:** General principles, process calculations and application in food processing operations.
- **Material Handling Equipments:** Introduction, Types of conveyors, Working operation, principle, and application in food industry.

UNIT-II: Fluid Flow and Pumps:

- **Fluid Flow:** Properties and classification of fluid, Concept of viscosity and its measurement- Capillary tube and rotational viscometer, Newtonian and non-Newtonian fluids, Reynold's number, equation of continuity, Bernoulli's theorem, Poiseuille's equation, flow measuring devices-Pitot tube, Venturimeter, orifice meter, Rheology of foods and application of rheological models.
- **Pumps:** Liquid Transport system, Selection criteria of pipes for processing plants, types of pumps.

UNIT-III Principles of Heat and Mass Transfer

- **Heat Transfer:** Steady and unsteady heat transfer. Conductive heat transfer-Fourier's law, thermal conductivity, conduction through rectangular slab, hollow cylinder, spherical shell, composite rectangular wall (series), and composite cylinder. Convective heat transfer-convective heat transfer coefficient, free and forced convection, and overall heat transfer coefficient. Types of Heat exchangers.
- **Mass Transfer:** Basic concepts of analogy between heat, mass and momentum transfer, Fick's Law of diffusion, interphase mass transfer, Convective mass transfer coefficient, Basic mass transfer equations for molecular diffusion in solids, liquids and gases
- **Psychrometry:** Properties of dry air, water vapor and water vapor mixture, psychrometric chart and its application.

PRESCRIBED BOOKS:

- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- McCabe WL & Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Singh RP & Heldman DR. 2013. *Introduction to Food Engineering, 5th edition*.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know the basics of Food Engineering.

CO2: Know how to design food plant and various systems involved.

CO3: Understand principles of fluid flow, heat and mass transfer, steam, psychrometrics etc.

CO4: Perform Mathematical Calculations involved in food processing operations.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II
COURSE CODE: MSFT52-204
COURSE TITLE: LAB: FOOD ENGINEERING-I

Credit hours (per week): 01
(P=1 TOTAL=1)
Total Hours: 15
Time: 3 Hours

Max. Marks: 25
Practical Marks: 18
Internal Assessment: 07

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students will understand

- Basics of Fundamentals of Food Processing Operations, principles of heat and mass transfer.
- Working of equipments in Food Industry related to transport of Fluids, Thermal Processing and Material Handling along with basics as applied to Food Processing Operations.
- Basics of Psychometrics & its applications.
- Mathematical Calculations related to above Engineering Applications.

Practicals:

1. Design calculations of of belt conveyor, bucket elevator and screw conveyor.
2. Calculation of Reynold's Number.
3. To calculate coefficient of discharge using venturimeter.
4. To calculate coefficient of discharge using orificemeter.
5. To check the performance of pump using given fluid.
6. Study of psychrometrics-use and application.
7. Determination of heat transfer coefficient in free and forced convection.
8. Study of boiling point elevation.
9. Determination of thermal conductivity of food materials.

PRESCRIBED BOOKS:

- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- McCabe WL & Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Singh RP & Heldman DR. 2013. *Introduction to Food Engineering, 5th edition*.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know the basics of Food Engineering.

CO2: Know how to design food plant and various systems involved.

CO3: Understand principles of fluid flow, heat and mass transfer, steam, psychrometrics etc.

CO4: Perform Mathematical Calculations involved in food processing operations.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II**COURSE CODE: MSFT52-205****COURSE TITLE: DAIRY TECHNOLOGY-II (Milk Products Processing)****Credit hours (per week): 03****(L=2, T-1 TOTAL=3)****Total Hours: 45****Time: 3 Hours****Max. Marks: 75****Theory Marks: 55****Internal Assessment: 20****INSTRUCTIONS FOR PAPER SETTERS:**

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Student will be able to understand the composition of various milk products, manufacturing methods for the production of various dairy products, various defects in milk products and their possible cause and remedies, different legislation for the quality control of milk products.

COURSE CONTENTS:**Theory:****UNIT-I**

Cream: Different types of cream, composition, production methods. Factors affecting the richness of cream produced by cream separator. Care of cream separator. Selection of site for setting up creamery. Neutralization and ripening of cream.

Butter: Types of butter, composition. Preparation of butter. Defects of butter—their possible causes and remedies. Factors affecting the churnability of cream. Churning theories.

Cheese: Classification of cheese. Preparation methods of cheddar cheese. Quality of milk for cheesemaking.

UNIT-II

Condensed and evaporated milk: Definition, composition & standards. Condensing operations.

Dried milk products: Introduction, objects of production, standards and composition. Preparation of dried milk and milk powder by roller and spray drying methods. Packaging and storage. Malted milk powders and infant milk food.

Ice Cream: Different types of ice creams and their composition. Ingredients used and their role in processing. Manufacturing process. Defects in ice-cream, their possible causes and remedies.

UNIT-III

Ghee : Preparation of ghee from cream and from butter, advantages and disadvantages of both methods. Pre-stratification method of ghee preparation. Legal standards, Granularity in ghee.

Khoa: Manufacturing of khoa, Physico-chemical changes in milk on its conversion into khoa, shelf life and average composition of khoa.

Paneer and Channa: Manufacturing method of paneer, Legal standards and shelf life of paneer. Preparation of channa and its difference from that of paneer.

Miscellaneous dairy products: Brief introduction to Kulfi, Srikhand, Lassi and Rabri. BIS and legal standards of milk and milk products.

PRESCRIBED BOOKS:

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, UK
- Milk & Milk Products by Eckles Combs, Henery C, and Willes C, 1997, Tata McGraw Hill Publishers, USA.
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers, USA. Technology of Indian Milk Products by Anya RP, Mathur BN, Chandan RC and Banerjee AK, 2002.. Dairy India Publ.

COURSE OUTCOMES:

CO1: Have knowledge about classification and composition of various milk products.

CO2: Know about commercial making of various milk products and quality control involved.

CO3: Identify defects of butter and ice-cream and their possible causes and remedies.

CO4: Know about Miscellaneous dairy products.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II

COURSE CODE: MSFT52-206

COURSE TITLE: LAB: DAIRY TECHNOLOGY-II (Milk Products Processing)

Credit hours (per week): 02

(P=2 TOTAL=2)

Total Hours: 30

Time: 3 Hours

Max. Marks: 50

Practical Marks: 37

Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Student will be able to understand the composition of various milk products, manufacturing methods for the production of various dairy products, various defects in milk products and their possible cause and remedies, different legislation for the quality control of milk products.

Practicals:

1. Preparation of flavoured milk.
2. Cream separation, neutralization and ripening.
3. Preparation of Butter.
4. Preparation of Khoa.
5. Preparation of Paneer and Channa.
6. Preparation of common varieties of ice-cream.
7. Quality evaluation of milk and milk products.
8. Visit to different milk plants to learn about milk condensing and drying operations.
9. Visit N.D.R.I., Karnal.

PRESCRIBED BOOKS:

- Outlines of Dairy Technology by Sukumar De, 1980, Oxford University Press, UK
- Milk & Milk Products by EcklesCombs, Henery C, and Willes C, 1997, Tata McGraw Hill Publishers, USA.
- Principles of Dairy Processing by Warner JN, 1976, Wiley Science Publishers, USA.
Technology of Indian Milk Products by Anya RP, Mathur BN, Chandan RC and Banerjee AK, 2002.. Dairy India Publ.

COURSE OUTCOMES:

CO1: Have knowledge about classification and composition of various milk products.

CO2: Know about commercial making of various milk products and quality control involved.

CO3: Identify defects of butter and ice-cream and their possible causes and remedies.

CO4: Know about Miscellaneous dairy products.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II**COURSE CODE: MSFT52-207****COURSE TITLE: TECHNOLOGY OF LEGUMES AND OILSEEDS PROCESSING****Credit hours (per week): 03****(L=2, T-1 TOTAL=3)****Total Hours: 45****Time: 3 Hours****Max. Marks: 75****Theory Marks: 55****Internal Assessment: 20****INSTRUCTIONS FOR PAPER SETTERS:**

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Student will be able to understand the structure, composition and processing of pulses and oilseeds, technology involved in Oil Extraction & Oil Seed Processing along with equipments, nutritional importance of oils and fats, Quality assessment test for fats and oils.

COURSE CONTENTS:**THEORY:****UNIT-I**

Structure and composition of legumes. Dal milling and processing of pulses, cooking methods, utilization of legumes, anti-nutritional factors in legumes and methods of removal.

Soybean Processing, Soy products- Technology of soymilk, tofu, soy protein concentrate and isolates.

UNIT-II

Oilseeds– composition, oil extraction with expellers, solvent extraction processes, purification of crude oil and hydrogenation, interesterification and refining processes for oil.

UNIT-III

Nutritional importance of oils and fats. Quality assessment tests for fats and oils. Manufacture of margarine & mayonnaise.

PRESCRIBED BOOKS:

- Chakrabarty MM. 2003. *Chemistry and Technology of Oils and Fats*.
- Prentice Hall Hamilton RJ & Bhati A. 1980. *Fats and Oils - Chemistry and Technology*. App. Sci. Publ.
- Kay DE. 1979. *Food Legumes*. Tropical Products Institute.
- Mathews RH. 1989. *Legumes Chemistry, Technology and Human Nutrition*. Marcel Dekker.
- Salunkhe DK. 1992. *World Oilseeds: Chemistry, Technology and Utilization*. VNR.
- Swern D. 1964. *Bailey's Industrial Oil and Fat Products*. Inter Sci. Publ.

COIURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Understand the structure, composition, quality evaluation of various legumes and oilseeds.

CO2: Know the processing of pulses and oilseeds.

CO3: Become aware of the importance & processing of high protein products.

CO4: Assess the quality of fats and oils.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II**COURSE CODE: MSFT52-208****COURSE TITLE: LAB: TECHNOLOGY OF LEGUMES AND OILSEEDS PROCESSING****Credit hours (per week): 02****(P=2 TOTAL=2)****Total Hours: 30****Time: 3 Hours****Max. Marks: 50****Practical Marks: 37****Internal Assessment: 13****INSTRUCTIONS FOR PAPER SETTERS:****Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.****COURSE OBJECTIVES:**

Student will be able to understand the structure, composition and processing of pulses and oilseeds, technology involved in Oil Extraction & Oil Seed Processing along with equipments, nutritional importance of oils and fats, Quality assessment test for fats and oils.

Practicals:

1. Preparation of soya milk/tofu.
2. Experimental expeller processing and solvent extraction of oil seeds.
3. Quality evaluation of oil extracted from oilseeds.
4. Experimental Milling of Legumes.
5. Separation and evaluation of starch and protein from different legumes.
6. Cooking quality, textural evaluation and physico–chemical testing of legumes.
7. Preparation of edible flours, protein concentrates and isolates.
8. Determination of trypsin inhibitors.
9. Visit to Legume & Oil seeds processing plants.

PRESCRIBED BOOKS:

- Chakrabarty MM. 2003. *Chemistry and Technology of Oils and Fats*.
- Prentice Hall Hamilton RJ &Bhati A. 1980. *Fats and Oils - Chemistry and Technology*. App. Sci. Publ.
- Kay DE. 1979. *Food Legumes*. Tropical Products Institute.
- Mathews RH. 1989. *Legumes Chemistry, Technology and Human Nutrition*. Marcel Dekker.
- Salunkhe DK.1992. *World Oilseeds: Chemistry, Technology and Utilization*. VNR.
- Swern D. 1964. *Bailey's Industrial Oil and Fat Products*. Inter Sci. Publ.

COIURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Understand the structure, composition, quality evaluation of various legumes and oilseeds.

CO2: Know the processing of pulses and oilseeds.

CO3: Become aware of the importance & processing of high protein products.

CO4: Assess the quality of fats and oils.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II
COURSE CODE: MSFT52-209
COURSE TITLE: TECHNOLOGY OF EGG & POULTRY PROCESSING

Credit hours (per week): 03
(L=2, T-1 TOTAL=3)
Total Hours: 45
Time: 3 Hours

Max. Marks: 75
Theory Marks: 55
Internal Assessment: 20

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

COURSE OBJECTIVES:

Students will understand the structure of egg, composition and nutritional quality of egg and poultry, the concept and methods of processing and preservation of egg and poultry, manufacturing practices of egg and poultry meat based products and their processing techniques.

COURSE CONTENTS:

Theory:

UNIT-I

Eggs: Structure and composition of eggs. Functional properties of eggs. Nutritive value of eggs. Interior qualities - Evaluation, quality troubleshooters in eggs, Egg grading. Spoilage of eggs. Preservation of eggs. Handling, packaging, storage and transportation of eggs. Freezing of eggs. Dehydration of eggs - Egg powders, egg foams, factors influencing foaming.

UNIT-II

Poultry: Types, factors affecting quality, chemical composition and nutritive value of poultry meat. Slaughtering and dressing of poultry. Rigor mortis and Meat tenderization.

UNIT-III

Grading and packaging of poultry meat, storage, transportation of poultry meat. Preservation of poultry meat by different methods. Refrigeration of poultry meat, Waste Utilization of poultry industry by-products. Layout and design of poultry processing Industry.

PRESCRIBED BOOKS:

- Egg Science & Technology by Staddelman
- Poultry Products Technology by G.J. Mountney

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know about egg structure, composition, nutritive value of egg and poultry.

CO2: Understand the egg preservation methods and assessment of egg quality.

CO3: Become aware of slaughtering and dressing of poultry and their waste utilization.

CO4: Make layout and design of poultry processing Industry.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II

COURSE CODE: MSFT52-210

COURSE TITLE: LAB: TECHNOLOGY OF EGG & POULTRY PROCESSING

Credit hours (per week): 02

(P=2 TOTAL=2)

Total Hours: 30

Time: 3 Hours

Max. Marks: 50

Practical Marks: 37

Internal Assessment: 13

INSTRUCTIONS FOR PAPER SETTERS:

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

Practicals:

1. Determination of Egg components.
2. Determination of proximate composition of eggs.
3. Grading and quality evaluation of eggs.
4. Effect of high temperature on coagulation time of egg contents.
5. Preservation of eggs.
6. Determination of egg density.
7. Preparation of egg products, boiled, fried, poached, scrambled, omellette.
8. Slaughtering and dressing of poultry.
9. To make retail cuts of dressed chicken and calculating % yields.
10. Preparation of chicken pickle
11. Preparation of chicken patties.
12. Visit to poultry processing industry

PRESCRIBED BOOKS:

- Egg Science & Technology by Staddelman
- Poultry Products Technology by G.J. Mountney

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know about egg structure, composition, nutritive value of egg and poultry.

CO2: Understand the egg preservation methods and assessment of egg quality.

CO3: Become aware of slaughtering and dressing of poultry and their waste utilization.

CO4: Make layout and design of poultry processing Industry.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –II

COURSE CODE: MSFT52-211

COURSE TITLE: IN PLANT TRAINING

CREDIT HOURS (per week): 02

Total Marks: Satisfactory/Unsatisfactory

COURSE OBJECTIVES:

Students will acquire

- Practical knowledge and skill.
- Understands the working of food industry.

In-plant Training of 4 weeks duration in Food Processing Industry after the completion of 2nd Semester.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Get a learning platform where they can enhance their employ ability skills.

CO2: Enhance practical knowledge regarding food technology.

CO3: Have self- confidence that helps them in understanding their job skill.

CO4: Become entrepreneurs and provide sill to others also.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –III
COURSE CODE: MSFT61-301
COURSE TITLE: FOOD PACKAGING TECHNOLOGY

CREDIT HOURS (per week): 06
(L=3,T-2 P=1 TOTAL=6)
TOTAL HOURS:90
Time: 3 Hours

Max. Marks: 150
Theory Marks: 75
Practical Marks:35
Internal assessment: 40

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students shall gain knowledge on the different types of materials used for packaging foods, manufacturing processes for different packaging materials, quality testing techniques for different packaging materials, laws, regulation and the monitoring agencies involved in food safety.

COURSE CONTENTS:

Theory

UNIT-I

Definitions, objectives and functions of packaging and packaging materials. 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

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength; tear strength, their methods of testing and evaluation.

Barrier properties of packaging materials: Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement.

UNIT-III

Food packaging systems: Different forms of packaging such as rigid, semi-rigid, 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 f) fats and oils

New trends in food packaging: Retortable pouch technology. Aseptic processing of food products.

Packaging machinery: form fill and seal, thermoform, shrink wrap. Package standards and regulations.

Practicals:

1. Identification and testing of packaging materials.
2. Determination of wax from wax paper.
3. Testing of lacquered tin plate sheets.
4. Measurement of tin coating weight by Clarke's method.
5. To conduct ferricyanide paper test for porosity.
6. Determination of equilibrium moisture content.
7. Determination of water vapour transmission rate of packaging material.
8. Testing the compression strength of the boxes.
9. Packaging the food material in seal and shrink packaging machine and study its shelf life.
10. Testing the strength of glass containers by thermal shock test.
11. Testing the strength of filled pouches by drop tester.
12. Testing the compression strength of boxes.

PRESCRIBED BOOKS:

- Crosby NT. 1981. *Food Packaging: Aspects of Analysis and Migration Contaminants*. App. Sci. Publ.
- Kadoya T. (Ed). 1990. *Food Packaging*. Academic Press.
- Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
- Palling SJ. (Ed). 1980. *Developments in Food Packaging*. App. Sci. Publ.
- Painy FA. 1992. *A Handbook of Food Packaging*. Blackie Academic.
- Sacharow S & Griffin RC. 1980. *Principles of Food Packaging*. AVI Publ.
- Stanley S & Roger CG. 1970. *Food Packaging*. AVI Publ.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Get deep knowledge on different functions performed by packaging material.

CO2: Understand properties of packaging materials, their methods of testing and evaluation.

CO3: Get knowledge about packaging requirements for fresh and processed food.

CO4: Get knowledge about food packaging laws and regulations.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –III
COURSE CODE: MSFT61-302
COURSE TITLE: FOOD ENGINEERING-II

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTAL HOURS:60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students will be able to understand the basics of Fundamentals of Food Processing Operations, Working of equipments in Food Industry.

COURSE CONTENTS

UNIT-I: Basic Units Operations

- **Filtration:** Theory, constant rate and constant pressure filtration, Equipments
- **Centrifugation:** Theory, Settling equations in centrifuge, Equipments
- **Membrane Separation:** Theory, Performance equation, Types of membrane separation units
- **Size Reduction:** Definition and requirements of size reduction, forces used in size reduction, equipment for size reduction. Critical speed in a tumbling mill. Modes of operation, energy requirements calculation for comminuting of solids.

UNIT-II: Food Engineering operations-I

- **Evaporation:** Parts of evaporator, single effect and multiple effect evaporators, different types of evaporators, steam economy, design of evaporator, thermal and mechanical vapour recompression system.
- **Distillation:** Vapor liquid equilibrium relations, Distillation methods, McCabe Thiele method.
- **Refrigeration:** Components of refrigeration system, refrigeration cycle and calculation of refrigeration load.

Unit-III: Food Engineering operations-II

- **Freezing:** Types of freezing systems, Calculation of freezing time by Plank's equation
- **Dehydration:** Theory of drying, free and bound, critical moisture content, equilibrium moisture content, drying rate curves, drying time prediction, types of driers.

Practicals:

1. Determination of freezing time by using Plank's equation.
2. To calculate the refrigeration load in cold storage plant.
3. Study of dehydration characteristics of food materials using tray drier.
4. Study of distillation operation.
5. To study working operation of hammer mill
6. To study working operation of roller mill.
7. To calculate the particle size of given flour sample using sieve analysis.
8. To calculate specific cake resistance and filter medium resistance in a filtration process.
9. To study working principle of rotary vacuum evaporator.

PRESCRIBED BOOKS:

- Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press.
- McCabe WL & Smith JC. 1971. *Fundamental of Food Engineering*. AVI Publ.
- Singh RP & Heldman DR. 2013. *Introduction to Food Engineering, 5th edition*.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Know about the principles of Unit operation.

CO2: Understand principles of separation and size reduction processes in food.

CO3: Know about the fundamentals of food engineering and its process.

CO4: Do mathematical calculations related to food processing operations.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –III
COURSE CODE: MSFT61-303
COURSE TITLE: TECHNOLOGY OF FISH & MEAT PROCESSING

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTAL HOURS:60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

Students will understand the structure, composition, post-mortem changes and nutritional quality of meat and fish and the technology behind preparation of various meat and fish products and byproduct utilization.

COURSE CONTENTS:

Theory

UNIT-I

Meat: Chemical composition and microscopic structure of meat. Postmortem biochemical changes. Physico-chemical properties of meat. Slaughtering of animals- beef and pig. Packaging, Storage and Transportation of meat.

UNIT-II

Deboning of meat by mechanical methods. Meat tenderization and effects of processing on meat tenderization.

Meat Sausages and Restructured meat products. Intermediate moisture and dried products.

Meat plant sanitation and safety, Byproduct utilization. Inspection and grading of meat.

UNIT-III

Fish: Types of fish, composition, structure, post-mortem changes in fish. Handling, storage and transportation of

fish. Preservation of fish: Curing, smoking, freezing and drying of fish, Comminuted Fish Products. Fish pastes and sauces. Fish oils, fish protein concentrates, fishmeal. By products utilization of fish industry.

Practicals:

1. To study the slaughtering of animals.
2. To evaluate the meat quality.
3. Preparation of Meat pickle and meat patties.
4. Preparation of cured meat.
5. To study the manufacturing of meat sausages.
6. Shelf-life studies on processed meat products.
7. To evaluate the quality of raw fish.
8. To determine meat to bone ratio of fish meat.
9. Dressing of fish and to calculate the dressing percentage of fish.
10. Preparation of fish products.
11. Dehydration and Freezing of fish.
12. Visit to local slaughterhouse.

PRESCRIBED BOOKS:

- Principles of Meat Science by Forrest et.al. 1975.
- Developments in Meat Science by Lawrie–Vols. 1,2,3,4, 1998.
- Processed Meats by Pearson (1996).
- Fish Processing Technology by George M. Hall (1997).

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand the structure, composition, and nutritional value of meat and fish.

CO2: Know about postmortem and biochemical changes in meat and fish.

CO3: Understand processing, preservation and quality control of meat and fish.

CO4: Become aware of manufacturing practices of meat based and fish based by products & their uses.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –III
COURSE CODE: MSFT61-304
COURSE TITLE: APPLIED RESEARCH METHODOLOGY

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTALHOURS:60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- Develop skills in qualitative and quantitative data analysis and presentation.
- Develop advanced critical thinking skills.

COURSE CONTENTS:

Theory

UNIT-I

- **Introduction:** Types and objectives of research, research process, principle of research design, Principles of research design and methodology.
- **Planning and designing:** Choosing research topic, literature review, formulation a research problem, articulating hypothesis.
- **Sampling and analysis of data:** Random sampling, complex sampling, data collection, frequency distribution and its representation, Measurement of central tendency, dispersion, skewness and kurtosis.

UNIT-II

- **Data analysis:** correlation, regression analysis.
- **Testing of hypothesis:** Concept of probability, probability distribution, Normal, Poisson, Chi-square, t-test, z-test, F-test, level of significance, confidence intervals, testing of correlation coefficients.

UNIT-III

- ANOVA- One way and Two way ANOVA.
- **Statistical software:** Basics and application of statistical software.
- **Synopsis and Thesis Writing:** Synopsis and thesis writing Chronology. References writing methods, ethical consideration in research.
- Writing review paper and research papers.

Practicals:

Student will required to review literature on their respective given problem and submit the same for evaluation.

PRESCRIBED BOOKS:

- Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.
- Arya, P.P. and Pal, Y. (2001). Research methodology in management: Theory and case studies, Deep and Deep publishers Pvt. Ltd., New Delhi.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Get knowledge regarding the principles of research design and its methodologies.

CO2: Write synopsis, thesis and analyse data.

CO3: Write review of literature, formulating a research problem, articulating hypothesis.

CO4: Understand basics and application of statistical softwares.

(Signature)

**M. Sc. FOOD TECHNOLOGY – SEMESTER III
COURSE CODE: MSFT61-305**

COURSE TITLE: ADVANCED INSTRUMENTATION IN FOOD TECHNOLOGY

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTALHOURS:60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR THE PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- To know about importance of analysis in food.
- To learn about working and applications of different instruments in food analysis
- To know about quality of food based on data obtained from different instruments.
- To gain practical knowledge about different advanced technologies in food industry.

COURSE CONTENTS:

Theory:

UNIT I

Food Analysis: Role and Importance in Food Technology

Basic instruments: Refractometer, moisture analysers, Saccharometer, Lactometer,

Spectroscopic instruments: Photometer, UV-Visible, Atomic Absorption Spectroscopy, Nuclear Magnetic Resonance spectroscopy, Mass Spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR)

Microscopic techniques in food analysis: Light microscopy and Electron microscopy

UNIT II

Chromatography: Paper chromatography, Liquid chromatography, Gas and High Pressure Liquid Chromatography.

Hyphenated techniques: Gas Chromatography-Mass Spectroscopy, Liquid Chromatography-Mass Spectroscopy.

Separation techniques: Micro-extraction, ultrafiltration and supercritical fluid extraction.

UNIT III

Rheological instruments: Rapid viscoanalyser, Amylograph, Farinograph, Rheometer.

Special techniques: Ultrasound in food analysis, thermal analysis of food using Differential scanning calorimetry, Texture analyzer.

Practicals:

1. Estimation of pigments from various food samples by spectrometric method.
2. Demonstration of two dimensional paper chromatography.
3. Preparation of slides for various food samples and analyze using compound microscope.
4. Separation and identification of carotenoids by column chromatography.
5. Demonstration of instruments: GLC, HPLC, Atomic absorption, Flame photometer, Farinograph, UV-Vis spectrophotometer.
6. Interpretation of graphs obtained from different instruments: Farinograph, RVA, UV-Vis spectrophotometer, Texture analyzer, DSC
7. Determination of refractive index of different food samples.

PRESCRIBED BOOKS:

1. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
4. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
5. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.

COURSE OUTCOMES:

- CO 1: Importance of food analysis.
CO 2: Role of various advanced instruments-Spectroscopic techniques.
CO 3: Different types of chromatography techniques.
CO 4: Combination of techniques for food analysis, separation techniques, rheological techniques, textural analysis.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –III
COURSE CODE: MSFT61-306
COURSE TITLE: MASTER’S SEMINAR

CREDIT HOURS (per week): 04
(L=0,T-0 P=4 TOTAL=4)

Max. Marks: 100

TOTAL HOURS: 60
Time: 3 hours

COURSE OBJECTIVES:

Students will be able to improve scientific aptitude and presentation skills.

COURSE OUTCOMES:

On completing the course, the students will be able to:

- CO1: Develop scientific aptitude
- CO2: Build confidence for delivering lectures
- CO3: Improve their presentation skills
- CO4: Improve their writing skills

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –IV
COURSE CODE: MSFT62-401
COURSE TITLE: FOOD QUALITY ASSURANCE & MANAGEMENT

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTALHOURS: 60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- Able to analyze color, flavor, texture and other sensory characteristics of food for quality assurance.
- To understand the Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products.
- Understand and apply the principles of sensory science in product development and optimization, studies of alternative processing, packaging and storage, as well as relating sensory to physical properties of food.
- Able to measure consumer perception and acceptance of food products.

COURSE CONTENTS:

Theory:

UNIT-I

Concept of quality: Objectives, importance and functions of quality control, Quality attributes- physical, chemical, and sensory Quality Attributes: their measurement and evaluation; Sensory and instrumental methods for testing quality.

UNIT-II

Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products. Concept of HACCP & GMP

UNIT-III

Sampling procedures and plans; Food Safety and Standards Act, 2006; Various organizations dealing with inspection, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS). Quality assurance, Total Quality Management; GHP; GLP. Food adulteration.

Practicals:

1. Testing and evaluation of quality attributes of raw and processed foods.
2. Objectives, importance and functions of quality control.
3. Methods of quality assessment of food materials fruits, vegetables, cereals, dairy products, meat, egg and processed products.
4. Sensory methods for measuring food quality.
5. Analysis of products for FPO specifications.
6. Qualitative and quantitative Determination of adulterants in food products.
7. Determination of food additives and food constituents
8. Visit to Units with HACCP certification.

PRESCRIBED BOOKS:

- Amerine MA, Pangborn RM & Rosslos EB. 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
- Early R. 1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic.
- Furia TE. 1980. *Regulatory status of Direct Food Additives*. CRC Press.
- Jellinek G. 1985. *Sensory Evaluation of Food - Theory and Practice*. Ellis Horwood.
- Krammer A & Twigg BA. 1973. *Quality Control in Food Industry*. Vol. I, II. AVI Publ.
- Macrae R, Roloson R & Sadlu MJ. 1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XVI. Academic Press.
- Piggot J.R. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
- Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill.

COURSE OUTCOMES:

- On completing the course, the students will be able to:
- CO1: Learn about various quality attributes of foods and various aspects of food safety.
- CO2: Understand involvement of food agency for implementing various food laws in India.
- CO3: Understand the concept of quality control and assurance, risk assessments, GMPs etc. in food sector.
- CO4: Know the importance of sensory evaluation and quality control in food.

(Signature)

**M. Sc. FOOD TECHNOLOGY - SEMESTER –IV
COURSE CODE: MSFT62-402**

COURSE TITLE: INDUSTRIAL MICROBIOLOGY & FERMENTED FOODS

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTALHOURS: 60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks: 25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- To understand the processing methods of Filtration, precipitation, centrifugation, cell disruption, Liquid extraction, drying & crystallization.
- Knowledge about the beneficial role of microorganisms in different types of fermented foods.

Course Contents:

Theory

UNIT-I

Introduction : History of fermentation processes

Fermentor Design : Fermentor parts and instrumentation.

UNIT-II

Downstream processing methods : Filtration , precipitation, centrifugation, cell disruption, Liquid extraction, drying & crystallisation.

Production of products: Potable and fuel alcohols, amino acids, organic acids, enzymes and vitamins, Antibiotics.

UNIT-III

Fermented milk products : Curd, yogurt, acidophilus milk, Bulgarian milk, butter milk, Kefir, Kumiss.

Legume based fermented foods: Soya sauce, miso, tempeh, idli.

Fermented vegetable products: Sauerkraut, cucumbers.

Fermented meat products: Meat sausage.

Practicals:

1. To prepare the fermented food sauerkraut and study its microbiology and spoilage.
2. To determine and compare effect of deep-freezing and refrigeration on the viability of microorganisms.
3. To isolate and recognize the microorganisms responsible for the fermentation of yoghurt.
4. To study the production of wine, vinegar, amylase, protease.
5. To study of design of fermentor (batch and continuous for production of yeast)
6. To determine the Dissolved oxygen concentration of fermented broth.
7. To study the kinetics of growth of yeast in batch/continuous culture.

PRESCRIBED BOOKS:

- Baiely, J.E. and Ollis, D.F. Bio Chemical Engineering Fundamentals (1986), McGraw Hills. Rehm, H.J. and Reed, G. (ed), Biotechnology, Vol 1-2, Verlagchemie.
- Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (1984), Pergamon Press.
- Pirt, S.J. Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London.
- Moo-young, M. Comprehensive Biotechnology, Vol. 1-4, Pergamon Press, Oxford.
- Industrial Microbiology by Prescott SC & Dunn CG, 2006 CBS Publishers, New Delhi.
- Industrial Microbiology by Casida LE, 1968, New Age International Publishers Ltd., New Delhi.

COURSE OUTCOMES: On completing the course, the students will be able to:

CO1: Know about fermentor, its parts and instrumentation involved.

CO2: Understand processing methods of downstreams and extraction of products.

CO3: Know about the technical aspects involved in the production of various fermented products.

CO4: Correlate relevance of fermentation in food technology.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –IV
COURSE CODE: MSFT62-403
COURSE TITLE: ADVANCES IN FOOD NUTRITION

CREDIT HOURS (per week): 04
(L=2,T-1 P=1, TOTAL=4)
TOTALHOURS:60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks:25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

- Students will get the knowledge about relationship between food, nutrition and health, Understanding the concept of balanced diets and menu planning along with different methods of cooking and ways to prevent nutrient losses.
- Plan and prepare meals and nutritious dishes for various age groups and patients.

Course Contents:

Theory

UNIT-I

Importance of nutrition to health and growth; Relation of food and diseases; Nutritional requirement of human body & RDA.

Preparation of balanced diets; Deficiencies of essential nutrients; Effect of cooking and processing on nutrients; Nutritional value of processed foods; Therapeutic nutrition.

UNIT-II

Nutritional requirements of special group of people such as infants, pregnant and lactating mothers, patients, aged people.

Functional foods and nutraceuticals with attributes to control cardiovascular diseases, cancer, obesity, ageing.

UNIT-III

Functional aspects of dietary fibre, amino acids & peptides, antioxidants, vitamins, fatty acids etc. Assessment of nutritional quality of food.

Practicals:

1. Identification of food sources for various nutrients.
2. Instruction to diet planning using food exchange list.
3. Calculation of BMI & BMR.
4. Evaluation of own diet.
5. Planning of diet for children, adult and old people.
6. Planning of diet for patient suffering from Ulcer, Anaemia, Diabetes, Diarrhoea and Cardiac diseases.

PRESCRIBED BOOKS:

- Bamji MS, Rao NP & Reddy V. 2003. *Textbook of Human Nutrition*. Oxford & IBH.
- Joshi SA. 1999. *Nutrition and Dietetics*. Tata McGraw Hill.
- Khanna K, Gupta S, Passi SJ, Seth R & Mahna R. 1997. *Nutrition and Dietetics*. Phoenix Publ.
- Swaminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Make relationship between food, nutrition and health.

CO2: Understand various metabolic processes involved while consuming food.

CO3: Know about concept of balanced and healthy diets for various age groups.

CO4: Use food as medicine.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –IV

COURSE CODE: MSFT62-404

COURSE TITLE: APPLICATION OF ENZYMES IN FOOD INDUSTRY

CREDIT HOURS (per week): 04

(L=2,T-1 P=1, TOTAL=4)

TOTALHOURS:60

Time: 3 Hours

Max. Marks: 100

Theory Marks: 50

Practical Marks:25

Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVES:

The course will educate the students about fundamental principles of enzymes and their applications in food processing for quality enhancement of various foods.

Course Contents:

Theory:

UNIT-I

Classification: Classes of enzymes, mechanism of enzyme action, Michaelis-Menten equation, Enzyme inhibition, factors affecting enzyme activity.

UNIT-II

Significance of amylases, protease, lipoxidases, lipase and pentosanase in baking industry.

Enzymes in starch industry – Production of modified starches, corn syrups containing glucose, maltose, glucose and fructose etc.

Enzymes in dairy industry:

- i) Natural enzymes in milk
- ii) Hydrogen peroxide Catalase treatment.
- iii) Rennin and its formation
- iv) Lactose and Miscellaneous application.

UNIT-III

Enzymes in fruits and vegetables products:

- i) Distribution of pectic substances and pectin enzymes in fruits.
 - ii) Specific applications of enzymes in juice technology like clarification, debittering, etc. Enzymes in meat industry–Tenderization of meat
- Enzymes in brewing, mashing and beer finishing operation. Immobilized enzymes

Practicals:

1. Estimation of absolute and specific activity of alkaline phosphatase from crude cell extract
2. Determination of activity in presence of activators.
3. Determination of activity in presence of inhibitors.
4. Determination of optimum pH
5. Determination of optimum temperature
6. Determination of K_m & V_{max}
7. Determination of Competitive, non-competitive inhibitors

BOOKS PRESCRIBED:

- Palmer, and Philip, Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, Horwood Publishing Group, Chichester, 2007.
- Price, N. C. and Stevens, L., Fundamentals of Enzymology. The cell and molecular biology of catalytic proteins. Oxford University Press.
- Pandey, A. Webb, C., Socol C. R. and Larroche, C. Enzyme Technology. Asiatech Publishers, INC. New Delhi, 2004.
- Tucker, G.A. and Taybor, A.J., Enzymes in food processing. Springer Publisher, 1995.
- Moll, M. (1999), Brewing Science, Vol I.
- Reed Gerald, Enzymes in food processing. Academic Press Inc; 2nd edition, 2005.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Understand the role of various enzymes used in food technology and their working mechanisms.

CO2: Understand factors affecting enzyme activity.

CO3: Understand the significance of different enzymes in baking industry at industry level.

CO4: Use enzymes for quality enhancement of foods.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –IV
COURSE CODE: MSFT62-405
COURSE TITLE: NUTRACEUTICAL AND FUNCTIONAL FOODS

CREDIT HOURS (per week): 04
(L=2,T-1 P=1 TOTAL=4)
TOTALHOURS: 60
Time: 3 Hours

Max. Marks: 100
Theory Marks: 50
Practical Marks: 25
Internal assessment: 25

INSTRUCTIONS FOR PAPER SETTERS:

Theory: – Question paper will contain eight questions in all and students will be asked to attempt five questions. All questions will carry equal marks. Question no. 1 will be objective type and compulsory.

Practical – Question Paper will be set with the mutual consent of Internal and External Examiners at the spot.

COURSE OBJECTIVE:

Students will understand the concept of nutraceutical and functional foods and their benefits for curing chronic diseases.

COURSE CONTENTS

Theory

UNIT-I

Introduction: History, Definition, Classification, Sources, examples. Health benefits and future promises in Indian diet. Difference between nutraceuticals, functional foods and phytonutrients.

UNIT-II

Bioactive components as Nutraceuticals

Definition, Sources, Classification and role of different bioactive components in promoting health.

Probiotic, prebiotics and Synbiotics as Nutraceuticals

Chemistry, Sources and bioavailability, effect of processing, effects on human health and potential applications in risk reduction of diseases,

UNIT-III

Processing of nutraceuticals and their interactions with different environmental factors. Packaging and labelling of different nutraceuticals.

Practicals:

1. Estimation of crude fat contents of foods by Soxhlet's method
2. Estimation of ascorbic acid from lemon & amla juice by titration method.
3. Preparation of Functional food/ Nutraceutical product
4. Estimation of Curcumin/Lycopene.
5. Detection of food additives in packaged food products.
6. Extraction of carotenoids from food samples.
7. Determination of acidity of milk by titrimetric method.
8. Preparation of nutritionally enriched cookies

PRESCRIBED BOOKS:

- Handbook of Nutraceuticals and Functional Foods, Second Edition; Robert E.C. Wildman; CRC Press
- Nutraceutical beverages Chemistry, Nutrition and health Effects; Fereidoon Sahidi, Deepthi K. Weerasinghe; American Chemical Society
- Vegetables, fruits, and herbs in health promotion Ronald R. Watson; CRC Press
- Fruit and Cereal Bioactives: Sources, Chemistry, and Applications; Özlem Tokusoglu; Clifford Hall III; CRC Press

COURSE OUTCOME:

On completing the course, the students will be able to:

CO1: Identify the role of different nutraceuticals in human diet

CO2: Know about health benefits of nutraceuticals

CO3: Understand processing of nutraceuticals

CO4: Understand labeling of available nutraceuticals in market.

(Signature)

M. Sc. FOOD TECHNOLOGY - SEMESTER –IV
COURSE CODE: MSFT62-406
COURSE TITLE: M.Sc. DISSERTATION

CREDIT HOURS (per week): 04

TOTAL HOURS: 60

Time: 3 Hours

Max. Marks: 100

COURSE OBJECTIVES:

Students develop a scientific temper and a sense of enquiry through various food technology papers.

COURSE OUTCOMES:

On completing the course, the students will be able to:

CO1: Write synopsis for research topic.

CO2: Develop research and project writing skills

CO3: Understand the techniques of data collection and analysis

CO4: Write dissertation.

(Signature)