

**B.Sc.**

**Food Processing & Packaging**

*Rayat Shikshan Sanstha's*

**Yashwantrao Chavan Institute of Science, Satara (Autonomous)**

**Undergraduate Programme**

**B. Sc. in Food Processing & Packaging**

**Syllabi of the course**

**Choice based credit system syllabus**

**(To be implemented from academic year 2021-22)**

**Department of Food Processing & Packaging**

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**Syllabus for B. Sc. (Food Processing & Packaging)****Preamble**

This syllabus is framed to accommodate the widening horizons of the discipline of food processing and packaging. They reflect the current changing needs of the students. Students learn Food Processing and Packaging as a separate subject from B.Sc.I, which increase the employability of students in food processing sector of Indian economy which now-a-days given priority in policymaking. The exposure of students to the subject will enable them of independent handling of food processing and packaging unit.

The syllabus is based on basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

**General Programme Objectives**

1. To nurture the academicians with focus and commitment to their subject.
2. To shape good and informed citizens from the students entering into the programme.
3. To create a skilled work force to match the requirements of the society.
4. To impart knowledge of science is the basic objective of this programme.
5. To develop scientific attitude is the major objective so as to make the students open minded, critical and curious.
6. To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute to science.

**General Programme Outcomes**

1. The students will graduate with proficiency in subject of their choice.
2. The students will be eligible to continue higher studies in their subject.
3. The students will be to pursue higher studies abroad.
4. The students will be eligible to appear for the examination for jobs in government organization.
5. The students will be eligible to apply for jobs with a minimum B.Sc. program.

### **Programme Specific Objectives of the Course**

1. To impart knowledge of various areas related to food processing and packaging.
2. To enable the students to understand food composition and its physical, chemical, nutritional, microbiological and sensory aspects.
3. To familiarize the students about the processing and preservation techniques of variety of foods.
4. To emphasize the importance of food safety, food quality, food laws and regulations.
5. To expose the students to different food processes used in industries and in research field.
6. To prepare the students to accept the challenges in life sciences.
7. To develop skills required in various industries, research labs and in the field of agriculture, food, human health.
8. To enable the students to understand packaging materials and effective packaging processes.

### **Program Specific Outcomes of the Course**

After successful completion of B.Sc. Food Processing and Packaging Course student will be able to:

1. Apply critical thinking and analytical evaluation to contemporary food science information and literature
2. Apply principles from general chemistry, biology, physics, statistics, and mathematics to food science problems
3. Demonstrate practical proficiency in a food analysis laboratory.
4. Identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
5. Explain the principles and current practices of processing techniques and the effects of processing parameters on product quality.
6. Explain the properties and uses of various packaging materials.
7. Identify government regulations required for the manufacture and sale of food products.
8. Go for higher studies in the field of food processing and packaging.

<b>B. Sc. Part I</b>
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1. **Title:** Food Processing and Packaging
2. **Year of Implementation:** The syllabus will be implemented from August, 2021 onwards.
3. **Duration:** The course shall be a fulltime.
4. **Pattern:** Semester examination.
5. **Medium of Instruction:** English.
6. **Structure of Course:**

### Program Structure of B.Sc.-I Semester I

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA									
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)									
B. Sc. FOOD PROCESSING AND PACKAGING (ENTIRE)									
B. Sc. I SEMESTER – I (Duration – 6 Months)									
Sr. No.	Course Code	Name of the Course	TEACHING SCHEME						
			Theory			Practical			
			No. of lectures	Hours	Credits	Course Code	No. of lectures	Hours	Credits
1	BFPT - 101	Principles of food processing and packaging -I	3	2.4	2	Lab-I BFPP- 110 (Food Processing and Food Additives-I)	4	3.2	2
2	BFPT - 102	Food Additives, Contaminants and Toxicology -I	3	2.4	2				
3	BFPT - 103	Food Microbiology – I	3	2.4	2	Lab-II BFPP- 111 (Food Microbiology and Preservation-I)	4	3.2	2
4	BFPT - 104	Food Preservation – I	3	2.4	2				
5	BFPT -105	Food Chemistry - I	3	2.4	2	Lab-III BFPP- 112 (Food Chemistry and Analytical Techniques-I)	4	3.2	2
6	BFPT - -106	Analytical Techniques -I	3	2.4	2				
7	BFPT - 107	Human Nutrition -I	3	2.4	2	Lab-IV BFPP- 113 (Human Nutrition and Food Packaging- I)	4	3.2	2
8	BFPT 108	Food Packaging- I	3	2.4	2				
9	BFPT - AECC-1	English-I	3	2.4	2		---	--	
<b>Total of SEM I</b>			<b>27</b>	<b>21.6</b>	<b>18</b>		<b>16</b>	<b>12.8</b>	<b>8</b>

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE,SATARA									
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)									
B. Sc. FOOD PROCESSING AND PACKAGING (ENTIRE)									
B. Sc. I SEMESTER – II (Duration – 6 Months)									
Sr No	Course Code	Name of the Course	TEACHING SCHEME						
			Theory			Practical			
			No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	BFPT - 201	Principles of food processing and packaging-II	3	2.4	2	Lab-V BFPP-210 (Food Processing and Food Additives-II)	4	3.2	2
2	BFPT -202	Food Additives, Contaminants and Toxicology –II	3	2.4	2	Lab-VI BFPP-211 (Food Microbiology and Preservation -II)	4	3.2	2
3	BFPT -203	Food Microbiology-II	3	2.4	2	Lab-VII BFPP- 212 (Food Chemistry and Analytical Techniques -II )	4	3.2	2
4	BFPT -204	Food Preservation–II	3	2.4	2	Lab-VIII BFPP- 213 (Human Nutrition and Food Packaging- II)	4	3.2	2
5	BFPT -205	Food Chemistry –II	3	2.4	2	---	--		
6	BFPT -206	Analytical Techniques -II	3	2.4	2				
7	BFPT -207	Human Nutrition –II	3	2.4	2				
8	BFPT -208	Food Packaging- II	3	2.4	2				
9	BFPT AECC-2	English-II	3	2.4	2				
10	<b>Total of SEM II</b>		<b>27</b>	<b>21.6</b>	<b>18</b>		<b>16</b>	<b>12.8</b>	<b>8</b>
12	<b>Total of SEM I and SEM II</b>		<b>54</b>	<b>43.2</b>	<b>36</b>		<b>32</b>	<b>25.6</b>	<b>16</b>

**B: B.Sc., FP: Food Processing and packaging, T: Theory, P:  
Practical Semester- I**

<b>Sr. No</b>	<b>Course Code</b>	<b>Subject title</b>
<b>1</b>	BFPT - 101	Principles of food processing and packaging -I
<b>2</b>	BFPT - 102	Food Additives, Contaminants and Toxicology-I
<b>3</b>	BFPT - 103	Food Microbiology-I
<b>4</b>	BFPT - 104	Food Preservation-I
<b>5</b>	BFPT - 105	Food Chemistry-I
<b>6</b>	BFPT - 106	Analytical Techniques -I
<b>7</b>	BFPT - 107	Human Nutrition-I
<b>8</b>	BFPT - 108	Food Packaging -I
<b>9</b>	BFPT -AECC-1	English- I
<b>10</b>	Lab-I BFPP- 110	Food Processing and Additives-I
<b>11</b>	Lab-II BFPP- 111	Food Microbiology and Preservation-I
<b>12</b>	Lab-III BFPP- 112	Food Chemistry and Analytical Techniques-I
<b>13</b>	Lab-IV BFPP- 113	Human Nutrition and Food Packaging -I

**Semester –II**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Subject Title</b>
1	BFPT - 201	Principles of food processing and packaging-II
2	BFPT - 202	Food Additives, Contaminants and Toxicology-II
3	BFPT- 203	Food Microbiology-II
4	BFPT-204	Food Preservation-II
5	BFPT - 205	Food Chemistry-II
6	BFPT - 206	Analytical Techniques-II
7	BFPT - 207	Human Nutrition-II
8	BFPT - 208	Food Packaging -II
9	BFPT AECC-2	English-II
10	Lab-V BFPP- 210	Food Processing and Additives-II
11	Lab-VI BFPP- 211	Food Microbiology and Preservation-II
12	Lab-VII BFPP- 212	Food Chemistry and Analytical Techniques -II
13	Lab-VIII BFPP- 213	Human Nutrition and Food Packaging - II



**Evaluation Structure B.Sc. I  
Semester I**

Theory Course	ESE	Internal Evaluation				Practical course	Practical	Submission	
		ISE- I	ISE- II	H.A.- I	H.A.- II			Exam	Case study/ Educational Tour/ Seminar
BFPT-101	30	5	5	5	5	LAB- I	15	5	5
BFPT-102	30	5	5	5	5				
BFPT-103	30	5	5	5	5	LAB- II	15	5	5
BFPT-104	30	5	5	5	5				
BFPT-105	30	5	5	5	5	LAB- III	15	5	5
BFPT-106	30	5	5	5	5				
BFPT-107	30	5	5	5	5	LAB- IV	15	5	5
BFPT-108	30	5	5	5	5				
AECC-1	30	5	5	5	5*				
<b>TOTAL</b>	<b>270</b>	<b>180</b>					<b>60</b>	<b>20</b>	<b>20</b>
<b>GRAND TOTAL</b>	<b>550</b>								

For English\*:- Open Book Test/ Survey/ Writing Skill

**Evaluation Structure B.Sc. I  
Semester II**

Theory Course	ESE	Internal Evaluation				Practical course	Practical	Submission	
		ISE- I	ISE- II	H.A.- I	H.A.- II			Exam	Case study/ Educational Tour/ Seminar
BFPT-201	30	5	5	5	5	LAB- V	15	5	5
BFPT-202	30	5	5	5	5				
BFPT-203	30	5	5	5	5	LAB- VI	15	5	5
BFPT-204	30	5	5	5	5				
BFPT-205	30	5	5	5	5	LAB- VII	15	5	5
BFPT-206	30	5	5	5	5				
BFPT-207	30	5	5	5	5	LAB- VIII	15	5	5
BFPT-208	30	5	5	5	5				
AECC-2	30	5	5	5	5*				
<b>TOTAL</b>	<b>270</b>	<b>180</b>					<b>60</b>	<b>20</b>	<b>20</b>
<b>GRAND TOTAL</b>	<b>550</b>								

For English\*:- Open Book Test/ Survey/ Writing Skill

## SEMESTER – I

## BFPT – 101- PRINCIPLES OF FOOD PROCESSING AND PACKAGING – I

**Course Objective: Students should:**

1. Know the method of primary processing for different foods.
2. Know the method of secondary processing for different foods.
3. Know the introduction and common methods of food processing.
4. Know the objectives and functions of food packaging.

**Unit I: Primary processing. (9 lectures)**

Introduction, Classification and Method of Cleaning, Sorting, Grading, Cutting, Seeding, Chilling and freezing.

**Unit II: Secondary processing. (9 lectures)**

Introduction, Classification and Method of Slicing, Pulping, Paste, Frying, Chilling and freezing, Milling.

**Unit III: Common food processing. (9 lectures)**

Introduction, Classification and Method of Cooking, Baking, Frying, Roasting, Toasting, Grilling, Blanching, Extrusion.

**Unit IV: Introduction to Food Packaging. (9 lectures)**

Objectives and functions of food packaging, Requirements for effective food packaging, Types of packaging Materials, General properties of packaging material.

**RECOMMENDED BOOKS:**

1. Paine F.A. and Paine H. Y. A *Handbook of Food Packaging*, (Blackie Academic Professional, 1983).
2. Chandra Gopala Rao, *Essentials of food process engineering*, (BS Publications, 2006.)
3. Rao DG, *Fundamentals of food engineering*, (PHI learning private Ltd, 2010.)
4. Robertson G. L., *Food Packaging– Principles and Practice*, (CRC Press Taylor and Francis, 2012.)
5. Singh R.P. and Heldman D.R. *Introduction to food engineering*, (Academic press, 2009.)

**Course Outcomes-****Unit I : After completion of the unit, Students are able to:**

1. Define primary processing of food.
2. Understand the primary processing as cleaning, sorting, grading, cutting, and blanching.

**Unit II : After completion of the unit, Students are able to:**

1. Define secondary processing of food.
2. Understand the secondary processing as slicing, pulping, paste, frying, chilling, freezing and milling.

**Unit III : After completion of the unit, Students are able to:**

1. Learn common food processing methods like cooking, baking, frying, toasting, roasting.
2. Learn common food processing methods like grilling, blanching, extrusion.

**Unit IV After completion of the unit, Students are able to:**

1. Understand functions of food packaging
2. Understand general properties of packaging material.

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**BFPT 102 - FOOD ADDITIVES, CONTAMINANTS AND TOXICOLOGY-I**  
**Course Objective: Students should:**

1. Know the classification of additives in food processing and preservation.
2. Know the functions of additives in food processing and preservation.
3. Understand the safety and quality evaluation of food additives and contaminants.
4. Know the direct food additives.

**Unit I: Introduction of food additives. (9 lectures)**

Additives in food processing and preservation – classification and their functions, ADI, GRAS and naturally occurring compounds, Nutritional and non-nutritional food additives.

**Unit II: Safety and quality evaluation. (6 lectures)**

Safety and quality evaluation of food additives and contaminants, International numbering system for food additives.

**Unit III: Direct food additives. (12 lectures)**

Preservatives, Antioxidants, Acidulants, Chelating/ Sequesterants – Introduction, their chemistry, types and functions.

**Unit IV: Color as Direct food additives (9 lectures)**

Colors-Types and properties, regulatory aspects, safety issues and Natural food colors-heme pigments, chlorophylls, carotenoids, anthocyanins and flavonoids, tannins, caramel and other artificial food colors

**RECOMMENDED BOOKS:**

1. Fennema, O.R. Marcel Dekker *Principles of Food Science: Part-I Food Chemistry*, , New York, Ed. 1976
2. Potter, N.N. *Food Science*, , Westport. 3rd Ed. 1978.
3. Furia T.E. *Handbook of food additives*. VolII and VolIII, 1980
4. George A.B *Encyclopedia of food color additives*, , VolIII; CRC Press, 1996.

**Course Outcomes-****UNIT I: After completion of the unit, Students are able to:**

1. Define food additives
2. Understand classification of food additives.

**UNIT II : After completion of the unit, Students are able to:**

1. Understand safety evaluation of food additives.
2. Understand quality evaluation of food additives.

**UNIT III : After completion of the unit, Students are able to:**

1. Define preservatives, antioxidants, acidulants and chelating/sequesterants.
2. Understand properties and functions of preservatives, antioxidants, acidulants and chelating/ sequesterants.

**UNIT IV : After completion of the unit, Students are able to:**

1. Define colors.
2. Understand classification of colors.

**LAB-I BFPP- 110 - FOOD PROCESSING AND ADDITIVES-I****Course Objective: Student should:**

1. Know the principle and working of baking, frying, roasting, grilling and blanching processes.
2. Understand the method of determination of adulteration in milk, cereals, oils and fats, spices, etc.
3. Know the application of additives in bakery, fruits, vegetables, milk and meat products.
4. Know clarification of fruit juices.

**Practicals-**

1. Principle and working of baking process.
2. Principle and working of frying process.
3. Principle and working of roasting process.
4. Principle and working of grilling process.
5. Principle and working of blanching process.
6. Identification of packaging material.
7. Spectrophotometric method for total chlorophyll A and B.
8. Clarification of fruit juices.
9. Use of additives (according to GRAS) in fruits, vegetables, milk and meat products.
10. Determination of adulteration in milk, cereals, oils and fats, spices.

**RECOMMENDED BOOKS:**

1. Manual of method of analysis of food (Food additives) Food Safety and Standard Authority of India, Ministry of family welfare, Government of India, New Delhi-2012
2. Jim Smith and Lily Hong Shum, Food Additives Data book, 2<sup>nd</sup> edition, 2011.
3. Potter, N.N. Springer, Food Science., 5<sup>th</sup> edition, 1999.
4. Furia, T.E., Handbook of food additives. Vol I and Vol II, CTC press, 1980.
5. Fennema, O.R. Ed. Marcel Dekker, Principles of Food Science: Part-I Food Chemistry. New York. 1976.

**Course Outcomes-**

**After completion of the Lab course, Students are able to:**

1. Operate oven.
2. Understand end point of frying, roasting, and grilling.
3. Learn estimation of chlorophyll pigments.
4. Understand techniques of clarification of juices.
5. Select specific food additives for specific food.
6. Detect adulteration in different food.

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**BFPT – 103- FOOD MICROBIOLOGY-I****Course Objective: Students should:**

1. know the important contributions of various scientists in microbiology and scope of microbiology.
2. know the important genera of microorganisms associated with food and their characteristics.
3. know the microbial nutrition and culture media.
4. know the control of microorganisms

**Unit I: History and Scope of Microbiology (9 Lectures)**

Important contributions of various scientists, Scope of microbiology, Introduction to microorganisms - bacteria, algae, fungi, protozoa and viruses, importance of bacteria, yeast, and moulds in foods.

**Unit II: General Characteristics of Microorganisms (9 Lectures)**

Structure of Prokaryotic and Eukaryotic cell, Morphology of bacteria: Size, Shape and Arrangements, Cytology of bacteria - structure and functions of cell wall, cell membrane, Capsules and slime layer, flagella, Pili, nuclear material, mesosome, ribosome and spores.

**Unit III: Microbial nutrition And Culture Media (9 Lectures)**

Microbial Nutrition- Nutritional requirements of microorganisms, Nutritional types of

microorganism based on carbon and energy sources, Culture media: Common components of media and their functions, Types of media.

**Unit IV: Control of Microorganisms****(9 Lectures)**

Definitions Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Antisepsis, Sanitization. Mode of action, application and advantages of: Physical agents, Chemical Agents, Gaseous Agent.

**RECOMMENDED BOOKS:**

1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R. Krieg, Microbiology (McGraw Hills Publication, 1986) 5th edition.
2. A. J. Salle, Fundamental Principles of Bacteriology (McGraw-Hill Book Co. New York and London 1973) 7th Edition
3. Martin Frobisher, Fundamentals of Microbiology (W. B. Saunders, Philadelphia, 1962) 7th edition.
4. Ananthanarayan and Paniker's, A Textbook of Microbiology (Orient Black Swan, 7<sup>th</sup> edition) 2016
5. R. Y. Stanier, J. L. Ingraham, M. L. Wheelis and P. R. Painter, General Microbiology (Macmillan Education Ltd., London, 2001) 5<sup>th</sup> edition.
6. Dr. C.B. Powar, Dr. H.F. Dagainawala, General Microbiology (Himalaya Publications, 2010)
7. Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology (McGraw Hill Education) 2nd edition.
8. Dr. H. A. Modi, Elementary Microbiology, Fundamentals of Microbiology (Akta. Prakashan Nadiad, 1995) Vol. I.
9. C. P. Baveja, Microbiology (Arya publications, 6th Edition, 2019) UNIT I to IV
10. K.P. Tolaro, Foundations in Microbiology (McGraw Hill Education) 7th International edition 2009.
11. Michael T Madigan; Thomas D Brock, Brock biology of microorganisms, (San Francisco, CA: Pearson/Benjamin Cummings) 12th edition 2008.
12. S.S. Purohit, Microbiology fundamentals and applications, (Agrobios Publisher, 2003, 6<sup>th</sup> edition.)
13. Doyle and Beuchat and Montville, Food Microbiology (ASM Press, 2001.)
14. Frazier W. C. and Westhoff D. C., Food Microbiology, (TMH Publication, New Delhi, 2004)

**COURSE OUTCOMES-**



**UNIT I – After completion of the unit, Students are able to:**

1. understand history of microbiology.
2. understand scope of microbiology.

**UNIT II After completion of the unit, Students are able to:**

1. draw and explain structure of prokaryotic and eukaryotic cell.
2. understand functions of cell organelles.

**UNIT III: After completion of the unit, Students are able to:**

1. understand the nutritional requirements of micro-organisms.
2. understand the culture media, their types, media components and their functions.

**UNIT IV After completion of the unit, Students are able to:**

1. understand techniques required for control of microorganism.
2. understand different agents used for sanitization.

**BFPT -104- FOOD PRESERVATION – I****Course Objective: Students should:**

1. Understand the scope of food preservation
2. Know the principles and types of preservation, shelf life of food products.
3. Know the food preservation by high temperature and low temperature.
4. Know the food preservation by drying and dehydration.

**Unit I: Introduction of food preservation (9lectures)**

Definition and scope of food preservation, principles of preservation, preservatives and its types, shelf life of food products

**Unit II: Food Preservation by high temperature (9lectures)**

Introduction, classification and method of sterilization, pasteurization, blanching and canning

**Unit III: Food Preservation by Drying and dehydration (9 lectures)**

Definition, drying as a means of preservation, Differences between sun drying and Dehydration (Mechanical drying), Factors affecting rate of drying, normal drying curve, Types of driers used in the food industry.

**Unit IV: Food Preservation by Low temperature (9lectures)**

Introduction to refrigeration, cool storage and freezing, definition and principle of freezing, freezing curve, Changes occurring during freezing, Types of freezing -slow freezing, quick freezing, freeze drying, Introduction to thawing, changes during thawing and its effect on food.

**RECOMMENDED BOOKS:**

1. B. Srilakshmi, *Food science*, (New Age Publishers, 2002.)
2. Meyer, *Food Chemistry*, (New Age, 2004.)
3. Bawa. A.S, O.P Chauhan et al, *Food Science*, (New India Publishing agency, 2013.)
4. Frazier W. C. and Westhoff D. C., *Food Microbiology*, (TMH Publication, New Delhi, 2004.)

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**Course Outcomes-****Unit I-After completion of the unit, Students are able to:**

1. Understand principle of preservation.
2. Explain classification of preservatives.

**Unit II-After completion of the unit, Students are able to:**

1. Understand processes of pasteurization and sterilization.
2. Understand processes blanching and canning.

**Unit III -After completion of the unit, Students are able to:**

1. Understand differences between sun drying and dehydration.
2. Understand methods of dehydration.

**Unit IV After completion of the unit, Students are able to:**

1. Understand principle of freezing.
2. Understand freezing techniques.

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**LAB-II BFPP- 111- FOOD MICROBIOLOGY AND PRESERVATION-I****Course Objective: Student should:**

1. know the principle and working of instruments such as incubator, oven, autoclave, water bath colorimeter, weighing balances, muffle furnace and centrifuge, etc.
2. know the method of weighing, adjusting the pH of media and sterilize the media by autoclaving.
3. Know the preservation of food by canning and osmotic dehydration.

**Practicals-**

1. Introduction to the Basic Microbiology Laboratory Practices
2. Study of instruments used for microbiology (Incubator, oven, autoclave, water bath etc.).
3. Principle and working of analytical instrument such as colorimeter, weighing Balances, muffle furnace and centrifuge.
4. Functioning and use of compound microscope
5. Cleaning and sterilization of glassware
6. Preparation and sterilization of media (Nutrient broth, Nutrient agar, MacConkeys agar, Sabouraud's agar)
7. Preparation of slant, stab and plates using nutrient agar

8. Preservation of food by the process of freezing.
9. Drying of food using Tray dryer/other dryers.
10. Preservation of food by canning. (Fruit/Vegetable/meat)
11. Cut-out analysis of canned food.
12. Preservation by Osmotic dehydration.

**RECOMMENDED BOOKS:**

1. David T. Plummer, An Introduction to practical biochemistry (McGraw-Hill Book Company (U.K.) Ltd., London 1978) 2nd edition
2. J. Jayraman, Laboratory Methods in Biochemistry (New Age International, 2011)
3. Dr. Nikunj Patel, Experimental Microbiology (Educreation Publishing)
4. Shivaraja Shankara YM, Ganesh MK, Shivashankara AR, Laboratory Manual for Practical Biochemistry (Jaypee Brothers, Medical publisher Pvt. Ltd, 2008)
5. R. Singh, S. K. Sawhney, Introductory Practical Biochemistry (Narosa, 2009)
6. K Wilson, K H Goulding, Principles and techniques of Practical biochemistry (Edward Arnold, London. 1986) (third edition)
7. F. J. Baker, Bacteriological techniques (Butterworth & Co Publishers Ltd, 1967)
8. Rakesh Patel, Experimental Microbiology (Aditya Book Centre, 5<sup>th</sup> edition, Vol. I and Vol. II, 2009)
9. Ronald Atlas, Handbook of Media for Clinical and Public Health Microbiology, (CRC Press, 2013)
10. Emanuel Goldman and Lorrence Green, Practical Handbook of Microbiology (Taylor & Francis, 2008)
11. Manual of method of analysis of food for microbial testing – Food Safety and Standard Authority of India, Ministry of family welfare, Government of India, New Delhi-2012
12. Neelima Garg, K.L. Garg, K.G. Mukerji, Laboratory Manual of Food Microbiology, (I.K. International Pvt Ltd, 2010.)
13. William G. Walter, Laboratory manual for food microbiology, 4th edition, 2011.
14. Marion L. Fields, Laboratory manual in food preservation, (Avi Publishing Co Inc.; New edition, 1983.)
15. M. Shafiur Rahman, Handbook of food preservation, (CRC Press, 2007.)
16. Frobisher, Hinsdill, Crabtree, Goodheart, Fundamentals of microbiology (W.B. Saunders Company, 9th edition, 1974.)
17. Dey and Dey, Medical bacteriology, Allied agency, 7th edition, 1973.
18. Frazier W. C. and Westhoff D. C., Food Microbiology, TMH Publication, New Delhi, 2004.)
19. Stanier R.Y., Palgrave Macmillan, General microbiology, (Palgrave Macmillan, 5th revised edition, 1987.)

**COURSE OUTCOMES-**

**After completion of Lab course, Students are able to:**

1. learn basic microbiology laboratory practices and operate different instruments used for microbiology (incubator, oven, autoclave, water bath etc.).
2. learn media preparation required for cultivation of different microorganism.
3. understand techniques of cleaning and sterilization and preparation, sterilization of different media and preparation of slant, stab and plates using nutrient agar.
4. Learn the preservation of food by canning and osmotic dehydration.

## BFPT - 105 FOOD CHEMISTRY – I

**Course Objective: Students should:**

1. Know the chemistry of foods - composition of food, role of each component and their interaction.
2. Know the structure of different biomolecules.
3. Know the functional aspects of food components and to study their role in food processing.
4. Know the water activity

**Unit I: Introduction to Food Chemistry and Water (9 lectures)**

Definition of food, food science, food chemistry, Composition of food, Importance of food chemistry, Water-Structure of water and ice, Phase diagram of water, Types of water, Sorption isotherms, Moisture content, Water activity and food packaging.

**Unit II: Carbohydrates (9 lectures)**

Definition of carbohydrates, Nomenclature, Classification of Carbohydrates, Structure of carbohydrates, Chemical reactions of carbohydrates – oxidation, reduction, crystallization.

**Unit III: Proteins (9 lectures)**

Definition of proteins, Chemical composition of proteins, classification and structure, Plant proteins and animal proteins

**Unit IV: Lipids (9 lectures)**

Definition of fats and oils, Chemical composition of fats and oils, Classification of lipids, Physical properties of fats and oils, Chemical properties of fats and oils.

## RECOMMENDED BOOKS:

1. Fennema, Owen R., Marcell Dekker, Food Chemistry, (New York, 3rd Ed, 1996).
2. Potter, N.N. and Hotchkiss, J.H., Food Science, (Chapman and Hall, 5th Ed, 1995).
3. DeMan, J.M., Principles of Food Chemistry, (AVI, Springer, 4<sup>th</sup> edition 2018).

**Course Outcomes-****Unit I After completion of the unit, Students are able to:**

1. Understand the composition of food and importance of food chemistry.

2. Understand the role of water in food processing.

**Unit II: after completion of the unit, students are able to:**

1. Define carbohydrate and explain its nomenclature and classification.
2. Understand the structure and chemical reactions of carbohydrates during food processing.

**Unit - III : After completion of the unit, students are able to:**

1. Define proteins and explain its classification.
2. Understand the structure and chemical reactions during food processing

**Unit iv after completion of the unit, students are able to:**

1. Define lipids and explain its classification
2. Understand the structure, physical and chemical properties of lipids.

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**BFPT – 106 ANALYTICAL TECHNIQUES – I****Course objective: Students should:**

1. Know the methods of proximate analysis of food.
2. Understand the different types of solution.
3. Understand the colorimetry and spectrophotometry.
4. Understand the atomic absorption spectroscopy.

**Unit I: Proximate Analysis of Food****(9 lectures)**

Introduction, Preparation of sample, Methods for estimation of moisture, protein, fat, fiber, ash and carbohydrate.

**Unit II: Types of Solution****(9 lectures)**

Molar Solution, Normal solution, Colloidal solutions, Buffer solutions, Measurement of pH.

**Unit III: Colorimetry and spectrophotometry (9 lectures)**

Principle, Beer's - Lambert's law, Construction, Working, Care of colorimeter, Standard solutions, Blank solutions.

**Unit IV: Atomic absorption spectroscopy (9 lectures)**

Principles, Instrumentation, Application.

**RECOMMENDED BOOKS:**

1. Morris B. Jacobs, *The chemical analysis of foods and food products*, (CBS Publishers and distributors New Delhi, III Edition, 2000.)
2. S. Ranganna, *Hand book of analysis and quality control for fruit and vegetable products*, (Tata McGraw Hill Publishing Co. New Delhi, 3<sup>rd</sup> edition, 2007.)
3. D.T. Plummer, *An introduction to practical biochemistry*, (Tata McGraw Hill Publishing Co. New Delhi, 3<sup>rd</sup> edition, 2004.)
4. Pomeranz Y., Meloan, *Food Analysis: Theory and practice*, (Clifton E. 1994. 3 Edn. IS: 6273 (Part- 1 and Part-2). Chapman and Hall, 3<sup>rd</sup> edition, 2004.)

**Course Outcomes-****Unit I: After completion of the unit, Students are able to:**

1. Understand the methods for estimation of moisture, protein and fat.
2. Understand the methods for estimation fiber, ash and carbohydrate

**Unit II: After completion of the unit, students are able to:**

1. Understand the molar solution, normal solutions, colloidal solutions, buffer solution.
2. Calculate the molarity, normality of solutions.

**Unit II : After completion of the unit, students are able to:**

1. Understand the principle, construction and working of colorimetry
2. Understand the principle, construction and working of spectrophotometry.

**Unit IV: after completion of the unit, students are able to:**

1. Understand the principle, instrumentation of atomic absorption spectroscopy.
2. Understand the application of atomic absorption spectroscopy



**LAB III BFPP 112 FOOD CHEMISTRY AND ANALYTICAL TECHNIQUES –I****Course Objective: Student should:**

1. Know the method of estimation of carbohydrates and protein in food samples.
2. Know the method of estimation of reducing and non-reducing sugars and starch in food samples.
3. Know the method of determination of pH and acidity in different food sample.
4. Know the method of determination of moisture content and ash content in different food sample.

**Practical-**

1. Determination of hardness of water.
2. Estimation of carbohydrates by phenol sulfuric acid method.
3. Estimation of protein by Biuret method.
4. Estimation of reducing and non-reducing sugars.
5. Estimation of starch by anthrone method.
6. Determination of smoke point for different fat and oils.
7. Preparation of Primary and Secondary solutions.
8. Determination of pH of different food samples.
9. Determination of acidity of given food samples.
10. Determination of Moisture Content from given food samples.
11. Determination of Ash content from given food samples.
12. Estimation of Calorific value using Calorimeter

**RECOMMENDED BOOKS:**

1. Connie M. Weaver, James R. Daniel, *The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists*, 1996.
2. Dennis D. Miller, *Food Chemistry: A Laboratory Manual*, (Wiley 2017)
3. Morris B. Jacobs, *The chemical analysis of foods and food products*, (CBS Publishers and distributors New Delhi. 3<sup>rd</sup> edition).
4. S. Ranganna, *Hand book of analysis and quality control for fruit and vegetable products*, (Tata McGraw Hill Publishing Co. New Delhi, 2003)

**Course Outcomes**

**After completion of the Lab course, Students are able to:**

1. Understand the method of determination of hardness of water.
2. Estimate total carbohydrates, protein, starch, ash, moisture content from different food samples.
3. Estimate reducing and non-reducing sugars from different food samples and method of determination of smoke point for different fats and oils.
4. Understand preparation of primary and secondary solutions.
5. Understand the method for determination of pH and acidity from different food samples.
6. Estimate calorific value by using calorimeter.

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**BFPT – 107 HUMAN NUTRITION-I**

**Course Objective: Students should-**

1. learn the relationship between food, nutrition and health.
2. learn the functions of food and energy value of food.
3. understand the concept of nutrient.
4. learn the digestion, absorption and function of various nutrients and their sources.

**Unit I: Introduction of Food and Nutrition****(9 lectures)**

Introduction to nutrition, food as a source of nutrients, functions of food, types of nutrition, Health, Recommended Daily Allowances (RDA). Food guide-Basic five food groups, Nutritional status, Understanding relationship between food and health of people.

**Unit II: Energy Value of food****(9 lectures)**

Unit of measuring energy, calorific value of food, Basal Metabolic Rate and factors affecting it, SDA of food, Calculation of energy requirement, Biological value of Food.

**Unit III: Nutrients and their function****(9 lectures)**

Introduction, Classification, functions, dietary sources, digestion, absorption metabolism of carbohydrates, Proteins and fats, storage in body, Role of fibers in human

nutrition, Vitamins (Water and fat soluble), definition, classification, RDA, functions, bioavailability, Dietary sources, deficiency, excess. Water as a nutrient, functions, daily requirement, water balance.

**Unit IV: Community Nutrition****(9 lectures)**

Improvement of nutrition of a community-Modern methods of improvement or nutritional quality of food, food fortification, enrichment and nutrient supplementation. National and international agencies uplifting the nutritional status-WHO, FAO, ICAR, ICMR, NIN, CFTRI.

**RECOMMENDED BOOKS:**

1. Sunetra Roday, Food Science and Nutrition,(2<sup>nd</sup> Edition: Oxford Publication:Oxford University Press,2018)
2. M. Swaminathan Advanced text book on Food and Nutrition,Vol.I and II,(2<sup>nd</sup> Edition: BAPPCO Publication:The Bangalore Press,2006).
3. Jim Mann and A. Stewart Truswell,Essentials of Human Nutrition, (3<sup>rd</sup>Edition: Oxford publication:Oxford University Press,2010).
4. B. Srilakshmi Nutrition Science,(6<sup>th</sup>Edition:New Age International Publishers:New Age International P Limited,2018)
5. Michel J.Gibney, Hester H. Vorster and Frans J. Kok Introduction to Human Nutrition:Blackwell Publishing:A John Wiley & Sons, Ltd 2002).

**COURSE OUTCOMES-****Unit I After completion of the unit, Students are able to:**

1. Students are able to understand the concept of food, nutrition, nutrients.
2. Students are able to understand the functions of food.

**Unit II After completion of the unit, Students are able to:**

1. Students are able to understand how to calculate energy value of food and biological value of food.
2. Students are able to understand the concept of basal metabolic rate(BMR)

**Unit III After completion of the unit, Students are able to:**

1. Students are able to understand of nutrients and classification of nutrients.

2. Students are able to understand digestion, absorption, metabolism of nutrients
- Unit IV After completion of the unit, Students are able to:
1. Students are able to understand food fortification, enrichment and nutrient supplementation.
  2. Students are able to understand National and international agencies uplifting the nutritional status-WHO, FAO, ICAR, ICMR, NIN, CFTRI.

### **BFPT-108: FOOD PACKAGING I**

#### **Course Objective: Students should:**

1. know the importance, functions and types of food packaging.
2. know the properties and functions of wood and paper
3. understand the properties and functions of glass and metal packaging.
4. know the different packaging techniques.

#### **Unit I: Introduction to Food Packaging.**

**(9 Lectures)**

History, Importance and functions of Food packaging. Properties of packaging material in relation to these functions, package design. Classification of packaging material – On the basis of packaging material ,packaging component ,Packaging technique. Materials used in packaging- rigid, semi rigid and flexible. Types of containers-primary and secondary, flexible and rigid, hermetic and non hermetic.

#### **Unit II: Wood and Paper Packaging.**

**(9 Lectures)**

Packaging materials: Wood- structure, types, properties and wooden containers used in packaging, types of wooden boxes. Paper and paper board- structure, making, properties, types and uses of paper and paper board, CFB boxes and their comparison with wooden containers.

#### **Unit III: Glass and Metal Packaging**

**(9 Lectures)**

Packaging materials: Glass – composition, properties, structure, types and manufacture of glass containers, their uses, breakage in glass, closure for glass

containers. Metals- properties of metals, different metals used in food packaging, steel plate and functions of various constituents of steel, formation of two piece and three piece cans, tinning process, tin free steel, aluminum containers, lacquering –type and applications, aluminum foil, corrosion of metal cans.

**Unit IV: Packaging Methods****(9 Lectures)**

Aseptic packaging of foods: sterilization of packaging material, food contact surfaces and aseptic packaging systems, active food packaging – definition, scope, physical and chemical principles involved, edible films and coatings.

**RECOMMENDED BOOKS:**

1. Robertson, G.L., Taylor and Francis Group Boca raton, Food Packaging: Principles and Practice, London New York press, published CRC, 3rd Ed, 2006.
2. Richard coles, Derek McDowell and Mork J Food Packaging Technology, Kirwan published Black well publishing CRC Press, August 2003
3. B. Shrilakshmi Food Science, published New Age International, 2003.
4. Edited by Raija Ahvenainen Novel Food Packaging Techniques, published Woodhead Publishing Limited, First Edition, June 2003

**COURSE OUTCOMES-****Unit I: After completion of the unit, Students are able to:**

1. understand the history, importance and functions of food packaging.
2. explain the types of food packaging materials.

**Unit II: After completion of the unit, Students are able to:**

1. understand the wood and paper as packaging materials.
2. understand the types and uses of paper, CFB boxes and their comparison with wooden containers.

**Unit III: After completion of the unit, Students are able to:**

1. understand the glass and metals- their types, making properties.
2. explain the type and applications of packaging materials

**Unit IV: After completion of the unit, Students are able to:**

1. understand the aseptic packaging of foods
2. understand the active food packaging

**Lab-IV BFPP- 113-HUMAN NUTRITION AND FOOD PACKAGING– I****Course Objective: Student should:**

1. identify the food sources for various nutrients using food composition tables.
2. estimate the BMI of different age groups.
3. design nutritional labeling of food products.
4. know the principle and working of vernier calliper to measure thickness of paper and paperboard.
5. understand the measurement of Cobb's value and GSM value of paper and paperboard

**Practicals-**

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self using 24 hour dietary recall and its nutrition analysis.
3. Preparation of weaning foods for infants.
4. Planning of nutritious snacks for different age and income groups.
5. Nutritional labeling of food products.
6. Calculation of BMI of an individual and interpretation of result.
7. To determine GSM (gram per square meter) of paper and paperboard.
8. To determine thickness of paper and paperboard.
9. To determine Cobb's value of a paperboard.
10. To determine the thermal shock resistance of a glass container.
11. To find out the porosity of tinplate.
12. To identify the different types of packaging materials.

**RECOMMENDED BOOKS-**

1. Bevier, Isabel Usher, Susannah Food and nutrition; laboratory manual, Department of household science, University of Illinois: (Urbana-Champaign campus) 1863
2. B. Srilakshmi, Human Nutrition For B. Sc. Nursing Students, (2<sup>nd</sup> ed, New Age International

(P)Ltd,2016)

3.Sunetra Roday, Food Science and Nutrition,(2<sup>nd</sup> Edition: Oxford Publication:Oxford University Press,2018)

4. T. Dashman.Laboratory Manual for Human Nutrition Lab Manual,(1<sup>st</sup> Edition,Kendall/Hunt Publishing Co ,U.S.: Lab Manual edition,2008)

5. S.Ranganna Handbook of Analysis and Quality control for fruits and vegetable products, , (2<sup>nd</sup> edition, McGraw Hill Education(India) PVT.LTD, Chennai1986)

6. Richard coles, Derek McDowell and Mork J Kirwan,Food Packaging Technology, CRC Press:Black well publishing, August 2003)

7. Raija Ahvenainen,Novel Food Packaging Techniques,(1<sup>st</sup>Edition,CRC:Woodhead Publishing Limited,June 2003)

#### **COURSE OUTCOMES-**

##### **After completion of the Lab course, Students are able to:**

1. Students are able to understand the concept of how to identify the food sources for various nutrients using food composition tables.
2. Students are able to understand the concept of how to record diet of self using 24 hour dietary recall and it's nutritional analysis.
3. Students are able to understand the concept of how to prepare weaning foods for infants.
4. Students are able to understand the concept of how to prepare nutritional labeling of food products.
5. Students are able to understand the concept of how to calculate BMI.
6. Calculate GSM of paper and paper board, measure thickness of paper, measure the porosity of tin plate.
7. Identify the different types of packaging materials, evaluate shelf life of packaged foods.

## Semester II

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE,SATARA									
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM (CBCS)									
B. Sc. FOOD PROCESSNG AND PACKAGING (ENTIRE)									
B. Sc. I SEMESTER – II (Duration – 6 Months)									
Sr No	Course Code	Name of the Course	TEACHING SCHEME						
			Theory			Practical			
			No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	BFPT - 201	Principles of food processing and packaging-II	3	2.4	2	Lab-V BFPP-210 (Food Processing and Food Additives -II)	4	3.2	2
2	BFPT -202	Food Additives, Contaminants and Toxicology -II	3	2.4	2				
3	BFPT -203	Food Microbiology-II	3	2.4	2	Lab-VI BFPP-211 (Food Microbiology and Preservation -II)	4	3.2	2
4	BFPT -204	Food Preservation-II	3	2.4	2				
5	BFPT -205	Food Chemistry -II	3	2.4	2	Lab-VII BFPP- 212 (Food Chemistry and Analytical Techniques -II )	4	3.2	2
6	BFPT -206	Analytical Techniques -II	3	2.4	2				
7	BFPT -207	Human Nutrition -II	3	2.4	2	Lab-VIII BFPP- 213 (Human Nutrition and Food Packaging - II)	4	3.2	2
8	BFPT -208	Food Packaging -II	3	2.4	2				
9	BFPT AECC-2	English-II	3	2.4	2		---	--	
	<b>Total of SEM II</b>		<b>27</b>	<b>21.6</b>	<b>18</b>		<b>16</b>	<b>12.8</b>	<b>8</b>
	<b>Total of SEM I and SEM II</b>		<b>54</b>	<b>43.2</b>	<b>36</b>		<b>32</b>	<b>25.6</b>	<b>16</b>



## SEMESTER – II

## BFPT 201 PRINCIPLES OF FOOD PROCESSING AND PACKAGING – II

**Course Objective: Students should:**

1. Know the scope, importance and future prospects of food processing industry.
2. Know the classification, scope and importance of plant food processing.
3. Know the classification, scope and importance of animal food processing.
4. Know the packaging of food.

**Unit I: Processing Industry****(9 Lectures)**

Scope of food processing industry, Importance, Future Prospects, Sectors of food processing industry, Classification of food – perishable and semi-perishable food.

**Unit II: Principle of Plant Food Processing****(9 lectures)**

Introduction, Classification, Scope and Importance of plant food processing- Fruit and vegetable processing, Cereal and legume processing, Oilseeds processing

**Unit III: Principle of Animal Food Processing****(9 lectures)**

Introduction, Classification, Scope and Importance of animal food processing- Milk processing, Meat processing, Fish processing, Poultry processing

**Unit IV: Packaging of Food****(9 lectures)**

Packaging Rules, Labeling, Packaging Techniques, Bar-coding.

**RECOMMENDED BOOKS:**

1. Coles R, McDowell D and Kirwan MJ, Food Packaging Technology (CRC Press, 2003)
2. De Sukumar, Outlines of Dairy Technology, Oxford Publishers, 2002
3. Jenkin swa and Harrington Jp, Packaging Foods with Plastics, (Technomic publishing Company Inc., USA, 1991.)

4. ManayNSandShadaksharaswamyM,Food-FactsandPrinciples, (NewAge International(P)Ltd. Publishers,NewDelhi,2<sup>nd</sup>edition,2001.)
5. PotterNH,FoodScience, (CBSPublication,NewDelhi,1998)
6. RamaswamyHandMarcottM,FoodProcessingPrinciplesandApplications,(CRC Press, 2006)
7. RangannaS,HandbookofAnalysisandQualityControlforFruitsandVegetable,Tata McGrawHill,2<sup>nd</sup>edition,2007NewDelhi)

**Course Outcomes-****Unit I : After completion of the unit, Students are able to:**

1. Understand the scope of food processing sector.
2. Explainthe classificationofthe food

**Unit II : After completion of the unit, Students are able to:**

1. Explainthe classificationplant food processing
2. Explainprocessing offruit and vegetable, cereal, legume and oilseeds.

**Unit III : After completion of the unit, Students are able to:**

1. Explainthe classificationofanimal foodprocessing
2. Explainprocessing ofmilk, meat, fishand poultry.

**Unit IV After completion of the unit, Students are able to:**

1. Understand the packaging rules and labeling.
2. Understand the packaging techniques, bar-coding.

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**BFPT- 202 FOOD ADDITIVES, CONTAMINANTS AND TOXICOLOGY-II****Course Objective: Students should:**

1. Know the chemistry, types and functions of food additives.
2. Know the direct food additives.
3. Know the indirect food additives.
4. Understand methods for detection of food additives.

**Unit I : DIRECTFOODADDITIVES - I (9 lectures)**

Sweeteners- Natural and low calorie/ Non –nutritive sweeteners, Their Chemistry, Types and Functions, Emulsifiers, - Their Chemistry, Types and Function, Stabilizers and Thickeningagents- Their Chemistry, Typesand Functions

**Unit II: Direct Food Additives-II (9 lectures)**

Flour bleaching agents, Antimicrobialagents – Their Chemistry, Types and Functions, Anticaking agents, Humectants – Their Chemistry, Types and Functions, Flavor and flavor enhancers-Types of flavors, extractiontechniques of flavors, flavor emulsions, essentialoils and oleoresins.

**Unit III: Indirect Food Additives (9 lectures)**

Food Contaminants– Definition, Types, Food Toxicants– Definition, Types, Terminologies inToxicology

**Unit IV: Methods for Detection of Food Additives (9lectures)**

Acute and Chronic studies, Methods for Detection of Food Additives, LD50 Value

**RECOMMENDED BOOKS:**

1. Fennema, O.R., Principles of Food Science, Part-I Food Chemistry. Marcel Dekker, New York, Ed.1976
2. Potter, N.N., Food Science, 3rd Ed. AVI, Westport1978.
3. . Branen A.L. and Davidson, P.M., Marcel Dekker, Antimicrobials in Foods New York 1983.
4. Furia, T.E., Handbook of food additives. VolI and VolIII 1980.

**Course Outcomes-****Unit I : After completion of the unit, Students are able to:**

1. Understand the chemistry, types and functions of sweeteners.
2. Understand the chemistry, types and functions of emulsifiers, stabilizers and thickening agents.

**Unit II : After completion of the unit, Students are able to:**

1. Understand the chemistry, types and functions of anticaking agents and humectants.
2. Understand the chemistry, types and functions of flavor and flavor enhancers.

**Unit III : After completion of the unit, Students are able to:**

1. Understand the concept of food contaminants and its types.
2. Understand the concept of food toxicants and its types.

**Unit IV : After completion of the unit, Students are able to:**

1. Explain the methods for detection of food additives.
2. Calculate the LD 50 value.

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**LAB V BFPP 210 FOOD PROCESSING AND ADDITIVES-II****Course Objectives: Student should:**

1. Know the principle and working of pulping and paste making
2. Know the principle and working of frying and toasting processes.
3. Know the method for detection of stabilizers and thickeners from different food samples.
4. Know the method for detection of natural colors, benzoic acid, and saccharin from different food samples.

**Practical-**

1. Principle and working of pulping process.
2. Principle and working of Paste process.
3. Principle and working of frying process.
4. Principle and working of toasting process.
6. Detection of stabilizers and thickeners (sodium alginate, starch, methyl cellulose, de

- esterified pectin's) from different food sample.
7. Identification of synthetic food colors.
  8. Identification of natural colors from food sample.
  9. Detection of Benzoic acid from food sample
  10. Detection of Saccharin from food samples.

**RECOMMENDED BOOKS:**

1. Food Safety and Standard Authority of India, Ministry of family welfare *Manual of method of analysis of food (Food additives)* –, Government of India, New Delhi-2012
2. Jim Smith and Lily Hong-Shum *Food Additives Data book*, second edition.
3. Potter, N.N *Food Science*, AVI, Westport. 3rd Ed, 1978.
4. Furia, T.E. *Handbook of food additives*. Vol II and Vol III, 1980.
5. Fennema, O.R *Principles of Food Science: Part-I Food Chemistry*. Marcel Dekker, New York. . 1976

**Course Outcomes-****After completion of the Lab course, Students are able to:**

1. Understand and perform the processes as pulping, paste making, frying and toasting.
2. Learn method for detection of stabilizers and thickeners from different food samples.
3. Understand method of identification of natural colors.
4. Understand method for detection of benzoic acid from food sample.
5. Understand detection of saccharin from food samples.

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## BFPT – 203 FOOD MICROBIOLOGY- II

**Course Objective: Students should:**

1. know the role of microbes in contamination of food and spoilage of food.
2. know the cultivation of micro-organisms
3. know the stains and staining techniques.
4. know the identification of bacteria.

**Unit I: Microbial contamination of food and spoilage of food. (9 Lectures)**

Contamination from air, water, soil, sewage, Techniques for evaluation of contamination, Spoilage of Specific Food Products, Food poisoning, Intoxication, Food borne illness.

**Unit II: Cultivation of Micro-organisms (9Lectures)**

Pure culture technique, Methods of isolation and cultivation, Enumeration of Microorganisms-qualitative and quantitative

**Unit III: Stains and staining techniques (9Lectures)**

Classification of stains- acidic, basic and neutral, Principles, Procedures, mechanisms and applications of staining procedures, Simple staining, Negative staining, Gram staining, Differential staining.

**Unit IV: Identification of bacteria. (9Lectures)**

Maintenance of stock cultures – (Agar slants and Agar stabs)

Systematic study of pure cultures:

- i. Morphological characteristics.
- ii. Cultural characteristics-
- iii. Biochemical Characteristics -Sugar fermentation, Production of metabolites -H<sub>2</sub>S gas, Production of enzymes - Amylase, Caseinase and Catalase
- iv. Serological and genetic characteristic.

**RECOMMENDED BOOKS:**

1. Michael J. Pelczar, Jr. E.C.S. Chan, Noel R. Krieg, Microbiology (McGraw Hills Publication, 1986) 5th edition.
2. A. J. Salle, Fundamental Principles of Bacteriology (McGraw-Hill Book Co. New York and London 1973) 7th Edition
3. Martin Frobisher, Fundamentals of Microbiology (W. B. Saunders, Philadelphia, 1962) 7th edition.
4. Ananthanarayan and Paniker's, A Textbook of Microbiology (Orient Black Swan, 7<sup>th</sup> edition) 2016
5. R. Y. Stanier, J. L. Ingraham, M. L. Wheelis and P. R. Painter, General Microbiology (Macmillan Education Ltd., London, 2001) 5<sup>th</sup> edition.
6. Dr. C.B. Powar, Dr. H.F. Daginawala, General Microbiology (Himalaya Publications, 2010)
7. Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, Prescott, Harley, and Klein's Microbiology (McGraw Hill Education) 2nd edition.
8. Dr. H. A. Modi, Elementary Microbiology, Fundamentals of Microbiology (Akta. Prakashan Nadiad, 1995) Vol. I.
9. C. P. Baveja, Microbiology (Arya publications, 6th Edition, 2019) UNIT I to IV
10. K.P. Tolaro, Foundations in Microbiology (McGraw Hill Education) 7th International edition 2009.
11. Michael T Madigan; Thomas D Brock, Brock biology of microorganisms, (San Francisco, CA: Pearson/Benjamin Cummings) 12th edition 2008.
12. S.S. Purohit, Microbiology fundamentals and applications, (Agrobios Publisher, 2003, 6<sup>th</sup> edition.)
13. Doyle and Beuchat and Montville, Food Microbiology (ASM Press, 2001.)
14. Frazier W. C. and Westhoff D. C., Food Microbiology, (TMH Publication, New Delhi, 2004)
15. Dey and Dey, Medical bacteriology, (Allied agency, 7<sup>th</sup> edition, 1973.)
16. Frobisher, Hinsdill, Crabtree, Goodheart, Fundamentals of microbiology, (W.B. Saunders Company, 9<sup>th</sup> edition, 1974.)

**COURSE OUTCOMES-****UNIT I After completion of the unit, Students are able to:**

1. understand the microbial contamination of food and techniques for evaluation of contamination.
2. understand the food spoilage and food borne illness.

**UNIT II After completion of the unit, Students are able to:**

1. understand techniques required for isolation and purification.
2. understand enumeration of microorganisms.

**UNIT III After completion of the unit, Students are able to:**

1. explain the classification of stains
2. understand the principle, mechanism, procedure and applications of different staining procedures.

**UNIT IV After completion of the unit, Students are able to:**

1. understand the maintenance of stock culture
2. understand the morphological, cultural, biochemical, serological and genetic characteristics of bacteria.



**BFPT– 204- FOOD PRESERVATION II****Course Objective: Students should:**

1. Know about introduction and mechanism of action of radiation in food preservation.
2. Understand effect of radiation on microorganisms.
3. Know the non-thermal preservation of food.
4. Know about plasma, bio preservation and hurdle technology.

**Unit I: Food preservation by Radiation (9 lectures)**

Introduction and units of irradiation, Mechanism of action of radiation, Radiation process, Effect of radiation on food, Effect of radiation on microorganisms

**Unit II: Non-thermal preservation of food (9 lectures)**

Pulsed electric field processing, Ohmic heating, Dielectric heating, Microwave processing

**Unit III: Other methods non-thermal food preservation (9 lectures)**

Infrared heating, High pressure processing, processing using ultrasound

**Unit IV: Recent methods of food preservation (9 lectures)**

Plasma, Bio preservation, Hurdle technology

**RECOMMENDED BOOKS:**

1. Joseph H. Hotchkiss, Norman N. Potter, *Food Science*, (CBS Publication, 5<sup>th</sup> edition, 2007.)
2. Ramaswamy H. and Marcotte M., *Food Processing Principles and Applications*, (CRC Press, 2005.)
3. M. deMan, John Finley, W. Jeffrey Hurst, Chang Lee *Principles of Food Chemistry*, (Springer International Publishing, 4<sup>rd</sup> Ed., 2018.)
4. Manay N. S. and Shadaksharaswamy M., *Food-Facts and Principles*, (New Age International Ltd. Publishers, 1987)

**Course Outcomes-****Unit I : After completion of the unit, Students are able to:**

1. Define radiation.
2. Explain the process and effect of radiation on food and microorganisms.

**Unit II : After completion of the unit, Students are able to:**

1. Understand the nonthermal preservation techniques as pulsed electric field and ohmic heating.
2. Understand the nonthermal preservation techniques as dielectric heating and microwave processing.

**Unit III : After completion of the unit, Students are able to :**

1. Understand the non thermal preservation by infrared heating.
2. Understand thermal preservation techniques as high pressure processing and ultrasound

**Unit IV After completion of the unit, Students are able to:**

1. Understand the preservation techniques-plasma and bio preservation.
2. Understand the preservation techniques-hurdle technology.

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**LAB VI BFPP 211 FOOD MICROBIOLOGY AND PRESERVATION-II****Course Objective: Students should:**

1. Know the isolation of bacteria by streak plate technique, isolation of molds from foods.
2. Know the staining methods.
3. Know the detection ability of bacteria to produce caseinase enzyme and sugar fermentation.
4. know use of natural and chemical preservatives in food preservation.
5. know the effect of surface area of food on drying rate .

**Practical-**

1. Isolation of bacteria by streak plate technique.
2. Staining methods-(Monochrome staining, Gram staining, Negative staining).

3. Isolation of molds from foods.
4. SPC of food sample.
5. Detection ability of bacteria to produce caseinase enzyme.
6. Detection ability of bacteria to ferment sugar.
7. Cultivation of anaerobic bacteria.
8. Quality characteristics of foods preserved by drying/dehydration/freezing.
9. Pasteurization of fluids using different methods.
10. Effect of surface area of food on drying rate.
11. Preservation of food by using natural preservatives.
12. Preservation of food by using chemical preservatives.

**RECOMMENDED BOOKS :**

1. David T. Plummer, An Introduction to practical biochemistry (McGraw-Hill Book Company (U.K.) Ltd., London 1978) 2nd edition
2. J. Jayraman, Laboratory Methods in Biochemistry (New Age International, 2011)
3. Dr. Nikunj Patel, Experimental Microbiology (Education Publishing)
4. Shivaraja Shankara YM, Ganesh MK, Shivashankara AR, Laboratory Manual for Practical Biochemistry (Jaypee Brothers, Medical publisher Pvt. Ltd, 2008)
5. R. Singh, S. K. Sawhney, Introductory Practical Biochemistry (Narosa, 2009)
6. K Wilson, K H Goulding, Principles and techniques of Practical biochemistry (Edward Arnold, London. 1986) (third edition)
7. F. J. Baker, Bacteriological techniques (Butterworth & Co Publishers Ltd, 1967)
8. Rakesh Patel, Experimental Microbiology (Aditya Book Centre, 5<sup>th</sup> edition, Vol. I and Vol. II, 2009)
9. Ronald Atlas, Handbook of Media for Clinical and Public Health Microbiology, (CRC Press, 2013)
10. Emanuel Goldman and Lorrence Green, Practical Handbook of Microbiology (Taylor & Francis, 2008)
11. Manual of method of analysis of food for microbial testing—Food Safety and Standard Authority of India, Ministry of family welfare, Government of India, New Delhi-2012
12. Neelima Garg, K.L. Garg, K.G. Mukerji, Laboratory Manual of Food Microbiology, (I.K. International Pvt Ltd, 2010.)
13. William G. Walter, Laboratory manual for food microbiology, 4th edition, 2011.
14. Marion L. Fields, Laboratory manual in food preservation, (Avi Publishing Co Inc.; New edition, 1983.)
15. M. Shafiur Rahman, Handbook of food preservation, (CRC Press, 2007.)
16. Frobisher, Hinsdill, Crabtree, Goodheart, Fundamentals of microbiology (W.B. Saunders Company, 9th edition, 1974.)
17. Dey and Dey, Medical bacteriology, Allied agency, 7th edition, 1973.
18. Frazier W. C. and Westhoff D. C., Food Microbiology, TMH Publication, New Delhi, 2004.)

19. Stanier R.Y., Palgrave Macmillan, General microbiology,(Palgrave Macmillan, 5th revised edition, 1987.)

**Course Outcomes:**

**After completion of the Lab course, students are able to:**

1. Learn techniques of isolation of bacteria by streak plate, isolation of molds from foods.
2. Understand the staining methods.
3. Understand the detection the ability of bacteria to produce caseinase enzyme and sugar fermentation.
4. Understand the method of food preservation by the process of freezing, canning and osmotic dehydration.
5. Learn how to operate tray dryer and method of drying of food in tray dryer.

**BFPT -205 FOOD CHEMISTRY - II****Course Objective: Students should:**

1. Understand the classification, structure of vitamins.
2. Understand the minerals and effect of processing on minerals.
3. Know the food colors and food flavors.
4. Know about the role of enzymes, enzymes in food processing

**Unit I: Vitamins****(9 Lectures)**

Classification, Structure, Water soluble vitamins, Fat soluble vitamins, Effect of processing on vitamins.

**Unit II: Minerals****(9 Lectures)**

Major Minerals: Calcium, Iron, Phosphorus etc., Minor Minerals: Zinc, Magnesium, Manganese etc. Effect of processing on minerals.

**Unit III: Food Colors and Food Flavors****(9 Lectures)**

Food Colors-Types, Structure, Effect of processing on color, Food Flavor-Natural flavor- Types, Structure Artificial flavor- Types, Structure Effect of processing on flavor, True tastes, taste process mechanism of taste stimulation.

**Unit IV : Enzymes****(9 Lectures)**

Introduction, Classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes.

**RECOMMENDED BOOKS:**

1. DeMan, John M., Principles of Food Chemistry ,( Springer, 4<sup>th</sup> edition, 2018).
2. Fennema, Owen R, Marcell Dekker, Food Chemistry, ( New York, 3rd Ed, 1996).
3. Gordon W, New Product Development from Concept to Marketplace Fuller, (CRC Press, 2004).
4. Whitehurst and Law, Enzymes in Food Technology, (CRC Press, Canada, 2<sup>nd</sup> edition, 2002).

**Course Outcomes-****Unit I: After completion of the unit, Students are able to:**

1. Understand the classification and structure of vitamins.
2. Understand the effect of processing on vitamins.

**Unit II : After completion of the unit, Students are able to:**

1. Understand the major and minor minerals.
2. Understand the effect of processing on minerals.

**Unit III : After completion of the unit, Students are able to:**

1. Understand the type and structure of color and flavor
2. Understand the effect of processing on food color and flavor.

**Unit IV : After completion of the unit, Students are able to:**

1. Understand the enzymes and their classification
2. Understand the industrial uses of enzymes.

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**BFPT-206 ANALYTICAL TECHNIQUES –II****Course Objective: Students should:**

1. Know the principle, construction, types and applications of electrophoresis.
2. Know the principle, construction, types and applications of flame photometer.
3. Know the principle, construction, types and applications of fluorimetry.
4. Know the principle, construction, types and applications of different chromatographic techniques.

**Unit I: Electrophoresis****(9 lectures)**

Principle, Types of electrophoresis, Moving boundary electrophoresis, Zone electrophoresis, Isoelectric focusing, Factors affecting electrophoresis, Applications

**Unit II: Flamephotometer****(9 lectures)**

Principle, Construction, Working, Applications

**Unit III: Fluorimetry****(9lectures)**

Principle, Working, Applications, Fluorimetric determination of thiamin and Riboflavin

**Unit IV: Chromatographic Techniques****(9 lectures)**

Principle, Classification, Partition chromatography, Adsorption chromatography, Gel chromatography, Ion exchange chromatography, Affinity chromatography, Paper chromatography, Column chromatography, HPLC.

**RECOMMENDED BOOKS:**

1. Morris B. Jacobs, *The chemical analysis of foods and food products*, (CBS Publishers and distributors New Delhi, III Edition.)
2. S. Ranganna, *Hand book of analysis and quality control for fruit and vegetable products*, (Tata McGraw Hill Publishing Co. New Delhi, 2<sup>nd</sup> edition, 2007.)
3. D.T. Plummer, *An introduction to practical biochemistry*, (Tata McGraw Hill Publishing Co. New Delhi, 3<sup>rd</sup> edition, 2004.)
4. Pomeranz Y., Meloan, *Food Analysis: Theory and practice*, (Clifton E. IS: 6273 Chapman and Hall, 3<sup>rd</sup> Edn. 1994.)
5. Maynard and Joslyn, *Methods in food analysis*, (Academic Press Inc. U.S. 2<sup>nd</sup> edition, 1973.)

**Course Outcomes****Unit I After completion of the unit, Students are able to:**

1. Understand the principle and working of electrophoresis.
2. Understand the applications of electrophoresis.

**Unit II After completion of the unit, Students are able to:**

1. Understand the principle and working of flame photometer.
2. Understand the effect flame photometer.

**Unit III : After completion of the unit, Students are able to:**

1. Understand the principle and fluorimetry.
2. Understand the application of fluorimetry.

**Unit IV : After completion of the unit, Students are able to:**

1. Understand the principle and working of different chromatographic techniques.
2. Understand the application of uses of different chromatographic techniques.

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**LAB VII BFPP - 212 FOOD  
CHEMISTRY AND ANALYTICAL TECHNIQUES II.**

**Course Objective: Students should:**

1. Know the method of estimation of fat, volatile oil, vitamins, salt, minerals, iodine value, saponification value from food samples.
2. Know the method of separation of amino acids from food sample.
3. Know the method of determination of percent free fatty acids from food sample.
4. Know the working, principle and application of HPLC, uv-spectrophotometer.

**Practicals-**

1. Separation of amino acids by two dimensional paper chromatography.
2. Determination of Protein content in food by Kjeldahl's method.
3. Estimation of Fat by Soxhlet method.
4. Estimation of Volatile oil by Clevenger's method.
5. Determination of Thin Layer Chromatography.
6. Demonstration of instrument: HPLC, UV-Spectrophotometer.
7. Determination of carotenoids with respect to flour pigments.



8. Estimation of vitamins A content.
9. Estimation of salt content in brine.
10. Estimation of salt content in butter.
11. Estimation of iodine value of oil.
12. Estimation of saponification value of fat or oil.
13. Determination of percent free fatty acids.

**RECOMMENDED BOOKS:**

1. Connie M. Weaver, James R. Daniel, *The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists*, (CRC Press; 2<sup>nd</sup> edition, 2017)
2. Dennis D. Miller, *Food Chemistry: A Laboratory Manual* (Wiley-Interscience; 1<sup>st</sup> edition, 1998)
3. Morris B. Jacobs, *The chemical analysis of foods and food products*, (CBS Publishers and distributors New Delhi, III<sup>rd</sup> Edition, 1999.)
4. S. Ranganna, *Hand book of analysis and quality control for fruit and vegetable products*, (Tata McGraw Hill Publishing Co. New Delhi, 2017.)

**Course Outcomes-****After completion of the Lab course, students are able to:**

1. Learn method of separate of amino acids / coal tar dyes by two-dimensional paper chromatography and determination of thin layer chromatography.
2. Learn to determine protein content by kjeldahl's method, fat by Soxhlet method and volatile oil by levenger's method.
3. Learn demonstration of instruments: HPLC, UV-spectrophotometer.
4. Understand method of estimate of salt content, iodine value, saponification value and estimation of vitamins.
5. Understand method for determine of percent free fatty acids.
6. Learn method of determine of carotenoids with respect to flour pigments.

**BFPT 207 HUMAN NUTRITION- II****Course Objective: Students should:**

1. know the concept of balanced diet, planning balanced meals
2. know the concept of factors influencing meal planning.
3. know the concept of nutrition and food requirements of expectant mother, lactating women, infants, pre- school children and school children, adolescents and during old age.
4. know the concept of clinical nutrition and diet therapy.

**Unit I: Balanced Diet and Concepts of Meal planning (9 lectures)**

Concept of balanced diet, Food Pyramids, Meal planning – Introduction, planning balanced meals, factors influencing meal planning, Indian meal pattern vegetarian & non vegetarian

**Unit II: Nutritional Care of Women's and Infants (9 lectures)**

- a. Expectant Mother –Pre conceptual nutrition, Nutrition and food requirements
- b. Lactating Women-Role of hormones in milk production, Nutrition and food requirements
- c. Infants -Nutrition and food requirements.

**Unit III: Nutritional Care of Children's, Adolescents and during Old Age (9lectures)**

- a. Pre-school children and school children-Nutritional and food requirements, Nutritional related problems of preschooler, packed lunches and school lunch program.
- b. Adolescents and during Old Age-Nutrition requirements, food requirements, Nutritional related problems.

**Unit IV: Clinical Nutrition (9 lectures)**

Definition of dietetics, Introduction to term dietician.

- a) Basic concepts of Diet Therapy- Introduction, Principles and classification of therapeutic diets.
- b) Causes, risk factors and dietary management of obesity and underweight and Anemia.

**RECOMMENDED BOOKS:**

1. Sunetra Roday, Food Science and Nutrition,(2<sup>nd</sup> Edition: Oxford Publication:Oxford

- University Press,2018)
2. M. Swaminathan Advanced text book on Food and Nutrition, Vol.I and II,(2<sup>nd</sup> Edition: BAPPCO Publication:The Bangalore Press,2006).
  3. Jim Mann and A. Stewart Truswell,Essentials of Human Nutrition, (3<sup>rd</sup>Edition: Oxford publication:Oxford University Press,2010).
  4. Michel J.Gibney, Hester H. Vorster and Frans J. Kok Introduction to Human Nutrition:Blackwell Publishing:A John Wiley & Sons, Ltd 2002).
  5. B.Srilakshmi, Dietetics,(7<sup>th</sup> Edition, New Age International(P)Ltd:New Delhi,2010)
  6. Joan Webster-Gandy Angela Madden Michelle Holdsworth, Oxford Handbook of Nutrition and Dietetics,(1<sup>st</sup> Edition,Oxford medical publication:Oxford university press,2006)
  7. Peggy S. Stanfield & Y. H. Hui, Nutrition and Diet Therapy(5<sup>th</sup> Edition,Johns & Bortlett publishers, 2006)

1. Sunetra Roday, Food Science and Nutrition, Oxford publication, 7<sup>th</sup> edition.
2. Advanced textbook on Food and Nutrition, Vol I and II, Dr. M. Swami Nathan, BAPPCO Publication, Second Edition, 2006
3. Essentials of Human Nutrition, Third Edition: Jim Mann and A. Stewart Truswell, Oxford publication, 2010.
4. Introduction to Human Nutrition, First Indian Reprint. Michel J.Gibney, Hester H. Vorster and Frans J. Kok, Blackwell Publishing,2002
5. Srilakshmi B.(2018)Dietetics,New Delhi,New Age International.

**COURSE OUTCOMES-****Unit I After completion of the unit, students are able to:**

1. understand the concept of balanced diet and food pyramid.
2. understand the meal planning and meal patterns.

**Unit II After completion of the unit, students are able to:**

1. understand the nutrition and food requirements of expectant mother and lactating women.
2. understand the nutrition and food requirements of infants.

**Unit III After completion of the unit, Students are able to:**

1. understand the nutrition and food requirements of pre-school children and school children.
2. understand the nutrition and food requirements of adolescents and during old age.

**Unit IV After completion of the unit, Students are able to:**

1. understand the diet therapy.
2. understand the Causes, risk factors and dietary management of obesity and underweight and Anemia.

## BFPT 208 FOOD PACKAGING II

**Course Objectives: Students should:**

1. Know classification and uses of plastic polymers.
2. know the techniques and methods used for packaging.
3. know the types of oxygen absorbents and its application.
4. understand the safety considerations in food packaging.

**Unit I: Plastic Packaging (9 Lectures)**

Plastic packaging materials: plastic banned in India, classification of polymers, functional and mechanical properties of thermoplastic polymers; Processing and converting of thermoplastic polymers, testing of plastic packages.

**Unit II: Techniques and Methods Used for Packaging (9 Lectures)**

Techniques and methods used for Packaging of cereals and cereal product, fruits and vegetables and their products, milk and milk products and meat and meat products, beverages. Shelf life evaluation of packed products.

**Unit III: Oxygen Absorbents (9 Lectures)**

Classification and main types of oxygen absorbents, factors influencing the choice of oxygen absorbents, Application of oxygen absorbents for shelf-life extension of food and advantages and disadvantages of oxygen absorbents.

**Unit IV: Safety Considerations in Food Packaging (9 Lectures)**

Labeling, Types of food safety problems associated with package, package labeling and food safety. Food packaging and environment-recycling, composting, thermal treatment and landfill.

**RECOMMENDED BOOKS:**

1. Robertson, G.L. published CRC Press, Taylor and Francis Group Boca raton, *Food Packaging: Principles and Practice*, (London New York press,2006.)
2. Richard coles, Derek McDowell and Mork JKirwan, *Food Packaging Technology*, (Blackwell publishing CRC Press)
3. B. Shrilakshmi, *Food Science*, (New Age International,2003)
4. Raija Ahvenainen, *Novel Food Packaging techniques*, (Woodhead Publishing Limited)

**COURSE OUTCOMES:****Unit I: After completion of the unit, Students are able to:**

1. understand the classification of polymers, functional and mechanical properties.
2. understand the thermoplastic polymers

**Unit II: After completion of the unit, Students are able to:**

1. understand the techniques of shelf life evaluation of packed products
2. understand the methods used for packaging

**Unit III: After completion of the unit, Students are able to:**

1. explain the classification of oxygen absorbent.
2. understand the types, advantages and disadvantages of oxygen absorbent.

**Unit IV: After completion of the unit, Students are able to:**

1. understand the labeling and food safety problems associated with package.
2. Understand food packaging and environment-recycling, composting, thermal treatment and landfill.

**LAB-VIII BFPP- 213 HUMAN NUTRITION AND FOOD PACKAGING-II****Course Objective: Students should:**

1. know the method of planning of diet chart for pre-school children, school children, adolescent, old age person.
2. know the method of planning of diet chart suffering from Anemia.
3. know the method of planning therapeutic Diets for obese and underweight person.
4. know the principle and working of tearing, bursting, tensile strength tester etc.

**Practical-**

1. Planning and preparation of balanced diet for an adolescent.
2. Planning and preparation of balanced diet for schoolchildren. Preparation of packed lunch
3. Preparation of complementary feeds for infants- weaning foods.
4. Planning, preparation and calculation of following diets a. Liquid diet b. Diet for Diabetes mellitus.
5. Planning meal for senior citizen. Planning & preparation of diet chart suffering from

Anemia.

6. Planning and preparation of therapeutic Diets for obese and underweight person
7. Determination grease resistance of packaging materials.
8. Determination of water vapor transmission rate of various packaging materials.
9. Preparation of labels for different types of food products according to package labeling laws.
10. Determination Tear resistance of different packaging materials.
11. Determination Bursting strength of different packaging materials
12. Determination Tensile strength of different packaging materials.

#### **RECOMMENDED BOOKS:**

1. B.Srilakshmi, Human Nutrition For B. Sc. Nursing Students, (2<sup>nd</sup> ed, New Age International (P)Ltd, 2016)
2. T.Dashman, Laboratory Manual for Human Nutrition, (2<sup>nd</sup> Edition, Hardwood Academic Publication, 1991).
3. S. Ranganna, Handbook of Analysis and Quality control for fruits and vegetable products published McGraw Hill Education (India) PVT.LTD, Chennai, 2<sup>nd</sup> edition, 2007.
2. Taylor and Francis Group Boca raton, Food Packaging: Principles and Practice Robertson G.L. Published, CRC Press, London New York press, 3<sup>rd</sup> ed, 2006

#### **COURSE OUTCOMES-**

##### **After completion of the Lab course, students are able to:**

1. Understand how to plan diet chart for pre-school children, schoolchildren, and adolescent, an old age person.
2. Understand how to plan diet chart suffering from anemia.
3. Understand how to plan therapeutic Diets for obese and underweight person.
4. Determine Tear resistance, Bursting strength, Tensile strength of packaging material.
5. Prepare labels for different types of food products.

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