Sant Gadge Baba Amravati University, Amravati
NEP Syllabus
UG Programme

Faculty: Science and Technology
Programme: B.Sc. (Food Science)
Course: B.Sc. I Semester I: Open Elective

Teaching and Learning Scheme: for the Degree of Bachelor of Science
(Three Years- Six Semesters Bachelor's Degree Programme)

116202 Open Elective Theory 1: Principles of Food Preservation							
Level	**Semester**	**Course code**	**Course Name**	**Credits**	**Teaching Hours**	**Exam Duration**	**Max marks**
4.5	I	116202	Principles of Food Preservation	2	30	2Hrs	30

Course Objectives	• To acquaint with principles of different techniques used in processing and preservation of foods. • To make the students aware of the different methods of food processing and preservation • To impart knowledge of the applications of these methods to a particular product			
Course Outcomes	Upon completion of this course successfully, students will be able to • Explain the need of processing and preservation of food • Discuss the similarities and differences between various methods • Categorize different methods of food preservation and processing • Apply the right method to the right food item			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Food spoilage: Definition, causes, factors affecting, types; Food preservation: Introduction, need, principles, methods & classification Food preservation by preservatives: Class I and Class II preservatives with applications	**8 Hrs**	8 Marks	Chalk & Board, Power Point Presentation, Videos, Group Discussion, Assignments, surprise quizzes, question and answering sessions
Unit II	Preservation by low temperature: Refrigeration & freezing: introduction, principle, difference; Types of freezing such as sharp freezing, quick freezing, dehydro-freezing, and freeze drying; Advantages, disadvantages;	**7 Hrs**	7 Marks	
Unit III	Preservation by high temperature	**8 Hrs**	8 Marks	

	Factors affecting heat resistance of microorganisms Pasteurization: introduction, principle, and types Sterilization: introduction, principle, and types Blanching: introduction, principle, and application Canning: introduction, principle, process, and application Factors affecting the time of sterilization of cans			
Unit IV	Food preservation by moisture control Drying and dehydration: introduction, principle; Factors affecting drying, treatments before and after drying, Types of drying Food preservation by radiation, concentration, using salt and sugar	**7 Hrs**	7 Marks	
References	• Advanced Text Book on Food & Nutrition (Volume I and II), Swaminathan M, The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006 • A First Course in Food Analysis, by A.Y. Sathe, New Age Int. Publication • Chemical Changes in Food During Processing by Richardson T • Drying and dehydration of Food by Loeseeke VWH • Encyclopedia of Foods – A Guide to Healthy Nutrition, Academic Press-An Imprint of Elsevier, San Diego, California • Food Additives by Mahindra S.N • Food and Food Production Encyclopedia by Considmem Douglas • Food Facts & Principle; Shakuntala Manay, M. Shadaksharaswamy; New Age International (p) Limited. • Food- Nutrition and Health, Vijaya Khader; Kalyani Publishers • Food Science & Nutrition; Sunetra Roday; Oxford University Press. • Food Science; Sumati R. Mudambi, Shalini M. Rao; New Age International (p) Limited • Food Science; N. N. Potter. • Outline of Food Technology by Harry W Von • Principles and Practices for the Safe Processing of Foods by Shapton D A • Text Book on Food Storage and Preservation by Khader V • The technology of Food Preservation by Desrosier N			
Model Questions	**Short Answer Questions** 1. Explain types of food spoilage 2. Discuss the principles of food preservation 3. Justify the need of food preservation 4. differentiate between class I and II preservatives 5. Discuss the role of KMS in food preservation 6. Defend the mechanism of preservation by low temperature 7. Discuss the mechanism of freeze drying			

	8. Justify the advantages and disadvantages of quick freezing 9. Differentiate between refrigeration and freezing 10. Compare sharp freezing with quick freezing 11. Explain dehydro-freezing 12. List out the factors affecting heat resistance of microorganisms 13. Explain the principle of blanching 14. Explain the principle of Pasteurization 15. Explain the principle of sterilization 16. Explain the principle of canning 17. Enlist the types of pasteurization 18. Establish a relationship between time of sterilization of cans and other factors 19. Compare drying with dehydration 20. enlist the factors affecting drying 21. Discuss the types of dryers 22. Discuss the mechanism of preservation by salt or sugar 23. Justify the mechanism of preservation by irradiation **Long Answer Questions** 1. Describe Convince the need and types of food preservation 2. Discuss the principles of food preservation with examples 3. Explain the factors affecting food spoilage 4. differentiate between class I and II preservatives with examples 5. Discuss the advantages and disadvantages of class II preservatives 6. Compare the methods of food preservation by low temperature 7. Discuss the mechanism of freeze drying with its advantages and disadvantages 8. Differentiate between refrigeration and freezing with examples 9. Compare sharp freezing with quick freezing with its advantages and disadvantages 10. Summarize freeze drying with its advantages and disadvantages 11. Draw a flow diagram to explain the process of canning 12. Draw a flow diagram to explain Pasteurization 13. Establish a relationship between time of sterilization of cans and other factors 14. Compare drying with dehydration. Enlist the types of dryers 15. Enlist the factors affecting drying 16. Summarize irradiation with its mechanism, advantages and disadvantages

116203 Open Elective Theory 2: Fundamentals of food processing							
Level	**Semester**	**Course code**	**Course Name**	**Credits**	**Teaching Hours**	**Exam Duration**	**Max marks**
4.5	I	116203	Fundamentals of food processing	2	30	2Hrs	30

Course Objectives	• To acquaint with principles of different techniques used in processing of foods. • To make the students aware of the different methods of cooking and food processing • To impart knowledge of the applications of these methods to a particular product			
Course Outcomes	Upon completion of this course successfully, students will be able to • Explain the need of cooking and processing of food • Discuss the similarities and differences between various methods • Categorize different methods of cooking and processing • Apply the right method to the right food item			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Cooking: introduction, Importance & objectives, Preliminary preparation of cooking Methods of cooking Moist heat methods: boiling, stewing, steaming, pressure cooking, poaching, blanching Dry heat methods: roasting, toasting, grilling, baking, sautéing, frying, braising Baking- theory, equipments, applications, Advantages & disadvantages An overview on Dielectric heating, ohmic heating and infrared heating	**8 Hrs**	8 Marks	Chalk & Board, Power Point Presentation, Videos, Group Discussion, Assignments, surprise quizzes, question and answering sessions
Unit II	Microwave cooking: introduction, principle, design of microwave oven, safe and unsafe containers, advantages and disadvantages Extrusion cooking: Introduction, definition, principle, classification (hot extruders, cold extruders, single screw, double screw, high shear, low shear), factors affecting extrusion cooking advantages and disadvantages Solar cooking: introduction, principle, design of solar cooker, advantages and disadvantages	**7 Hrs**	7 Marks	
Unit III	Unit operations in food processing:	**8 Hrs**	8 Marks	

	Cleaning, sorting, grading, peeling, size reduction (in solid and liquid food), mixing, forming, sedimentation, separation (filtration, centrifugation, solvent extraction, distillation, evaporation, etc.) Membrane concentration, types of membranes, reverse osmosis Mass balance, modes of heat transfer (conduction, convection, radiation), heat exchangers, co-current and counter-current heating and cooling, direct and indirect heating			
Unit IV	Food additives: Introduction, definition, role of additives in food processing, classification food colors (Natural & synthetic), flavoring agents (natural and artificial), Low calorie sweeteners, antioxidants, emulsifiers, stabilizers (gelatin, pectin, agar) Adulteration & adulterants: Introduction, definition, classification (intentional & unintentional), impact of food adulteration	**7 Hrs**	7 Marks	
References	• Advanced Text Book on Food & Nutrition (Volume I and II), Swaminathan M, The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006 • A First Course in Food Analysis, by A.Y. Sathe, New Age Int. Publication • Chemical Changes in Food During Processing by Richardson T • Drying and dehydration of Food by Loeseeke VWH • Encyclopedia of Foods – A Guide to Healthy Nutrition, Academic Press-An Imprint of Elsevier, San Diego, California • Food Additives by Mahindra S.N • Food and Food Production Encyclopedia by Considmem Douglas • Food Facts & Principle; Shakuntala Manay, M. Shadaksharaswamy; New Age International (p) Limited. • Food- Nutrition and Health, Vijaya Khader; Kalyani Publishers • Food Science & Nutrition; Sunetra Roday; Oxford University Press. • Food Science; Sumati R. Mudambi, Shalini M. Rao; New Age International (p) Limited • Food Science; N. N. Potter. • Outline of Food Technology by Harry W Von • Principles and Practices for the Safe Processing of Foods by Shapton D A • Text Book on Food Storage and Preservation by Khader V • The technology of Food Preservation by Desrosier N			
Model Questions	**Short Answer Questions** 1. Outline the objectives of cooking 2. Justify the importance of preliminary preparation of cooking			

	3. Discuss the advantages of moist heat method 4. compare cooking method steaming with pressure cooking 5. Differentiate between toasting and grilling 6. Explain the principle of baking 7. Explain dielectric heating 8. Outline the principle of microwave cooking 9. Discuss the advantages and disadvantages of microwave cooking 10. Outline the principle of extrusion cooking 11. Discuss the advantages and disadvantages of extrusion cooking 12. Differentiate between hot and cold extruders 13. Differentiate between high shear and shear extruders 14. Outline the advantages and disadvantages of solar cooking 15. Justify the importance of size reduction in food processing 16. discuss filtration 17. Explain membrane concentration 18. Discuss the types of membranes 19. Differentiate between conduction and convection 20. Differentiate between conduction and radiation 21. Differentiate between co-current and counter-current heat exchangers 22. Summarize the role of additives in food processing 23. Differentiate between natural and synthetic food colors with examples 24. Summarize the role of low calorie sweeteners **Long Answer Questions** 1. Defend the role of cooking in nutrition and processing 2. Classify the methods of cooking. Give the advantages and disadvantages 3. Explain the principle of baking. Differentiate between baking and roasting 4. Discuss the preliminary preparations of cooking. Justify their importance 5. Explain the advantages and disadvantages of dielectric and ohmic heating 6. Draw a diagram of microwave oven. explain each part with its working 7. Clarify the importance of microwave cooking with its mechanism and advantages 8. Classify extruders with their applications 9. Discuss the principle of extrusion cooking with the factors affecting 10. Draw a diagram of solar cooker showing its mechanism 11. State the importance of unit operations and its role in food processing 12. Compare the methods of separation with examples 13. Define heat transfer. Explain the modes of heat transfer with examples 14. Classify adulterants 15. Justify the importance of additives. Give the classification

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116207 Open Elective Theory 3: Technology of Fruits and Vegetables Processing							
Level	**Semester**	**Course code**	**Course Name**	**Credits**	**Teaching Hours**	**Exam Duration**	**Max marks**
4.5	II	116211	Technology of Fruits and Vegetables Processing	2	30	2Hrs	30

Course Objectives	• To impart knowledge of different methods of fruits and vegetable processing • To acquaint with principles of different techniques used in processing and preservation of fruits and vegetables.			
Course Outcomes	Upon completion of this course successfully, students will be able to • Adapt conventional practices and modern technology for preservation of fruits and vegetables • Gain expertise on the preservation methods of surplus fruits and vegetables at home scale level • Select the appropriate method for the preservation of fruits and vegetables • Justify the need and importance of processing and preservation			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Introduction, Importance of fruits and vegetable, need of preservation, Reasons of spoilage, Method of preservation Pickles, chutneys and sauces: Processing, Types, Causes of spoilage Dehydration of fruits and vegetables: Sun drying & mechanical dehydration, packing and storage	**8 Hrs**	8 Marks	Chalk & Board, Power Point Presentation, Videos, Group Discussion, Assignments, surprise quizzes, question and answering sessions
Unit II	Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, containers of packing, lacquering, syrups and brines for canning, spoilage in canned foods	**7 Hrs**	7 Marks	
Unit III	Fruits beverages: Introduction,	**8 Hrs**	8 Marks	

	Processing of fruit juices (selection of fruits, juice extraction, de-aeration, straining, filteration and clarification) Preservation of fruit juices: pasteurization, preservation by sugars and chemical, freezing, drying, tetra-packing, carbonation, processing of squashes, cordials, nectors, concentrates and powder			
Unit IV	Jams and jellies: Introduction Jam: Constituents, selection of fruits, processing & technology Jelly: Essential constituents(Role of pectin, ratio), Theory and processing of jelly, defects in jelly Tomato products: Selection of tomatoes, pulping & processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.	**7 Hrs**	7 Marks	
References	• Advanced Text Book on Food & Nutrition (Volume I and II), Swaminathan M, The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006 • A First Course in Food Analysis, by A.Y. Sathe, New Age Int. Publication • Chemical Changes in Food During Processing by Richardson T • Commercial Unit and Vegetable Products by W B Crusess. W.V. Special Indian Edition, Pub: Agrobios India • Drying and dehydration of Food by Loeseeke VWH • Encyclopedia of Foods – A Guide to Healthy Nutrition, Academic Press-An Imprint of Elsevier, San Diego, California • Food Additives by Mahindra S.N • Food and Food Production Encyclopedia by Considmem Douglas • Food Facts & Principle; Shakuntala Manay, M. Shadaksharaswamy; New Age International (p) Limited. • Food Science & Nutrition; Sunetra Roday; Oxford University Press. • Food Science; Sumati R. Mudambi, Shalini M. Rao; New Age International (p) Limited • Food Science; N. N. Potter. • Outline of Food Technology by Harry W Von • Preservation of fruits & Vegetables by Girdharilal, Siddappaa, G.S and Tandon, G.L., ICAR, New Delhi, 1998Principles and Practices for the Safe Processing of Foods by Shapton D A • Text Book on Food Storage and Preservation by Khader V • The technology of Food Preservation by Desrosier N			
Model Questions	**Short Answer Questions** 1. Explain the need for the preservation of fruits and vegetables 2. Discuss the reasons of spoilage of fruits 3. Discuss the reasons of spoilage of vegetables 4. Explain the mechanism of preservation of vegetables by pickeling			

	5. Categorize the causes of spoilage 6. Discuss the steps in the dehydration of F & V 7. State the factors affecting the canning time 8. Explain the requirements of properties of containers for canning 9. Enlist the types of juicers used for fruit juice production 10. Justify the need of deaereation of juices 11. Explain pasteurization of juices 12. Discuss the step straining in the fruit juice processing 13. Discuss the preservatives used for the preservation of fruit juices 14. Explain carbonation with its importance 15. Explain tetra packing of juices 16. Enlist the ingredients required for jam preparation 17. Explain the theory of gel formation in jelly 18. Justify the need of selection of fruits in jam/ jelly making 19. Glorify the role of pectin in jelly formation 20. Differentiate between tomato puree and paste 21. Differentiate between tomato sauce and ketchup **Long Answer Questions** 1. State the importance of fruits and vegetables. Justify the need of preservation. 2. List out the methods of preservation of fruits and vegetables. Discuss any one. 3. Justify the importance of pickling. Draw a flow diagram of mango pickle preparation 4. Explain the preservation of cucumber by pickling with flow diagram 5. elaborate the method of dehydration of any F/V with flow diagram 6. Explain the working of mechanical dryers with detailing of each step 7. Draw a flow diagram showing each step in canning of fruits and vegetables 8. Explain the role of syrups and brines in the canning with examples 9. Details the factors affecting the canning process 10. Outline each step of canning 11. Classify fruit beverages 12. Explain fruit juice processing with flow diagram 13. Justify the need of preservation of fruit juices with examples 14. Explain the drying of fruit juices with flow diagram 15. Explain the preparation of tomato ketchup with flow diagram 16. Explain the preparation of jam with flow diagram

116208 Open Elective Theory 4: Technology of Milk and Milk Products							
Level	**Semester**	**Course code**	**Course Name**	**Credits**	**Teaching Hours**	**Exam Duration**	**Max marks**
4.5	II	116208	Technology of Milk and Milk Products	2	30	2Hrs	30

Course Objectives	• To know the need and importance of dairy industry • To know the compositional and technological aspects of milk and processed milk products. • To develop young entrepreneurs for self-employment through dairy technology and associated activities			
Course Outcomes	Upon completion of this course successfully, students will be able to • Understand the importance of dairy industry and the basic technology needed • Explain the need of milk and milk product processing • Start up a small enterprise related to milk and milk product • Apply various methods to milk and milk product processing			
Unit System	**Contents**	**Workload Allotted**	**Weightage of Marks Allotted**	**Incorporation of Pedagogies**
Unit I	Importance of dairy development in India Collection of milk: Reception, Platform testing; Physicochemical properties of milk: Color, taste, pH and buffering capacity, refractive index, viscosity, surface tension, freezing, boiling point, specific heat, etc.; composition, constituents and nutritional Importance; Effect of heat, acid, enzymes, phenolic compounds, salts, microorganisms, etc. Preservatives, Neutralizers and Adulterants in Milk and their Detection	**8 Hrs**	8 Marks	Chalk & Board, Power Point Presentation, Videos, Group Discussion, Assignments, surprise quizzes, question and answering sessions
Unit II	Equipment used in dairy industry: Processing, transport, mixing, heating, etc. Cleaning and maintenance of equipments Refrigeration System: Basic Principles and Components of Refrigeration System	**7 Hrs**	7 Marks	

	Different Cooling Systems for Milk and Milk Products.			
Unit III	Processing of milk: Clarification, separation, bacto-fugation, homogenization, Pasteurization and Ultra-high-temperature processing; Packaging: materials process and machinery. Different types of fluid milk produced commercially, Storage and Distribution Systems	**8 Hrs**	8 Marks	
Unit IV	Processing of milk products: Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, ice-cream, channa, paneer, cheese, etc. Defects during Manufacturing and Storage	**7 Hrs**	7 Marks	
References	• Advanced Text Book on Food & Nutrition (Volume I and II), Swaminathan M, The • A First Course in Food Analysis, by A.Y. Sathe, New Age Int. Publication Bangalore Printing and Publishing Co. Ltd, Bangalore. 2006 • Applied microbiology Dr. Parihar Pramila , New delhi Swastik Publication • Chemical Changes in Food During Processing by Richardson T • Dairy Microbiology by Parihar & Parihar • Encyclopedia of Foods– A Guide to Healthy Nutrition,Academic Press – An Imprint of Elsevier, San Diego, California • Food Additives by Mahindra S.N • Food and Diary Microbiology Dr Rao M K New Delhi Mangalam publication • Food and Food Production Encyclopedia by Considmem Douglas • Food Facts & Principle, Shakuntala Manay, M. Shadaksharaswamy;New Age International (p) Limited. • Food Microbiology by Adam Moss • Food Microbiology by W.C. Fraizer, Tata Macgraw Hill Publication • Food Science; Sumati R. Mudambi, Shalini M. Rao; New Age International (p) Limited • Food Science; N. N. Potter. • Industrial Microbiology, Patel A H, Mumbai Mcmillan, Mumbai • Modern Food Microbiology Jay J M , New Delhi CBS Publication • Nutritive Value of Indian Food; Dr. C. Gopalan NIN Hyderabad. • Outline of Food Technology by Harry W Von • Principles and Practices for the Safe Processing of Foods by Shapton D A • Text book of Microbiology Purohit S, Jodhpur Arobios India • Text Book on Food Storage and Preservation by Khader V • The technology of Food Preservation by Desrosier N			
Model Questions	**Short Answer Questions** 1. Outline the importance of dairy industry in India 2. List out the types of milks 3. List out the dairy products in India with their importance 4. Discuss the physical properties of milk			

	5. Define freezing, boiling point, and pH of milk 6. Discuss pasteurization of milk 7. Discuss the adulteration in milk 8. List out the equipments used in dairy industry 9. Explain the cleaning agents used in dairy industry 10. outline the principle and components in milk refrigeration 11. Discuss the different cooling systems for milk 12. Explain clarification of milk 13. Discuss the types of fluid milk produced commercially 14. Give the importance of storage of milk 15. Discuss milk distribution system 16. Draw a flow chart for ice-cream preparation 17. Draw a flow chart of yougurt manufacturing 18. Draw a flow chart of cheese manufacturing 19. Draw a flow chart of ghee manufacturing 20. Draw a flow chart of butter manufacturing **Long Answer Questions** 1. Discuss the dairy industries in detail 2. Explain the platform testing of milk 3. Discuss the physical properties of milk in detail 4. Discuss the effect of heat, acid, and enzymes on milk 5. Explain the common adulteration in milk. How it is detected? 6. Discuss the working of cream seperator 7. Discuss the working of homoginizer 8. Discuss the principles and Components of Refrigeration System in milk 9. Overview the cooling systems for milk and milk products 10. Overview the ultra-high temperature processing of milk 11. Discuss the storage and distribution system of milk 12. Enlist the different types of fluid milks. Explain any one with flow diagram 13. Illustrate the manufacturing process of flavored milk with flow diagram 14. Illustrate the manufacturing process of cottage cheese with flow diagram 15. Illustrate the manufacturing process of ice-cream with flow diagram 16. Illustrate the manufacturing process of paneer with flow diagram