

**CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA**



# **DEGREE OF B. Sc. F T**

**BACHELOR OF SCIENCE IN FOOD TECHNOLOGY**

**(CHOICE BASED CREDIT AND SEMESTER SYSTEM FOR  
UNDERGRADUATE CURRICULUM)**

**UNDER THE FACULTY OF FOOD TECHNOLOGY**

## **SYLLABUS**

**(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019 – '20 ONWARDS)**

**BOARD OF STUDIES IN FOOD TECHNOLOGY (UG)**

***CHRIST COLLEGE (AUTONOMOUS), IRINJALAKUDA - 680125, KERALA, INDIA***

**JUNE, 2019**

## LIST OF MEMBERS IN BOARD OF STUDIES

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<b>UNIVERSITY NOMINEE</b>	Dr. Pushpalatha Professor & Head Banana Research station KAU, Kannara, Thrissur
<b>SUBJECT EXPERT</b>	1. Mrs. Cibiya George Head, Department of Food Technology DGM MES Mampad College Malappuram Dist.  2. Mrs. Bhavya Head, Department of BVOC Food Processing ST. Teresa's college, Ernakulam
<b>INDUSTRY REPRESENTATIVE</b>	1. Mrs. Sheila. P. Methil Food Technology consultant & Trainer, Farm to Fork centre, Changampuzha park, Edappilly, Kochi.
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## ABOUT THE COURSE

B. Sc Food Technology is a 3-year science course for the students who have a scientific bend and wish to work and research on food. The course consists of 3 years that is divided into 6 semesters to make the concepts easily understandable. The main target for food technologists is to improvise the food quality, making sure food lasts longer than usual, using fewer food items to get more quantity, creating disease-resistant food items, etc.

Food Technology deals with a blend of physical, chemical or microbiological techniques and processes for transforming raw ingredients into food and also other forms in food processing industry. Food technologists work in food industries and food processing organizations to process, preserve, package and labelling food and food items. Research teams under food technology use scientific means such as DNA technology, gene editing to edit genomes of the food items to improve its quality.

## PROGRAMME SPECIFIC OUTCOME

Bachelor of science, Food Technology	B.sc Food Technology	CCASFT
PSO1	Understand the depth of knowledge in different topics of Food Technology	
PSO2	Apply theoretical knowledge of principles and concepts of innovative ideas in practical problems of Food industry	
PSO3	Identify the area of their interest in academics and in research and development	
PSO4	Continue advanced study in various fields like cereals, dairy, alcohol, sugar, bakery and confectionery, fruits, vegetables, oil and oil seed processing, meat and fish	
PSO5	Understanding concepts such as the composition of food, develop in candidates an understanding of foods nutritional, physicochemical and microbial properties	
PSO6	Provide students an advanced insight to different techniques related to food preservation and food processing and also to teach students concept such as the importance of food quality, plant sanitation, food laws and regulations and packaging in food industry	
PSO7	Begin an employment in various fields like science, education, hotel, hospitals, food industries, laboratories, quality testing organisations, entrepreneur, research etc.	

## **B.SC FOOD TECHNOLOGY DEGREE PROGRAMME-LRP (LANGUAGE REDUCED PATTERN)**

The basic Degree programme means the entire course study and examinations for the award of degree. The duration of BSc Food Technology under graduate programme shall be of 6 semesters distributed over a period of 3 years. A sequence of 18 academic weeks with a unit of five working days constitute one semester. Course means a segment of subject matter to be covered in a semester (traditionally referred to as a paper). BSc Food Technology degree programme is a language reduced pattern has common courses of compulsory English and additional languages in 1st and 2nd semester which is taught by language teachers. Those are common English course I, common English course II, common English course III, common English 4 IV. Additional language course I and additional language course II. It may be Hindi, Arabic or Malayalam. Additional language may be chosen by students according to their wish. General course 1,2,3,4 are with a code of A which may be taught by either parent department. Complimentary courses refer to course related to core course of BSc Food Technology degree programme which has physics and chemistry and are distributed in first four semesters. Food science & Quality control is chosen as complimentary course for B.Sc Chemistry programme with a code of C and finally open course which is taught to the students of other than B. Sc. Food Technology degree programme from parent department. There are 3 open courses, of which is taught to the students of other than BSc. Food Technology degree programme from parent department. There are 3 open courses of which one course will be selected by student at his / her choice and will be studied in fifth semester with a code of D. Audit courses are mandatory for the completion of the programme but credits will not be counted. Audit courses are mandatory for the completion of the programme but credits will not be counted for the calculation of SGPA or CGPA. There shall be one audit course in each first four semesters. Audit courses material may be getting from MOOC, SWAYAM or any other online platform and students can also attain these credits from anyone of the above said online platform (which is optional). Audit course code is E. Audit courses examination will be conducted by college itself from the pool of questions which is supplied from university. The college should send the list of passed students to the university at least before commencement of fifth semester examination. List of courses I each semester with credits are given below.

<b>Sl. No.</b>	<b>Name of the course</b>	<b>Credits</b>	<b>Semester</b>
1	Environment Studies	4	1
2	Disaster Management	4	2
3	Human Rights/Intellectual property Rights/Consumer Protection	4	3
4	Gender Studies/Gerontology	4	4

Credits means a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course. Each course shall have certain credits. For passing the degree programme the student shall be required to achieve a minimum of 120 credits of which 38 credits shall be from common courses (14 credits for common English courses, 8 credits for Additional language courses and 16 credits for General Courses.) 56 credits from core, complimentary (24 credits) and 3 credits from open course. Students of BSc Food Technology should undergo a project work for a period of 15 days during 5th or 6th semester which is done as 'In plant Training'.

## Credit Distribution of B.Sc. Food Technology Programme

Sem.	Common Course		Additional Language	General		Core Course						Complementary Course		Open Course	Total		
	English											I	II				
I	3	3	4			3						2	2		17		
II	4	4	4			3						2	2		19		
III				4	4	3	-						2	2		15	
IV				4	4	4	3						2 <sup>+</sup> 4	2+4		27	
V						3	5	3								3	14
VI						3	3	4	4	3	5	2	2			28	
Total	14 Credits (350 Marks)		8 Credits (200 Marks)	16 credits (400 Marks)		55 Credits (1350 Marks)						12 Credits (400 Marks)	12 credits (400 Marks)	3 Credits (75 Marks)	120		
	38 Credits (1350 Marks)						82 Credits (2225 Marks)								<b>120</b>		
													<b>Total Marks</b>	<b>3175</b>			

**on**

Common: English	2x100 2x75	350	550
Additional: Mal/Hindi.....	2x100	200	
General	4x100	400	400
Core (including project)	10 x 75 6 x 100	750 600	1350
Open course	1x75	75	75
Complementary I & II	4X75X2 1x100x2	600 200	800
<b>Total marks</b>			<b>3175</b>

### Examinations

There shall be University Examinations at the end of semester. A student shall be permitted to appear for the semester examination, only if he or she secures not less than 75% attendance in each semester. Practical Examination shall be conducted by the University at the end of 4<sup>th</sup> & 6<sup>th</sup> semester

### Evaluation and Grading

Mark system is followed instead of direct grading for each question. After external and internal evaluations marks are entered in the answer scripts. All other calculations, including grading, will be done by the university using the software. Indirect Grading System in 10point scale is followed. Each course is evaluated by assigning marks with a letter grade (O, A+, A, B+, B, C, P, F, I & Ab) to that course by the method of indirect grading.

## Ten Point Indirect Grading System

% of Marks (Both Internal & external put together)	Grade	Interpretation	Grade Point Average	Range of Grade point	Class
95 and above	O	Outstanding	10	9.5 - 10	First Class with distinction
85 to below 95	A <sup>+</sup>	Excellent	9	8.5 - 9.49	
75 to below 85	A	Very good	8	7.5 – 8.49	
65 to below 75	B <sup>+</sup>	Good	7	6.5 – 7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 – 6.49	
45 to below 55	C	Average	5	4.5 – 5.49	Second Class
35 to below 45	P	Pass	4	3.5 – 4.49	Third class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

### Course Evaluation

The evaluation Scheme for each course shall contain two parts. They are

1) External Evaluation 2) Internal Evaluation

#### External Evaluation

External evaluation carries 80% marks. University examinations will be conducted at the end of each semester. The external question papers may be of uniform pattern with 80/60 marks the courses with 2/3 credits will have an external examination of 2hour duration of 60 marks and courses with 4/5 credits will have an external examination of 2.5 hours duration of 80 marks.

#### Theory Question Paper pattern (for 60 marks/1 to 3 Credits)

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2 Hours	Short answer	12	2	20
	Paragraph	7	5	30
	Essay	2	1x10	10
<b>Total Marks</b>				60

#### Theory Question Paper pattern (for 80 marks/4 to 5 Credits)

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2.5 Hours	Short answer	15	2	25
	Paragraph	8	5	35
	Essay	4	2x10	20
<b>Total Marks</b>				80

## Practical Examination

The external examination in practical courses shall be conducted by two examiners appointed by the University. The project evaluation can be conducted by external examiner only. Food Processing & Preservation (FTL3B06P), Food Chemistry & Analytical Instrumentation (FTL4B08P) courses practical examination will be combined, the course code stands FTL4B08P(Credits 3) and conducted at the end of second year, similarly Cereals, Pulses and Oilseeds Technology (FTL5B12P) and Technology of Fruit, Vegetables, Spices & Plantation crops (FTL6B19P) courses practical examination will be combined, the course code stands FTL6B19P (Credits 5), Technology of Animal Foods FTL6B20P (Credits 5) and Analysis of Foods FTL5B14P (Credits 2) will be conducted at the end of 6th semester including Project work / In Plant training evaluation (Credit 2).

### Practical Exam Pattern (Core & Complementary of 4-5 credits)

Rec		Work done	Spot test	Viva-voce	Total
	5	20x2	20	10	80

### Practical Exam Pattern (Core & Complementary of 1-3 credits)

Record	Procedure	Work done	Spot test	Viva-voce	Total
5	5	15x2	10	10	60

## Internal Evaluation

Internal evaluation will be of 20% in each course. The college has to send the marks obtained by the students in internal exam to the university by head of department through principal of the college. Internal assessment marks should be published in the department notice board. A grievance committee is constituted at department level to look in to the matter of any discrepancy. The internal assessment shall be based on a pre-determined transparent system involving written test, assignments, seminars and attendance in respect of theory course and on tests/records/viva-voce/attendance in respect of practical course. Internal evaluation for project shall be based on content and Method of presentation.

### Distribution of Marks for Theory (Core & Complimentary) 4 to 5 credits (Max Internal 20)

Attendance		Test Paper		Seminar/Assignment/Viva	
85% and above	4 marks	85% - 100%	8 marks	Outstanding	8 marks
75 - <85%	2 marks	65% - 85 %	6 marks	Excellent	7 marks
50 - <75%	1 mark	55% - 65 %	4 marks	Very Good	6 marks
		45% - 55%	3 marks	Good	5 marks
		35% - 45%	2 marks	Average	4 marks
		Less than 35%	1 mark	Poor	1 mark
<b>Maximum</b>	<b>4 marks</b>	<b>Maximum</b>	<b>8 marks</b>	<b>Maximum</b>	<b>8 marks</b>

**Internal Test Papers - 60marks Pattern**

Duration	Pattern	No. of Questions	Marks	Ceiling of Marks
2 hrs	Short answer	6	5x2	10
	Paragraph		2x5	10
	Essay	4	1x10	10
Total Marks				30

**Distribution of marks for Theory (Core & Complimentary) 1 to 3 Credits (Max Internal 15)**

Attendance	Test Paper	Seminar/Assignment/Viva
85% and above 3 marks	85% - 100% 6 marks	Outstanding 6 marks
75 - <85% 2 marks	65% - 85 % 5 marks	Excellent 5 marks
50 - <75% 1 mark	55% - 65 % 4 marks	Very Good 4 marks
	45% - 55% 3 marks	Good 3 marks
	35% - 45% 2 marks	Average 2 marks
	Less than 35% 1 mark	Poor 1 mark
<b>Maximum 3 marks</b>	<b>Maximum 6 marks</b>	<b>Maximum 6 marks</b>

**Internal Test Papers -80 marks pattern**

Duration	Pattern	Total number of questions	Marks for each question	Ceiling of Marks
1 Hr	Short answer	6	5x2	10
	Paragraph	4	4x5	20
	Essay	2	1x10	10
Total Marks				40

**Distribution of Marks for Practical (Core & Complimentary 4-5 credits)**

Components	Max
Attendance	5
Lab performance	5
Viva-voce	10

**Distribution of Marks for Practical (Core & Complimentary 1-3 credits)**

Components	Maximum 15 Marks
Attendance	5
Lab performance	2.5
Viva-voce	7.5

### Project work / in plant training

Students of B.Sc. Food Technology should undergo a project/ in plant training work for a period of 15 days during the sixth semester. The programme is arranged by the department of Food Technology in consultation with the food industries inside and outside Kerala. The purpose of the programme is to get hands-on experience on various aspects of food industries that form the strong foundation for the young food technologists. The department will allot students to the industry, in consultation with the industry concerned and based on merit of the students. The selected student should report for the programme on the stipulated date and attend the programme regularly without any lapse. On completion, each student should prepare a project / training report duly certified by the supervisor in the industry, a seminar should be conducted in the department. The bonafide project/ training report attested by the head of the department will be evaluated by the external examiner and a viva voce will be conducted.

### BSc Food Technology – Core Course structure, works load and credit distribution

Course Code	Instructional Hours/week		Credits	Marks				Total
	Theory	Practical		Theory		Practical		
FTL1B01 FTL1B02P	1	2	1+2 = 3	60	15	-	-	75
FTL2B03 FTL2B04P	1	2	1+2 = 3	60	15	-	-	75
A11	4	-	4	80	20	-	-	100
A12	4	-	4	80	20	-	-	100
FTL3B05 FTL3B06P	3	4	3	60	15	-	-	75
A13	4	-	4	80	20	-	-	100
A14	4	-	4	-	-	-	-	-
FTL4B07	3	-	4	80	20	-	-	100
FTL4B08P	-	4	3	-	-	60	15	75
FTL5B09	3	-	3	60	15	-	-	75
FTL5B10	5	-	4	80	20	-	-	100
FTL5B11	5	-	3	60	15	-	-	75
FTL5B12P	-	4	3	-	-	-	-	-
FTL5B13P	-	3	-	-	-	-	-	-
FTL5B14P	-	3	2	60	15	-	-	75
FTL5D01/02/03	2	-	3	60	15	-	-	75
FTL6B15E	4	-	3	60	15	-	-	75
FTL6B16	3	-	4	80	20	-	-	100
FTL6B17	4	-	4	80	20	-	-	100
FTL6B18	4	-	4	80	20	-	-	100
FTL6B19P	-	4	3+2=5	-	-	80	20	100
FTL6B20P	-	4	5	-	-	80	20	100
FTL6B21PR	-	2	2	-	-	60	15	75
			<b>78</b>	<b>920</b>	<b>230</b>	<b>520</b>	<b>130</b>	<b>1650</b>

### Semester I

Course code	Title of course	Hours per week	No. of credits	Total credits
A01	English Language I	4	3	17
A02	English Language II	5	3	
A07	Second Language	5	4	
FTL 1 B 01	Perspectives of Food Science & Technology	1+2(P)	2+1=3	
	Complementary Physics(T) I	2	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) I	2	2	
	Complementary Practical	2	-	

### Semester II

Course code	Title of course	Hours per week	No. of credits	Total credits
A03	English Language	4	4	19
A04	English Language	5	4	
A08	Second Language II	5	4	
FTL 2 B 03	Food Microbiology I	1+2(P)	1+2=3	
	Complementary Physics(T) II	2	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) I	2	2	
	Complementary Practical	2	-	

### Semester III

Course code	Title of course	Hours per week	No. of credits	Total credits
A11	Common General Course I	4	4	15
A12	Common General Course II	4	4	
FTL 3 B 05	Food Engineering	3	3	
FTL 3 B 06 (P)	Food Processing & Preservation	4	-	
-	Complementary Physics(T)III	3	2	
	Complementary Practical	2	-	
	Complementary chemistry(T) III	3	2	
	Complementary Practical	2	-	

### Semester IV

Course code	Title of course	Hours per week	No. of credits	Total credits
A13	Common General Course III	4	4	27
A14	Common General Course IV	4	4	
FTL 4 B 07	Food Chemistry & Analytical Instrumentation	3	4	
FTL 4 B 08 P	Food Chemistry & Analytical Instrumentation	4	3	
	Complementary Physics(T) IV	3	2	
	Complementary Practical	2	4	
	Complementary chemistry(T) IV	3	2	
	Complementary Practical	2	4	

### Semester V

Course code	Title of course	Hours per week	No. of credits	Total credits
FTL 5 B 09	Food Microbiology II	3	3	15
FTL 5 B 10	Cereals, Pulses and Oil seeds Technology	5	4	
FTL 5 B 11	Food Preservation & Packaging Technology	5	3	
FTL 5 B 12 P	Cereals, Pulses and Oil seeds Technology	4	-	
FTL 5 B 13 P	Food Microbiology II	3	-	
FTL 5 B 14 P	Analysis of foods	3	2*	
FTL 5 D 01 / 02 / 03	1. Technology of Spices 2. Fruits and Vegetables Processing 3. Food & Health	2	3	

**\*Exam will be conducted at 6th semester**

### Semester VI

Course code	Title of course	Hours per week	No. of credits	Total credits
FTL 6 B 15 E	Dairy Technology	4	3	27
FTL 6 B 16	Technology of Animal Food	3	4	
FTL 6 B 17	Food safety, Food laws & regulations	4	4	
FTL 6 B 18	Technology of Fruits, Vegetables, Spices & Plantation Crops	4	4	
FTL 6 B 19 P	Technology of Fruits, Vegetables, Spices & Plantation Crops	4	3+2=5	
FTL 6 B 20 P	Technology of Animal Foods	4	5	
FTL 6 B 21Pr	Project work	2	2	

## COMPLEMENTARY COURSE

Course code	Title of course	No. of credits	Total credits
FTL1C01	Principles of Nutrition	2	12
FTL2C02	Food Chemistry	2	
FTL2 C03(P)	Food Chemistry P	-	
FTL 3 C 04	Principles of Food Science	2	
FTL3 C05(P)	Principles of Food Science P	-	
FTL 4C06	Food Preservation & Quality Control	2	
FTL4C07(P)	Food Science P	4	

## SEMESTER I

### FTL1B01 – PERSPECTIVES OF FOOD SCIENCE & TECHNOLOGY

*Number of Credits: 3*

#### Objective

- To build up a strong base in Food science & Technology by providing knowledge in food composition, food quality assessment and nutritional facts of different foods. Knowledge on major research institutions, journals and industries related to the field.

#### Course Outline

##### Unit 1 – Introduction

Scope of food science and Technology. Functions of food. Nutrients, Water, Carbohydrates, Proteins, Lipids, Vitamins and Minerals. (2hours).

##### Unit 2 – Composition and nutritive value

Pulses & Legumes, Nuts & Oilseeds, Meat, Fish, Egg and Milk. Structure and composition of wheat and Rice. Classification and Composition of Fruits, Vegetables and Spices. (5hours)

##### Unit 3 – Food Quality Assessment

Sensory assessment-Appearance of food- visual perception, colour of foods, smell, flavour and taste. Threshold tests, difference tests, ranking test & hedonic scale. (3hours)

##### Unit 4 – Food Additives

Preservatives, coloring agents, flavour and flavor enhancer, Anti-oxidants, Artificial sweeteners, stabilizers, thickening agents, anticaking agents, bleaching and maturing agents, flour improvers, leavening agents, surface active agents. (3hours)

##### Unit 5 – Health Foods

Functional foods, Prebiotics, Probiotics, Nutraceuticals, organic foods, GM foods (1hour).

##### Unit 6 – Food Research & Food Technology updates

Major centres of food research in India –CFTRI, DFRL, NIFTEM, IIFPT & CIFT. Major Food Industries

in India. Journals:- Journals of Food Science & Technology, Indian Food Industry, Beverage Food World, Indian Food Packer. AFST (I)

### **References**

#### 1. Introduction

- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers.
- Potter N N, Hotchkiss JH. Food Science. CBS publishers and distributors
- Sumati R Mudambi, Rajagopal M V. Fundamentals of Food and Nutrition. New Age international publishers.

#### 2. Composition and nutritive value.

- Potter N N, Hotchkiss JH. Food Science. CBS publishers and distributors
- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers

#### 3. Food quality assessment.

- Potter N N, Hotchkiss JH. Food Science. CBS publishers and distributors
- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers

#### 4. Food additives.

- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers.
- Murano, Peter S. Understanding Food Science and Technology. Thomson

#### 5. Health foods.

- Sumati R Mudambi, Rajagopal M V. Fundamentals of Food and Nutrition. New Age International Publishers
- Shubhangini A Joshi. Nutrition and Dietics. Tata McGraw Hill Education Private limited.

#### 6. Food research and food technology updates.

- Journals: Indian Food Industry Food Packer Journal of Food Science and Technology Beverage Food World

## **FTL1B02P – PERSPECTIVES OF FOOD SCIENCE & TECHNOLOGY**

### **Course Outline**

1. Standardization of NaOH.
2. Standardization of HCl
3. Determination of Moisture using
  - a. Hot air oven
  - b) Distillation method
  - c). Infrared method
4. Determination of Acidity & pH
5. Determination of T S S
6. Qualitative test for carbohydrates – Molisch's test, Benedict's test, Iodine test, Anthrone test, Selivanoff's test.
7. Qualitative Test of Proteins
8. Practical Demonstration- Pilot / Industrial scale Food Production / Processing
9. Industrial Visit I: Food Processing Unit.

## SEMESTER II

### FTL2B03 – FOOD MICROBIOLOGY – 1

*Number of Credits: 3*

#### Objective

- Microbiology is an applied science, helping agriculture, health, and medicine and maintenance of the environment. Micro-organisms are extremely important in our everyday lives. This course focuses on the general principles of microbiology and includes the following topics: history of microbiology, microscopy and microbial cell structure.

#### Course Outline

##### Unit 1 – Evolution

History of microbiology, theory of spontaneous generation, Germ theory of disease, Koch's postulates, pure culture concept (2hours).

##### Unit 2 – Microscopy

Parts of microscope, Resolving power, Limits of resolution, Refractive index, Magnification. Light microscope – Bright field, Dark field. Electron microscope –Transmission electron microscope, Scanning electron microscope. (3hours).

##### Unit 3 – Micro-organisms

Structure, Morphology, Physical condition required for growth, growth curve. Reproduction – Binary fission, Transformation, Transduction and conjugation.

###### a) Bacteria

Nutritional requirements – phototrophs, chemotrophs, Autotrophs, Heterotrophs. (5hours).

###### b) Fungi

Morphology, Classification, Reproduction –Sexual and Asexual. (2hours)

###### c) Yeasts

Structure, Morphology, Reproduction –Budding Reproduction –Sexual and Asexual. (2hours)

###### d) Virus

Classification, Composition, Morphology, Replication of virus (2hours)

#### References

##### 1. Evolution

- Bibek Ray & Arun Bhuniya, 2007. Fundamental Food Microbiology. CRC Press

##### 2. Microscopy

- Suzanne Bell & Keith Morris, 2009. An Introduction to Microscopy. CRC Press.
- Elizabeth M. Slayter & Henry S. Slayter, 2000. Light and Electron Microscopy. Cambridge University Press.

##### 3. Bacteria, Fungi, Yeasts and Virus

- Ananthanarayanan R Jayaram Paniker C K, 2009. Text book of Microbiology. University Press Pvt

Ltd, Hyderabad

- Prescott, L.M, Harley, J.P & Klein D. A, Microbiology. MC Graw Hill, New York.
- Frazier J & Westhoff DC, 1988. Food Microbiology. MCGraw Hill, New York.
- Pelczar J M & Reid R D. Microbiology. Tota MC GrawHill.
- Stainer R. General Microbiology. Macmillan
- Banwart GJ, 1989. Basic Food Microbiology. AVIpublishers
- Jay J M, Loessner MJ & Golden D A, 2005. Modern FoodMicrobiology, Springer Verlag
- Black J G. Microbiology, Principles and Explorations JohnWiley

## **FTL2B04P – FOOD MICROBIOLOGY – 1**

### **Objective**

- To learn the names and uses of different types of microbiology equipments & glasswares.
- To develop skills in microbiological laboratory techniques.

### **Course Outline**

#### **Practical**

1. Introduction to equipments and glassware used in microbiology
2. Sterilization techniques: Dry heat and moist heat
3. Staining techniques – simple staining, gram staining, negative staining.

#### **References**

1. Harrigan. F. W, 2013. Laboratory Methods in Food Microbiology
2. James Cappuccino. Microbiology A Laboratory Manual. Pearson

## **SEMESTER III**

## **FTL3B05 – FOOD ENGINEERING**

*Number of Credits: 3*

### **Objective**

- This course is designed to teach students the fundamentals of food engineering. Students will acquire knowledge of food engineering principles in food processing such as heat and mass transfer operations, refrigeration and various unit operations. This will help to understand the concepts of equipment of refrigeration, freezing, thermal processing, drying, and other food operations.

### **Course Outline**

#### **Unit 1 – Engineering Properties of food materials**

Physical property – Size, Shape, Density, Specific gravity, Angle of repose.

Mechanical properties - Specific Heat, Thermal conductivity.

Rheological properties - Rheological characteristics of foods, viscosity, apparent viscosity- Newtonian and

Non-Newtonian. (6hours)

## **Unit 2 – Unit of Operations in Food Engineering**

Basic principle types and applications: Blanching, Evaporation, Drying, Freezing & Chilling, Extrusion, Frying. (5 hours)

## **Unit 3 – Refrigeration and Freezing**

Refrigeration Principle of refrigeration, Vapour compression refrigeration cycle. Freezing Principle of freezing & freezing rate. Types of freezers- Air blast, Contact, Immersion, Fluidized bed and Cryogenic freezers. (6hours)

## **Unit 4 – Evaporation**

Principle, single effect evaporation, multiple effect evaporation.

Types of evaporators - Horizontal tube, Vertical tube, Falling film evaporator, Raising film Evaporator. (6hours)

## **Unit 5 – Driers**

Driers Principle, constant rate & falling rate of period of drying.

Types of driers -Drum drier, Cabinet drier, Tunnel drier, Spray drier, Fluidized bed drier, Freeze drier. (6hours)

## **Unit 6 – Heat Transfer**

Mode of heat transfer– Conduction, Convection, Radiation.

## **Unit 7 – Heat Exchanger**

Classification, contact type heat exchange - Immersion, Non-contact type heat exchanger, Plate Heat exchanger, Scrape d surface Heat exchanger, Tubular Heat exchanger, Double & Triple tube Heat exchanger, Shell & Tube Heat exchanger.

Pasteurization: LTLT, HTST, UHT,

Pasteurizing equipments. (10hours)

## **Unit 8 – Boilers**

Boiler- Principle, working of water tube & fire tube boiler (5 hours)

## **References**

1. Unit operations and heat transfer

- Rao D G. Fundamentals of Food Engineering. PHI learning private limited.
- Sahay K M & Singh K K,1994. Unit operations of Agricultural processing Vikas Publishing House.

2. Heat Exchanger

- Singh R P, Heldman DR1993 Introduction to Food Engineering Academic press
- Romeo. Toledo T fundamentals Food Process Engineering CBS Publishers
- Rao D G. Fundamentals of Food Engineering. PHI learning private limited
- Charm SE, Macabe, W L smith J C & Hariot P 1993. Unit operations of Chemical Engineering. McGraw Hills.

3. Refrigeration and Freezing

- R S Khurmi & J k Gupta, A Textbook of Refrigeration & Air conditioning,
- S Chand, Rao D G. Fundamentals of Food Engineering. PHI learning private limited.

#### 4. Evaporation

- Charm SE, Macabe, W L smith J C & Hariot P 1993. Unit operations of Chemical Engineering. McGraw Hills.
- Rao D G. Fundamentals of Food Engineering. PHI learning private limited
- Sahay K M & Singh K K,19 94. Unit operations of Agricultural processing Vikas Publishing House

#### 5. Driers and Boilers

- Rao D G. Fundamentals of Food Engineering. PHI learning private limited
- Sahay K M & Singh K K,1994. Unit operations of Agricultural processing Vikas Publishing House
- R S Khurmi & J K Gupta, A Textbook of Thermal engineering, S Chand

#### 6. Rheology

- Rao D G. Fundamentals of Food Engineering. PHI learning private limited
- Sahay K M & Singh K K,1994. Unit operations of Agricultural processing Vikas Publishing House

## **FTL3B06P – FOOD PROCESSING & PRESERVATION**

### **Course Outline**

#### **Practical**

1. Blanching of Vegetables.
2. Dehydration of vegetables using cabinet drier.
3. Determination of moisture content
4. Dehydration of fruits in sugar syrup
5. Qualitative determination of benzoic acid & SO<sub>2</sub>
6. Sensory evaluation
7. **Industrial Visit II: Well established Food Processing Unit**

## **SEMESTER IV**

## **FTL4B07 – FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION**

*Number of Credits: 4*

### **Objective**

- To provide basic knowledge of structure, composition, chemical reaction & classification
- To know importance and properties of minor nutrients.
- To familiarise the principles and working of Instruments for food analysis

### **Course Outline**

#### **Unit 1 – Carbohydrates**

Classification, properties and reactions of

a) Monosaccharide's : Glucose & Fructose

b) Oligosaccharides : Maltose, lactose. Sucrose- properties- crystallization and inversion.

c) Polysaccharides : starch: components of starch, gelatinization, retrogradation, modified starch.  
Cellulose, hemicellulose, pectic substances, gums, dietary fibre (8hours)

### **Unit 2 – Proteins**

Introduction to food protein, structure of protein, classification of proteins, amino acids, physicochemical properties, denaturation, reactions, protein determination (6hours)

### **Unit 3 – Lipids**

Classification, fatty acids, saturated, unsaturated, polyunsaturated fatty acids, chemical properties, reactions, rancidity, auto-oxidation, antioxidants. (6hours)

### **Unit 4 – Water**

Introduction, physical & chemical properties of water, moisture in foods, methods of moisture determination, hydrogen bonding, Free & bound water (6hours)

### **Unit 5 – Pigments**

Properties and Occurrence: Chlorophyll, Carotenoids, Flavanoids, Anthocyanins, Anthoxanthins, Myoglobin. (6hours)

### **Unit 6 – Enzymes**

Introduction, Definition, Occurrence, Classification. Properties of Enzymes- Specificity, Factors affecting enzyme activity. Enzymes in food Industry. (6hours)

### **Unit 7 – Colloids**

Colloidal chemistry, Properties of solutions, Sols & Suspensions, Food colloids. (4hours)

### **Unit 8 – Emulsions**

Emulsion, Types, Emulsifying Agents (2hours)

### **Instrumentation (6hours)**

### **Unit 9 – Colorimetry**

Principles, Beer – Lambert's Law, Techniques and Instrumentation. Fluorimetry.

### **Unit 10 – Spectrophotometry**

Principles, Parts of Spectrophotometers. Atomic Absorption spectrophotometry (6hours)

### **Unit 11 – Chromatography**

Classification - Adsorption, Partition, Ion exchange. Paper, Column, Thin layer, Gas chromatography, High Pressure Liquid Chromatography. GCMS (8hours)

## **References**

### 1. Carbohydrates

- Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.
- Meyer, L.H 1987 Food Chemistry CBS publishers.
- Belitz, H.D 1999 Food Chemistry Springer Verlag

- Fennema, OR. 1996 Food Chemistry Marcel Dekker

## 2. Proteins

- Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.
- Meyer, L.H 1987 Food Chemistry CBS publishers.
- Belitz, H.D 1999 Food Chemistry Springer Verlag
- Fennema, OR. 1996 Food Chemistry Marcel Dekker

## 3. Lipids

- Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.
- Meyer, L.H 1987 Food Chemistry CBS publishers.
- Belitz, H.D 1999 Food Chemistry Springer Verlag
- Fennema, OR. 1996 Food Chemistry Marcel Dekker

## 4. Water

- Manay N.S, Shadaksharaswamy M., Foods: Facts and Principles New Age International Publishers
- Meyer L. H 1987 Food Chemistry CBS publishers

## 5. Pigments

- Manay N. S, Shadaksharaswamy M. Foods: Facts and Principles New Age International Publishers
- Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.

## 6. Enzymes

- Manay N.S, Shadaksharaswamy M. Foods: Facts and Principles New Age International Publishers

## 7. Colloids

- Wong, Dominic W.S Mechanism and Theory in Food Chemistry. CBS publishers

## 8. Emulsions

- Wong, Dominic W.S Mechanism and Theory in Food Chemistry. CBS publishers

## 9. Colorimetry

- Sharma B. K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.
- Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
- Pomrenz Y & Meloan C E 1996 Food Analysis Theory and Practice CBS

## 10. Spectrophotometry

- Sharma B. K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.
- Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
- Pomrenz Y & Meloan C E 1996 Food Analysis Theory and Practice CBS

## 11. Chromatography

- Sharma B. K. 2004, Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi.
- Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett

- Pomrenz Y & Meloan C E 1996 Food Analysis Theory and Practice CBS

## **FTL4B08P – FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION**

### **Course Outline**

#### **Practicals**

1. Chemical Analysis of Lipids
  - a) Determination of Iodine value
  - b) Determination of saponification value
  - c) Determination of peroxide value
  - d) Determination of Free Fatty Acid
2. Analysis of Protein Kjeldahl's methods Analysis of Water
3. Total solids, Acidity of water, Alkalinity of water, Determination of Chloride, Hardness of water.
4. Paper chromatography
5. Ash content

#### **Reference**

1. Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
2. Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.

## **SEMESTER V**

## **FTL5B09 – FOOD MICROBIOLOGY - II**

*Number of Credits: 3*

### **Objective**

- Students will acquire knowledge on techniques for the isolation epidemiology of food borne, and spoilage of microorganism, the microbiology of water, milk, fermented foods

### **Course Outline**

#### **Unit 1 - Culture Media**

Bacteriological Media – Selective, Differential, Enrichment Media. (5hours)

#### **Unit 2 - Methods of isolating Pure culture**

Serial dilution, Pour plate, streak plate, stroke Culture. (5hours)

#### **Unit 3 - Control of Microorganism**

Physical agents – high temperature, low temperature, desiccation, osmotic pressure radiation, filtration.

Chemical agents-Characteristics of an ideal antimicrobial chemical agent, Alcohols, Aldehydes, Dyes, Halogens, Phenols, Acids, Alkalis, Gases. (6hours)

#### **Unit 4 - Food spoilage**

Food spoilage: Sources of contamination, factors responsible for spoilage, factors affecting kinds and number of microorganisms in food. Chemical changes due to spoilage. (8hours)

## **Unit 5 - Effect of spoilage**

Contamination and spoilage of Fruits and Vegetables, Meat & Meat products, Milk & Cream, Cereal & Cereal products, Spoilage of canned food. (8hours)

## **Unit 6 - Microbial intoxications & Infections**

Definition, Exotoxin, Endotoxin, intoxications and infections – sources, symptoms Methods of Prevention and investigation of food borne disease outbreak. (7hours)

## **Unit 7 - Microbes in fermented foods**

Fermented vegetable products, Sauer Kraut, pickles, soy sauces, idli Fermented dairy products – Cheese, yoghurt (5hours)

## **Unit 8 - Water & Milk testing**

Microbiological testing of water & milk (4hours)

## **References**

1 & 2 Culture Media, Methods of isolating Pure culture

- Banwart G J ,1989. Basic Food Microbiology. AVI publishers
- Ananthanarayanan R Jayaram Paniker C K 2009 Text book of microbiology. University Press Pvt Ltd, Hyderabad
- Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York
- Black, JG. Microbiology. Principles and Explorations John Wiley

3. Control of Microorganism

- Banwart G J,1989. Basic Food Microbiology. AVI publishers
- Jay J M, Loessner M J & Golden D A 2005. Modern Food Microbiology. Springer Verlag
- Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York
- Pelczar J M & Reid R D. Microbiology. Tata McGraw Hill
- Stainer R. General Microbiology. MacMillan
- Black, JG. Microbiology. Principles and Explorations John Wiley

4. Food spoilage

- Banwart G J ,1989. Basic Food Microbiology. AVI publishers
- Jay J M, Loessner MJ & Golden D A 2005. Modern Food Microbiology. Springer Verlag
- Prescott L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York
- Frazier J & Westhoff D C. 1988. Food Microbiology. McGraw Hill, New York.

5. Effect of spoilage

- Banwart G J ,1989. Basic Food Microbiology. AVI publishers
- Frazier J & Westhoff D C. 1988. Food Microbiology. McGraw Hill, New York.
- Jay J M, Loessner M J & Golden D A 2005. Modern Food Microbiology. Springer Verlag

6. Microbial intoxications & Infections

- Banwart G J ,1989. Basic Food Microbiology. AVI publishers
- Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York

- Frazier J & Westhoff D C. 1988. Food Microbiology. McGraw Hill, New York.

#### 7. Microbes in fermented foods

- Banwart G J ,1989. Basic Food Microbiology. AVI publishers
- Prescott, L.M, Harley, J.P and Klein, D.A Microbiology. McGraw Hill New York
- Frazier J & Westhoff D C. 1988. Food Microbiology. McGraw Hill, New York.

#### 8. Water & Milk testing

- Frazier J & Westhoff D C. 1988. Food Microbiology. McGraw Hill, New York.
- Banwart G J ,1989. Basic Food Microbiology. AVI publishers

## FTL5B10 – CEREALS, PULSES AND OIL SEEDS TECHNOLOGY

*Number of Credits: 4*

### Objective

- To introduce science & technology associated with cereals, pulses & oil seeds.
- To exposure to various baking technologies including bread, cake, biscuit and confectionaries.
- To provide a good knowledge on processing technologies related to rice, wheat, millets, pulses, nuts and oilseeds.

### Course Outline

#### Unit 1 - Technology of Wheat and Rice

**Wheat :** Milling of wheat, byproducts – Whole wheat flour, Maida, semolina, Gluten.

**Rice :** Milling of rice, byproducts of rice milling – Husk, Bran, Broken rice Parboiling- Merits and demerits, Curing, Aging of rice, Rice products – Flaked rice, Puffed rice. (15hours)

#### Technology of Oats and Barley

#### Unit 2 – Bakery & Confectionary

**Baking :** Principles of baking, classification of baked foods. (4hours)

**Bread :** Bread making –Role of ingredients, Bread faults & remedies, staling of bread. (10hours)

**Cake :** Cake making, Role of ingredients, Types of making, cake faults and remedies. (9hours)

**Biscuit :** Biscuits & Cookies, Crackers and Wafers, technology of Biscuits, faults & Remedies (8hours)

**Confectionary:** Raw materials, Hard candy, Toffee, Caramel.

#### Unit 2 – Millets

Pearl millet, Finger millet (5hours)

#### Unit 4 – Pulses

Processing- Soaking, Germination, Decortication, Cooking and Fermentation. Changes during germination, Antinutritional factors, Factors affecting cooking time. (5hours)

#### Unit 5 - Nuts & Oil seeds

Sources, Composition, Processing of oil seeds – Soya bean, coconut. Hydrogenation. Refining of fats & oils, bleaching, de-odourising, hydroxylation, shortening, margarine. Protein isolates, Texturised vegetable protein (8hours)

## ***References***

### **1. Technology of Wheat and Rice**

- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
- Srilakshmi B. Food Science. New Age International Publishers
- Sahay K M &. Singh K K, 1994. Unit operations of Agricultural processing Vikas Publishing House
- F.J.B. Reifschneider, S. Hussain, in Encyclopedia of Grain Science, 2004
- Dendy DA V & Dobraszczyk B J Cereals and cereal products, Aspen
- Kent NL 1983 Technology of cereals Pergamon press
- J.R.N. Taylor, in Encyclopedia of Grain Science, 2004
- Vijayakhader. Text book of Food Science and Technology. ICAR

### **2. Bakery and confectionary**

- Wel, Y. H, Bakery products, Science and Technology, Black Hui Matl publishing, 2006
- z S.A; Bakery Technology and Engineering; 3 edn, CBS Publishers and distributors
- Faridi H, The science of cookie and cracker production; CBS Publishers and distributors
- E J Pyler. Bakery science Technology. Vol I, II. Sosland Publications.
- Manley D. 2000. Technology of Biscuits, Crackers and Cookies. CRC press.
- Faridi H. Science of Cookie & Cracker Production

### **3. Millets**

- J.R.N. Taylor, in Encyclopedia of Grain Science, 2004
- Leder, Sorghum and millets, Cultivated Plants, Primarily as Food Sources ,2004
- F.J.B. Reifschneider, S. Hussain, in Encyclopedia of Grain Science, 2004
- Dendy D A V & Dobraszczyk BJ Cereals and cereal products, Aspen
- Kent NL 1983 Technology of cereals Pergamon press
- M.I. Gomez, S.C. Gupta, in Encyclopedia of Food Sciences and Nutrition (Second Edition), 2003

### **4. Pulses**

- Srivastava RP & Kumar S .2003 Fruit and Vegetable preservation Principles and Practices. International Book Distributors
- Chakraverthy, A. (1995). Post-harvest technology of cereals, pulses and oilseeds. Oxford & IBH publishing Pvt. Ltd
- Pandey, P. H. (1998). Principles and Practices of Post-Harvest Technology. Kalyani publishing Pvt. Ltd
- Sahay KM &. Singh KK, 1994. Unit operations of Agricultural processing, Vikas Publishing House
- Chavan, U. D. (2012). Post-Harvest Management and Processing Technology: cereals, pulses, oilseeds, fruits and vegetables. Daya Publishing house
- Srilakshmi B. Food Science. New Age International Publishers
- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
- Vijayakhader. Text book of Food Science and Technology. ICAR

## 5. Nuts & Oil Seeds

- S. Manany, N S. Swamy Food Facts and Principles. New Age International Publishers
- Srilakshmi B. Food Science. New Age International Publishers
- Sahay K M &. Singh K K, 1994. Unit operations of Agricultural processing Vikas Publishing House
- Vijayakhader. Text book of Food Science and Technology. ICAR
- Srivastava, P. K. and Kachru, R. P. (1995). Compendium of technologies for oil seed processing and utilization. Central Institute of Agricultural Engineering, Bhopal.
- Chakraverthy, A. (1995). Post-harvest technology of cereals, pulses and oilseeds. Oxford & IBH publishing Pvt. Ltd
- Pandey, P. H. (1998). Principles and Practices of Post-Harvest Technology. Kalyani publishing Pvt. Ltd
- Chavan, U. D. (2012). Post-Harvest Management and Processing Technology: cereals, pulses, oilseeds, fruits and vegetables. Daya Publishing house

## **FTL5B11 – FOOD PRESERVATION & PACKAGING TECHNOLOGY**

*Number of Credits: 3*

### **Objective**

Food preservation prevents undesirable changes in the wholesomeness, nutritive value or sensory quality of food and reduces chemical, physical and physiological changes of an objectionable nature and eliminates contamination. The goal of food preservation is to increase the shelf life of a food while keeping it safe. It ultimately ensures its supply during times of scarcity and natural drought. By means of both enormous reduction in spoilage of perishable foods by preservation and newly developed products it is possible to build up country's economy by making more food available to the people at affordable prices.

### **Course Outline**

#### **Unit 1 – Thermal Processing**

Principles and application–Blanching, Pasteurization, Sterilization, Ultra high temperature sterilization, Canning, Aseptic processing. (5hours)

#### **Unit 2 – Drying**

**Significance:** Natural drying- Sun and Solar drying, Artificial drying- Hot air drying, drying pre-treatments – sulphuring & Sulphiting, Dehydrofreezing, Freeze drying. (8hours)

#### **Unit 3 – Low Temperature Processing**

**Refrigeration:** Low temperature preservation of Fresh Fruits, Vegetables, Meat & Fish products. Chilling injury. (5hours)

**Freezing:** Principle, Freezing rate, Quick freezing, Slow freezing, Quality of frozen foods- Retrogradation, Protein denaturation, Freezer burn. (3hours)

#### **Unit 4 – Irradiation**

Source of ionization irradiation, Dose and Dosimetry, Mode of action, Scope of irradiation. (3hours)

## **Unit 5 – Fermentation**

Principles, Significance, Types of fermentation - Acetic, Lactic and Alcoholic. (3hours)

## **Unit 6 – Chemical Preservation**

Natural preservatives-Mode of action. Chemical Preservatives - Sulphur dioxide, Benzoic acid, Sorbic acid, Propionic acid, Acetic acid. (4hours)

## **Unit 7 – Recent Trends**

Food preservation applications – Pulsed electric fields, High pressure technology, Ohmic heating, Microwave heating, Ultrasonics, Nanotechnology, Hurdle technology.

## **Unit 8 – New Product Development**

Food needs, consumer preference and Market survey, Steps in new product development. (3hours)

## **Unit 9 – Introduction to Food Packaging**

Definition, functions & Properties. Classification of packaging – Primary, Secondary, Tertiary Packaging. Flexible, Rigid & semi rigid packaging materials. (4hours)

## **Unit 10 – Types of Packages & Technologies**

Metal, Glass, Paper, Plastic, Retortable Pouches, CAP, MAP, Smart, active, Aseptic, Biodegradable, Edible packages. Packaging symbols, Nutritional labelling. (10hours)

## **References**

### 1. Thermal Processing

- Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- Murano, Peter S. Understanding Food Science and Technology. Thomson
- Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.
- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

### 2. Drying

- Khader, Vijaya Textbook on Food Storage and Preservation Kalyani Publishers
- Fennema Owen R. Principles of food Science. Marcel Dekkar, Inc
- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

### 3. Low temperature processing

- Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.
- Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York
- Fellow, P.J, Food processing technology: Principles and Practice.3rd edition
- Pruthi JS Quick Freezing Preservation of Foods Allied publishers Limited
- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

### 4. Irradiation

- Potter, N. N, Hotchkiss, J. H. Food Science. CBS Publishers, New Delhi. 2000.

- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

#### 5. Fermentation

- Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.

#### 6. Chemical Preservation

- Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
- Desrosier NW James N,1977 Technology of Food Preservation CBS Publishers
- Arti Sanhla Food Preservation. Principles and practices
- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

#### 7. Recent Trends

- Chauhan, P., Non thermal Processing of Foods. 1st Edition
- Shafiur Rahman M., 1999, Hand book of food preservation. Marcel Dekker, Inc, New York.
- Subalakshmi, G and Udipi, S.A. Food Processing and preservation. New Age International Publishers, New Delhi, 2001.
- McWilliams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984.
- Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.

#### 8. New product development

- Fadi Aramouni, Ph.D. Kathryn Deschenes, M. S methods For Developing New Food Products an Instructional Guide
- Food product innovation A Background Paper by Ray Winger Gavin Wall Food And Agriculture Organization Of The United Nations Rome, 2006

## **FTL5B12P – CEREALS, PULSES & OIL SEEDS TECHNOLOGY**

### **Course Outline**

#### **Practical**

1. Determination of Moisture
2. Determination of Ash
3. Sedimentation value
4. Determination alcoholic acidity
5. Estimation of Gluten
6. Determination of Water absorption power
7. Qualitative analysis of gluten – Belshanke value
8. Determination of falling number
9. **Preparation of Bread**

10. Preparation of Biscuit
11. Preparation of Cake
12. Determination of Physical parameters of wheat and rice
13. Industrial Visit I II: Food research institute/industry.

## **FTL5B13P – FOOD MICROBIOLOGY II**

### **Objective**

- To study the methods of isolation and culturing of microorganisms
- To analyse different types of specimens microbiologically:  
Incoming raw material such as meat Water -treated & raw water for coliforms Microbial flora in foods such as milk

### **Course Outline**

#### **Practical**

1. Isolation of pure culture: Pourplate, Streak plate
2. Microbial analysis of meats – Total plate count – Staphylococcus
3. Microbial analysis of Milk- Total plate count, Spices-Yeast and Mold, TPC
4. Microbial analysis of water – Coliforms

## **FTL5B14P – ANALYSIS OF FOODS**

*Number of Credits: 2*

### **Course Outline**

#### **Practical**

1. Determination of reducing sugar, total reducing sugar in honey/jaggery/sugar (Lane & Eynone Method).
2. Determination of Fructose: glucose ratio in honey (Iodometry).
3. Determination of Gum Base Content in Bubble gum/ chewing gum/ Cocoa butter (soxhlet extraction method)
4. Detection and identification of synthetic food colours (Paper chromatographic method/ TLC)
5. Determination of Fat content in cocoa butter
6. Determination of acidity of extracted fat in cashew nuts / biscuits (Soxhlet extraction method)
7. Estimation of crude fibre in fruits
8. Estimation of starch content in vegetables
9. Estimation of Protein (Colorimetric method) content in food.
10. Estimation of invert sugar in Jaggery/Honey
11. Test for chicory in coffee
12. Determination of Peroxidase enzyme
13. Rehydration ratio of dried foods

## ***Reference***

1. Ranganna S 2001. Hand book of analysis and quality control of fruits and vegetable products Tata McGraw Hill.
2. Nielson S 1994 Introduction to Chemical Analysis of Foods Jones & Bartlett
3. Pomrenz Y & Meloan C E 1996 Food Analysis Theory and Practice CBS
4. Food Safety Standard authority of India site manual

## **SEMESTER VI**

### **FTL6B15 – DAIRY TECHNOLOGY**

*Number of Credits: 3*

#### **Objective**

- Knowledge and experience to manufacture safety and high-quality

#### **Course Outline**

##### **Unit 1 – Composition**

Composition of milk from various sources, factors affecting composition of milk. (6hours)

##### **Unit 2 – Properties**

Physical and Chemical properties- Flavour, Colour, acidity, viscosity, Specific gravity, Freezing point, Boiling point, Effect of- heat, enzymes, acids and alkali. (7hours)

##### **Unit 3 - Types of Milk**

Toned, Double toned milk, Standardized milk, Homogenized milk, and Recombined milk. (6hours)

##### **Unit 4 - Processing Milk**

Processing, distribution and storage of liquid milk. (4hours)

##### **Unit 5 - Dairy Products**

###### **a) Cream and Butter**

Composition, Processing and Technology. Theories and factors affecting Churning (4hours)

###### **b) Ice cream**

Technology of Icecream: Ingredients, formulations, Freezing, Hardening, Storage, Distribution and defects. Frozen dessert. (5hours)

###### **c) Cheese**

Introduction, Classification of cheese. Processing of cheese: Cottage and Cheddar. (4hours)

###### **d) Fermented milk Products**

Curd, yoghurt, Acidophilus milk, Kefir, koumiss, Probiotic (3hours)

###### **e) Milk powder**

Whole and skim milk powders, Instant milk powder. (5hours)

##### **Unit 6 - Technology of Dairy by-products**

Whey protein products. (1hour)

## Unit 7 - Dairy plant sanitation

Objectives, CIP, Sanitizers. (3hours)

### **Reference**

#### 1&2. Composition, Properties

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.
- Eckles, Clarence, Henry Milk and Milk Products, Tata MC Graw Hill publishers

#### 3.Types of Milk

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.
- Eckles, Clarence, Henry Milk and Milk Products, Tata MC Graw Hill publishers
- Ananthakrishnan C P, Khan A Q, Padmanabhan P N. Technology of Milk Processing. Srilakshmi Publishers.

#### 4. Processing of Milk

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 5. Dairy Products Cream and Butter

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 6. Ice cream

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 7. Cheese

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 8. Fermented milk productions

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 9. Milk powder

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

#### 10. Technology of Dairy by-products, Dairy plant sanitation

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.

## **FTL6B16 – TECHNOLOGY OF ANIMAL FOODS**

*Number of Credits: 4*

### **Objective**

- The course provides a good knowledge on the basic principles involving in animal food industry which includes selection of raw materials, slaughtering techniques, preservation technologies, by product utilization of meat, poultry and fish.

### **Course Outline**

#### **Unit 1 - Slaughter and Inspection of Meat**

Humane method, Inspection of meat- Ante mortem and post-mortem inspection. Slaughter of sheep, pigs, poultry. Post mortem changes, ageing. Structure of meat, Factors affecting tenderness of meat, Effect of

cooking on texture, colour and flavour. (10hours)

## **Unit 2 – Cured Meat**

Role of ingredients, Methods of curing, Processing of Ham, Bacon. Sausage - classification, emulsion, ground sausage, processing, casings, Factors affecting quality of cured meat (10hours)

## **Unit 3 – Preservation**

Refrigeration, freezing, thermal processing, dehydration, irradiation, chemical, antibiotics. (8hours)

## **Unit 4 – By-products**

Rendering, Feeds, Hides, Skins, Hoofs, Horns. (6hours)

## **Unit 5 – Egg**

Grading, Changes during storage. Egg quality- Factors affecting egg quality, Measures of egg quality, Effect of cooking, Factors affecting coagulation, Industrial use of egg. Preservation of egg Refrigeration, Freezing, Thermal processing, Dehydration, Coating. (14hours)

## **Unit 6 - Fish & Fish Products**

Introduction, Spoilage indices Preservation Cold storage, freezing, smoking, pickling, canning of fish, Drying Fish products Fish protein concentrate, Fish oils- Body oil, Liver oil, Fish meal, Fish Ensilage, Chitosan, pearl Essence, Glue, Gelatin. (16hours)

## **References**

### 1. Slaughter and Inspection of Meat

- Gracey J F Collins DS Meat Hygiene ELBS,
- Mountney T. Carmen G Prakhurst R Poultry Products Technology, CBS Publishers,
- Shakuntala Maney Food Facts and principles,
- B. Sreelakshmi, Food Science
- G. Subbulaksmi, Food processing and preservation

### 2. Cured Meat

- GraceyJF Collins DS Meat Hygiene ELBS,
- Person AM Gillet T A Processed Meats. CBS publishers,
- Lawrie R A Lawries Meat Science Tata Mc Graw Hill

### 3. Preservation

- Gracey JF Collins DS Meat Hygiene ELBS
- Lawrie R A Lawries Meat ScienceTata McGrawHhill
- G. Subbulaksmi, Food processing and preservation

### 4. By products

- Ockerman H W, Hancen C L Animal Byproduct Processing Elis Horwood

### 5. Egg

- Gopakumar K Tropical Fishery Products Oxford
- Jhingran VG Fish & Fisheries of India Hindustan Publishing Company
- Biswas K P, A Text Book of Fish and Fisheries Technology Tata McGraw Hill

## 6. Fish & Fish Products

- Stadelman, William J. Egg Science and Technology. CBS.
- Parkhurst, Carmen R. Poultry Meat and Egg Production. CBS

# FTL6B17 – FOOD SAFETY, FOOD LAWS & REGULATIONS

*Number of Credits: 4*

## Objective

- The major objective of this course is to teach the students to understand the concept of food safety and quality management. Students can understand the fundamentals of food sampling, food adulteration and packaging technology. Students can also understand the overall requirements for the food plant sanitation. Students can learn about the current food laws and regulations.

## Course Outline

### Unit 1 - Food Safety & Hygiene

Importance of Food Safety, Food Hygiene, Highrisk food, Low risk food, Danger Zone, Personal hygiene. (7hours)

### Unit 2- Food Safety and Quality Management

GHP, GMP, SOP, HACCP (Food contaminants-Physical, Chemical, Biological and Allergens), ISO 22000, ISO 9001, Codex Alimentarius Commission (Codex), FAO (16hours)

### Unit 3 - Traceability & Recalling

Objectives and Applications (3 hours)

### Unit 4 - Food Plant Sanitation

Structural requirements, SSOP, CIP, Chlorination, Detergents, Disinfectants and Sanitizers, (8hours)

### Unit 5- Food Laws & Regulations

Food Safety and Standards Act, FDA, Evolution in Food laws and regulations- PFA, FPO, AGMARK, BIS, (10hours)

### Unit 6 - Food Adulteration

Common Food adulterants and their tests: Milk, Vegetable oil, Spices, Tea, Pulses, Sugar, Honey (10hours)

### Unit 7 - Food Sampling

Objectives, Sample collection, Sampling tools, Sampling procedure, Analysis. (10hours)

## References

### 1. Food safety and hygiene

- Sunetra Rodey “Food hygiene and sanitation with case studies”
- Richard A sprenger “Hygiene for Management” High field

### 2. Food safety and Quality Management

- Puja Dudeja; Amarjeet Singh; “Food safety implementation from farm to fork”

### 3. Traceability & Recalling

- Guideline for food recall-FSSAI

### 4. Food plant sanitation

- Sunetra Rodey. “Food hygiene and sanitation with case studies”

### 5. Food laws & Regulations

- Sukhneet Suri, Anita Malhotra; “Food science Nutrition and safety”. FSSAI Manual [www.fssai.gov.in](http://www.fssai.gov.in)

### 6. Food Adulteration

- B Sreelekshmi; “Food science”

### 7. Food Sampling

- FSSAI manual on general guidelines on sampling

### 8. Packaging Technology

- Mathlouthi, M Food Packaging and Preservation. Aspen
- Larousse, Jean Food Canning Technology Wiley - VCH
- Mahadeviah M & Gowramma RV 1996 Food Packaging Materials. Tata McGraw Hill
- Painy FA.1992 A Hand Book of Food Packaging. Blackie Academic
- Stanley S & Roger CG 1970 Food Packaging AVI Publications
- Gupta, Ajay K R Handbook on Modern Packaging Industries Asia Pacific Business Press Inc
- Srinivasa Gopal TK Sea Food Packaging CIFT. Cochin
- Robertson, Gordon L. Food Packaging Marcel Dekker Inc.
- Hand book of Packaging Technology. Engineering India Research Institute.

## **FTL6B18 – TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION CROPS**

*Number of Credits: 4*

### **Objective**

- The major objective of this course is to teach the students to understand the concept of food safety and quality management. Students can understand the fundamentals of food sampling, food adulteration and packaging technology. Students can also understand the overall requirements for the food plant sanitation. Students can learn about the current food laws and regulations.

### **Course Outline**

#### **Unit 1 - Post harvest management**

Maturity indices, Ripening, Changes during ripening-Climacteric & Non-Climacteric, storage-Controlled Atmospheric & Modified Atmospheric Storage (6hours)

#### **Unit 2 - Pectin, Jam, Jelly and Marmalade**

Pectin Definition of pectin, classification, Pectic enzymes, Properties, jelly grade of pectin, Testing of pectin. Jam, Jelly and Marmalade Definition, jam making, jelly making, Defects. (6hours)

### **Unit 3 - Fruits juices & Fruit preparations**

Fruit Juices Ready to serve beverages, Squashes Cordials, Nectars, Concentrates Fruit juice powder- Freeze drying, Foam mat drying.

Fruit preparations Preserves, Candies Crystallized fruits & Gelled fruits.

Pickle and chutneys - Action of preservatives Pickling process, defects. (10hours)

### **Unit 4 - Tomato products**

Tomato juice, puree, paste & Ketchup specification of the above products. (6hours)

### **Unit 5 – Canning**

Classification of canning of fruits- Pineapple, Oranges, Canning of vegetables - Peas, Carrots, syrups & brines for canning (6hours)

### **Unit 6 - Drying & Dehydration**

Enzyme Inactivation, Sulphuring Sun drying - grapes and dates. Dehydration of vegetables and Fruits. (4 hours)

### **Unit 7 – Browning**

Enzyme activity, enzymatic browning Non-enzymatic browning, its prevention. (4 hours)

### **Unit 8 – Spices**

Definition, classification, chemical composition, uses of spices. (4hours)

### **Unit 8 – Major Spices**

Refining and processing of pepper. Pepper products – white pepper, dehydrated green pepper.

Processing of Turmeric, Ginger, Chillies and Cardamom. Spice oils & oleoresins. (8hours)

### **Unit 9 - Tea, coffee & Cocoa**

Chemical composition, processing & grading (10hours)

## **FTL6B19P – TECHNOLOGY OF FRUITS, VEGETABLES, SPICES & PLANTATION CROPS**

*Number of Credits: 5*

### **Course Outline**

#### **Practical**

1. Determination of Sulphur dioxide
2. Estimation of Vitamin C
3. Estimation of tannin – colorimetric method
4. Estimation of alcohol content
5. Determination of salt content in pickles
6. Determination of reducing sugar
7. Lye peeling
8. Adequacy of blanching
9. Preparation of ketchup
10. Preparation of Jam & Jelly
11. Preparation of squash

## **References**

1. Pandey P.H Principles of post-harvest technology, Kalyani Publications.
2. Cruess W. V 1997, Commercial fruit and vegetables products. Anees Offset Press, New Delhi.
3. Lal G, Siddappa S and Tandon G L. Preservation of fruit and vegetables. ICAR.
4. Thompson A K 1995, Post harvest Technology of Fruits and Vegetables. Black well Sci.
5. Verma L R & Joshi V.K., 2000 Post Harvest Technology of Fruits & Vegetables. Indus Publications.
6. Potter N. N, Hotchkiss J H, Food Science. CBS Publishers.
7. Manany S, N. S. Swamy Food Facts and Principles. New Age International Publishers
8. Srivastava R P & Kumar S 2003, Fruit and Vegetable preservation Principles and Practices. Interntional Book Distributor

## **FTL6B20P – TECHNOLOGY OF ANIMAL FOODS**

*Number of Credits: 5*

### **Objective**

- To perform various platform tests for milk
- To identify the difference between milk packets
- To prepare khoa or peda by using milk

### **Course Outline**

1. Acidity of Milk & curd
2. Fat content in Milk
3. Determination of total solids, SNF and specific gravity of milk
4. Determination of Total ash in milk
5. Acidity of butter
6. Moisture content of butter
7. Salt content in butter
8. Adulteration in milk
9. Preparation of Khoa, Peda
10. Moisture content in Ghee
11. FFA of Ghee
12. Internal & External quality of egg
13. Proximate composition of Meat & Fish

## **OPEN COURSE**

## **FTL5D01 – TECHNOLOGY OF SPICES**

*Number of Credits: 3*

### **Objective**

- To understand the basic knowledge about Major spices and its products.

- To know the Chemical composition of spices and manufacturing technology of Spice oil and oleoresins.
- To get the knowledge about processing technology of major Spices.

## Course Outline

### Unit 1 - Spices, Spice oils & Oleoresin

Definition, Classification, Chemical composition, Use of Spices. Spice oil and Oleoresins - Definition, Technology of Manufacturing (10 hours)

### Unit 2 - Major Spices:

#### a) Pepper

Refining and processing of pepper.

Pepper products: White pepper, dehydrated green pepper, Pepper oil, Oleoresin. (10 hours)

#### b) Chillies

Drying of chillies, quality attributes of chillies and paprika (7hours)

#### c) Cardamom

Composition, Drying of fruits, Bleaching, Grading, Cardamom products, Essential oil and oleoresins (7hours)

#### d) Ginger

Curing, Bleaching, Grading Ginger Products, Ginger oils, Ginger oleoresin, Dehydrated Ginger, Bleached Ginger (7hours)

#### e) Turmeric

Curing, Grading, Turmeric powder, Essential oil, Oleoresin (7hours)

## References

### 1. Spices, Spice oils & Oleoresin

- Major Spices of India J S Pruthi
- Quality assurance in spices and spice products J S Pruthi
- Handbook on Spices and Condiments (Cultivation, Processing and Extraction), H. Panda

### 2. Major Spices: Pepper, Chillies, Cardamom, Ginger, Turmeric

- Major Spices of India J S Pruthi
- Quality assurance in spices and spice products J S Pruthi
- Handbook on Spices and Condiments (Cultivation, Processing and Extraction), H. Panda

## FTL5D02 – FRUITS AND VEGETABLES PROCESSING

*Number of Credits: 3*

## Objective

- To introduce science and technology associated with fruit and vegetable processing.
- To know about the principles in processing of fruit and vegetable.
- To understand the quality specification of different fruit and vegetable products.

## Course Outline

### Unit 1 - Fruits and Vegetables

Definition, Composition, Classification, Nutritive value, changes during ripening. Flavors of Fruits and Vegetables. Vegetable cookery, changes during cooking Browning and its prevention (15hours)

### Unit 2 - Preservation of Fruits and Vegetables

Heat, Salt, Sugar, Freezing, Food additives (9 hours)

### Unit 3 - Fruit and Vegetable Products

Fruit Juice, Squashes, Cordials, Nectar, Concentrates, Fruit juice Powder, Jam, Jelly. Different types of Pickles and Chutneys.

Product Specification (15hours)

### Unit 4 - Tomato Products

Tomato juice, Puree, Paste, Ketchup (9hours)

## References

### 1. Fruit & Vegetable

- Food science: Norman N. Potter, Joseph. H. Hotchkis, Manany S, N. S. Swamy; Food facts and principles New age International publishers.
- Enzymatic browning and its prevention; Chang.Y. Lee, John. R. Whitaker.

### 2. Preservation of fruit and vegetable

- Preservation of fruit and vegetable: Gridharilal, G.S. Siddappa and G. L. Tandon
- Fruit and vegetable preservation and practices; Kumar Sanjeev and R. P Srivastava.

### 3. Fruit and vegetable products

- Commercial fruit and vegetable products; W.V. Cruess
- Fruit and vegetable processing; Suman Bhatti

### 4. Tomato products

- The complete book on tomato and tomato products manufacturing; NCPS board of consultants and engineers.
- Fruit & Vegetable preservation and practices; Kumar Sanjeev and R. P Srivastava.
- Preservation of fruit and vegetable: Gridharilal, G.S. Siddappa and G. L. Tandon

## FTL5D03 – FOOD AND HEALTH

*Number of Credits: 3*

## Objective

- To understand the basic concept of food which includes classification, Nutritional composition, Different sources, recommended dietary allowance and various methods of nutrient measurement on body requirement.
- To provide knowledge about food additives, Food adulteration, and Food Poisoning.

## Course Outline

### Unit 1 - Introduction to Food

Definition, Types and classification of Food- junk food, functional food, Nutritional composition of Food- Carbohydrate, Protein, Fat, Water, Mineral, Vitamins, Food Groups.

Sources of Food - carbohydrate, protein, fat.

Recommended daily allowance of nutrients.

Types of work and energy requirements.

Body Mass Index (12hours)

### Unit 2 - Life style and Food related diseases

Obesity, Diabetics, cardio vascular Disease, constipation, Intolerance-Lactose & Gluten, Chinese syndrome (12hours)

### Unit 3 - Food Additives

Definition, importance in food preparation, functions of food additives - anti -oxidants, preservatives, coloring agent, flavours, and emulsifiers. (8hours)

### Unit 4 - Food Adulteration

Definition, common adulterants found in food. (8hours)

### Unit 5 - Food allergens and food poison

Definition, common adulterants found in food.

Common food allergens. Food poisoning, symptoms and control, Botulism, Staphylococcus, E.coli and salmonella (8hours)

## References

#### 1. Introduction to Food

- Fundamentals of Food & Nutrition S R Mumbai & M V Rajagopal
- Handbook of Food & Nutrition M Swaminathan
- Nutrition Science Srilakshmi B

#### 2. Life style and Food related diseases

- Natural Dietics, A Handbook on Food, Nutrition & Health Jussawalla, J M
- Fundamentals of Food, nutrition & Diet Therapy Sumati R Mumbai, Rajagopal, M. V
- Educational Planning group. Food & Nutrition, New Delhi

#### 3. Food Additives

- Food Additives Handbook Lewis, Richard J
- Hygiene & public health Yashpal bedi
- You & your Health V. N. Bhawe

#### 4. Food Adulteration

- Hygiene & public health Yashpal bedi
- You & your Health V. N. Bhawe

## 5. Food allergens and food poison

- Hygiene & public health Yashpal bedi
- You & your Health V. N. Bhave

# A014 – NUTRITION AND HEALTH

*Number of Credits: 4*

## **Objective**

Nutrition and Health study deals with the importance of food and nutrients supplementation in human diet. It has an application in healthcare in daily life and for meal planning. In these decades the aware about dietary requirements and nutritive value of different food is leads to prevent malnutrition among people. The goal of this education is to reinforce specific nutrition related practices or behaviors to change habits that contribute to poor health; this is done by creating a motivation for change among the students, to establish behavior for promotion and protection of good health.

## **Course Outline**

### **Unit 1 – Concept of Health**

Definition of physical health, mental health, social health, spiritual health-determinants of health, indication of health (4hours)

### **Unit 2 – Concept of Nutrition**

Definition of terms: Nutrition, under nutrition, Malnutrition, Health & Nutritional status – adequate, optimum & good nutrition. Relation of good nutrition to normal physical development & sound health (6hours)

### **Unit 3 – Energy**

Definition of Caloric & Joule. Measurement of calorific values of food, basal metabolism, specific dynamic action of foods, energy needs of body, measurement of energy balance of body (6hours)

### **Unit 4 – Food Guide**

Nutrients supplied by foods. Basic food groups (4hours)

### **Unit 5 – Carbohydrates**

Sources, Classification, digestion, absorption, transportation & utilization, functions, sources, requirements and effect of deficiency. Dietary Fibre- Definition, classification, sources, role of fibre in human nutrition (8hours)

### **Unit 6 – Proteins**

Classification, digestion absorption, transportation & utilization, functions, sources & requirements. Essential aminoacids, evaluation of protein quality, supplementation and deficiency. (8hours)

### **Unit 7 – Lipids**

Classification, saturated and unsaturated fatty acids, digestion, absorption, transportation & utilization, functions, sources & requirements and effect of deficiency (10hours)

### **Unit 8 – Minerals**

Functions, sources, absorption and factors affecting the utilization of Calcium, Phosphorus, Iron, Iodine, Copper and Fluoride, effects of deficiency (6hours)

### **Unit 9 – Vitamins**

Classification, functions, sources, factors affecting destruction, factors enhancing vitamins in foods, absorption, requirements & deficiency conditions – Vit A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid (8hours)

### **Unit 10 – Water**

Importance, distribution in body, function sources, requirements, water balance (6hours)

### ***References***

1. Concept of Health
  - Nutrition- concepts and controversies- Eleanor Whitney – Eighth Edition (2000)
  - Fundamentals of Food & Nutrition S R Mudambi & M V Rajagopal
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan, Bappco, Bangalore.
2. Concept of Nutrition
  - Human Nutrition and Dietetics –Davidson S. Passmore
  - A text book of Foods, Nutrition and Dietetics- Begum, R.
3. Energy
  - Understanding Nutrition -Whitney P.N. and Roes S.R., West Publication Co, 1996.
  - Nutrition Science- Srilakshmi, B
4. Food Guide
  - Education planning group.Food & Nutrition,1980.Arya publishing group, New Delhi
  - Srilakshmi, B, Nutrition Science, New age international (P) Ltd publishers, New Delhi, 2006.
5. Carbohydrates
  - Handbook of Food and Nutrition M Swaminathan
  - Nutrition Science- Srilakshmi, B
6. Proteins
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan, Bappco, Bangalore.
7. Lipids
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan
8. Minerals
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan
9. Vitamins
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan
10. Water
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan

**MODEL QUESTION PAPERS**

**FTL 1 B 01 PERSPECTIVES OF FOOD SCIENCE & TECHNOLOGY (3 credits)**

**Time 2 Hours  
Marks**

**Total 60**

*SECTION A*

Each carry 2 marks

(Max.20 Marks)

1. Define Carbohydrates.
2. Name proteins present in Egg.
3. Give two examples for monosacharides.
4. Name any two Anti-Oxidants?
5. Expand IICPT and DFRL.
6. Name any four oil seeds.
7. What are amino-acids? Give examples.
8. Name major spices.
9. Give two probiotics.
10. What do you mean by organic foods?
11. Write the importance of Milk in human nutrition.
12. What are stabilizers?

*SECTION B*

Each Carry 5 marks (Max.30 Marks)

13. Write on composition and nutritive value of Milk.
14. Write a note on health foods.
15. Structure and composition of Rice.
16. Write a short note on preservatives.
17. Write on Carbohydrates and it's classification.
18. Discuss in detail about CFTRI and DFRL.
19. Write about sensory analysis of food.

**SECTION C**

(1×10 = 10)

20. Discuss in details about health foods.
21. Composition and nutritive value of Meat, Fish and Egg.

**FTL 2 B 03 FOOD MICROBIOLOGY – I (3  
credits)**

**Time 2 Hours  
Marks**

**Total 60**

*SECTION A*

Each carry 2 marks

(Max.20 Marks)

1. What are the 4 stages of the bacterial growth curve?
2. What is the difference between positive and negative staining?
3. What happens during binary fission in bacteria?
4. Write a note on ascomycetes.
5. Define limits of resolution of a microscope.
6. Write the classification of Virus.
7. Differentiate prokaryotes and eukaryotes.
8. What is pure culture technique?
9. Write a note on bacteriophage.
10. Write the parts of a microscope.
11. Define water activity.
12. What is staining technique?

*SECTION B*

Each Carry 5 marks (Max.30 Marks)

13. Differentiate TEM and SEM.
14. Write a note on theory of spontaneous generation.
15. Write the sexual reproduction in bacteria.
16. Briefly explain bacteriophage.
17. Write a note on structure of fungus.
18. Explain bacterial growth curve.
19. Write a note on Morphology of Virus.

*SECTION C (1x10=10)*

20. Explain the structure of bacterial cell with the aid of a neatlylabelled diagram, also mention the roles of these structures.
21. Explain electron microscopy.

**FTL 3 B 05 FOOD ENGINEERING (3 Credits)**

**Time 2.0 Hours**

**Total 60 Marks**

*SECTION A*

Each carry 2 marks

(Max.20 Marks)

1. Write the equation for Stephan Boltzmann's law.
2. List the important components of refrigeration system.
3. Briefly explain the types of atomizers used in spray dryers.
4. Differentiate contact and non-contact heat exchangers.
5. Define Apparent Viscosity.
6. Write briefly about fire tube boiler.
7. Differentiate conduction and convection mode of heat transfer.
8. Give plank's equation to estimate freezing time.
9. Briefly describe falling film evaporator.
10. Differentiate pasteurization and sterilization.
11. Give an equation to explain rate of convective heat transfer.
12. Differentiate Newtonian and Non-Newtonian fluids.

*SECTION B*

Each Carry 5 marks (Max.30 Marks)

13. With the help of a neat sketch explain the working of shell and tube heat exchanger.
14. Explain in detail the vapor compression refrigeration cycle.
15. Explain the working of multiple effect evaporators. What are its advantages over singleeffect Evaporator.
16. Explain the working of water-tube boiler. How it is different from fire-tubeboiler?
17. List the important characteristics that are usually considered in the selection of refrigerant.  
Explain their importance
18. What is viscosity? Give SI unit of viscosity. Explain how apparent viscosity is calculated?
19. What is freezing point depression? Explain the working of Air blast freezer.

*SECTION C (1x10=10)*

20. With the help of a neat sketch describe the working of rising film evaporator. How it is different from falling film evaporator. Give merits and demerits of these evaporators.
21. What are the applications of freezing in food processing? With the help of a neat sketch explain the working of immersion freezer. What are its limitations and

**FTL 4 B 07 FOOD CHEMISTRY & ANALYTICAL INSTRUMENTATION (4 Credits)**  
**Time 2.5Hours** **Total 80**  
**Marks**

*PART A*

Each carry 2 marks (Max.25 Marks)

1. Name two method of estimating protein in food material
2. What are enzymes?
3. What is enzymatic browning
4. What is the principle of Paper chromatography?
5. What you mean by emulsion?
6. How are proteins classified?
7. Mention different gases used in gas chromatography
8. Write down the principles of TLC
9. State Beer-lamberts law
10. Mention the important part of HPLC
11. What are essential amino acids? Give any two examples.
12. Write the chemical name of Fat?
13. Write two function of Fat?
14. Classify protein.
15. What is gelatinisation of starch?

*PART B*

Each Carry 5 marks (Max.35 Marks)

16. Kjeldahl's Methods for estimati on of Protein
17. Classification of Carbohydrates
18. Hydrogenation
19. Discuss the steps in Thin layer chromatography.
20. Non-Enzymatic browning reaction
21. Write the principle of HPLC
22. Write a note on Column Chromatography
23. Classify fatty acids. Give examples.

*PART C (2x10 = 20 Marks)*

24. What are enzymes? What are the uses of enzymes in food industry?
25. Explain in detail about the determination of moisture?
26. Discuss briefly about chromatography techniques? How paper chromatography isapplicable in food analysis?
27. Explain in detail of working of Atomic Absorption Spectrophotometer?

**FTL 5 B 09 FOOD MICROBIOLOGY II (3  
Credits)**

**Time 2.5 Hours  
Marks**

**Total 60**

**Part A**

Each carry 2 marks

(Max.20 Marks)

1. What do you mean by Asepsis?
2. What is food intoxication? Give an example
3. Name any three viruses associated with food poisoning
4. Differentiate between exotoxin and endotoxin.
5. Differentiate yeast and mold
6. Name any two bacteria and two molds involved in spoilage of meat
7. Define coli forms
8. What is serial dilution
9. Physical and agent used for controlling micro-organism.
10. What is TA Spoilage?
11. How does contamination takes place in milk?
12. Mention any two spoilage in meat?

**Part B**

Each Carry 5 marks (Max.30 Marks)

13. Explain food poisoning caused by *C. Botulinum*
14. Explain preservation by high temperature
15. What is sauerkraut? Describe the process involved in the production of sauerkraut
16. Differentiate pour plate and streak plate
17. Explain microbiological testing of milk
18. Describe the spoilage caused by thermophilic spore forming bacteria in canned foods?
19. Differentiate selective and differential media.

**Part C**

1x10 = 10 Marks

20. What is MPN? Describe the methods involved in testing of water
21. Explain the spoilage in canned food.

**FTL 5 B 10 CEREALS, PULSES & OIL SEEDS & TECHNOLOGY (4 Credits)**

**Time 2.5 Hours**

**Total 80 Marks**

*PART A*

Each carry 2 marks

(Max.25 Marks)

1. What is floor time?
2. Define rheology?.
3. What is leavening agent?
4. What is Parboiling of rice?
5. Define principles of baking?
6. What is staling of bread?
7. What is anti nutritional factors in Pulses?
8. What is decortication of nuts?
9. Draw the structure of wheat and name the parts?
10. What is tempering of Wheat?
11. Name the different mixing method of cakes?
12. Write the ingredients used in biscuit making.
13. What is toffee?
14. Differentiate between crystalline candy and non crystalline candy?
15. Differentiate between cookies and biscuit?

*PART B*

Each Carry 5 marks (Max.35 Marks)

16. What do you mean by leavening action.
17. What is Gluten? Give its importance.
18. What is parboiling, write its advantages.
19. What do you mean by curing of rice?
20. Write the importance of role of ingredients in bread.
21. Explain toffee manufacturing briefly.
22. What is the impact of ageing of wheat flour?  
How ageing could be Minimized by using chemicals?
23. Write on TVP

*PART C*

**Answer any two of the following**

**(2x10 = 20 Marks)**

24. Explain the milling of wheat in detail.
25. What is parboiling and differentiate between single boiled and double boiled rice. Write the merits and demerits of Parboiling.
26. Write in detail about various processing steps of bread manufacture.
27. Describe in detail on the processing of oil seeds.

**FTL 5 B 11 FOOD PRESERVATION & PACKAGING TECHNOLOGY (3 Credits)**  
**Time 2 Hours** **Total 60**  
**Marks**

**SECTION-A**

Each carry 2 marks (Max.20 Marks)

1. State the importance of blanching in food preservation
2. Differentiate slow and quick freezing.
3. Expand:1)HTST 2) UHT
4. Mention any two application of Irradiation in food.
5. Give any one example for artificial preservative and state its function.
6. What is fermentation and give example?
7. What you mean by chilling injury?
8. Principle of microwave heating
9. Write a note on Ultrasonics.
10. Principle of drying
11. What you mean by Hurdle technology.
12. What is the unit of radiation?

**SECTION-B**

Each Carry 5 marks (Max.30 Marks)

13. Give an outline of food irradiation
14. Write a note on ohmic heating
15. Write a note on high pressure technology
16. Explain steps in new product development
17. What do you mean by cryogenic freezing
18. Write a note on freeze drying
19. Differentiate acetic and lactic fermentation

**SECTION-C**

(1X10=10 Marks)

20. Explain the mechanism of spray and drum driers?
21. What are different methods of freezing?

**FTL 6 B 16 TECHNOLOGY OF ANIMAL  
FOODS (4 Credits)**

**Time 2.5 Hours**

**Total 80**

**Marks**

**Part A**

Each carry 2 marks

(Max.25 Marks)

1. Write on Ageing of meat.
2. Distinguish between penetrative and non penetrative bullets in stunning
3. Comment on Post mortem examination of meat.
4. What is Thermostabilization?
5. Comment on rendering in animal by-product utilization.
6. Explain meat tenderization and the methods.
7. Write on the role of irradiation in meat preservation.
8. What are the egg quality parameters.
9. Describe the different grades of eggs on their size.
10. What are comminute and non comminute meat products.
11. Give a detail on stunning of animals.
12. Differentiate between PSE and DFD meat.
13. Write the function of curing salt in meat.
14. What is the equation for Haugh Unit and write the significance .
15. What is the De-acetylated form of Chitin and its uses?

**Part B**

Each Carry 5 marks (Max.35 Marks)

16. Write on the structure of meat with a detailed sketch.
17. Write a short note on casings used in sausage manufacture.
18. What is fish gelatin? How is it obtained and write the uses.
19. Explain briefly on the production of FPC and its application in food industry.
20. Brief on the slaughterhouse waste utilization.
21. Elaborate on the processing of poultry with the help a flow diagram.
22. Write the chemistry of curing and give detailed description on the ingredients.
23. Write the factors influencing the colour and flavor of meat.

**Part C**

**(2×10=20 marks)**

24. With the help of a neat sketch describe the lairage in a meat industry.
25. What is Humane method of slaughter and the methods involved. Describe the slaughtering and processing of pig.
26. What is meat emulsion? With the help of a flow chart write the processing of a comminuted meat product and classify it based on the final product availability.
27. Elaborate on the physical, chemical and microbiological spoilage of fish. What are the major products and byproducts of fish industry?

**FTL 6 B 15 E DAIRY TECHNOLOGY ( 3 Credits)**

**Time 2Hrs.**

**Total 60 Marks**

**Section A**

Each carry 2 marks

(Max.20 Marks)

1. What is CIP
2. Difference between ice-cream and frozen desert
3. Health benefits of probiotics
4. Explain any two quality control tests for milk
5. Milk fat percent of light, heavy, and plastic cream
- 6 What is standardized milk.
7. What is rennet
8. Physicochemical properties of cream. Explain any two
9. What is yoghurt
10. Explain the role of calcium chloride in cheese processing
11. What is acid curd in cottage cheese.
12. What is hardening in ice-cream .

**Section B**

Each Carry 5 marks (Max. 30 Marks)

13. Define Ice-cream? Explain overrun in ice cream
14. Define the steps in cream processing
15. What are the factors affecting composition of milk
16. Differentiate Homogenised and Recombined Milk?
17. What is pasteurization. Explain UHT pasteurization.
18. What is cheese? Classify cheese.
19. Define churning. Explain factors influencing churnability of cream?

**Section C**

(1×10=10)

21. Physico chemical properties of milk
22. Explain the steps in cheese making

**FTL 6 B 17 FOOD SAFETY, FOOD LAWS & REGULATIONS**  
**Time 2.5 Hours**  
**Marks**

**Total 80**

*SECTION-A*

Each carry 2 marks

(Max.20 Marks)

1. What do you meant by MAP?
2. Differentiate primary and secondary packaging?
3. Differentiate high risk food and low risk food?
4. Define food adulteration?
5. Name any four sampling tools?
6. What do you meant by CAC?
7. Differentiate disinfectants and Sanitizer?
8. List any four physical hazards?
9. What do you meant by CAP?
10. Name any one adulterant used in milk and it's detection method?
11. What do you meant by non-probability sampling.
12. What do you meant by SSOP?
13. What do you meant by FDA?
14. List four important functions of packagin ?
15. Write about FAO?

*SECTION-B*

Each Carry 5 marks (Max.35 Marks)

16. Write a note on GMP and GHP?
17. Outline the structural requirements of a food plant?
18. Write a note on traceability and recalling?
19. Write a note on common food adulterants and their tests?
20. Explain about the functions and design of glass packaging material?
21. Write about Personal Hygiene for food safety?
22. Differentiate between active and smart packaging with examples.
23. Write short note on ISO:22000

*SECTION-C*

(2X10==20)

26. Briefly discuss about Food Safety and Standards Act?
27. Briefly discuss the recent trends in packaging?
28. Explain in detail HACCP principles and process in Food Industry
29. Write in detail any food safety management system.

**CROPS (4 credits)**

**Time 2.5 Hours**

**Total 80 Marks**

**PART A**

Each carry 2 marks

(Max.25 Marks)

1. Name the pectin degrading enzymes
2. Write the specification tomato sauce
3. Define maturity index of fruits
4. What is controlled atmospheric storage?
5. Write the types of pickle.
6. Write the types of browning with example
7. What is blanching?
8. What is Cocoa Butter?
9. What is the function of salt in pickling?
10. Differentiate between squash and cordials.
11. What are the factors affecting gel formation
12. How is browning prevented?
13. What are spice oils?
14. What is the changes occurring during ripening
15. what is syneresis of jam?

**PART B**

Each Carry 5 marks (Max.35 Marks)

16. Describe the process preparation of fruit cordial
17. Describe the steps in processing of black Tea.
18. What are pectic enzymes? Discuss their importance in ripening of fruits.
19. What are all the steps in manufacture of oleoresins?
20. Which are the different methods of peeling?
21. Explain manufacture of Chocolate.
22. Differentiate glazed fruit and candied fruit
23. Briefly explain preparation of tomato ketchup. Give the specification.

**PART C**

**Answer any two of the following**

(2x10 = 20 Marks)

24. What are the steps involved in canning of fruits.
25. Steps involved in manufacture of Jams. Discuss defects in Jam preparation.
26. Give the different steps involved in Cocoa bean processing? Discuss the steps involved in coffee processing.
27. Discuss browning of fruits and vegetables and its prevention.

**Open course**

**FTL 5 D 01 TECHNOLOGY OF SPICES (3 Credits)**

**Time 2 Hours**

**Total 60 Marks**

*PART A*

Each carry 2 marks (Max.20 Marks)

1. Name two Aromatic spice.
2. Name two Pungent spice.
3. Chemical used for bleaching Cardamom.
4. Name the alkaloid responsible for biting taste of Pepper.
5. King of Spices & queen of spices.
6. Name the major spices of India.
7. What do you mean by "Garbling"?
8. Define Spice.
9. What is the important use of Paprika?
10. Mention the uses of Ginger oils.
11. Mention the important factors that affect quality of Chillies
12. What is function of "Aspirator" in processing Spices?

*PART B*

Each Carry 5 marks (Max.30 Marks)

13. What are Spice oils?
14. How are Spices classified?
15. Briefly explain production of Oleoresin.
16. Explain steps in curing of Turmeric.
17. Explain the processing of cardamom
18. What are the uses of spices?
19. Differentiate between Spices & condiments?

*PART C*

**Answer any one of the following**

**(1x10 =10 Marks).**

20. Explain the different steps involved in processing of Black Pepper.
21. Explain important steps in extraction of Oleoresin.

**FTL 5 D 02 FRUIT AND VEGETABLE PROCESSING (3 Credits)**  
**Time 2 Hours** **Total 60 Marks**

*PART A*

Each carry 2 marks

(Max.20 Marks)

1. Name the Tomato based product.
2. Instruments to measure sugar
3. Type of browning reaction in cut surface of Apples.
4. Name a fruit coming under the group Drupe.
5. Name a food additive.
6. What are Non-climatic Fruits ? (Give example)
7. What do you mean by Encymatic browning ?
8. Write any four changes during ripening of fruits.
9. What do you mean by fermentation? Name a fermented fruit basedProduct?.
10. Name four mango based products available in market.
11. What do you mean by blanching of vegetables?
12. What are class II preservatives?

*PART B*

Each Carry 5 marks (Max.30 Marks)

13. Write the P<sup>H</sup> of low acid and High acid foods.
14. Which are the different methods of peeling.
15. Browning of fruits.
16. Ripening of Fruits.
17. Composition of leafy vegetables.
18. Write briefly processing of pickles
19. Explain briefly different types of storage of fruits & vegetable

*PART C*

**Answer any one of the following**

**(1x10 = 10 Marks)**

18. Write a note on classification of fruits. Discuss the general
19. Write a note on pickling. Give the function of ingredients.

**FTL 5 D 03 FOODS & HEALTH (3 Credits)**

**Time 2 Hours  
Marks**

**Total 60**

*PART A*

Each carry 2 marks

(Max.20 Marks)

1. Define food adulterants.
2. What are Carbohydrates? Give example.
3. What are fat soluble vitamins? Give example.
4. What you mean by BMI?
5. What is Nutrients?
6. What are the major food groups?
7. What you mean by RDA?
8. Write the importance of enzymes.
9. What is preservatives?
10. What is Lactose Intolerants?
11. Name any two food source for protein.
12. Give examples for macro and micro minerals.

*PART B*

Each Carry 5 marks

(Max.30 Marks)

13. Briefly explain classification of food.
14. Write a short note on common adulterants found in food.
15. Enlist the food additives and write their importance in food preparation.
16. Write a short note on nutritional composition of food.
17. Write the functions of preservatives with examples.
18. Briefly explain food poisoning. write the symptoms and their control.
19. Write a short note on Types of work and Energy requirements.

*PART C*

**(ANSWER ANY 1 QUESTION)**

**(1X10=10)**

20. What is life style diseases? Briefly discuss each of them.
21. Explain briefly about the digestion and absorption of nutrients.

**A014 NUTRITION & HEALTH (4 Credits)**

**Time 2.5 Hours  
Marks**

**Total 80**

*PART A*

Each carry 2 marks

(Max.25 Marks)

1. Define Health
2. What is mal nutrition?
3. What is under nutrition?
4. What is over nutrition?
5. What is spiritual health?
6. Name the food groups
7. The linkage between two amino acids in a protein
8. What is water balance?
9. What is goitre?
10. Essential Amino acids
11. What is the Energy value of carbohydrate and fats
12. Define Protein Efficiency Ratio.
13. Classify the type of water
14. What is saturated fatty acids and Give one example.
15. Two important factors affecting BMR

*PART B*

Each Carry 5 marks (Max.35 Marks)

16. Classify the carbohydrates and give one example to each
17. Specific dynamic action of Food
18. How protein quality will calculate?
19. Role of Iodine in Diet
20. Write the functions of fats
21. Write a short note on BMR?
22. Write a note on dietary fibre
23. Write the digestive enzymes present in Gastro Intestinal Tract.

*PART C*

**Answer any two of the following**

**(2x10 = 20 Marks)**

24. How minerals are classified. Explain in detail the role of any two minerals in humannutrition
25. How are fats digested and absorbed in the body? Mention the role of bile juice in fat digestion
26. Explain in detail the role of water soluble vitamins in the human system. Give any four deficiency disease
27. How nutrients are important to human health? Discuss in detail.

**COMPLEMENTARY COURSE**  
**FOOD SCIENCE AND QUALITY CONTROL**  
**FTL1C01 PRINCIPLES OF NUTRITION**

*Number of Credits: 2*

**Objective**

This course will provide students with an understanding of the basic concepts of adequate nutrition, the important of food and well-balanced diet, effects of good nutrition on health, factors which affect eating habits, description of nutrients, their sources, functions and the daily requirements. This will help to understand how key nutrients (carbohydrates, lipids, vitamins, minerals and water) affect health, disease, and energy balance and weight control. You will learn about nutrient requirements during physical activity and you will explore the field of vitamins and mineral supplements and about foods and water.

**Course Outline**

**Unit 1 - Concept of nutrition: Definition of terms**

Nutrition, under nutrition, malnutrition, symptoms and remedy, Health and nutritional status-adequate optimum and good nutrition Energy – Definition of calorie and Joule, Energy value of foods, Basal Metabolic Rate (BMR), factors affecting BMR (6hours)

**Unit 2 – Food Guide**

Nutrients supplied by foods. Basic five food groups – Cereals, pulses, fruits and vegetables, milk and meat, fats and sugar (3hours)

**Unit 3 – Nutrients and Health: Water**

Importance, distribution in body, function, sources, water balance, regulation and requirement, abnormalities in water balance. (3hours)

**Unit 4 – Carbohydrates**

Functions, sources, requirement digestion and absorption, effects of deficiency. (3hours)

**Unit 5 – Fibers**

Definition, classification, sources, role of fiber in human nutrition (3hours)

**Unit 6 – Protein**

Functions, sources, requirement, essential amino acids, determination of nutritional quality of proteins, digestion and absorption. (3hours)

**Unit 7 – Lipids**

Functions, sources, digestion and absorption, role of essential fatty acids, Health concerns in lipid nutrition-obesity, hypertension, atherosclerosis, requirements and effects of deficiency. (3hours)

**Unit 8 – Vitamins**

Classification, sources, requirement, deficiency of Vitamin A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid. (3hours)

## **Unit 9 – Minerals**

Functions, sources, deficiency of calcium, phosphorus, sodium, potassium, iron, iodine and fluorine.

(3hours)

## **Unit 10 - Balanced diet**

Meal planning, factors affecting meal planning, principles of meal planning. (1hour)

## **Unit 11 – RDA**

Factors affecting RDA, principles deriving RDA (1hour)

## ***References***

1. Concept of nutrition
  - Fundamentals of Food & Nutrition S R Mudambi & M V Rajagopal
  - A text book of foods, Nutrition and Dietetics M Raheena Begum
2. Food guide
  - Education planning group. Food & Nutrition, 1980. Arya publishing group, New Delhi
3. Water
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan, Bappco, Bangalore.
4. Carbohydrates
  - Handbook of Food and Nutrition M Swaminathan
  - Nutrition Science- Srilakshmi, B
5. Fibre
  - Manay N.S, Shadaksharaswamy, M., Foods - Facts and Principles, New Age International Publishers, New Delhi, 2004.
6. Protein
  - Handbook of Food and Nutrition M Swaminathan
  - Nutrition Science- Srilakshmi, B
7. Lipids
  - Handbook of Food and Nutrition M Swaminathan
  - Nutrition Science- Srilakshmi, B
8. Vitamins
  - Nutrition Science- Srilakshmi, B
  - Manay, N.S, Shadaksharaswamy, M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
9. Minerals
  - Nutrition Science- Srilakshmi, B
10. Balanced diet
  - A text book of foods, Nutrition and Dietetics M Raheena Begum

## 11. RDA

- Essential of food & Nutrition –Vol. 1
- M. Swaminathan, Bappco, Bangalore.

# FTL2C02 FOOD CHEMISTRY

*Number of Credits: 2*

## Objective

This discipline encompasses the study of chemical process and interactions of all components of food and also provide how products change under certain food processing techniques and ways either to enhance or to prevent them from happening.

## Course Outline

### Unit 1- Carbohydrates

Classification, Structure, browning reaction, changes during cooking (2hours)

### Unit 2 – Pectin

Composition & structure (2hours)

### Unit 3 - Protein

Introduction to food proteins, classification, structure, physico chemical properties, denaturation, reactions, protein determination, changes during cooking (6hours)

### Unit 4 - Fats & Oils

Classification, saturated, unsaturated, polyunsaturated fatty acids physical and chemical properties, refining of fats and oils - bleaching, deodorizing, hydroxylation, shortening, Products of fat - margarine, vanaspati, lard, tallow. (8hours)

### Unit 5 – Enzymes

Classification, nomenclature, enzyme specificity, factors affecting enzyme activity, enzyme inhibition, role in food processing (4hours)

### Unit 6 – Water

Introduction, physical and chemical properties of water, moisture in foods, hydrogen bonding, bound water (2hours)

### Unit 7 – Pigments

Pigments in foods, chlorophyll, flavanoids, anthocyanin, anthoxanthins, quinines, xanthenes, betalains, Effect of processing and storage on pigments, physical and chemical properties (4hours)

### Unit 8 – Flavours

Flavour compounds in foods - terpenoids, flavanoids, and Sulphur compounds, effect of processing and storage on flavours (2hours)

### Unit 9 - Properties of foods

Colloids – Properties, sols, gels, foam, emulsion and suspension (2hours)

## ***References***

1. Carbohydrates
  - Manay N.S, Shadaksharaswamy M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
2. Pectin
  - Manay N.S, Shadaksharaswamy M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
3. Protein
  - Manay N.S, Shadaksharaswamy M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
  - Fennema O R. - Food Chemistry 3<sup>rd</sup> edition, Marcel Dekker Inc, New York., 1996.
4. Fats & Oils
  - Manay N.S, Shadaksharaswamy M., Foods- Facts and Principles, New Age International Publishers, New Delhi, 2004.
  - Meyer L H - Food Chemistry. CBS publisher s & distributors, New Delhi. 2002
5. Enzymes
  - Campbell M K and Farrell S O- Biochemistry 5th edition-international student, 2006
6. Water
  - Essential of food & Nutrition –Vol. 1 M. Swaminathan, Bappco, Bangalore.
  - Foods Facts and Principles N Shakuntalamanay M
7. Pigments
  - Srilakshmi B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.
8. Flavours
  - Srilakshmi B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.
9. Properties of food
  - Foods Facts and Principles N Shakuntalamanay M
  - Food science Norman N. Potter

## **FTL2C03P FOOD CHEMISTRY**

*Number of Credits: 2*

### **Objective**

- To provide practical awareness
- To test the presence of carbohydrates and proteins in food samples

### **Course Outline**

## **Practical**

- 1) Colour reactions of carbohydrates b) Estimation of reducing sugar
- 2) Colour reactions of proteins b) Estimation of protein.
- 3) Determination of acid value and free fatty acid.
- 4) Determination of acidity in fruit juices.
- 5) Determination of ascorbic acid

## **References**

- Food Chemistry Owen R Fennema
- Food Chemistry Lillian Hoagland Meyer
- Foods Facts and Principles N Shakuntalamanay
- M Shadaksharaswamy
- Food science Norman N. Potter

# **FTL3C04 PRINCIPLES OF FOOD SCIENCE**

*Number of Credits: 2*

## **Objective**

This course demonstrates how the laws of science are at working in producing, processing, preparing and preserving food. To introduce the basic fundamentals of food science and the chemistry behind various food items.

## **Course Outline**

### **Unit 1 - Plant Foods**

Introduction to food science. (2hours)

### **Unit 2 - Cereals, pulses and legumes**

Composition, nutritive value, antinutritional factors, changes during cooking. Germination and changes Germination.

### **Unit 3 - Fruits and vegetables**

classification, composition, nutritive value, changes during cooking of vegetables, ripening of fruits (4hours)

### **Unit 4 - Spices and condiments**

Classification, composition and use (4hours)

### **Unit 5 - Animal Foods: Milk and milk products**

Composition, nutritive value, effect of acid, heat, enzyme, salt on milk, Processing of milk – clarification, pasteurization and homogenization, cheese, butter, skim milk powder, whole milk powder, condensed milk, yoghurt. (6hours)

### **Unit 6 – Egg**

Structure, composition, nutritive value, grading, changes during storage, role of egg in food industry. (2hours)

#### **Unit 7 – Meat**

Structure, composition, nutritive value, post mortem changes, changes during cooking, ageing. (4hours)

#### **Unit 8 - Fish and Poultry**

Composition and nutritive value, fish products – fish meal, fish flour and fish oils. (4hours)

#### **Unit 9 – Sugars**

Liquid sweeteners, properties of sugar, reactions of sugar, stages of heating. (3hours)

### ***References***

#### **1. Plant Foods**

- Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

#### **2. Cereals, pulses and legumes**

- Srilakshmi, B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

#### **3. Fruits and vegetables**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

#### **4. Spices and condiments**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

#### **5. Animal Foods: Milk and milk products**

- Sukumar D E. Outlines of Dairy Technology, Oxford University Press.
- Johnson, Webb. Fundamentals of Dairy Chemistry. CBS Publishers and Distributers

#### **6. Egg**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

#### **7. Meat**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

#### **8. Fish and Poultry**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

#### **9. Sugars**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy

## **FTL3C05P PRINCIPLES OF FOOD SCIENCE**

### **Objective**

- To provide practical awareness
- Be able to use the laboratory techniques

### **Course Outline**

## **Practical**

- 1) Determination of Moisture content – Hot air oven method.
- 2) Determination of Ash content.
- 3) Determination of Gluten content in wheat flour.
- 4) Determination of Water absorption power of Maida
- 5) Preparation of jam.

## **References**

- Foods: Facts and principles N Shakuntalamanay & M S Swamy
- Food Science - B Srilakshmi
- Food science, Chemistry & Experimental foods M Swaminathan
- Text Book on Foods storage and preservation Vijayakhader

## **FTL4C06 FOOD PRESERVATION AND QUALITY CONTROL**

*Number of Credits: 2*

### **Objective**

This course applies the principle of food science to control and assure the quality of food products and to understand the preservation and current practices of preservation techniques and the effects on product quality.

### **Course Outline**

#### **Unit 1 - Food Preservation**

Significance of preservation, Methods of food preservation - low temperature, high temperature, preservatives, osmotic pressure, dehydration, irradiation. (8hours)

#### **Unit 2 - Food Additives**

Food additives – Role of food additives, antioxidants, chelating agents, colouring agents, curing agents, emulsifiers, flavour enhancers, flavour improvers, humectants and anticaking agents, leavening agents, stabilizers and thickeners, artificial sweeteners, preservatives, food fortifiers. (8hours)

#### **Unit 3 - Food Adulteration**

Food adulteration – types of adulterants, common adulterants in foods, toxicants in foods, impact of food adulteration in humans. (8hours)

#### **Unit 4 - Food Laws and Quality**

Food laws and quality control – HACCP, Codex alimentarius, PFA, FPO, MFPO, BIS, AGMARK (8hours)

## **References**

1. Food preservation
  - Pruthi J S Quick Freezing Preservation of Foods Allied publishers Limited
  - Subbulakshmi G and Udippi S.A Food Processing and Preservation
  - Foods:New Age international (P) publishers, New Delhi 2001

## 2. Food additives

- Manay N.S, Shadaksharaswamy M., Foods - Facts and Principles, New Age International Publishers, New Delhi, 2004.

## 3. Food adulteration

- Manay N.S, Shadaksharaswamy M, Foods - Facts and Principles, New Age International Publishers, New Delhi, 2004.
- Srilakshmi B. Food Science (3rd edition), New Age International (P) Limited Publishers, New Delhi, 2003.

## 4. Food laws and quality

- Richard A Sprenger, Hygiene for Management, Highfield.

# **FTL4C07P FOOD PRESERVATION AND QUALITY CONTROL**

*Number of Credits: 4*

## **Course Outline**

### **Practical**

- 1) Detection of adulterants in foods such as milk, honey etc.
- 2) Estimation of SO<sub>2</sub> in fruit products.
- 3) Estimation of purity of potassium metabisulphite
- 4) Qualitative determination of benzoic acid

**Model Question Paper**

**FTL 1 C 01 PRINCIPLES OF NUTRITION (2 Credits)**

**Time 2 Hours  
Marks**

**Total 60**

*PART A*

Each carry 2 marks  
Marks)

(Max.20

1. What is the daily energy requirement for a man and woman?
2. What is flurosis
3. What is Osteoporosis? Why it occurs?
4. What are the functions of protein?
5. What is the role of bile in fat digestion?
6. What are micro minerals? Give two examples
7. What are the deficiency symptoms of riboflavin?
8. Define balanced diet.
9. Write the basic five food groups
10. Write a note on Plant and animal protein
11. Name the vitamins which come under the category of Vitamin B complex.
12. What is scurvy

*PART B*

Each Carry 5 marks (Max.30 Marks)

13. What are carbohydrates.
14. What are Fat soluble vitamins, give its importance
15. What is peptide bond. How it is formed
16. briefly explain the digestive system
17. Classification of Carbohydrates
18. How fats are classified
19. How proteins are classified

*PART C*

**answer any one, 10 Mark**

20. Write the principles of meal planning.
21. How is nutritive value of protein determined? Compare animal and plantprotein quality.

**FTL 2 C 02 FOOD CHEMISTRY (2 Credits)**

**Time 2 Hours**

**Total 60Marks**

**Part A**

Each carry 2 marks

(Max.20 Marks)

1. What is you meant y reducing sugar
2. Write structure of the simplest amino acid
3. What is wood sugar?
4. What is enzymatic browning.
5. Name the element and four rings present in chlorophyll
6. Which is the prosthetic group in haemoglobin?
7. What is citral?
8. What is meant by enzyme specificity?
9. What are essential amino acids? Give 2 examples.
10. Define iodine value of oils.
11. Draw the structure of glycerol
12. What are polysaccharides

**PART B**

Each

Carry 5 marks (Max.30 Marks)

13. What are suspensions
14. Why sucrose is a non-reducing sugar
15. What are betalains?
16. Write the structural difference between chlorophyll a and b.
17. Write the role of fibre?
18. What is native protein?
19. Write the composition of butter.

**PART C, Answer any one, 10 mark**

20. Write the effect of processing and storage on chlorophyll pigments in foods.
21. Write nomenclature and method of classification of enzymes and discuss

**FTL 3 C 04 PRINCIPLES OF FOOD SCIENCE (2 Credits)**

**Time 2 Hours  
Marks**

**Total 60**

*PART A*

Each carry 2 marks

(Max.20 Marks)

1. What is MFCS?
2. Which are the Muscle proteins
3. Name an enzyme which is used to tenderize meat.
4. Which is the Queen of spices
5. What is ageing of meat?
6. What are the pigments present in fruits and vegetables?
7. Name any antinutritional factor present in pulses
8. What is rigor mortis
9. Name the proteins present in egg
10. What is enzymatic browning?
11. What are the properties of sugars?
12. What is phosphatase test?

*PART B*

Each Carry 5 marks (Max.30 Marks)

13. Explain the composition of milk and effect of heat on it
14. Explain in detail the production of any two, milk product of commercial importance
15. Write a brief note on changes taking place in meat during curing and smoking.
16. Explain non enzymatic browning with example
17. Explain Caramalisation
18. Give a note on nutritive value of egg
19. Write a note on different spices

*PART C*

**Answer any one carries 10 marks**

1. Explain in detail the structure and composition of egg Highlight its importance in food industry.
2. Explain the physical and chemical changes that occur during heating of sugar What is its application in food industry?

**FT 4 C 06 FOOD PRESERVATION AND QUALITY CONTROL (2 Credits)**

**Time 2 Hours  
Marks**

**Total 60**

*PART A*

Each carry 2 marks

(Max.20 Marks)

1. What does GRAS stands for?
2. What is MFPO?
3. What is sharp freezing?
4. Name two foods which are preserved by the principle of osmosis.
5. What is the unit of radiation?
6. Name the only permitted inorganic preservative in fruits and vegetable products?
7. Name any two thickener
8. Name two natural colours
9. Name the pathogen commonly found in cereal products
10. What is food adulteration?
11. What are the causes of food spoilage?
12. What are artificial sweeteners? Name any two.

*PART B*

Each Carry 5 marks

(Max.30 Marks)

13. Describe food additives with suitable examples?
14. How do you classify preservatives?
15. Write a note on food irradiation
16. Explain different types of preservatives
17. Write atleast one test for determination of adulteration for four different foods
18. What are antioxidants.? Give example
19. What are colouring agents? Give different types

*PART C*

**Each carries 10 marks**

**(1X10=10)**

20. Write in detail different methods of food preservation
21. Explain the incidental contaminants and their harmful effects on the body.