Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. I (Food Technology)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2024-2025

Syllabus for Bachelor of Science Part I

1. **Title**: B.Sc. Food Technology
2. **Year of Implementation**:2024-25
3. **Preamble:**

B.Sc. Food Technology course under autonomy has been prepared keeping in view the unique requirements of B.Sc. Food Technology students. The emphasis of the contents is to provide students the latest information along with due weightage to the concepts of classical trends in technology in food so that they are able to understand the all subjects.

The course content also lists new practical exercises so the students get hands on experience of the latest techniques that are currently used in Food industries .Project curriculum spanning over the one year of the course is designed in a way to understand the basics of food technology. Along with students are also provided with an opportunity to peruse the practical knowledge about subject. The course will also inspire students to pursue higher studies and research in Food Technology for becoming an entrepreneur a deniable students to get employed in Food, Nutraceuticals and Agriculture Industries.

4. **General Objectives**:

- To construct and designing of the courses to suite industrial needs.
- To more emphasis on applied aspects of Food Technology.
- To develop aptitude of students in the field of research.
- To enrichment of basic knowledge in areas of Food Technology.
- To shape good and informed citizens from the students entering into the programme.

5. Programme Outcomes:

i] The students will graduate with proficiency in the Food technology

ii] The students will be eligible to continue higher studies in Food technology

iii] The students will be eligible to pursue higher studies abroad.

iv] The students will be eligible to appear for the examinations for jobs in government organizations.

v] The students will be eligible to apply for jobs with a minimum requirement of B.Sc. programme

PROGRAM SPECIFIC OBJECTIVES

i. The broad goal of the teaching of under graduate students wide ranging contexts which involve the use of knowledge and skills of Food Technology.

ii. Their understanding, knowledge and skills in food technology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

iii. The graduate students of Food Technology should have knowledge of the diverse places were food technology is involved. The graduate students of food technology should have Understood of diverse food technology processes.

iv. The graduate students of food technology should have basic skills such as food analysis, food processing, shelf-life testing, sensory analysis, food preservation techniques, etc.

v. The main objective of the course is to provide students with the basis to face the study of the major fundamentals of food chemistry, food processing, food microbiology, food preservations, food packaging, food engineering etc.

vi. At the time of completion of the programme the student will have developed extensive knowledge of food safety and regulations

6 .PROGRAM SPECIFIC OUTCOMES

At the end of the three-year programme the student will understand and be able to explain different branches of food technology .

ii] The student will be able to explain about various applications of food technology such as food processing, food packaging, food preservation, food analysis etc

iii] The students will be able to design and execute experiments related to Basic of food chemistry, food analysis , food processing, etc.

iv] The students will be able to execute a short research project incorporating techniques of Basic and Advanced food technology under supervision

6. **Duration**: Three/FourYear
7. **Exam Pattern :**Semester
8. **Medium of Instruction**: English
9. **Structure of B.Sc.I:**

B.Sc.(Food Technology)

Programme Structure as per NEP 2020 (2.0)

(As per Govt.of Maharashtra GR Dated 13th March2024)

FromAcademicYear2024-25

	B.Sc.(Food Technology):Semester–I				
Sr.No	**Sem**	**Com./Vertical**	**Paper Code**	**Subject/Paper**	**Cr.**
		Course I			
1	Sem-I	DSC I	BFTT111	Principles of Food Processing	02
2	Sem-I	DSCII	BFTT 112	Technology of Food Packaging	02
3	Sem-I	DSC Lab I	BFTP113	Practical based on BFTT 111 and BFTT 112	02
		Course II			
4	Sem-I	DSC I	BFTT114	Food Microbiology – I	02
5	Sem-I	DSC II	BFTT115	Food Preservation–I	02
6	Sem-I	DSC Lab II	BFTP116	Practical based on BFTT 114 and BFTT 115	02
		Course III			
7	Sem-I	DSC I	BFTT 117	Human Nutrition	02
8	Sem-I	DSC II	BFTT118	Biochemistry	02
9	Sem-I	DSC LabIII	BFTP 119	Practical based on BFTT 117 and BFTT 118	02
10	Sem-I	OE-I	BFTT OE 1	Agricultural Economics	02
11	Sem-I	IKS- I	BFTT IKS I	Indian Knowledge System	02
	.			**Cum Cr**	**22**

	B.Sc.(Food Technology) :Semester–II				
Sr.No	**Sem**	**Com./Vertical**	**Paper Code**	**Subject/Paper**	**Cr.**
		Course I			
1	Sem-II	DSC I	BFTT 121	Fruit and Vegetable Processing Technology	02
2	Sem-II	DSC II	BFTT122	Technology of Seafoods	02
3	Sem-II	DSC LabI	BFTT123	Practical based on BFTT 121 and BFTT 122	02
		Course II			
4	Sem-II	DSC I	BFTT 124	Food Microbiology – II	02
5	Sem-II	DSC II	BFTT125	Food Preservation–II	02
6	Sem-II	DSC LabII	BFTT 126	Practical based on BFTT 124 and BFTT 125	02

		Course III			
7	Sem-II	DSC I	BFTT127	Food Laws and Standards	02
8	Sem-II	DSC II	BFTT 128	Food Additives and toxicology	02
9	Sem-II	DSC LabIII	BFTTP129	Practical based on BFTT 127 and BFTT 128	02
10	Sem-II	OE-II	BFTT OE 2	Agriculture Risk Management	02
11	Sem-II	VEC I	BFTT VEC 1	Democracy, Election and Constitution	02
				Cum Cr	**22**
	Exitoption: Award of UG Certificate in Major with40-44 credits and an additional 4 credit score NSQF course/Internship OR Continue with Major and Minor				

SEMESTER I

SEMESTER I

COURSE BFTT 111:-PRINCIPLES OF FOOD PROCESSING

Course Objectives: Students should be able to…

1. understand the concept of food
2. know different methods of primary and secondary processing in food industry.
3. illustrate various cooking methods.
4. Explain physicochemical changes of food after cooking

Credits (Total 02 Credits)	BFTT 111 PRINCIPLES OF FOOD PROCESSING	No. of hours (30hrs)
UNIT-I	**Introduction to food**	**7**
	• Definition of food, Scope of food processing industry, importance and future Prospects, classification of food, constituents of foods. • Introduction of Food preservation, food spoilage, causes of food spoilage, Factors affecting food spoilage, food poisoning Food-borne intoxication, Food born infection.	
UNIT-II	**Primary processing and Secondary processing.**	**8**
	• Primary processing- Introduction, classification, and methods of cleaning, Sorting, grading, cutting, chilling, and freezing. • Secondary processing- Introduction, classification, and methods of Slicing Pulping, paste, frying and milling.	
UNIT-III	**Common food processing**	**7**
	• Introduction, Classification and Methods of Cooking -Baking, frying, roasting, toasting, grilling, blanching, extrusion.	
UNIT-IV	**Effect of processing on nutritional value of food**	**8**
	• Physicochemical changes during grilling, roasting, frying, effect of processing on vitamins, effect of processing on minerals, effect of processing on carbohydrate, effect of processing on lipids.	

Course Outcomes: **Student will be able to…**

1. identify food spoilage.
2. apply methods of primary and secondary processing in food industry.
3. implement preservation and processing methods in food.
4. analyze nutritional changes during processing.

REFERENCE BOOKS:

1. Mishra. J. P., Mohapatra. S., Rastogi. M, Verma. S. and Singh. V. 2023. Textbook ofIntegrated Farming Systems for Sustainable Agriculture. B. P. International, Kolkata.
2. Mercer, Donald G. 2023. Bridging the gap in the communication of food science knowledge and technology. Science Direct.
3. Porter, M. E. 2023. Mrs. 0Porter's New Southern Cookery Book. Andrews McMeel Publishing LLC. Sydney, London.
4. Greer, Sandra C., 2023. Chemistry for Cooks: An Introduction to the Science of Cooking. MIT Press, Cambridge.
5. Jafari. S. M., Hedayati, Sara, Vahid B., 2023, Cooking equipment for the food industry. InHigh-Temperature Processing of Food Products, Woodhead Publishing, New Delhi.
6. Girdharilal, Siddapa. G. S., Tandon. G. L., 2022. Preservationoffruits and vegetables. 3rded. Indian Council of Agricultural research, New Delhi.
7. Fellows, Peter John., 2021.Food processing technology: principles and practice. Woodhead publishing,
8. Jafari, Seid. M., 2021. Engineering Principles of Unit Operations in Food Processing: Unit Operations and Processing Equipment in the Food Industry. Woodhead Publishing, New Delhi.
9. Acton,Eliza.,2020.Moderncookery.Longmanspublications,London.
10. Earle, Richard L. 2013. Unit operations in food processing. Elsevier Publications, Dutch.
11. Mark J. K., Coles, Richard, Derek McDowell, 2003. Food packaging technology. Vol. 5. CRC press, Boca Raton.

SEMESTER I
COURSE :-BFTT 112 TECHNOLOGY OF FOOD PACKAGING

Course Objectives: Students should be able to…

- understand the importance, functions and types of food packaging.
- know the properties and functions of wood and paper
- list the properties and functions of glass and metal packaging.
- explain the different packaging techniques.

Credits (Total02 Credits)	**BFTT 112 TECHNOLOGY OF FOOD PACKAGING**	**No. of hours (30hrs)**
UNIT-I	**Introduction to Food Packaging**	**7**
	• History, define packaging, Importance and functions of Food packaging. Properties of packaging. • Types of packaging, application of packaging, Types of packaging material, Materials used in packaging-rigid, semi rigid and flexible.	
UNIT-II	**Wood and Paper Packaging**	**8**
	• Packaging materials: Wood structure, types, properties and wooden containers used in packaging. • Paper and paperboard- structure, making, properties, types and uses of Paper and paperboard, CFB boxes and their comparison with wooden containers.	
UNIT-III	**Glass ,Metal and Plastic Packaging**	**8**
	• Packaging materials: Glass–composition, properties, structure, types and manufacture of glass containers, their uses. • Metals- properties of metals, different metals used in food packaging, uses of metal packaging. • Plastic packaging materials: types of polymer, classification of polymers, functional and mechanical properties of thermo plastic polymers, thermosetting polymer and elastomer polymer	
UNIT-IV	**Safety Considerations in Food Packaging**	**7**

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

Course Outcomes- Students will be able to…

1. analyze the types of food packaging materials.
2. determine the types and uses of paper, CFB boxes.
3. describe the manufacturing process of glass and metal.
4. make use of food labeling.

REFERENCE BOOKS:

1. RobertsonG.L.,2012. Food Packaging-Principles and Practice 3rd Ed Narendra Publishing House. New Delhi
2. RobertsonG.L.,2009.Food Packaging and Shelf life: A Practical Guide, Narendra Publishing House, New Delhi
3. Singh R.P. and Heldman D.R.2010.IntroductiontoFoodEngineering,AcademicPress, New Delhi.
4. John, P.J.A.2008.Hand book on Food Packaging. Narendra Publishing House, New Delhi.
5. Robertson. G.L., Taylor and Francis. G.B.,2006. Food Packaging: Principles and Practice, 3rd Ed. London New York press.
6. RobertsonG.L.,2005.Food Packaging: Principles and Practice,2nd Ed. London New York press.
7. Shrilakshmi.B.2003.Food Science, New Age International Publishers, New Delhi
8. Ahvenainen.R.2003NovelFoodPackagingTechniques,1stEd,Wood head Publishing Limited. New Delhi.
9. Richard C.,McDowell. M.andMork.J.2003 Food Packaging Technology, CRC press, New Delhi.
10. Gosby.N.T.2001.Food Packaging Materials. Applied Science Publication, New Delhi.
11. FrankA.P.1983.A Handbook of Food Packaging, ARM publications. Bangalore.

SEMESTER I

BFTP 113

BFTP 113:- Practical based on BFTT 111 and BFTT 112

Course Objectives: Students should be able to…

1. know the the principle of various cooking methods
2. understand time temperature relationship during processing.
3. explain the principle and working of vernier caliper to measure thickness of paper and paperboard.
4. develop nutritional labeling of food products.

Credits (Total Credits2)	**BFTP 113** **Practical based on BFTT 111 and BFTT 112**	**No.of hours(30 hrs)**
1	To study the principle and working of baking process.	2
2	To study the principle and working of frying process.	2
3	To study the principle and working of roasting process.	2
4	To study the principle and working of grilling process.	2
5	To study the principle and working of blanching process.	2
6	To study the principle and working of extrusion process.	2
7	To study the principle and working of steaming method.	2
8	To study the product on the basis of preservation.	2
9	To identify different types of packaging materials.	2
10	To determine GSM (gram per square meter) of paper and paperboard.	2
11	To determine thickness of paper & Paperboard	2
12	To determine Cobb's value of a paperboard.	2
13	To determine the thickness of plastic	2
14	To identification of plastic packaging material	2
15	To study the preparation of labels for different types of food products according to package labeling laws.	2

Course Outcomes: Students will be able to…

1. understand different equipment's used in cooking
2. identify critical control point.
3. measure compete strength of different food packaging material.
4. create labeling of food products.

REFERENCE BOOKS:

1. George.W.2023.Handbookofodors in plastic materials. Elsevier Publications, New Delhi.
2. Fellows.P.,PeterJ.2022.Food processing technology: principles and practice. Wood head publishing, New Delhi.
3. ProctorandAndrew,2018.Alternatives to Conventional Food Processing 2nd Edition. Vol. 53. Royal Society of Chemistry, London.
4. Robertson, Gordon L. 2016. Food packaging: principles and practice.CRC press, New Delhi.
5. Baker, Christopher. G.J., Ranken. M.D.,andKill.R.C.2012.Food industries manual. Springer Science & Business Media, Bangalore
6. Kadoya,Takashi,2012.Food packaging. Academic Press, New Delhi.
7. Heldman,DennisR.,2012.Food processing. Springer Science &Business Media, New Delhi.
8. Ramaswamy, Hosahalli.S.,and Michele.M.2005.Food processing: principles and applications. CRC Press, New Delhi
9. Weaver, Connie M. ,and James R.D.2003.The food chemistry laboratory: a manual for experimental foods, dietetics, and food scientists. CRC press, New Delhi.

SEMESTER I
COURSE BFTT 114:-FOOD MICROBIOLOGY -I

Course Objectives: Students should be able to…

1. understand the important contributions of various scientists in microbiology and scope of microbiology.
2. know the important genera of micro-organisms associated with food and their characteristics.
3. illustrate the microbial nutrition and culture media.
4. explain the control of microorganisms and mode of action of antiseptic and disinfectants.

Credits (Total02 Credits)	**BFTT114 FOOD MICROBIOLOGY-I**	**No. of hours (30hrs)**
UNIT-I	**History and Scope of Microbiology**	**8**
	• 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**	**7**
	• 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, Pilli, nuclear material, mesosome, ribosome and spores.	
UNIT-III	**Microbial Nutrition And Culture Media**	**8**
	• 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**	**7**
	• Definitions Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Antisepsis, Sanitization. • Mode of action, application and advantages of: Physical agents, Chemical Agents, Gaseous Agent.	

Course Outcomes: **Student will be able to…**

1. recall history of microbiology.
2. classify the nutritional requirements of micro-organisms.
3. apply the techniques required for control of microorganism
4. explain functions of cell organelles.

REFERENCE BOOKS:

1. Ananthanarayan and Paniker's,2016.A Text book of Microbiology,7th edition. Orient Blackswan, Hyderabad.
2. Tolaro.K.P.,2009.Foundations in Microbiology,7thInternational edition. McGraw Hill Education, Bangalore.
3. Michael. T. M.,Thomas. D.B.,2008. Brock biology of microorganisms, 12th edition, CA: Pearson/Benjamin Cummings, San Francisco
4. Purohit S. S., 2003. Microbiology fundamentals and applications, 6thedition, Agrobios Publisher, Jodhpur.
5. Frazier W.C. and Westhoff D.C. 2004. Food Microbiology, TMH Publication, New Delhi.
6. Stanier.R.Y.,Ingraham.J.L.,Wheelis.M.L.andPainter.P.R.,2001.General Microbiology, 5th edition, Macmillan Education Ltd., London.
7. MichaelJ.P.,Chan.C.S.,NoelR.K.,1986.Microbiology5thedition, McGraw Hills Publication, America.
8. Salle.A.J.,1973.Fundamental Principles of Bacteriology.7th Edition, McGraw-Hill Book Co. New York and London,
9. Martin. F., 1962.Fundamentals of Microbiology W. B. Saunders, 7th edition, Philadelphia. U.S.
10. Adams, Martin R., Maurice O.Moss, and Maurice O.Moss.2000.Food microbiology. Royal society of chemistry, Cambridge.

SEMESTER I
COURSE BFTT 115:-FOOD PRESERVATION–I

Course Objectives: Students should be able to…

1. understand the scope of food preservation
2. know the food preservation by high temperature and low temperature.
3. illustrate the food preservation by drying and dehydration.
4. explain the principles and types of preservation, shelf life of food products

Credits (Total Credits2)	BFTT 115 FOOD PRESERVATION–I	No. of hours (30hrs)
UNIT-I	**Introduction of food preservation**	**7**
	• Definition, scope, Need, Advantages & principles of Food preservation, Types of Food Preservatives – Class I Preservatives & Class II Preservatives, Mechanism of preservatives. • Food Spoilage – Types of food Spoilage ,Shelf life of the product – Intrinsic factors & Extrinsic Factors	
UNIT-II	**Food Preservation by high temperature**	**8**
	• Introduction high Temperature, methods and mechanism • Sterilization-Physical & Chemical Methods • Pasteurization- Types and Mechanism of Pasteurization • Blanching- Methods of blanching: Steam blanching & Hot water blanching • Canning: Methods of canning	
UNIT-III	**Food Preservation by Drying and dehydration**	**7**
	• Drying & Dehydration, Difference between drying & dehydration • Types of Conventional and Non Conventional drying – Principle, Mechanism. • Factors Affecting rate of drying, Normal drying curve	

UNIT-IV	**Food Preservation by Low temperature.**	**8**
	• Chilling, Cryogenic chilling, chilling Storage, Frozen food storage, Changes in food during Chilling. • Introduction and types of freezing-slow freezing, quick freezing, freeze drying changes in food during Freezing. • Introduction to thawing, changes during thawing and its effect on food	

Course Outcomes-Students will be able to…

1. explain the principle of preservation
2. compare the between sun drying and dehydration.
3. apply the processes of pasteurization and sterilization.
4. explain principle and type of freezing.

REFERENCEBOOKS:

1. Man. M., John. F., Hurst. W. J., 2018. Chang Lee Principles of Food Chemistry, 4rd Ed., Springer International Publishing, New York.
2. Bawa.A.S.,Chauhanetal.O.P.,2013.FoodScience,NewIndiaPublishing agency, New Delhi.
3. 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
4. Rahman.M.S.,2007.Handbook of food preservation,CRC Press,New Delhi.
5. RamaswamyH.andMarcotteM.,2005.Food Processing Principles and Applications, CRC Press,
6. Meyer,2004.Food Chemistry**,** New Age Publishers, New Delhi.
7. Frazier W.C. and Westhoff D.C.,2004. Food Microbiology, TMH Publication, New Delhi.
8. B.Srilakshmi,2002.Food science,New Age Publishers, NewDelhi.
9. Manay N.S. and Shadaksharaswamy M., 1987. Food-Facts and Principles, New Age MarionL.F.,1983.Laboratory manual In food preservation,4thedition,Avi Publishing, New Delhi.

SEMESTER I
BFTP 116

BFTP 116 Practical based on BFTT 114 and BFTT 115

Course Objectives: Student should be able to…

1. understand the principle and working of various laboratory instruments.
2. know the handling techniques of laboratory equipment.
3. explain the role of microbiology in food processing.
4. apply the preservation techniques in food.

Credits (Total Credits2)	BFTP 116 Practical based on BFTT 114 and BFTT 115	No. of hours (30hrs)
1	To study the Introduction to the Basic Microbiology Laboratory Practices.	2
2	To study the use of instruments for microbiology (Incubator, oven, autoclave, water bath etc).	2
3	To study the Principle and working of analytical instrument such as colorimeter, weighing Balances, muffle furnace and centrifuge.	2
4	To study the functioning and use of compound microscope.	2
5	Cleaning and sterilization of glassware.	2
6	To Prepare culture media(Nutrient broth, Nutrient agar, Macconkeys agar, Sabouraud's agar).Sterilization of media	2
7	To prepare slant, stab and plates using nutrient agar.	2
8	To study the preservation of food by the process of freezing	2
9	To study the drying of food using Tray dryer/other dryers	2
10	To study the preservation of food by canning. (Fruit/Vegetable/meat)	2
11	To study the cut-out analysis of canned food.	2
12	To study the preservation of food by osmotic dehydration.	2
13	To Identify the class I preservatives from different food Products	2
14	To study the preservation of food by using chemical preservatives.	2

15	To study the preservation of food by using sugar as preservative.	2

Course Outcomes-Students will be able to…

1. recall basic microbiology laboratory practices.
2. formulate media required for cultivation of different microorganism.
3. apply techniques of cleaning and sterilization and preparation, sterilization of different media
4. elaborate the preservation of food by canning and osmotic dehydration.

REFERENCE BOOKS:

1. Ronald. A., 2013. Handbook of Media for Clinical and Public Health Microbiology, CRC Press, New Delhi.
2. Food Safety Standard Authority of India,2012.Ministry of family welfare, Government of India, New Delhi.
3. Jayraman.J.,2011.Laboratory Methods in Biochemistry New Age International, New Delhi.
4. WilliamG.W.,2011.Laboratory manual for food microbiology,4th edition,I.K. Publishers, New Delhi.
5. Singh.R.,Sawhney.S.K.,2009.IntroductoryPracticalBiochemistry,Narosa,
6. Patel.R.,2009.Experimental Microbiology5th edition,Vol.IandVol.II,Aditya Book Centre, New Delhi.
7. Emanuel. G.and Lorrence. G., 2008. Practical Handbook of Microbiology, Taylor and Francis
8. FrazierW.C.andWesthoffD.C.,2004.FoodMicrobiology,TMHPublication, New Delhi,
9. Shafiur R.M.,2007.Handbook of food preservation, CRC Press, New Delhi.
10. Stanier.R.Y.Palgrave.M.,1987. General microbiology, 5 th revised edition, Palgrave Macmillan, New York.
11. Wilson.K., Goulding. K.H.,1986. Principles and techniques of Practical biochemistry, 3rd edition, Edward Arnold, London.
12. MarionL.F.,1983. Laboratory manual in food preservation,4th edition,Avi Publishing, New Delhi.
13. DavidT.P.,1978.An Introduction to practical biochemistry,2nd edition,McGraw-Hill Book Company (U.K.) Ltd., London
14. Frobisher, Hinsdill, Crabtree, Good heart, 1974. Fundamentals of microbiology, 9th edition, W.B. Saunders. Company,
15. Deyand Dey,1973.Medical bacteriology,7th edition,Allied agency,
16. BakerF.J.,1967.Bacteriological techniques, Butterworth &Co-Publishers Ltd, New York.

SEMESTER I

Course BFTT 117 HUMAN NUTRITION

Course Objectives: Students should be able to…

1. understand the concept of nutrient.
2. know the relationship between food, Nutrition and health.
3. to understand the concept of balanced diet, planning balanced meal and factors influencing meal planning.
4. To know the nutrition and food requirements of pre-school children, school children adolescents and old age.

Credits (Total 02 Credits)	BFTT 117 HUMAN NUTRITION	No. of hours (30 hours)
UNIT-I	**Introduction of Food and Nutrition**	**7**
	• Introduction of nutrition, food as a source of nutrients, functions of food, types of nutrition • Food guide-Basic five food groups, • Nutritional status • Recommended Dietary Allowances (RDA), Acceptable daily Intake(ADI) • Understanding relationship between food and health of people.	
UNIT-II	**Nutrients and their functions**	**8**
	• Introduction, Energy value of food, Basal Metabolic Rate (BMR), Biological value of food. • Introduction, Classification, digestion, absorption metabolism, Dietary sources, RDA, • Macronutrients and Micronutrients- Introduction , Classification and their functions , Deficiency.	
UNIT-III	**Balanced Diet and concept of meal planning**	**7**

	• Concept of balanced diet, Food groups, Food Pyramid • Meal planning- Introduction, planning, balanced meals, factors influencing meal planning	
UNIT-IV	**Nutritional Care of Children's, Adolescents and During Old Age**	**8**
	• Pre-school children and school children- nutrition and food requirements, nutritional related problems of pre-schooler, packed lunches and school lunch programme. • Adolescents and during old age- nutritional requirements, food requirements, nutritional related problems	

Course outcomes: **Student will be able to…**

1. analyze relationship between food and health of people.
2. participate in nutrients and their functions.
3. create the the concept of balanced diet, food groups, food pyramid and meal planning.
4. Develop the nutrition and food requirements for pre-school children, school children, Adolescents and during old age

REFERENCE BOOKS:

1. Sunetra Roday Food Science and Nutrition (2nd Edition Oxford publication Oxford University press,2018)
2. M. Swaminathan Advanced text book on Food and Nutrition,Vol I and II,(2nd Edition BAPPCO Publication. The Banglore Press,2006)
3. Jim Mann and A, Stewart Truswell, Essential of Human Nutrition,(3 rd Edition: Oxford Publication: Oxford University press,2010)
4. B.Srilakshmi Nutrition Science,(6thEdition : New Age International Publishers ; New Age International P Limited,2018)
5. Michael J.Gibney,Hester H, Vorster and Frans J Kok Introduction to Human Nutrition: Blackwell publishing: A John Wiley and sons,Ltd 2002.)
6. Pr.GOLDEN M.& GRELLETY Y. The response to nutrient deficiency. Type 1&type 2 responses.2003.
7. FAO: Family Nutrition Guide.By Ann Burgess FAO Consultant with Peter Glasauer FAO Food and Nutrition Division, Rome 2004.

SEMESTER I
Course BFTT 118 BIOCHEMISTRY

Course Objectives: Students should be able to…

1. understand the utilization of carbohydrates disorders related to carbohydrate metabolism in body
2. know the utilization and free radical oxidation of lipids,disorders related to lipid metabolism in body.
3. explain the utilization of phenolics and its metabolism in body.
4. illustrate function and mechanism of enzyme and coenzymes.

Credits (Total Credits 2)	**BFTT 118 BIOCHEMISTRY**	**No. of hoursper unit/credits()**
UNIT – I	**Enzyme and Coenzyme**	**8**
	A) Enzyme: Classification, nomenclature, activation energy, Michaelis - Menten equation, Lineweaver Burk Plot. B) Factors affecting on enzymes action, mechanism of enzyme action, Coenzymes: Classifications [metabolite derived /vitamin derived] function of various types, structure of NAD+, NADP+, and FAD and FMN.	
UNIT – II	**Utilization of Carbohydrates**	**7**
	A) Glycolysis, Kreb cycle, Pentose phosphate pathway, glycogen metabolism, glycogen synthesis. B) Disorders in carbohydrate metabolism, EssentialMetabolic pathways.	
UNIT - III	**Influence of Phenolic Substances on Health**	**8**
	A) Free radicals in biological system, Oxidative stress andchronic diseases, antioxidant in fruits and vegetables, absorption and metabolism of polyphenolics, B) Efficiency of polyphenolics in Promoting human health.	
UNIT - IV	**Utilization of Lipid and Lipid Oxidation**	**7**

	A) Utilization of fats, Disorders related to lipid metabolism, clinical disorders associated with fats. B) Lipid oxidation -active oxygen species and free radical theory.	

Course outcomes: Student will be able to…

1. apply the basics of enzyme, its classification, nomenclatureand mechanism of action.
2. implement the utilization of carbohydrates.
3. identify the utilization of antioxidants and its effect on human body.
4. identify the utilization of lipid and lipid oxidation.

Reference Books

1.Principles of Biochemistry, Lehninger, David L. Nelson and Michael M. Cox; W. H.Freeman, , 7th ed. 2017. (Unit I, II, IV)

2.Biochemistry, Stryer, W. H. Freeman, , 6th Edition, 2006. (Unit I, II, IV)

3.Principles of biochemistry, Donald J. Voet, Judith G. Voet, Charlotte W. pratt. Wiley, , 4th Edition International Student Version edition 2012. (Unit I, II, IV)

4.Enzyme technology, Anusha Bhaskar, V. G.Vidhya, MJP Pub, 2009. (Unit I, II, IV)

Principles of enzyme technology, M.Y. Khan, Faraha Khan, , 1st edition, 2015.(Unit I)

5.Textbook of medical biochemistry, M.N.Chatterjea, Ranashinde,Jaypee Brothers Medical Publishers 2007. (Unit III)

BFTP 119

BFTP 119 Practical based on BFTT 117 and BFTT 118

Course Objectives: Student should be able to…

1.identify the foods sources for various nutrients using food composition table

2.Know the methods of planning diet chart for suffering from anemia

3.understand the enzyme and its activity.

4.estimate and analyze the vitamins, carbohydrates, lipids from food sample

Credits (Total Credits2)	BFTP119 Practical based on BFTT 117 and BFTT 118	No. of hours (30hrs)
1.	Identification of food sources for various nutrients using food composition tables	2
2.	Calculations of BMI of an individual and interpretation of result	2
3.	Record diet of self using 24 hours dietary recall and its nutrition analysis	2
4.	Preparation of weaning foods for infants	2
5.	Planning and preparation of balanced diet for school children's	2
6.	Planning and preparation of balanced diet for an adolescent	2
7.	Nutritional labeling of food	2
8.	Planning nutritious snack for different age and income groups	2
9.	Estimate the quantity of ascorbic acid by titration(Volumetric) method in food sample	2
10.	Estimate the quantity of Vitamin A in food sample	2
11.	Estimate the quantity of iron in food sample.	2
12.	Analysis of lipids present in food sample.	2
13.	Determination of total carbohydrates present in food sample	2
14.	Separation of carotenoids by thin layer chromatography	2
15.	To study the effect of temperature on enzyme activity.	2

Course Outcomes-Students will be able to…

1.understand the concept of how to identify the food sources for various nutrients using food composition table.

2. understand the concept of how to calculate BMI.
3. apply the principle and working of different chromatographic techniques,estimate vitamins (vit. C and vit. A)from food sample.
4. determine the quantity of carbohydrates, amino acids

REFERENCE BOOKS:

1. An introduction to practical biochemistry, Plummer, Tata McGraw Hill Publishing Co. NewDelhi.3rd edition, 2004.

2. Modern experimental biochemistry, Rodney Boyer, Dorling Kindersley (India) Pvt Ltd 3rd Edition, 2000.

3.B.Srilakshmi,HumanNutritionForB.Sc.NursingStudents,(2nded,NewAgeInternational (P)Ltd, 16)

4.T.Dashman,LaboratoryManualforHumanNutrition,(2ndEdition,HardwoodAcademic Publication,1991

5. S.Ranganna,Handbook of Analysis and Quality control for fruits and vegetable products published McGraw Hill Education (India) PVT.LTD,Chennai, 2ndedition,2007.

6.Taylor and Francis Group Bocarat on,Food Packaging:Principles and Practice Roberts onG.L.Published, CRCPress,London NewYork press,3rded,2006

SEMESTER I
COURSE BFTT OE 1:-Agricultural Economics

Course Objectives: Students should be able to…

1. get introduced to the branch of Agricultural Economics.
2. study the role of Agricultural sector in economic Development of India.
3. know the system of Farm Management.
4. identify the techniques of Risk Management in Agricultural Sector.

Credits (Total 02 Credits)	**Agricultural Economics**	**No. of hours per unit/credits(30)**
Unit-I	**Introduction of Agricultural Economics**	**8**
	Introduction of Agricultural Economics: Definition, Nature and Scope for the separate study of agricultural economics. Utility of agricultural economics Nature of uncertainty in agriculture Characteristics of agriculture	
Unit-II	**Indian Agriculture**	**7**
	Role of Agriculture in Indian Economy Place of agriculture in rural Economy Difference between agriculture and industry Systems of Cultivation – Peasant, Co-operative, State Farming, Corporate, Contract, Precision and Organic Farming, Farmers Club	
UNIT-III	**Agricultural Finance And Co-operation**	**8**
	Agricultural Finance : Meaning, Scope and significance, Credit needs and its role in Indian agriculture. Agricultural credit :Meaning, Definition, needs, classification, Credit analysis 3 R's and 4 R's	
UNIT- IV	**Agricultural Marketing, Trade and Prices**	**7**

	Agricultural Marketing: Concept and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation classification and characteristics of agriculture marketing	

Course Outcomes-Students will be able to…..

1. describe the branch of Agricultural Economics.
2. explain the role of agricultural sector in economic Development of India.
3. discuss technological changes in Indian Agricultural sector.
4. explain the system of Farm Management.
5. apply Risk Management Techniques in Agricultural Sector.

Reference Books:

1. Bhende,M.J.,2005,Agricultural Insurance in India: Problems and Prospects, NABARD, Occasional Paper-44
2. Bilgram, S.A.R.(1996),Agricultural Economics, Himalaya Publishing House,b Delhi.
3. Christopher Ritson(1977), Agricultural Economics –Principles and Policy, Czosby Luckwood Staples, London
4. Desai RG(2001):Agricultural Economics –Models Problems and Policy Issues, Himalaya Publishing House, Mumbai.
5. DonaldJ. Epp & JohnW. Malone(1981),Introduction to Agricultural Economics, Mc-Million Publishing Company, Inc. New York.
6. Ghatak,S.andK.Ingerscent(1984),Agriculture and Economic Development, Select books, New Delhi.
7. GOI(2007),Report of The Working Group on Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012) , GOI, New Delhi
8. Kumar KNR(2015):Agricultural Production Economics,Volume-I,Daya Publishing House, A Division of Astral International Pvt. Ltd, New Delhi.
9. Lekhi RK& Singh Jogindar (2013):Agricultural Economics,Kalyani Publisher,New Delhi.
10. Publishing House, Bombay.
11. Reddy,Ram,Sastry&Devi(2010):AgriculturalEconomicsOxford&IBHpublishing Co. Pvt. Ltd, New Delhi.
12. Sadhu A.N.& Singh Amarjit, Fundamentals of Agricultural Economics,(1996),Himalaya
13. Soni, R. N. (1995), Leading Issues in Agricultural Economics, Arihant Press, Jalandhar.7. Agriculture in Economic Development(1964),Carl Eicher and Lawrence Wit,McGraw Hill Book Company, New York

SEMESTER II

Semester II

COURSE BFTT 121: -FRUITS AND VEGETABLES PROCESSING TECHNOLOGY

Course Objectives: Students should be able to…

1. know classification and composition of fruits and vegetables
2. explain physiology of fruits and vegetables and their role in pre and post-harvest changes in product quality.
3. understand about preparation and evaluation of fruits and vegetables processed products..
4. summarize methods of preservation of fruits and vegetables.

Credits (Total Credits)	BFTT 121 FRUITS AND VEGETABLES PROCESSING TECHNOLOGY	No. of hours (30 hours)
UNIT-I	**Introduction of fruits and vegetables**	**8**
	• Classification and composition of fruits and vegetables climacteric and non-climacteric fruits • Indian scenario on production and processing of fruit and vegetables. • Post-harvest handling of fruits and vegetables: Respiration (RQ, climacteric and Non climacteric fruits), Assessment of maturity indices; Biochemical changes during ripening	
UNIT-II	**Quality aspect of fruit and Vegetables**	**7**
	• Physical and chemical indices of fruit maturity and ripening. Biochemical changes during maturation, ripening, processing and storage. • Methods of storage: refrigerated, controlled atmosphere and hypobaric storage. Minimal, quality factors for processing, fruit product order (FPO).	
UNIT-III	**Costing of Fruit & Vegetable Production**	**8**
	• Cost & Nutrient Value of Fruits and Vegetable, Cost of Cultivation of Fruits & Vegetable, Cost estimation of fruits and vegetable Products. • Transportation cost of fruits and vegetables, development of low cost storage structure for fruits and vegetables.	
UNIT-IV	**Fruit and Vegetable Products & Standards**	**7**

	• Ready to eat vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors. • Fruit and Vegetable Fibres - specific processing, different packing including aseptic, Product specifications and standards; food regulations with respect to fruit and vegetable products	

Course Outcomes: **Student will be able to…**

1	describe the classification and composition of fruits and vegetables
2	understand biological, chemical and physical properties of fruits and vegetables.
3	identify the technologies involved in the processing, preservation and value addition of fruit and vegetable.
4	demonstrate effects of various methods used for preparing, preserving, packaging and evaluation of various fruit and vegetable products

REFERENCE BOOKS:

1. Srivastava, R.P. & Kumar, S. (2005). Fruit and Vegetable Preservation. Lucknow: International Book Distributing Co.
2. Lal, G., Siddhapa, G.S., & Tandon, G.L. (2009). Preservation of Fruits and Vegetables. New Delhi: Indian Council of Agriculture Research.
3. Khurdia, D.S. (1995). Preservation of Fruits and Vegetables. New Delhi: Indian Council of Agriculture Research.
4. Salunkhe, D.K. and Kadam, S.S. (2005). Handbook of Fruit Science and Technology : Production, Composition, Storage, and Processing", Marcel Dekker.
5. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A (2005). Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications", Springer.
6. Thompson, A. K. (2003). Fruits and Vegetables- Harvesting, Handling and Storage: Blackwell, Oxford.
7. Verma, L. R. & Joshi, V. K. (2000). Post-harvest Technology of Fruits and Vegetables: Indus, New Delhi.
8. Potter, N., & Hotchkiss, J.H. (2006). Food Science. Delhi: CBS Publishers.
9. Hui, Y.H., Evaranuz, E.O. (2015). Handbook of Vegetable Processing and Preservation. 2nd Edition. USA: CRC Press.

Semester II

COURSE BFTT 122: - TECHNOLOGY OF SEAFOODS

Course Objectives: Students should be able to…

1. know the fish processes and factors affecting the quality of fresh fish.
2. understand the principles of preservation of seafoods.
3. summarize the principle of fish canning.
4. illustrate economics of seafood and its by-products.

Credits (Total 02 Credits)	**BFTT122 TECHNOLOGY OF SEAFOODS**	**No. of hours (30 hours)**
UNIT-I	**Basics of seafood**	**07**
	• Introduction to seafoods. Different types of seafoods Classification of fish, composition of fish, characteristics of fresh fish. • Post mortem changes (rigor mortis and spoilage). Handling and sanitation. Precautions taken in handling of fish. • Packaging of seafoods.	
UNIT- II	**Principles of preservation of seafoods**	**07**
	• Principles of seafood preservation- Cleaning and its techniques, lowering of temperature, increasing of temperature, denudation, use of salt and other preservatives, exposure to low radiation of gamma rays. • Principles of freeze drying- general aspects of freezing. Freezing systems (air blast freezing, plate or contact freezing, spray or immersion freezing). Relationship between chilling and storage life. Changes in quality in chilled and frozen storage, thawing. • Modern methods of preservation by irradiation and Modified Atmospheric Storage and Modified Atmospheric Packaging.	
UNIT- III	**Principles of Preservation Methods**	**08**
	• Principles of Preservation Methods- Preservation of fish by Drying. Preservation of fish by salting. Preservation of fish by smoking. • Salting methods (brining, pickling, kench curing, Gaspe curing) Canning: Introduction, Principles of canning. Pre-process operations and post process operations. • Storage of- Canned fish Cannery operations for specific canned products-Tuna, Mackerel, Sardine.	

UNIT- IV	Value Added Products and Its Quality Evaluation.	08
	• Status of value addition of fish and fish production in indian seafood sector. Advantages of value addition. • Different types of value added products- marinated and fermented products, fish paste, fish and prawn pickles, fish sauce, sausages, fish cake, fish ham. • By-products of the fish industry and their utilization- fish meal, fish body oil, fish liver oil, fish protein concentrate, fish hydrolysates, fish gelatin. Quality assurance and quality control of Seafoods.	

Course Outcomes: **Student will be able to…**

1. identify Fishery resources, types of fish, water activity and shelf-life.
2. demonstrate the chilling and freezing process of fish.
3. to prepare various fish products using preservation techniques.
4. make use of economics of seafood and its by-products.

REFERENCE BOOKS:

1. Fish Processing Technology, George. M. Hall published by Backie academic and professional,2nd edition.(Unit I, II, III, IV)
2. Applications of Seafood By-products in food industry and Human Nutrition, Janak. K. Vidanarachchi, Senaka Ranadheera, Wijerathne, R.M.C,S.M.C, Himali, Udayagani and Jana Pickova published Springer New York, Editors: Se-Kwon Kim (Unit I)
3. Post-harvest technology of fish and fish products, K. K. Bala chandran published DAYA publishing house,2016. (Unit II, III, IV)
4. Advances in Fish Processing Technology, D. P. Sen, published,Allied publishers, Feb2005.(Unit I , II , IV)
5. Seafood Processing: Technology, Quality and Safety Chapter 7- Drying of Fish, Minh Van Nguyen, Sigurjon Arason, Trygve Magne Eikevik, November 2013
6. Seafood Processing By-Products Trends and Applications, Se-Kwon Kim, Springer Verlag New York Inc. November 2013
7. FSSAI manual of methods of analysis of foods(meat and meat products and fish and fish Products) FSSAI Ministry of Health and Family welfare, Govt .of India,NewDelhi-16.

Semester II

LAB VI BFTP 123

LAB BFTP 123: BASED ON BFTT 121 AND BFTT 122

Course Objectives: Students should be able to…

1. explain physiology of fruits and vegetables and their role in pre and post-harvest changes in product quality.
2. understand about preparation and evaluation of fruits and vegetables processed products..
3. summarize the principle of fish canning.
4. illustrate economics of seafood and its by-products.

Credits (Total Credits 2)	**BFTP 123 BASED ON BFTT 121 AND BFTT 122**	**No. of hours (30 hours)**
1	To study Enzymatic browning of fruits and vegetables	2
2	Estimation of titratable acidity, ascorbic acid, total and reducing sugars in fruit juice.	2
3	To preparation and sensory analysis of fruit products (juice concentrates, syrup, jam and jellies)	2
4	Quality evaluation of fruit juice concentrates, jams	2
5	Qualitative determination of pectin content by alcohol test / jelmeter test in fruit extract.	2
6	Dehydration of fruits and vegetables.	2
7	To study morphological characteristics of fruits.	2
8	To study canning and cut out examination of canned fruits products.	2
9	Quality Evaluation Of Fish/prawn.(Physical Parameters)	2
10	Formulation Of Fish Products	2
11	To study the anatomy of fish.	2
12	Pre Canning operation of fish (selection, sorting, descaling)	2
13	Cutout Examination Of Canned Fish.	2
14	Determination Of Acidity Of Brine From Canned Fish Sample	2
15	Determination of moisture content from the different fish samples	2

Course Outcomes:- students will be able to…

1. understand biological, chemical and physical properties of fruits and vegetables.
2. identify the technologies involved in the processing, preservation and value addition of fruit and vegetable.
3. understand the pre and post process operations and storage of fish.
4. make use of economics of seafood and its by-products.

REFERENCE BOOKS

1. Lal, G., Siddhapa, G.S., & Tandon, G.L. (2009). Preservation of Fruits and Vegetables. New Delhi: Indian Council of Agriculture Research.
2. Khurdia, D.S. (1995). Preservation of Fruits and Vegetables. New Delhi: Indian Council of Agriculture Research.
3. Salunkhe, D.K. and Kadam, S.S. (2005). Handbook of Fruit Science and Technology : Production, Composition, Storage, and Processing", Marcel Dekker.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A (2005). Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications", Springer.
5. Thompson, A. K. (2003). Fruits and Vegetables- Harvesting, Handling and Storage: Blackwell, Oxford.
6. Verma, L. R. & Joshi, V. K. (2000). Post-harvest Technology of Fruits and Vegetables: Indus, New Delhi.
7. Potter, N., & Hotchkiss, J.H. (2006). Food Science. Delhi: CBS Publishers.
8. Fish Processing Technology, George. M. Hall published by Backie academic and professional,2nd edition.(Unit I, II, III, IV)
9. Applications of Seafood By-products in food industry and Human Nutrition, Janak. K. Vidanarachchi, Senaka Ranadheera, Wijerathne, R.M.C,S.M.C, Himali, Udayagani and Jana Pickova published Springer New York, Editors: Se-Kwon Kim (Unit I)
10. Post-harvest technology of fish and fish products, K. K. Bala chandran published DAYA publishing house,2016. (Unit II, III, IV)
11. Advances in Fish Processing Technology, D. P. Sen, published,Allied publishers, Feb2005.(Unit I , II , IV)

Semester II

COURSE BFTT 124: FOOD MICROBIOLOGY –II

Course Objectives: Students should be able to…

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

Credits (Total Credits 2)	BFTT 124 FOOD MICROBIOLOGY-II	No. of hours (30 hours)
UNIT-I	**Microbial contamination of food and spoilage of food.**	**7**
	• 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**	**8**
	• Pure culture technique, Methods of isolation and cultivation. • Enumeration of Microorganisms- qualitative and Quantitative	
UNIT-III	**Stains and staining techniques**	**7**
	• 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**	**8**
	• Maintenance of stock cultures – (Agar slants and Agar stabs) Systematic study of pure cultures: • Morphological characteristics. • Cultural characteristics • Biochemical Characteristics-Sugar fermentation, Production of metabolites -H2S gas, Production of enzymes - Amylase, Caseinase and Catalase Serological and genetic characteristic	

Course Outcomes: Students will be able to…

1. find the microbial contamination of food and techniques for evaluation of contamination.
2. examine microorganisms from food.
3. explain the principle, mechanism, procedure and applications of different staining procedures.
4. elaborate the biochemical characteristics for identification of microorganism.

REFERENCE BOOKS:

1. Ananthanarayan and Paniker's, 2016. A Textbook of Microbiology, 7th edition. Orient Blackswan, Hyderabad.
2. Tolaro. K.P., 2009. Foundations in Microbiology, 7th International edition. McGraw Hill Education, Bangalore.
3. Michael. T. M., Thomas. D. B., 2008. Brock biology of microorganisms, 12th edition, CA: Pearson/Benjamin Cummings, San Francisco
4. Purohit S. S., 2003. Microbiology fundamentals and applications, 6th edition, Agrobios Publisher, Jodhpur.
5. Frazier W.C. and Westhoff D.C. 2004. Food Microbiology, TMH Publication, New Delhi.
6. Stanier. R.Y., Ingraham. J. L., Wheelis. M. L. and Painter. P. R., 2001. General Microbiology, 5th edition, Macmillan Education Ltd., London.
7. Michael J. P., Chan. C. S., Noel R. K., 1986. Microbiology 5th edition, McGraw Hills Publication, America.
8. Salle. A. J., 1973. Fundamental Principles of Bacteriology. 7th Edition, McGraw-Hill Book Co. New York and London,
9. Martin. F., 1962.Fundamentals of Microbiology W. B. Saunders, 7th edition, Philadelphia. U.S.
10. Adams, Martin R., Maurice O. Moss, and Maurice O. Moss. 2000. Food microbiology. Royal society of chemistry, Cambridge.

Semester II

COURSE BFTT 125: FOOD PRESERVATION II

Course Objectives: Students should be able to …

1. understand mechanism of action of radiation in food preservation.
2. know effect of radiation on microorganisms.
3. illustrate the non-thermal preservation of food.
4. explain the plasma, bio-preservation and hurdle technology.

Credits (Total Credits-2)	**BFTT 125 FOOD PRESERVATION-II**	**No. of hours (30 hrs)**
UNIT-I	**Food preservation by radiation**	**7**
	• Irradiation- Introduction, Types, Sources, Applications, Advantages, Units, • Effect of radiation on food, Effect of radiation On Microorganisms	
UNIT-II	**Non-thermal preservation of food**	**8**
	• Pulsed electric field processing- Principle working, advantages and disadvantages ,application • Ohmic heating - Principle, advantages and disadvantages ,application • Dielectric heating, Microwave processing - Principle, advantages and disadvantages ,application • Microwave processing – Mechanism of microwave heating, equipment design	
UNIT-III	**Other methods non-thermal food preservation**	**7**
	• Infrared heating – types, Mechanism, advantages and disadvantages • High pressure processing – history, effect of pressure of microorganisms, principle, application of HPP • Processing using ultrasound	
UNIT-IV	**Recent methods of food preservation**	**8**
	• Plasma- Mechanism, advantages and disadvantages • Bio-preservation- types, Mechanism, advantages and disadvantages	

	• Hurdle technology- Principle, Types of Hurdles, advantages and disadvantages	

Course Outcomes- Students will be able to…

1. choose the non-thermal preservation techniques for food preservation.
2. apply non-thermal preservation techniques as dielectric heating and Microwave processing.
3. explain thermal preservation techniques as high-pressure processing and ultrasound.
4. elaborate the preservation techniques-plasma and bio-preservation

REFERENCE BOOKS:

1. Man. M., John. F., Hurst. W. J., 2018. Chang Lee Principles of Food Chemistry, 4rd Ed., Springer International Publishing, New York.
2. Bawa. A. S., Chauhanetal. O. P., 2013. Food Science, New India Publishing agency, New Delhi.
3. 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
4. Rahman. M. S., 2007. Handbook of food preservation, CRC Press, New Delhi.
5. Ramaswamy H. and Marcotte M., 2005. Food Processing Principles and Applications, CRC Press,
6. Meyer, 2004. Food Chemistry**,** New Age Publishers, New Delhi.
7. Frazier W.C. and Westhoff D.C., 2004. Food Microbiology, TMH Publication, New Delhi.
8. B. Srilakshmi, 2002. Food science, New Age Publishers, New Delhi.
9. Manay N.S. and Shadaksharaswamy M., 1987. Food-Facts and Principles, New Age International Ltd. Publishers, New Delhi.
10. Marion L. F., 1983. Laboratory manual in food preservation, 4^{th} edition, Avi Publishing, New Delhi.

Semester II

LAB V BFTP 126

LAB BFTP 126: BASED ON BFTT 124 AND BFTT 125

Course Objectives: Students should be able to…

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

Credits (Total Credits 2)	**BFTP 126 BASED ON BFTT 124 AND BFTT 125**	**No. of hours (30 hours)**
1	To study the isolation of bacteria by streak plate technique.	2
2	To study the staining methods- (Mono chrome staining, Gram staining, Negative staining).	2
3	To study the isolation of molds from foods.	2
4	To determine SPC of food sample.	2
5	To detect the ability of bacteria to produce casein as enzyme.	2
6	To detect the ability of bacteria to ferment sugar	2
7	To study the cultivation of anaerobic bacteria	2
8	To determine quality characteristics of foods preserved by drying/dehydration/freezing	2
9	To study the pasteurization of fluids using different Methods	2
10	To study the effect of surface area of food on drying rate.	2
11	To study the preservation of food by using natural preservatives.	2
12	To study the preservation of food by using chemical Preservatives	2
13	To study the preservation of food using sugar as a Preservative	2
14	To study the preservation of food by using oil as a Preservative	2
15	To study the preservation of food by using salt as a Preservative	2

Course Outcomes:- students will be able to…

1. recall techniques of isolation of bacteria by streak plate, isolation of moldsfrom foods.
2. apply the staining methods.
3. examine the detection the ability of bacteria to produce caseins enzyme and sugar fermentation.
4. choose the method of food preservation to preserve thedifferent types of food.

REFERENCE BOOKS

1. Ronald. A., 2013. Handbook of Media for Clinical and Public Health Microbiology, CRC Press, New Delhi.
2. Food Safety Standard Authority of India, 2012. Ministry of familywelfare, Government of India, New Delhi.
3. Jayraman. J., 2011. Laboratory Methods in Biochemistry New Age International, New Delhi.
4. William G. W., 2011. Laboratory manual for food microbiology, 4th edition, I. K. Publishers, New Delhi.
5. Singh. R., Sawhney. S. K., 2009. Introductory Practical Biochemistry, Narosa,
6. Patel. R., 2009. Experimental Microbiology 5th edition, Vol. I and Vol.II, Aditya Book Centre, New Delhi.
7. Emanuel. G. and Lorrence. G., 2008. Practical Handbook of Microbiology, Taylor and Francis
8. Frazier W. C. and Westhoff D. C., 2004. Food Microbiology, TMH Publication, New Delhi,
9. Shafiur R. M., 2007. Handbook of food preservation, CRC Press, NewDelhi.
10. Stanier. R. Y. Palgrave. M., 1987. General microbiology, 5th revised edition, Palgrave Macmillan, New York.
11. Wilson. K., Goulding. K. H., 1986. Principles and techniques of Practical biochemistry, 3rd edition, Edward Arnold, London.
12. Marion L. F., 1983. Laboratory manual in food preservation, 4thedition, Avi Publishing, New Delhi.
13. David T. P., 1978. An Introduction to practical biochemistry, 2nd edition, McGraw-Hill Book Company (U.K.) Ltd., London
14. Frobisher, Hinsdill, Crabtree, Good heart, 1974. Fundamentals of microbiology, 9th edition, W.B. Saunders. Company,
15. Dey and Dey, 1973. Medical bacteriology, 7th edition, Allied agency,
16. Baker F.J., 1967. Bacteriological techniques, Butterworth & Co-Publishers Ltd, New York.

COURSE BFTT 128:- FOOD LAWS AND STANDARDS

Course Objectives: Students should be able to…

1. understand importance and concepts of food law.
2. know the comprehension of food laws in food industries.
3. apply basic research, methods, data analysis in field of food law.
4. explain objectives and functions of food laws and regulation.

Credits (Total 02Credits)	**BFTT 128 FOOD LAWS AND STANDARDS**	**No. of hours (30hours)**
UNIT-I	**Food Safety and Standard Act, Rules and Regulations**	**7**
	• Food Safety and Standard Act 2006, Food Safety and Standards Rules and regulations Standards, Food Safety and Standards Rules and regulations Procedures. • Inspection and Audits in Food Industries.	
UNIT-II	**Global Scenario**	**8**
	• Codex Alimentarius Commission (CAC)- Purpose , Standards Committees and Working Groups, Member Participation, Procedure and Processes, International Recognition, Guidance and Implementation • World Trade Organization (WTO) implication- Purpose, Core Functions, Structure, Agreement and rules, Membership, Decision Making Process and Global Impact. • Other International Standard Setting Bodies.	
UNIT-III	**Export- Import Laws and Regulations**	**7**
	• Import Regulations, Export Regulations, Customs Procedure, Trade Agreements and Treaties, Compliance and Enforcement, Tariff Classification • Import Export Documentation, Trade Facilitation • Majors, Risk Management in Import Export Policies.	

UNIT-IV	**Other Laws and Standards Related to Food**	**8**
	• International Regulatory Bodies- Food and Agricultural Organization (FAO), World Health Organization (WHO), World Trade Organization (WTO), International Organization for Standardization. • National Agencies For Implementation of International Food Laws and Standards	

Course Out comes: Student will be able to…

1. explain scope of food laws and regulations
2. categorize food laws according to agencies
3. protect food laws and standards
4. understand food authorities

REFERENCE BOOKS:

1. The training manual for Food Safety Regulators. (2011) Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India.
2. The training manual for Food Safety Regulators. Vol.II- Food Safety regulations and food safety management. (2011) Food safety and Standards Authority of India. New Delhi.
3. Surak, J.G., and Wilson, S. (2007) American Society for Quality, 2nd Ed., Quality Press
4. New Delhi Foreign Trade Policy (27th August 2009 to 31st March 2014), Department of Commerce, Ministry of Commerce and Industry, Government of India.
5. Foreign Trade Policy (27th August 2009 to 31st March 2014), Department of Commerce, Ministry of Commerce and Industry, Government of India
6. Mortimre, S., and Wallace, C., (2005) HACCP: A practical approach, 2nd Ed, Aspen Publication

Semester II

COURSE BFTT 128: FOOD ADDITIVES AND TOXICOLOGY

Course Objectives: Students should be able to…

1. know the classification and functions of additives in food processing and preservation.
2. know the types and functions of direct and indirect food additives.
3. understand the safety and quality evaluation of food additives and contaminants.
4. study methods for detection of Food Additives

Credits (Total 02 Credits)	BFTT 128 FOOD ADDITIVES AND TOXICOLOGY	No. of hours (30 hrs)
UNIT-I	**Basics of Food Additives**	**7**
	• Additives in food processing and preservation – classification and their functions, ADI, GRAS and naturally occurring compounds, • Nutritional and non-nutritional food additives • Safety and quality evaluation of food additives, International numbering system for food additives • Introduction to direct and indirect food additives	
UNIT-II	**Chemistry of Direct Food Additives- I**	**8**
	• Preservatives, Antioxidants, Acidulants, Chelating/ Sequesterants- Introduction, their chemistry, types and functions • Sweeteners- Natural and low calorie/ Non –nutritive sweeteners, Their Chemistry, Types and Functions, Emulsifiers, Their Chemistry, Types and Function ,Stabilizers and Thickening agents- Their Chemistry, Types and Functions • Anticaking agents, Humectants – Their Chemistry, Types and Function • Flavor and flavor enhancers-Types of flavors, extraction	

	techniques of flavors, flavor emulsions, essential oils.	
UNIT-III	**Chemistry of Direct food additives –II**	**7**
	• Colors-Types and properties of food color. • Regulatory aspects, safety issues • Natural food colors- heme pigments, chlorophylls, carotenoids, anthocynains and flavonoids, tannins, caramel and other artificial food colors	
UNIT-IV	**Methods For Detection Of Food Additives**	**8**
	• Food Contaminants – Definition, Types, Food Toxicants – Definition, Types, Terminologies in Toxicology • Acute and Chronic studies • Methods for Detection of Food Additives, LD50 Value	

Course Outcomes: **Students will be able to…**

1. explain ADI,GRAS and INS system.
2. describe properties and functions of Preservatives, Antioxidants, Acidulates &Chelating/ Sequesterants the General aspects of freezing.
3. demonstrate chemistry, types and functions of Sweeteners, Emulsifiers, Stabilizers and Thickening agents
4. understand Safety and quality evaluation of food additives

REFERENCE BOOKS:

1.Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.

2. Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport. (Unit I,II, III&IV)

3. Furia, T.E. 1980. Handbook of food additives. Vol I and Vol II (Unit I,II, III&IV)

4.George A.B, Encyclopedia of food color additives, Vol III;CRC Press(UnitIV)

5.Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York. (Unit II)

6.Furia, T.E. 1980. Handbook of food additives. Vol I and Vol II

Semester II

LAB BFTP 129

BFTP 129: - BASED ON BFTT 127 AND BFTT 128

Course Objectives: Students should be able to…

1. know the principle and working of pulping and paste making.
2. explain the principle and working of frying and toasting processes.
3. know the emulsifiers and thickening agents
4. understand natural food colors and artificial colors.

Credits (Total Credits 2)	BFTP 129 BASED ON BFTT 127 AND BFTT 128	No. of hours (30 hours)
1	To study licensing and registration process.	2
2	To examine food labels for compliance with legal requirements.	2
3	To study FSSAI schedule 4.	2
4	Examination of cereals as per specifications.	2
5	Examination of milk and milk products as per specifications.	2
6	Examination of oil and oil products as per specifications.	2
7	Examination of fruit and vegetable products as per specifications	2
8	Visit to FDA department.	2
9	Detection of emulsifiers from different food samples	2
10	Detection stabilizers from different food samples	2
11	Detection thickeners from different food samples.	2
12	Isolation and estimation of synthetic food colors.	2
13	Identification of Natural food colors.	2
14	Detection of Benzoic acid from food sample	2
15	Detection of emulsifiers from different food samples	2

Course Outcomes: Students will be able to…

1. make use of pulping, paste making, frying and toasting principle.
2. analyze tear resistance, bursting strength, tensile strength of packaging material.
3. design labels for different food products.
4. compare different type food packaging materials.

REFERENCE BOOKS:

1. George.W. 2023. Handbook of odors in plastic materials. Elsevier Publications, New Delhi.
2. Fellows. P., Peter J. 2022. Food processing technology: principles and practice. Woodhead publishing, New Delhi.
3. Proctor and Andrew, 2018. Alternatives to Conventional Food Processing 2nd Edition. Vol. 53. Royal Society of Chemistry, London.
4. Robertson, Gordon L. 2016. Food packaging: principles and practice. CRC press, New Delhi.
5. Potter, N.N. 1978. Food Science. 3rd Ed. AVI, Westport. (Unit I,II, III&IV)
6. Furia, T.E. 1980. Handbook of food additives. Vol I and Vol II (Unit I,II, III&IV)
7. George A.B, Encyclopedia of food color additives, Vol III;CRC Press(UnitIV)
8. Branen A.L. and Davidson, P.M. 1983. Antimicrobials in Foods. Marcel Dekker, New York. (Unit II)
9. Furia, T.E. 1980. Handbook of food additives. Vol I and Vol II

BFTT OE 2 Agricultural Risk Management

Course Objectives: Student should be able to…

1. explain the nature of uncertainty in agriculture.
2. analyse risk management strategies.
3. illustrate market and management strategy.
4. understand crop insurance and risk mitigation tool

Credits (Total 02 Credits)	**BFTT OE 2 Agricultural Risk Management**	**No. of hoursper unit/credits**
Unit-I	**Agricultural Risk**	**15**
	• Nature of Uncertainty in Agriculture: Price, Yield and Technological. • Risks in Agriculture • Types of Risks: Climate, Drought, Production, Price, Financial • Market & Management Strategy	
Unit-II	**Risk Management Strategies Periods**	**15**
	• Risk Management Strategies: National AgriculturalInsurance • Scheme (NAIS), Pradhan Mantri Fisal Bima Yojana 2.2Crop Insurance as Risk Mitigation Tool • Crop Insurance, Weather Insurance 2.4 Farm IncomeInsurance, Livestock Insurance and Package Insurance	
Unit-III	**Emerging Commodity Markets**	**15**
	• Pre-harvest Concerns & Post-harvest Concerns, Commodity Futures, International Trade • Minimum Support Price (MSP), Market Intervention Scheme (MIS), Scheme for Tribals , Price Stabilization Fund Trust , Credit Risk Fund. • Insurance Delivery Strategies, Nationally Consistent Database.	
Unit-IV	**Setting up Centre for Risk Management in Agriculture**	
	• Climate Risks and Challenges in Climate Variability • Drought Risk and Floods & Cyclones • Catastrophe Protection for Non-Borrowing Farmers	

	• Bankruptcy Law	

Course Outcomes: Student will be able to…

1. relate the risks in agriculture.
2. analyze risk management strategies
3. identify farm income insurance
4. estimate nature of uncertainty of agriculture.

REFERENCE BOOKS:

1. Ghatak, S. and K. Ingerscent (1984), Agriculture and Economic Development, Select books, New Delhi.
2. GOI (2007), Report of The Working Group on Risk Management in Agriculture for the Eleventh Five Year Plan (2007-2012) , GOI, New Delhi
3. Kumar K N R (2015): Agricultural Production Economics, Volume-I, Daya Publishing House, A Division of Astral International Pvt. Ltd, New Delhi.
4. Lekhi R K & Singh Jogindar (2013): Agricultural Economics, Kalyani Publisher, New Delhi.
5. Reddy, Ram, Sastry & Devi (2010): Agricultural Economics Oxford & IBH publishing Co. Pvt. Ltd, New Delhi.
6. Sadhu A. N. & Singh Amarjit, Fundamentals of Agricultural Economics, (1996), Himalaya
7. Soni, R. N. (1995), Leading Issues in Agricultural Economics, Arihant Press, Jalandhar. Agriculture in Economic Development (1964), Carl 00Eicher and Lawrence Wit, McGraw Hill Book Company, New York.