

**MAHATMA GANDHI UNIVERSITY
KOTTAYAM**

**M Sc FOOD TECHNOLOGY & QUALITY ASSURANCE/
M Sc FOOD SCIENCE & TECHNOLOGY/
M Sc FOOD SCIENCE & QUALITY CONTROL**

**RESTRUCTURED SYLLABUS PROPOSAL
2012**

**Revised and restricted as per Choice Based Credit and Semester System
(CBCSS)**

Contents

Sl No	Topic	Page No
1	List of Expert Committee Members	1
2	Need and scope of the course	2
3	Purpose of the course	3
4	Regulations	4
1	1 Name of the course	5
2	2 Duration of the course	5
3	3 Eligibility for admission	5
4	4 Mode of admission	5
5	5 Rules for readmission	5
6	6 Curriculum	6-7
6.1	6.1 Core course (PC)	6
6.2	6.2 Elective course (PE)	6
Table 1	Table 1 Detailed scheme of M Sc Food Technology & Quality Assurance	8
Table 2	Table 2 Detailed scheme for the distribution of credits and period of instruction	9
Table 3	Table 3 Detailed scheme of instruction of the core courses	10
Table 4	Table 4 List of elective courses available for fourth semester and their detailed scheme of instruction	11
7	7 Evaluation and grading	12
7.1	7.1 Internal evaluation	12
7.2	7.2 Components of internal evaluation	12
7.2.1	7.2.1 Component weightage	12
7.2.2	7.2.2 Grades for attendance	12
7.2.3	7.2.3 Components of weightage for assignment	12
7.2.4	7.2.4 Components of weightage for seminar	12
7.2.5	7.2.5 Components of weightage for practical-internal	13
7.2.6	7.2.6 Components of weightage for project evaluation-internal	13
7.3	7.3 Components of weightage for project evaluation-external	13
7.4	7.4 Direct grading system for external and internal examinations	13
7.5	7.5 Pattern of questions	14
7.6	7.6 Grade card	14
5	Restructured Syllabus 2012: I and II semesters	16
6	I Semester	17
7	7 FT1MPC 701 – Basic Biochemistry	18-19
8	8 FT1MPC 702 – General Microbiology	20-21
9	9 FT1MPC 703 – Food Chemistry	22-23
10	10 FT1MPC 704 – Introduction to Food Science & Technology	24-25
11	11 FT1MPP 705 – Practical-Biochemistry	26
12	12 FT1MPP 706 – Practical-Microbiology	27
13	Model Question papers	28
14	14 FT1MPC 701 – Basic Biochemistry	29
15	15 FT1MPC 702 – General Microbiology	30
16	16 FT1MPC 703 – Food Chemistry	31
17	17 FT1MPC 704 – Introduction to Food Science & Technology	32
18	18 FT1MPP 705 – Practical- Biochemistry	33
19	19 FT1MPP 706 – Practical- Microbiology	34
20	II Semester	35
21	21 FT2MPC 707 – Food Engineering	36-37

22	FT2MPC 708 – Food Additives & Packaging Technology	:	38-39
23	FT2MPC 709 – Food Spoilage & Preservation Technology	:	40-41
24	FT2MPC 710 – Food Analysis	:	42-43
25	FT2MPP 711 – Practical-Food Preservation & Packaging Technology	:	44-45
26	FT2MPP 712 – Practical-Food Analysis I	:	46
27	Model Question papers	:	47
28	FT2MPC 707 – Food Engineering	:	48
29	FT2MPC 708 – Food Additives & Packaging Technology	:	49
30	FT2MPC 709 – Food Spoilage & Preservation Technology	:	50
31	FT2MPC 710 – Food Analysis	:	51
32	FT2MPP 711 – Practical-Food Preservation & Packaging Technology	:	52
33	FT2MPP 712 – Practical-Food Analysis I	:	53

SEMESTER I, II, III, IV

LIST OF EXPERT COMMITTEE MEMBERS

M Sc Food Technology & Quality Assurance/ M Sc Food Science & Technology/ M Sc Food Science & Quality Control

1. Prof. (Dr.) M.K. Mukundan
Chairman
Expert Committee for M Sc FS & T/M Sc FS & QC/ M Sc FT & QA
Director, Council for Food Research & Development
Maveli Bhavan
Gandhi Nagar
Kadavanthra
Kochi-682 020

2. Dr. T.V. Sankar
Head, Quality Assurance & Management Division
Central Institute of Fisheries Technology
Matsyapuri P.O.
Kochi- 682 029

3. Smt. Beena Cherian
Principal
College of Indigenous Food Technology
Perinjottakkal P.O.
Konni
Pathanamthitta-689 692

4. Dr. Balagopal
Head, Dept of Food Science & Technology
MACFAST, Tiruvalla

5. Smt. Mini Michael
Lecturer
Dept of Food Science & Quality Control
St. George College
Aruvithura

NEED AND SCOPE OF THE COURSE

ˆ In the world, India is the second largest producer of food after China; the country has achieved the potential of being the biggest, with the food and agricultural sector. Indian food industry is considered to supply about two third of total Indian retail market needs. In addition to that, modern skills and equipments have been introduced in food industries such as canning, dairy, cereal processing, specialty processing, packaging, frozen food, refrigeration and thermal processing. India's food processing industry has been growing at the rate of 13% despite the global slowdown. And now the government is aiming to double the turnover in the next five year by setting up mega food parks to attract even global capital.

At present the export from agro-sector represents about 16% of total Indian exports. The primary export commodities are cereals, fruits, vegetables and their processed products, and marine products but fast growing specialty products have also penetrated into the foreign markets. Considering the contribution of these products in Indian export, it is necessary to have appropriate technology for handling and processing of agricultural produce.

Food technologist develops the manufacturing process and recipes. They work on existing and newly discovered ingredients and technologies to invent new products, recipes and concept. They are involved in conducting experiments and producing sample products as well as designing the processes and machinery for making products with a consistent flavor, color and texture.

- Modifying existing products, processes and new product development (NPD).
- Checking and improving quality control procedures from raw material stage to the finished product incorporating traceability.
- Addressing issues of safety and quality.
- Selecting raw material and other ingredients.
- Maintaining proper hygienic condition of entire food industry.
- Develop steps undertaken to meet the requirements with respect to hygiene, sanitation, good manufacturing practices, HACCP and nutritional quality.

PURPOSE OF COURSE

The purpose of this course is to enable the graduate to acquire the scientific, technical and professional skills for teaching/research/executive career in the food industry/food research and teaching institutions through an of science underlying food technology together with a deeper comprehension of food quality assurance.

The expected outcomes are that students acquire and demonstrate:

- Knowledge and competence in the principles of quality assurance and quality management system as they are applied in the food manufacture and distribution to produce safe food meeting quality and legal requirements.
- Thorough knowledge of chemical, biological and physical principles which underlie food processing, package and storage.
- Ability to apply the principles of chemical analysis, microbiological and statistical control techniques to analyze and assure the quality and safety of food.
- Capacity to undertake research and leading to New Product Development.
- Capacity for critical evaluation, presentation and interpersonal communication skills.

REGULATIONS FOR

M Sc Food Technology & Quality Assurance/

M Sc Food Science & Technology/

M Sc Food Science & Quality Control

1. NAME OF COURSE: **M Sc Food Technology & Quality Assurance/
M Sc Food Science & Technology/
M Sc Food Science & Quality Control**

2. DURATION OF COURSE

1. The curriculum requirement of M. Sc. Food Technology and Quality Assurance/ M Sc Food Science & Technology/M Sc Food Science & Quality Control shall consist of a period of 2 academic years as prescribed in the curriculum.
2. The two academic years shall be split into 4 semesters (6 months each). Examinations will be conducted at the end of each semester in subjects prescribed in the respective scheme of examinations.

3. ELIGIBILITY FOR ADMISSION

Any student who has bachelor's degree in Biochemistry, Biotechnology, Chemistry, Food Science & Technology, Food Technology & Quality Assurance, Food Science & Quality Control, Home Science with Chemistry (as auxiliary), Microbiology or Life Science stream with a minimum of 55 % marks in aggregate from a recognized University can apply for the M. Sc Food Technology & Quality Assurance Program. SC/ST candidates need only a pass in the qualifying examination. SEBC (Socially and educationally backward class) OEC (Other Eligible Castes) will be given a relaxation of 3% and 5%, respectively in the prescribed minimum marks.

The admission to the M. Sc programme shall be as per the rules and regulations of the university.

4. MODE OF ADMISSION

- i. Selection of candidates will be based on the marks in the Degree examination or rank in the CAT and interview.
- ii. The candidates shall also satisfy the conditions regarding physical fitness as may be prescribed by the University.
- iii. No admission shall be made after 30 working days from the date of commencement of the first semester as per the academic calendar approved by the University
- iv. Weightage of marks for proficiency in NCC/NSS etc and bonus marks for ex-service men applicants and widows and children of Jawans- ex-service men will be given as per the existing rules of admission. Reservation for the candidates with outstanding reports in sports and games shall be allowed as per rules. 3% of the seat under merit quota is reserved for physically challenged candidates
- v. All the above rules will be subjected to the general rules prescribed by Mahatma Gandhi University from time to time

5. RULES FOR READMISSION

- i. Students who are unable to attend classes on medical grounds after completing the 1st two semesters may be re-admitted to the respective semester along with the subsequent batch.
- ii. Students seeking re-admission shall give a written application to the Principal

- iii. Students who have been removed from the nominal roles due to default in payment of the semester fees shall be re-admitted, subject to the existing rules of the University

6. CURRICULUM

M. Sc. Food Technology and Quality Assurance/ M Sc Food Science & Technology/M Sc Food Science & Quality Control Programme under Credit Semester system (CSS) consisting of 4 semesters shall extend over a period of 2 years. **Semester** means a term consisting of a minimum of 90 working days, inclusive of examination, distributed over a minimum of 18 weeks of 5 working days each. A student has to complete a minimum of 84 credits which would be distributed as following.

6.1 Core Course (PC)

- a) Theory : 45 Credits
- b) Practicals : 20 Credits

6.2 Elective Course (PE)

- a) Theory : 12 Credits
- b) Project : 4 Credits
- c) Viva-voce : 3 credits

‘Course’ means a segment of subject matter to be covered in a semester. **‘Credit’ (Cr)** of a course is a measure of the weekly unit of work assigned for that course in a semester.

‘Course Credit’ One credit of the course is defined as a minimum of one hour lecture/ minimum of 2 hours lab /field work per week for 18 weeks in a semester. The course will be considered as completed only by conducting the final examination. No regular student shall register for more than 24 credits and less than 16 credits per semester. The total minimum credits required for completing a PG programme is 80.

‘Programme Core Course’ (PC) means a course that the student admitted to a particular programme must successfully complete to receive the Degree and which cannot be substituted by any other course.

‘Programme Elective Course’ (PE) means a course which can be substituted by equivalent course from the same subject and a minimum number of courses is required to complete the programme.

‘Programme Project means a regular project work with stated credits on which the student undergo a project under the supervision of a teacher in the parent department/ any appropriate research centre in order to submit a dissertation on the project work as specified.

‘Academic week’ is a unit of five working days in which distribution of work is organized from day 1 to 5, with five contact hours of one hour duration in each day. A sequence of 18 such academic week constitutes a semester.

Zero Semester means a semester in which a student is permitted to opt out due to unforeseen genuine reasons.

Examination: To be conducted as per rules and regulations framed under credit and semester system.

1. There shall be University examination at the end of each semester.
2. Practical examinations shall be conducted by the University at the end of each semester.
3. Project evaluation and viva voce shall be conducted at the end of the programme only. Project evaluation and viva -voce shall be conducted by two external examiners and one internal examiner.
4. There shall be one end semester examination of 3 hours duration in each lecture based course and practical course
5. A question paper may contain short-answer type /annotation, short essay type questions/ problems and long essay type questions. Different type of questions shall have different weightage to quantity their range. Weightage can vary from course to course depending on their comparative importance but a general pattern may be followed by the Board of Studies.

The detailed scheme of M Sc Food Technology & Quality Assurance course (Table 1), detailed scheme for the distribution of credits and period of instruction (Table 2), detailed scheme of instruction of the core courses (Table 3) and list of elective courses available for fourth semester and their detailed scheme of instruction (Table 4) are given below

Table 1: Detailed Scheme of M Sc Food Technology & Quality Assurance

Study components	No of courses	Credit per course			Total credits	Total period of instruction (4 semesters)	Period of instruction for 4 semesters (Contact h/week)			
							1	2	3	4
PC	PROGRAM CORE COURSES									
Theory	12	9×4	3×3	45	45	15	15	15		
Practical	8	4×2	4×3	20	40	8	10	10	12	
Project/Dissertation	1	4		4						
Viva-voce	1	3		3						
Total				72	85					
PE	PROGRAM ELECTIVE COURSES									
Theory	4	3×4		12	12					12
GRAND TOTAL				84	97					

Table 2: Detailed Scheme for the Distribution of Credits and Period of Instruction

	Course code	Title of course	Credit per course	Contact hours per week	Total contact hours for the course	Total credits for the course
First Semester						
1	FT 1MPC 701	Basic Biochemistry	4	4	72	19
2	FT 1 MPC 702	General Microbiology	4	4	72	
3	FT 1MPC 703	Food Chemistry	4	4	72	
4	FT 1MPC 704	Introduction to Food Science and Technology	3	3	54	
5	FT 1MPP 705	Practical :Biochemistry	2	4	72	
6	FT 1MPP 706	Practical :Microbiology	2	4	72	
Second semester						
7	FT 2MPC 707	Food Engineering	4	4	72	20
8	FT 2 MPC 708	Food Additives and Packaging Technology	3	3	54	
9	FT 2MPC 709	Food Spoilage & Preservation Technology	4	4	72	
10	FT 2MPC 710	Food Analysis	4	4	72	
11	FT 2MPP 711	Practical: Food Preservation & Packaging Technology	2	4	72	
12	FT 2MPP 712	Practical: Food Analysis I	3	6	108	
Third semester						
13	FT 3MPC 713	Technology of Cereals, Pulses and Oil seeds	4	4	72	20
14	FT 3 MPC 714	Technology of Milk, Meat, Poultry & Fish	4	4	72	
15	FQA 3MPC 715	Technology of Beverages	4	4	72	
16	FT 3MPC 716	Technology of Fruits and Vegetables	3	3	54	
17	FT 3MPP 717	Practical-Processing Technology of Animal-based Foods	2	4	72	
18	FT 3MPP 718	Practical- Processing Technology of Agro-foods	3	6	108	
Fourth semester						
19	List of elective papers are given in table 2	Elective 1	4	4	72	25
20		Elective 2	4	4	72	
21		Elective 3	4	4	72	
24	FT 4MPP 724	Practical: Food Analysis II	3	6	108	
25	FT 4MPP 725	Practical: Food Processing	3	6	108	
26	FT 4MPD 726	Project evaluation	4			
27	FT 4MPP 727	Viva-voce	3			

Table 3: Detailed Scheme of Instruction of the Core Courses

No	Course code	Title of course	Exam duration (hours)	Credit per course	Contact hours per week	Total credits for the course
First Semester						
1	FT 1MPC 701	Basic Biochemistry	3	4	4	19
2	FT 1 MPC 702	General Microbiology	3	4	4	
3	FT 1MPC 703	Food Chemistry	3	4	4	
4	FT 1MPC 704	Introduction to Food Science and Technology	3	3	3	
5	FT 1MPP 705	Practical :Biochemistry	3	2	4	
6	FT 1MPP 706	Practical :Microbiology	3	2	4	
Second semester						
7	FT 2MPC 707	Food Engineering	3	4	4	20
8	FT 2 MPC 708	Food Additives and Packaging Technology	3	3	3	
9	FT 2MPC 709	Food Spoilage & Preservation Technology	3	4	4	
10	FT 2MPC 710	Food Analysis	3	4	4	
11	FT 2MPP 711	Practical: Food Preservation & Packaging Technology	3	2	4	
12	FT 2MPP 712	Practical: Food Analysis I	3	3	6	
Third semester						
13	FT 3MPC 713	Technology of Cereals, Pulses and Oil seeds	3	4	4	20
14	FT 3 MPC 714	Technology of Milk, Meat, Poultry & Fish	3	4	4	
15	FQA 3MPC 715	Technology of Beverages	3	4	4	
16	FT 3MPC 716	Technology of Fruits and Vegetables	3	3	3	
17	FT 3MPP 717	Practical-Processing Technology of Animal-based Foods	3	2	4	
18	FT 3MPP 718	Practical- Processing Technology of Agro-foods	3	3	6	
Fourth semester						
19	List of elective papers are given in table 2	Elective 1	3	4	4	25
20		Elective 2	3	4	4	
21		Elective 3	3	4	4	
24	FT 4MPP 724	Practical: Food Analysis II	3	3	6	
25	FT 4MPP 725	Practical: Food Processing	3	3	6	
26	FT 4MPD 726	Project evaluation	15 min presentation	4		
			5 min discussion			
27	FT 4MPP 727	Viva-voce		3		

Table 4: List of Elective Courses available for Fourth Semester and their Detailed Scheme of Instruction

No	Course code	Title of course	Exam duration (hours)	Credit per course	Contact hours per week
1	FT 4MPE 719	Food Quality Assurance & Management	3	4	4
2	FT 4MPE 720	Fermentation Technology	3	4	4
3	FT 4MPE 721	Food Processing Technology	3	4	4
4	FT 4MPE 722	Plantation & Flavor Technology	3	4	4
5	FT 4MPE 723	Food Sanitation and Hygiene	3	4	4

5. EVALUATION AND GRADING

The evaluation scheme for each course shall contain two parts, (a) Internal evaluation and (b) external evaluation. 25 % weightage shall be given to internal evaluation and the remaining 75 % to external evaluation, and the ratio and weightage between internal and external is 1:3. Both internal and external evaluations shall be carried out, using direct-grading system.

5.1 Internal evaluation

The internal evaluation shall be based on predetermined transparent system involving periodic written test, assignments, seminars and attendance in respect of theory courses and based on written tests, lab skill/ records/ viva and attendance in respect of practical courses. The weightage assigned to various components for internal evaluation is as follows.

5.2 Components of Internal Evaluation

5.2.1 Component weightage

- i. Assignment..... 1
- ii. Seminar.....2
- iii. Attendance.....1
- iv. Two Test papers.....2

5.2.2 Grades for Attendance

Percentage of Attendance (%)	Grade
<90	A
Between 85 and 90	B
Between 80 and below 85	C
Between 75 and below 80	D
<75	E

5.2.3 Assignment

Component	Weights
Punctuality	1
Review	1
Content	2
Conclusion	1
Reference	1

5.2.4 Seminar

Components	Weights
Area/Topic Selected	1
Review/ Reference	1
Content	2
Presentation	2
Conclusion	1

5.2.5 Practical- Internal

Components	Weights
Attendance	1
Laboratory Investment	2
Written/Lab test	2
Record	2
Viva-Voce / Quiz	1

5.2.6 Project evaluation: Internal

Components	Weights
Punctuality	1
Experimentation / Data Collection	1
Compilation	1
Content	1

5.3 Project evaluation: External

Components	Weights
Area/Topic Selected	1
Objectives	2
Review	1
Materials & Methods	2
Analysis	2
Presentation	2
Conclusion / application	2

5.4 Direct grading system for External and Internal Examinations

Direct grading system based on a 5-point scale is used to evaluate the performance of students in both external and internal examinations.

Letter grade	Performance	Grade point (G)	Grade range
A	Excellent	4	3.50 to 4.00
B	Very Good	3	2.50 to 3.49
C	Good	2	1.50 to 2.49
D	Average	1	0.50 to 1.49
E	Poor	0	0.0 to 0.49

The overall grade for a PG programme for certification shall be based on Cumulative Grade Point Average (CGPA) system with a 7- point scale and is given below.

CGPA	Grade
3.80 to 4.00	A+
3.50 to 3.79	A
3.00 to 3.49	B+
2.50 to 2.99	B
2.00 to 2.49	C+
1.50 to 1.99	C
1.00 to 1.49	D

A separate minimum of C Grade for Internal and External are required for a pass in the course. For a pass in a programme, a separate minimum grade C is required for all the courses and must score a minimum CGPA of 1.50 or an overall grade of C and above.

After the successful completion of a semester, semester grade point average (SGPA) of a student is calculated for each semester using the formula given below. For the successful completion of a semester, a student should pass all courses and score a minimum SGPA of 2.0. However a student is permitted to move on to the next semester irrespective of his/her SGPA.

For instance if a student has registered for 'n' courses of credits C_1, C_2, \dots, C_n in a semester and if she/he has scored credit points P_1, P_2, \dots, P_n respectively in these courses, then SGPA of the student in that semester is calculated using the formula.

$$SGPA = \frac{(P_1 + P_2 + \dots + P_n)}{(C_1 + C_2 + \dots + C_n)}$$

$$CGPA = \frac{(SGPA)_1 \times S_1 + (SGPA)_2 \times S_2 + (SGPA)_3 \times S_3 + (SGPA)_4 \times S_4}{S_1 + S_2 + S_3 + S_4}$$

Where S_1, S_2, S_3 and S_4 are the total credits in Semester 1, Semester 2, Semester 3 and Semester 4.

5.5 Pattern of Questions

Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The question setter shall ensure that questions covering all skills are set. He/she shall also submit a detailed scheme of evaluation along with the question paper. A question paper shall be a judicious mix of short answer type, short essay type/problem solving type and long essay type questions. Model question paper for each course, for first two semesters is attached after the restructured syllabus.

Weight: Different types of questions shall be given different weights to quantify their range as follows.

Sl No	Type of Questions	Weights	No. of questions to be answered
1	Short answer type questions (not exceeding one page)	1	5 out of 8
2	Short essay/problem-solving type questions (not exceeding two pages)	2	5 out of 8
3	Long essay type questions	5	3 out of 6

5.6 Grade Card

The University under its seal shall issue to the students, a grade card on completion of each semester which shall contain the following information. Name of the University, Name of the college, Title of the PG programme, Name of Semester,

Name and Register number of students, Code number, Title and credits of each course opted in the semester & Title and credits of the Project Work.

In addition to these, the grade card shall contain internal, external and total grade, Grade point (G), Letter grade and credit point (P) in each course opted in the semester, the total credit, total credit points and SGPA in the semester. The final Grade card issued at the end of the final semester shall contain the details of all courses taken during the entire programme including those taken over and above the prescribed minimum credits for obtaining the degree. The final Grade Card shall show the CGPA and the overall letter grade of a student for the entire programme.

Restructured Syllabus 2012

I and II Semesters

I Semester

FT1MPC 701 – BASIC BIOCHEMISTRY

Credit: 4

72 Hours

OBJECTIVES

- ❖ To serve as a torch to trace the intricate complexities and chemical mysteries of food
- ❖ Enable the students to understand the biochemical pathways and how they are relevant to their lives

Unit I

20 Hrs

Carbohydrates

Composition, classification: mono, disaccharides, Aldose, ketoses: Structure and Configuration, Trioses, tetroses, pentose, hexoses. Polysaccharides, Glycogen, starch, cellulose, chitin. Metabolic diseases: Diabetes Mellitus, Lactosemia, Galactosemia, Hereditary Fructose intolerance. Carbohydrate metabolism: Glycolysis, TCA cycle, glycogen metabolism, Pentose phosphate pathway (regulation and energetics).

Unit II

20Hrs

Proteins and Nucleotides

Composition, Sources, Classification, Peptides: Amino acid structure, isomerism, functions of proteins, biologically active peptides. Structure of proteins: Primary, secondary, tertiary & quaternary structure. Protein folding, inborn errors of amino acid metabolism: Phenyl Ketonuria, alkaptonuria, albinism. Urea cycle, oxido reduction reactions, decarboxylation, transamination of amino acids.

Nucleotides: Nucleosides, DNA and RNA structure, Replication, transcription and translation

Unit III

10Hrs

Lipids

Classification, fatty acids, naming, classification, properties of fatty acids; Essential and nonessential: Triglycerides, phospholipids, sphingolipids, sterols, structure, function, separation, analysis and characterization. β oxidation, ketogenesis, biosynthesis of fatty acids

Unit IV

12 Hrs

Photosynthesis and Enzymes

Photosynthesis: Photosystem I & II, Melvin – Calvin Cycle and its regulation, Photophosphorylation

Enzyme: catalysis, kinetics of enzymatic reactions, classification, active site, mechanism of enzyme reactions, inhibition, factors affecting enzymatic reactions. Multi-enzyme complex, iso-enzymes and Co enzymes.

Unit V

10Hrs

Nutritional Biochemistry

Energy value of foods, energy requirement, Methods used to determine the energy value of foods – Direct and indirect calorimetry, BMR, factors affecting BMR, Reference man and reference women. Protein deficiency diseases: Marasmus, Kwashiorkor, Marasmic Kwashiorkor. Evaluation of protein nutritive value – biological and chemical methods

Reference

- ❖ Michael Eskin N.A , 1990, Biochemistry of foods, 2nd edn , Academic press
- ❖ Abraham White, 1973, Principles of Biochemistry, 5th edn, Mc Graw Hill.
- ❖ Berg, J. M., Tymoczko, J. L, 2007 Biochemistry, Sixth edition, W H Freeman and Company, New York.
- ❖ Das, D, 1992, Biochemistry, Seventh Edition, Academic publishers, Calcutta.
- ❖ Jain, J. L., 2001, Fundamentals of Biochemistry, Fifth Edition, S. Chand and Company Ltd.
- ❖ Satyanarayana, U. and Chakrapani, U, 2006, Biochemistry, Third edition, Books and Allied Pvt ltd, Kolkata.

FT1MPC 702: GENERAL MICROBIOLOGY

Credit:4

72 hours

OBJECTIVES

- ❖ To throw light into the basics of Microbiology and to acquire an elementary knowledge about physiology of microorganisms, their control and their role in food borne illnesses.

Unit-I Introduction

16 hours

Classification of living system, History & scope of microbiology, Microscopy and specimen preparation, Cell-structure & function of prokaryote and eukaryote. Fungi- Classification, Structure and reproduction. Viruses: Introduction, general characteristics. Structure and replication with particular references to food borne viruses.

Unit-II Microbial Nutrition

15 hours

Microbial Nutrition: nutritional types of micro-organisms, nutrient requirements, growth curve, growth kinetics. Culture media and culture methods. Cultivation of bacteria. Isolation and identification: staining techniques, motility, colony characteristics, biochemical characteristics and identification for bacteria, Preservation of microbial cultures.

Unit-III Microbial genetics

16 hours

Microbial genetics-general principles, DNA as genetic material, genetic code, gene structure, plasmids, bacterial recombination- conjugation, transduction and transformation. Mutation: kinds of mutation, induced mutation and mutagens and their modes of action, detection & isolation of mutants.

Unit-IV Control of microorganisms

10Hrs

Control of microorganisms, sterilization principles and techniques, chemical and physical antimicrobial agents, Disinfectants, Antiseptic agents, Bactericidal agents, Virucide, Fungicide, Sporocide, bacteriostatic agents. Mechanisms of action of chemical disinfectants, Industrial and clinical uses of antimicrobial agents.

Measuring effectiveness of antimicrobial agents, phenol coefficient, TDP-Thermal Death Point, TDT- Thermal Death Time and DRT-Decimal Reduction Time (D-value, z-value, F-value). Antimicrobial spectrum, drug resistance in bacteria.

Unit-V Microbial diseases

15Hrs

Infections: sources of infection and modes & transmission of infection, Food borne diseases, pathogens and their control - bacterial infections & intoxications, viral infections, protozoan infections, pathogenic and toxigenic mold/fungi of food origin, Mycotoxins. Microbiology of air, water and milk

Reference:

- ❖ Frazier, W.C. Food Microbiology. 4th edition. Mc Graw Hill. New York, 2008
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- ❖ Kathleen Park Talaro (2002) Foundations in Microbiology, Fourth Edition, Mc Graw Hill, New York.
- ❖ Ananthanarayan R, Jayaram Panicker CK (2009) Text book of Microbiology, Eighth edition, Universities Press Pvt. Ltd., Hyderabad

FT1MPC 703 – FOOD CHEMISTRY

Credit: 4

72 Hours

OBJECTIVES

- ❖ To acquaint various functional chemical constituents in food.
- ❖ To build a relationship between the dynamic forces of food and the dynamic forces of digestion and growth.

Unit – I 10Hrs Introduction

Definition, history, basic concepts: basic constituents of food, water- structure, physical properties, water solute interactions (water binding, hydration and water holding capacity), water activity-definition and measurement, moisture sorption isotherm

Unit – II 15 Hrs Carbohydrates

Definition, Classification: monosaccharide, disaccharide, polysaccharide, Isomerisation. Starch – structure, gelatinization, Retrogradation, staling, starch types, starch complexes, hydrolysis of starch. Cellulose – types, gums, pectins, dietary fibre, honey. Browning reactions: Non Enzymatic reactions

Unit – III 20Hrs Proteins and Enzymes

Classification, structure, protein denaturation and denaturing agents, functional properties of proteins in food, Rheological properties of protein gels, Nutritional properties – protein quality. Chemical reactivity of proteins, changes induced by heating, oxidative changes, crosslinking. Enzymes in foods, nomenclature and classification, factors influencing enzyme activity, immobilized enzymes, enzyme inhibition, modification of food by endogenous enzymes, enzyme specificity, enzymatic browning reactions, enzymes in waste management.

Unit – IV 15Hrs Fats and Oils

Role of lipids in foods, chemical properties and reactions, chemistry and technology of fats and oils, lipolysis, rancidity, reversion, hydrogenation, inter esterification and winterization, food lipids and health. Fat Characterization. Waxes, sterols, cholesterol structure and properties. Uses of fat in food, Phospholipids : Lecithin and its uses.

Unit – V 12Hrs Vitamins and Minerals

Sources of vitamins, classification, bio availability, restoration and fortification, general causes for losses of vitamins in food, Deteriorative reactions optimization of nutrient retention, vitamin like compounds. Nutritional aspects of minerals and bioavailability, classification, chemical properties of vitamins and minerals- water soluble vitamins. Fat soluble vitamins- Vitamin A, Vitamin K, Vitamin D, Vitamin E. Minerals.

Reference:

- ❖ Damodaran,S.,Parkin , K L.,Fennema, O R.,1996, Fennema's Food chemistry- 4th edition, CRC press Taylor and Francis Group,New York
- ❖ Fennema, O R. -Food chemistry 3rd edition Replika press Pvt. Ltd.,India.
- ❖ Meyer, L H,2002,Food chemistry.CBS publishers& distributors, New Delhi.
- ❖ Campbell, M K and Farrell,2006, S O-Biochemistry 5th edition-international student Edition

FT1MPC 704: INTRODUCTION TO FOOD SCIENCE & TECHNOLOGY

Credit: 3

54Hrs

OBJECTIVES

- ❖ To provide an introductory foundation in Food Science and Technology upon which more advanced and specialized knowledge can be built.
- ❖ To enable students to apply scientific methods independently

Unit I Introduction

9Hrs

Food: Classification of foods, Health foods, Natural foods, Organic food, Functional food, Nutritional status of world population, Consequences of malnutrition on health and mental development, National and international programs for nutritional improvement.

Unit II Conventional foods

10 Hrs

Specialty foods, Fast foods, Diet foods, Nutritional foods, Nutraceuticals, labeling- nutritional foods, Foods and obesity, foods and cancer, Genetically modified foods, safety concerns of Genetically modified foods, Ethnic foods, low fat, gluten free, nondairy sugar free, carb and cholesterol free foods.

Unit III Science of Food

10 Hrs

Biological and chemical principles underlying the maintenance of food quality during the period after harvest to consumption. Post harvesting changes include chemical, enzymatic, physical and biological deteriorations, implications and prevention. Steps involved in converting a raw harvested food material to a preserved product with sound quality. Harvesting, transportation, storage, manufacture, preservation, packaging, distribution and marketing

Unit IV Food composition

10Hrs

Chemical properties of foods, proximate composition, regulation and impact of components in raw and processed foods of plant and animal origin. Food toxicology and food allergens, anti-nutritional factors.

Unit V Applied Statistics

15Hrs

Applied statistics—Methods of collecting data, representation of data, Measures of central tendency – mean, median, mode, Measures of dispersion: range, standard deviation, variance, Coefficient of variation, Standard error and sources of error, Correlation analysis, Regression analysis, Probability, Theoretical distributions—Normal, Binomial & Poisson, Sampling, sample surveys (random sample, systematic sample, cluster/multistage sample and quota sample), Test of significance: Students t-test, Chi-square Test and Goodness of fit, ANOVA, Design of Experiments.

Reference:

- ❖ Blackburn, C. W. and McClure, P.J, 2005, Food borne Pathogens Woodhead Publishing Limited Cambridge England
- ❖ Frederick, J.F, 2000, Encyclopedia of Food Science and Technology. Second edition vol 1-4, a widely interscience publication.
- ❖ Goldberg, I., 1999 Functional foods, Designer foods, pharma foods and nutraceuticals. An aspen publication, gaitthers burg, maryland.
- ❖ Roday, S., 2008, Food science and nutrition. Third edition, Oxford University Press, New Delhi.
- ❖ Joseph,K.X.,2004,Statistics third edition Calicut University central co-operative stores Ltd.
- ❖ Khader, V, 2001, Text book of Food science and Technology. Published by India Council of Agricultural Research, NewDelhi 110012.
- ❖ Kothari, C.R,2000, Research Methodology- Methods and Techniques, 2nd edition New age International (P) Ltd publishers, New Delhi
- ❖ Manay, N.S,2004, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi,
- ❖ Srilakshmi, B,2003, Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi
- ❖ Reddy Y.S, 2006, Newer concept and applications for food industry. Gene tech Books, New Delhi 110002,

FT1MPP 705: Practical- Biochemistry

Credits: 2

72 hours

OBJECTIVES

To provide a balanced introduction to laboratory techniques and principles that is important in the area of Biochemistry

- ❖ Qualitative tests for carbohydrates (10 hours)
- ❖ Qualitative tests for proteins: Millon's test, Nitroprusside test, Ninhydrin test. (6 hours)
- ❖ Biuret method for estimation of proteins (4 hours)
- ❖ Estimation of Protein by Lowry's method (4 hours)
- ❖ Estimation of Ascorbic acid (4 hours)
- ❖ Estimation of Protein by Micro Kjeldahl Method, (4 hours)
- ❖ Estimation of sugars by Anthrone method (4 hours)
- ❖ Estimation of sugar by phenol-sulphuric acid (4 hours)
- ❖ Estimation of cholesterol (4 hours)
- ❖ Estimation of thiamine (4 hours)
- ❖ Study of enzymes- lipases, amylases, proteases, invertases (10 hours)
- ❖ Chromatography : Paper and Thin layer (10 hours)
- ❖ Gas Chromatography (4 hours)

Reference:

- ❖ Sadasivam S, Manickam A (1996) Biochemical Methods, Second edition, New Age International Ltd, New Delhi.
- ❖ Plummer D T (1998) An Introduction to Practical Biochemistry, Third edition, Tata McGraw Hill, New Delhi

FT1MPP 706: Practical- Microbiology

Credits: 2

72 hours

OBJECTIVES

To provide a balanced introduction to laboratory techniques and principles those are important in the area of Microbiology

- ❖ Microscopy (2 hours)
- ❖ Methods of cleaning and sterilization (2 hours)
- ❖ Laboratory evaluation of disinfectants by Rideal Walker test (4 hours)
- ❖ Culture media (5 hours)
- ❖ Culture methods (5 hours)
- ❖ Staining techniques (10 hours)
- ❖ Examination of bacteria for motility (6 hours)
- ❖ Characterization of microbial colonies (4 hours)
- ❖ Biochemical properties of bacteria (10 hours)
- ❖ Measurement of microbial count- Micrometry & Total viable count (10 hours)
- ❖ Microbial growth- determination of growth curve (6 hours)
- ❖ Methods of microbial culture preservation (4 hours)
- ❖ Antibiotic sensitivity tests (4 hours)

Reference:

- ❖ Dubey R C, Maheswari DK (2002) Practical Microbiology, S. Chand & Company Ltd., New Delhi

Model Question papers

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT1MPC 701

BASIC BIOCHEMISTRY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. Explain mutarotation with an example.
2. Difference between amylose and amylopectin.
3. Structure and importance of phosphatidyl choline.
4. Mention the structure and role of t-RNA.
5. Distinguish between homo and hetero polysaccharides.
6. Explain photophosphorylation and its significance.
7. What are essential and non essential amino acids? Give examples.
8. Give structure and function of ATP.

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

1. Enumerate the properties of amino acids.
2. Elaborate the structure of DNA
3. Describe Urea cycle
4. What are allosteric enzymes? Explain the different types of allosterism with examples.
5. Explain how ATP is formed through electron transport chain.
6. Explain BMR and factors affecting BMR
7. Write an account of metabolic disorders associated with amino acid metabolism.
8. What are disaccharides? Explain the structure of different disaccharides.

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

1. Describe the citric acid cycle. Indicate the controlling points for citric acid cycle.
2. Explain the primary, secondary, tertiary and quaternary structure of proteins.
3. Explain Calvin cycle with regulation
4. Narrate the enzyme regulation with example
5. What do you understand by calorific value of foods? Mention the calorific value of major components of foods. Describe a method with neat sketch to determine the calorific value of wheat.
6. What are polysaccharides? Explain the structure of important polysaccharides with examples.

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT1MPC 702

GENERAL MICROBIOLOGY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

. Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. What do you mean by resolution of a microscope?
2. What is bacterial transformation?
3. Mention the role of lipopolysaccharides in gram negative bacteria.
4. What is differential media?
5. Define Z-value.
6. Comment on the toxin of *Clostridium botulinum*.
7. What is meant by thermal death time?
8. Give a brief note on Ames test.

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Comment on growth curve.
10. Point out the differences between eukaryotes and prokaryotes.
11. Give an account of bacterial endospore and its formation.
12. Discuss about sterilization by filtration?
13. Describe the methods of transduction in bacteria
14. Give a brief note on viral gastroenteritis.
15. What are the different modes and transmission of infection
16. Describe the methods of active transport in bacteria

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Classify the chemical disinfectants. Explain the mode of action of disinfectants
18. Describe the reproduction of fungi.
19. Give an account of food poisoning.
20. Discuss the principle and applications of transmission electron microscopy.
21. Write about the preservation of microbial cultures.
22. Give an account of spontaneous and induced mutations.

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT1MPC 703

FOOD CHEMISTRY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

. Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. Distinguish Between free water and bound water?
2. Briefly explain iso-electric pH of the protein?
3. What is saponification?
4. Write short note on shortenings?
5. What is fortification?
6. Write general structure of mono, di and tri glycerides?
7. Describe the functional properties of protein?
8. What is mutarotation?

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Discuss various applications for enzymes in food industry?
10. Explain the role of trace minerals and supplements in human diets?
11. What is rancidity, different types and its prevention?
12. Define Maillard's reaction and its practical application in food?
13. What you mean by tenderisation of meat?
14. Explain briefly the effect of pH on enzyme reactivity?
15. Explain protein denaturation with suitable examples?
16. Discuss about naturally occurring enzyme inhibitors?

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Explain in detail four level of structural organisation in protein?
18. Explain types of browning reaction and recommended modes of inhibition?
19. Define rancidity and flavour reversion, what are the factors affecting development of rancidity and flavour reversion?
20. What are antioxidants .Explain its mechanism of action in detail?
21. What are carbohydrates? Describe the classification of carbohydrates with example?
22. How do you classify lipids? Define significance of saponification value of oils and fats?

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT1MPC 704 INTRODUCTION TO FOOD SCIENCE & TECHNOLOGY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

. Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. Define organic foods?
2. What are functional foods?
3. What do you mean by nutraceuticals?
4. What are food allergens?
5. Define packaging.
6. What is standard deviation?
7. Define health foods.
8. What are GM foods?

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Comment on the chemical properties of foods.
10. Describe about national and international programs for nutritional improvement.
11. Explain median and mode. And discuss their relative merits and demerits.
12. Give an account of nutrition labeling.
13. Discuss about percentiles and percentile ranks.
14. Give the steps involved in converting a raw harvested food material to a preserved product.
15. Enumerate the methods for sampling.
16. Comment on foods related to obesity.

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Write in detail about the different packaging materials used in food industry.
18. What is ANOVA and give an example for estimation for ANOVA.
19. Give a brief account on biological and chemical principles underlying the maintenance of food quality?
20. Discuss different nutritional disorders in humans and their remedial measures.
21. Define the term water activity (a_w). List factors influencing a_w in food. Discuss the role and significance of a_w in food preservation.
22. Give an account of anti-nutrients and its toxicological effects.

Model Question Paper
M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance

FT1MPP705

Practical- Biochemistry 2012

Time: 3 hours

Maximum weightage: 30

1. Write down the principle and procedure for estimation of protein by Biuret method
 - a) Principle- 2 weights
 - b) Procedure- 3 weights

(5 weights)
2. Write down the principle and estimate the percentage of acidity in the given sample?
 - a) Principle- 2 weights
 - b) Method- 4 weights
 - c) Result- 2 weights

(8 weights)
3. Identify the sugar present in the given samples:- SAMPLE A & B
 - a) Method- 3 weights
 - b) Result- 1 weight

(8 weights)
4. Viva- voce

(5 weights)
5. Certified record

(4 weights)

Model Question Paper
M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance

FT1MPP706

Practical- Microbiology 2012

Time: 3 hours

Maximum weightage: 30

6. Identify the given bacterial culture by GRAM STAINING. Show the slide to the examiner?
a) Principle- 2 weights
b) Method- 4 weights
c) Result- 2 weights

(8 weights)
7. Write a brief note on the principle and procedure of examination of bacterial motility?
a) Principle- 2 marks
b) Method: 4
c) Result- 2 marks

(8 weights)
8. Write down the microbiological significance of specimen no. 1-5
a) Identification- ½ weights
b) Characteristics- ½ weights

(5 weights)
9. Viva- voce (5 weights)
10. Certified record: (4 weights)

II Semester

FT2MPC 707- FOOD ENGINEERING

Credit: 4

72Hrs

Objectives:

- ❖ To scale up laboratory methods to manufacturing process
- ❖ To understand the operations of food industries as a major functional area.

Unit I

10Hrs

Dimensions, Quantities and Units

Dimensions and units, Basic physical quantities: velocity and speed, acceleration, force and momentum, weight, pressure, work and energy, power. Dimensional analysis: dimensional consistency and dimensional analysis. Phase diagram of water.

Unit II

20Hrs

Heat transfer

Heat transfer in food processing: Heating and cooling of food products, Heat Exchangers, Thermal properties of foods, Heat Transfer: Modes of heat transfer, Conduction, Steady state heat transfer, Conduction in rectangular objects, tubular pipe and multilayered systems, Convection, Estimation of convective heat transfer coefficient, forced convection, free convection, Estimation of overall heat transfer coefficient, Insulation, Design of a Tubular heat exchanger, Radiative heat transfer, Black body radiation, Emissivity, Radiation heat transfer between two objects

Unit III

20Hrs

Fluid mechanics

Fluid mechanics: Liquid Transport system, Properties of liquids, Handling systems for Newtonian liquids, Continuity equation, Reynolds number, Velocity profile in a liquid flowing under fully developed flow conditions, Bernoulli equation, Energy equation for steady flow of fluids, Pump selection and performance evaluation, Flow measurement, Measurement of viscosity, Flow characteristics of Non-Newtonian fluids

Unit IV

10Hrs

Mechanical Operations

Mechanical Operations: Mixing and different types of mixers used in food industry, Forming, Size Reduction, Extruding, Agglomeration, Clarification and concentration
Membrane separation: Electro dialysis systems, Reverse Osmosis, Ultra filtration,
Mechanical Separations: Sedimentation, Centrifugation, Filtration
Phase Separations- Distillation and types
Chemical Separations: Leaching, Steeping, Extraction, Diffusion Concentration

Unit V

12Hrs

Freezing & drying

Refrigeration: Selection of refrigerant, Components of a refrigeration system, Pressure-enthalpy charts, Mathematical expressions useful in analysis of Vapor- compression refrigeration, Cooling load, Coefficient of performance, Refrigerant flow rate, Use of multistage systems
Freezing: Freezing systems, Direct and indirect contact systems, Properties of frozen food, Frozen food storage, Quality changes in food s during frozen storage
Evaporation: Types of evaporators, Design of a single and multiple effect evaporator, Vapor recompression systems

Reference:

- ❖ Dincer, I, 1997, Heat Transfer Food Cooling Applications. Taylor and Francis Publishers, USA.
- ❖ Heldman, D. R, 2007, and Lund, D.B. Handbook of Food Engineering 2nd edition. CRC press, Newyork.
- ❖ Singh, R.P., 2004, Introduction to Food Engineering 3rd edition. Academic Press, London.

FT2MPC 708 FOOD ADDITIVES & PACKAGING TECHNOLOGY

Credit: 3

54Hrs

Objectives:

- ❖ To know the structure and chemical characteristics of chemicals added to food.
- ❖ To provide insight into the scope of packaging technology in food industries.

Unit 1

10Hrs

Introduction

Functionality of food additives, Regulatory and legal aspects. Objectives of additives. Functional classification of additives. Natural and synthetic additives. Health and safety aspects of food additives. Generally Recognized As Safe (GRAS) and Acceptable Daily Intake

Unit II

14Hrs

Types of food additives

Additive numbering system; Permitted food colours- natural and artificial. Food flavours – natural and artificial. Sweeteners- natural and artificial. Antimicrobials, Aerating agents, Antistaling agents, Bodying agents, Clouding agents, Curing agents, Clarifiers, Dietary supplements, Dietary fibre, Emulsifiers, Enzymes, Fat replacers, Gelling agents, Leavening agents, Stabilizers, Surfactants, Tenderizers, Texturizers, Thickeners, Vitamins, Nutraceuticals, Viscosity modifiers, Whipping agents , antioxidants , chelating agents.

Unit III

10Hrs

Introduction to packaging technology

Packaging Introduction. Selection of packaging materials based on chemical and physical properties of foods. Primary, secondary and tertiary packaging of foods. Paper board , paper and fibre board packaging. Coated papers and their requirements, Shear strength and compression properties of corrugated cartons, Transportation tests and stacking tests

Unit IV

10Hrs

Packaging techniques

Special properties required for plastic materials for packaging foods, paper and metal laminations used in packing of foods, Microwave oven safe packaging (suseptron). Aseptic packaging of foods and the developing technology. Tests for packaging. MAP and CAP packaging. Biodegradable packaging materials, their advantages and disadvantages.

Unit V

10Hrs

Food adulteration

Food adulteration, definition, Reasons for food adulteration, methods of adulteration, methods of detection. Food Laws: Mandatory and Voluntary laws

Reference:

- ❖ Srilakshmi,B.,2005, Food Science., New Age International (P) Limited., New Delhi.
- ❖ Subalakshmi, G and Udipi, S.A, 2001, Food processing and preservation. New Age International Publishers, New Delhi.
- ❖ Potter, N. N, Hotchkiss, J. H, 2000 Food Science. CBS Publishers, New Delhi.
- ❖ Manay, N.S, Shadaksharaswamy, M.,2004, Foods- Facts and Principles, New Age International Publishers, New Delhi,
- ❖ Mahindru ,S N, Food Additives : Characteristics, detection , and estimation , A P H Publishing Corporation, New Delhi,

FT2MPC 709: FOOD SPOILAGE AND PRESERVATION TECHNOLOGY

Credit: 4

72Hrs

Objectives:

- ❖ To enumerate the undesirable changes occurring in foods and causative factors responsible for it.
- ❖ To provide an exhaustible coverage on all major aspects of food preservation in an easy and acceptable style.
- ❖ To nurse our body and promote good health benefits by improved food preservation techniques.

Unit I

10Hrs

Food Spoilage

Definition, factors affecting food spoilage: physical, biological, chemical. Specific spoilage organisms (SSO), Shelf life assessment, Extension of shelf life, Methods for assessment of spoilage, Spoilage indices: physical, chemical and microbiological. Spoilage occurring in different foods: meat, fish, egg, fruits, milk, bread, vegetables, frozen, canned & smoked foods

Unit II

15Hrs

Food Preservation by Heat Treatment

Principles of food preservation need for food preservation, methods of food preservation.

Pasteurization: Purpose of pasteurization, Types, equipments: Pasteurization of packaged foods (Water bath pasteurization, continuous steam or water spray pasteurization) , pasteurization of unpackaged liquids (Long hold or vat pasteurization , heat exchanger pasteurization, High temperature short time pasteurizers, ultra high temperature pasteurizers, vacreators , quality of pasteurized foods, thermal death time relationship: D value, F value and Z value, 12D concept.

Sterilization: Continuous rotary pressure sterilizer, hydro locks continuous cooker or cooler, hydrostatic pressure sterilizer, continuous pallet sterilizer, fluidized bed sterilization, hot sterilization, flash 18 process.

Canning: history, Principles of canning, steps involved in canning, types of containers used for canning: tin plate cans, TFS, two piece cans, three pieces cans, aluminium cans , composite cans, collapsible tubes, glass containers and retortable pouches.

Unit III

15Hrs

Food Preservation by Low temperature treatment

Refrigeration, Principles of refrigeration, mechanism of refrigeration, factors affecting refrigeration and refrigeration requirements. Change occurring during refrigeration. Chilling injury.

Freezing process, principles of freezing, quality of frozen foods, thermodynamics of food freezing, freezing methods: direct contact systems and Indirect contact systems. Effects of freezing on food. Cryogenic freezing, freeze drying, dehydro freezing, freezer burn, microbiology of frozen foods, storage and handling of frozen foods. Thawing and damage caused by intermittent thawing

Unit IV

15Hrs

Preservation by Removal of Moisture

Drying basics, Classification of drying. Rate of drying, drying curve, factors affecting drying, Thermal drying of foods: Air drying and Low air environment drying. Osmotic dehydration: osmotic process, factors affecting the osmotic dehydration process. Quality factors of dried foods. Food concentration, methods of concentration, changes during concentration

Potential Food Preservation Methods

Irradiation Preservation in Foods: Food irradiation process, dose and dosimetry, scope of irradiation, special advantages of irradiation, effect of food irradiation on micro organisms and food components and application of irradiation in foods of plant origin and animal origin.

Preserving food with Electricity (Ohmic heating): Definition, heat generation, effect of ohmic heating on foods and food components, applications in food industry.

Microwave heating: Principles, unit of microwave, advantages and disadvantages of microwave, applications of microwave in food industry. Application of pulsed electric field technology in foods.

Combined Methods for Food Preservation: Introduction, Principles of Combined preservation methods (Hurdle effect, hurdle technology, total quality, potential hurdles), application of hurdle technology.

Reference

- ❖ Shafiur Rahman M.,1999,Hand Book of Food Preservation, Marcel Dekker, Inc,New York
- ❖ Frazier, W.C, 2008, Food Microbiology. 4th edition. Mc Graw Hill. New York.
- ❖ Khetarpaul, N, 2009, Food microbiology, Daya publishing house, New Delhi.
- ❖ Potter, N.N. and Hotchkiss J. H, 1996, Food Science. CBS publishers and distributors.
- ❖ Srivastava, R.PO and Kumar, S, 1994, Fruit and vegetable preservation, International Book distribution Company, Lucknow.
- ❖ Cruess, W.V, 1997, Commercial fruits and vegetable products, Anees Offset press, New Delhi.
- ❖ Srilakshmi, B, 2003, Food Science. New Age International Publishers, New Delhi.
- ❖ MC.Williams, 1984, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi.
- ❖ Subalakshmi, G and Udipi, S.A, 2001, Food processing and preservation. New Age International Publishers, New Delhi.

FT2MPC 710: FOOD ANALYSIS

Credit:4

72Hrs

Objectives:

- ❖ To broaden and deepen the coverage and scope of food analysis.
- ❖ To provide an updated and high quality original contribution on new developments in food analysis and its emerging applications.

Unit I Sensory Evaluation

20Hrs

Subjective evaluation, Sensory evaluation: Definition, and applications, Sensory attributes of food: Appearance, Texture and Flavor;

Sensory perception: mechanism of taste, smell, somesthesis, kinesthesis, chemesthesis, Mechanism of color perception;

Requirements of sensory evaluation: Sensory laboratory design, Sensory booths, Sensory panels, Sample preparation and serving procedures, Score card, Sensory scaling- Line scales, Numeric scales, Hedonic scales;

Sensory measurement: Kinds of sensory tests- Difference:- Triangle, Duo-trio tests, Paired comparison test, Descriptive tests:- Texture profile, Flavor profile, Affective tests:- Preference test, Ranking, Hedonic tests.

Factors affecting sensory measurements: Psychological- Expectation error, Mutual suggestion effect, Distraction error, Stimulus error, Logical error, Attribute dumping, Halo effect and proximity error, Error of habituation, Order/Position effect, Contrast & convergence effect, Central tendency error, Motivation error; Physiological: Adaptation, Mixture interactions- Enhancement, Synergy & Suppression, Health; Environmental-Gender, Genetics, Age & Culture. Objective evaluation, Rheology- capillary viscometer, falling ball viscometer, rotational viscometer, Texture: viscometer, consistometer, penetrometer, succulometer, tenderometer, fibrometer, shortometer, texturometer.

Colour measurement- Spectroscopic Techniques, emission and absorption spectroscopy, visual colorimeters, spectrophotometers-, photoelectric colorimeters, CIE: tristimulus colorimetry, applications. Absorption spectrometry: Beer's law, identification of compounds

Unit II Composition of foods

10Hrs

Chemical Composition and Characteristics of foods: Titratable acidity, Moisture and total solids- Importance of moisture assay, Oven drying, Indirect, Physical, Chemical, azeotropic distillation, water activity. Ash analysis: Purpose, Total ash, soluble and insoluble ash, ashing procedures, minerals atomic absorption

Carbohydrate analysis: Importance, Sample preparation, Method of analysis- Calculation by difference, Chemical, Enzymatic, Physical and Modern analytical methods, Starch, Fiber

Unit III Chemical analysis

20Hrs

Crude fat analysis- solvent and nonsolvent wet extraction and instrumental methods, Fat characterization

Protein analysis- Total organic nitrogen, proteins, peptides, amino acids, other non-protein nitrogen, Protein separation and characterization- separation by differential solubility, size, adsorption and electrophoresis, Protein quality tests

Vitamin analysis- Bio and chemical assay

Mineral analysis, Analysis of Pigments, Chemical preservatives, Pesticide Residues and Filth

Heavy metals such as Hg, Cd, Pb, Cr⁶⁺, As & Se: importance and analysis, Total Volatile Base Nitrogen (TVBN): importance and analysis

Unit IV Analytical Instrumentation

12Hrs

Analytical Instrumentation: Chromatographic techniques, and Electrophoretic techniques
Densitometry: specific gravity of liquids and of solids, pycnometer, buoyancy, specific gravity balance, hydrometer
Refractometry: Refractive index, Lorenz equation, refractometers- Abbe, Pulfrich refractometers
Centrifugation- relative centrifugal force, types of centrifuges, rotor heads

Unit V Microbiological evaluation

10Hrs

Microbiological evaluation: Total viable count by TPC and pour plate, quality indices-indicator microorganisms- *E. coli*, faecal streptococci, *Staphylococcus aureus*, sulfite reducing bacteria- *Clostridium perfringens*, MPN. New concepts in indicators- bacteriophages

Reference:

- ❖ Nielsen, S.S, 2004 Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London.
- ❖ Mahindru, S.N, 2000, Food additives. Characteristics, detection and estimation. Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
- ❖ Pearson, D, 2002 The Chemical Analysis of Foods, Churchill Livingstone, New York,
- ❖ Sharma, B.K, 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi
- ❖ Jellinek, G., 1985, Sensory Evaluation of Food-Theory and Practice., Elis Horwood Ltd., England.
- ❖ Lawless H.T, 2010, Sensory Evaluation of Food, Food Science Text series, Springer science.
- ❖ Srilakshmi, B., 2005, Food Science., New Age International (P) Limited., New Delhi.
- ❖ Harry T Lawless, Hildegarde Heymann (2010) Sensory evaluation of Food: Principles and Practices, Second Edition, Springer, New York.
- ❖ Sarah Kemp, Tracey Hollywood, Joanne Hort (2011) Sensory evaluation: A Practical Hand-book, Wiley-Blackwell, New York

FT2MPP 711: Practical- Food Preservation & Packaging Technology

Credits: 2

72 hours

OBJECTIVES

To provide a balanced introduction to the principles and techniques that is important in the preservation and packaging of food

Preservation by using sugar 30 Hrs

- Preparation of ready to serve beverages
- Preparation of squash
- Preparation of jam
- Preparation of jelly
 - a) Test for pectin
 - b) Determination of Brix by Refractometric method
 - c) Determination of acidity
 - d) Estimation of sugar content
 - e) Estimation of vitamin C
- Preparation of cucumber candy
- Preparation of glazed fruits
- Preparation of crystallized fruits

Preservation by using salt and vinegar 22 Hrs

Pickling

- Preparation of mango pickle
- Preparation of lime pickle
- Preparation of garlic pickle
- Preparation of fish pickle
- Preparation of meat pickle
- Preparation of tomato ketchup and tomato puree

Preservation by removal of moisture 10 Hrs

- Dehydration of carrot
- Dehydration of cabbage
- Preparation of coconut chips

Testing of packaging materials 10 Hrs

- Bursting strength
- Puncture resistance
- Drop test
- Identification of plastics
- Thickness
- Water vapour transmission rate
- Gas transmission rate
- Tear strength
- Migration test

Reference

- Srivastava, R.P.O and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
- Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
- Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.
- Girdhari Lal, Siddappa G.S., Preservation of fruits and Vegetables.,1998

FT2MPP 712: Practical- Food Analysis I

Credits: 3

108 hours

OBJECTIVES

To provide a knowledge and training on principles and techniques for analysis of food composition.

Estimation of Carbohydrates 24 Hrs

- Estimation of Glucose by Lane and Eynon's method.
- Estimation of Sucrose by Lane and Eynon's method.
- Estimation of Aldose by Wilstatter's Iodometric titration.
- Estimation of Starch by Iodometric titration

Estimation of Protein 10 Hrs

- Micro-Kjeldhal's method

Estimation of Lipids 14 Hrs

- Determination of peroxide value
- Determination of iodine value of an oil
- Saponification value
- Estimation of free fatty acids
- Estimation of acid value

Estimation of Vitamins 8 Hrs

- Estimation of vitamin C by volumetric method
- Estimation of vitamin C by spectrophotometric method

Estimation of water hardness 4 Hrs

Estimation of crude fiber 6 Hrs

Estimation of titratable acidity in foods 4 Hrs

Estimation of moisture 10 Hrs

- Oven dry method
- Titration

Estimation of salt content by Mohr method 4 Hrs

Estimation of total ash 4 Hrs

Sensory tests 10 Hrs

Detection of adulterants 10 Hrs

REFERENCES

- Sadasivam, S. Manickam, A. Biochemical Methods, 2nd edition. New Age International (P) Limited, New Delhi. 2001
- Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston, London 2003

Model Question papers

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT2MPC 707

FOOD ENGINEERING 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
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Part A

Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. State Stefan Boltzmann's law.
2. Define Kick's law.
3. Describe reverse osmosis.
4. Describe the refrigeration cycle.
5. Distinguish between single effect and multiple effect evaporators.
6. What is filtration?
7. Differentiate between leaching and extraction.
8. Explain cryogenic freezing with neat diagram.

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Explain different types of heat transfer. What are the factors which affect the heat transfer?
10. What is freezing? Describe different phenomenon occurring during freezing of foods with the help of time-temperature curve?
11. Describe drum drying with neat diagram and examples.
12. Briefly explain extrusion technique.
13. Define Reynold's number and Prandl number and explain its significance
14. Express Bernoulli equation stating significance of each term involved.
15. What is spray drying? Describe the method with neat diagram
16. Define convection and explain how forced convection differ from natural convection

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Describe types of freezers used in food industry & various factors affecting freezing rate
18. Describe different types of heat exchangers with schematic diagram citing an example.
19. Mechanism of refrigeration.
20. Explain velocity profile of a thick fluid flowing through a pipe.
21. Derive an expression for heat transfer through composite wall consisting of four layers
22. Explain heat transfer by conduction. State Fourier's law of heat conduction describing the terms involved. Also explain why good electrical conductors are good thermal conductors?

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT2MPC 708 FOOD ADDITIVES & PACKAGING TECHNOLOGY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. What is food adulteration?
2. What do you mean by aseptic packaging?
3. Comment on the flavour enhancer responsible for chinese restaurant syndrome.
4. Define the term food additives.
5. Are food laws essential, if so why?
6. What does GRAS mean?
7. What are permitted food colours used according to PFA act?
8. What are biodegradable packaging materials?

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Write a brief note on natural and artificial food colorants.
10. Write a note on MAP and CAP?
11. What is corrosion in tin plate cans? Explain the factors responsible for corrosion?
12. Explain briefly the method for detection of adulterants in milk.
13. Give an account on any four types of food additives used in food industry.
14. Explain the mechanism of microwave heating.
15. Narrate the role of anti-oxidants in food processing.
16. What are transportation hazards? How do you minimize them?

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Describe briefly the mandatory food laws applicable to food industry in India.
18. Write short notes on
 - (a) Chelating agents
 - (b) Fat replacers
 - (c) Sodium benzoate
 - (d) Dietary supplements
19. Define food packaging and explain the functions of packaging.
20. What are dietary fibres? How are they classified? Mention their role in human metabolism.
21. Describe physical, chemical and optical property evaluation of flexible laminates.
22. Give an account on different types of corrugated fibre boards, their advantages, disadvantages and applications?

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT2MPC 709 FOOD SPOILAGE & PRESERVATION TECHNOLOGY 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. Give a brief note on fungal rot in fruits.
2. What are the defects that can occur in milk due to microbial growth?
3. Cite out the importance of FD Valve.
4. Define water activity.
5. What is the role of salt and sugar as a preservative?
6. Describe about the cold tolerant yeast.
7. Differentiate between the isotonic, hypertonic & hypotonic solutions.
8. Why do we preserve food?

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. What are the factors affecting shelf life of fruits and vegetables?
10. Explain the role of antibiotics as a preservative in meat.
11. What are the chemical changes occurring in milk due to spoilage?
12. Explain about fluidized bed freezing.
13. Write in brief about class I and class II preservatives.
14. Brief description on freeze drying.
15. Explain IQF.
16. What are the physical and chemical changes during freezing?

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Explain types of spoilage observed in canned foods.
18. Describe the principles of Hurdle technology and their applications.
19. Explain the principles and methods for canning.
20. What is irradiation? Mention the sources and mode of action of radiation in food commodities?
21. How will you assess the concentration of foods and mention the changes during assessment of food concentration?
22. What is pasteurization? Mention types of pasteurization with suitable diagrams and examples.

M. Sc Degree Examination

First semester

Faculty of Science

Branch: Food Technology and Quality Assurance/ Food Science & Technology/ Food Science & Quality Control

FT2MPC 710

FOOD ANALYSIS 2012

Time: 3 hours

Maximum weightage: 30

Instructions

1. Time allotted for the examination is 3hrs
 2. Answer any 5 out of 8 questions in Part A, 5 out of 8 in Part B, 3 out of 6 in Part C
 3. For each questions, respective grades will be awarded as follows: A- 4, B-3, C-2, D-1, E-0
-

Part A

. Short answer type questions, 1 weight each
(Answer any **5 questions** out of the following)

(1 × 5= 5)

1. What is score card? Explain its importance in sensory evaluation.
2. Explain Duma's method of protein determination.
3. Discuss principle of atomic absorption spectrometry.
4. What is refractive index? Explain its significance in food.
5. What is viscosity? How is it determined in mango pulp?
6. How do you estimate salt content in pickles?
7. Determination of moisture content in spices?
8. Explain the principle of Micro Kjeldahl's method.

Part B

Short essay type questions, 2 weights each
(Answer any **5 questions** out of the following)

(2 × 5= 10)

9. Explain total ash and types of ashing methods.
10. Describe sampling and types of sampling.
11. Physical methods of bioassay of vitamin A by Line test.
12. Describe in detail about azeotropic distillation.
13. Explain rheology with one instrument?
14. Define water activity and methods used to measure water activity?
15. Explain classification of sensory test methods?
16. Give an account of indicator organisms & their significance in food safety?

Part C

Essay type questions, 5 weights each
(Answer any **3 questions** out of the following)

(3 × 5= 15)

17. Explain the factors affecting sensory measurements.
18. Describe methods to detect coliforms in water and also mention the minimum standards required for potable water.
19. Name the different types of chromatography. Briefly outline the principles and application of ion-exchange chromatography in food analysis.
20. Discuss the principles involved in determination of sugars and starch by chemical test & polarimetry method.
21. Explain chemical methods employed for moisture analysis.
22. Describe in detail about dietary fibres, importance and its estimation?

Model Question Paper
M. Sc Degree Examination

Second semester

Faculty of Science

Branch: Food Technology and Quality Assurance

FT2MPP 711 Practical- Food Preservation & Packaging Technology 2012

Time: 3 hours

Maximum weightage: 30

1. Write the principle and procedure for determination of GTR of packaging material.
 - a) Principle- 2 weight
 - b) Procedure- 2 weight

(4 weights)

2. Prepare dehydrated carrot from 100g of fresh carrot provided. Calculate the percentage trim-loss, percentage yield and dehydration ratio and write the procedure for its preparation.
 - a) Principle- 2 weights
 - b) Method- 3 weights
 - c) Result- 3 weights

(8 weights)

3. Estimate the amount of pectin in the given sample.
 - a) Principle- 2 weights
 - b) Method- 3weights
 - c) Result- 1 weights

(6 weights)

4. Write down the procedure involved in the preparation of coconut chips.
 - a) Procedure-3 weights

(3 weights)

5. Viva

(5 weights)

6. Certified record

(4 weights)

M. Sc Degree Examination

Second semester

Faculty of Science

Branch: Food Technology and Quality Assurance

FT2MPP 712

Practical- Food Analysis II 2012

Time: 3 hours

Maximum weightage: 30

2. Write down the principle involved in the estimation of glucose by Wilstatter's Iodometric method.
 - c) Principle- 2 weights

(2 weights)

7. Determine the peroxide value of the given sample.
 - d) Principle- 2 weights
 - e) Method- 3 weights
 - f) Result- 3 weights

(8 weights)

8. Estimate the amount of sodium chloride in the given sample.
 - d) Principle- 2 weights
 - e) Method- 2 weights
 - f) Result- 1 weights

(5 weights)

9. Detect the adulterant in the given sample by appropriate tests. Write down the procedures
 - a) Procedure-3 weights
 - b) Result-3 weights

(6 weights)

10. Viva

(5 weights)

11. Certified record

(4 weights)