

**Syllabi (1<sup>st</sup> Year)**  
**for**  
**Integrated B.Sc. (Hons./Hons. with Research) -M.Sc. in**  
**Food Technology (Semester System)**  
As Per NEP, 2020  
(Multiple Entry-Exit, Internship and Choice Based Credit System)

**To be implemented w.e.f. Academic Session 2024-25**



**Department of Food Technology**  
**Guru Jambheshwar University of Science and Technology, Hisar**

<b>SEMESTER I</b> <b>Course Type: Discipline Specific Course (DSC-A1)</b> <b>Course Code: 24BFT0101T</b> <b>Course Title: Fundamentals of Food Science</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours per week:4+0+0</b> <b>Credits: 4</b> <b>Examination Duration: 3 Hours</b>	<b>Course Assessment Methods:</b> <i>Note for Paper Setters:</i> <b>Max. Marks: 100 (Internal: 30; External: 70)</b> Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively. <i>Note:</i> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand the basic concepts, terminology, status and scope of food science
L2	CO2	Understand functions, role and classification of food
L3	CO3	Recognize different food preservation and cooking techniques
L4	CO4	Apply new innovative product methodology with the application of appropriate techniques and packaging system

#### UNIT-I

Introduction to food: definitions, types, functions, classifications (based on perishability, source, nutritive value, origin), properties. Other relevant areas of food science (Food Technology, Food Science, Food Engineering, Food Preservation, Food Processing etc.). Food Spoilage: definitions, types and factors responsible. Scope, status and current trends in food science and food processing industries.

#### UNIT-II

Principles and methods (significance, classification, merits, demerits and applications) of food preservation: Blanching, pasteurization, sterilization, drying, dehydration, freezing, chilling, evaporation, concentration, fermentation, preservatives: natural antimicrobial methods.

#### UNIT-III

Thermal processing of foods: objectives, limitations. Moist heat methods (boiling, simmering, poaching, stewing, steaming and pressure cooking), dry heat methods (air as medium of cooking-grilling or broiling, toasting, pan broiling or roasting and baking; fat as a medium of cooking). Non-thermal methods (principles, mechanism, advantages and disadvantages): HPP, ozone packaging, MAP, hurdle, irradiation.

#### UNIT-IV

New food product development- need, factors influencing and steps in food product development. Food Packaging- definition, classification on the basis of mode, type of material used, different types of food and food products, functional properties.

#### **Recommended books:**

- Norman N. P., and Joseph H. H., (1997) Food Science 5th edition, CBS Publication, New Delhi.
- Shakuntala Manay N. (2022) Food: Facts and Principles 5 th edition, New Age International Publisher, New Delhi.
- Eppathshala online study material  
<https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iWHzbXYGExXDS52DSnAzdQ=>
- Gordon W. Fuller., (2011) New Food Product Development 3th edition, CRC Press, Taylor and Francis Group, New York.

<b>SEMESTER I</b> <b>Course Type: Discipline Specific course (DSC-A2)</b> <b>Course Code: 24BFT0102T</b> <b>Course Title: Introduction to Food Microbiology</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours per week:3+0+0</b> <b>Credits: 3</b> <b>Examination Duration: 2.5 Hours</b>	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i> <b>Max. Marks: 70 (Internal: 20; External: 50)</b>  Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and attendance will be 05 marks each. <i>Note:</i> The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand basic concept of microbiology
L2	CO2	Examine the role of intrinsic and extrinsic factors in growth of microbes
L3	CO3	Apply different microbes in preparation of fermented foods
L4	CO4	Evaluate toxicants produced by microflora

#### UNIT – I

Introduction, history, and scope of food microbiology: Morphology and physiology of bacteria, yeast, and molds. Isolation and identification of microorganisms, enumeration techniques (pour plating, standard plate count and MPN).

#### UNIT – II

Microbial Growth: Definition of growth, growth curve, generation time. Intrinsic and extrinsic factors, Effect of environmental factors such as temperature, oxygen, moisture, salt, pH, oxidation-reduction potential and radiations on growth.

#### UNIT-III

Role of microflora in food: Microorganisms used in food industry, Food Spoilage Organisms. Food spoilage organisms. Food borne infections and poisoning organisms, sanitation and hygiene.

#### Recommended readings:

- Frazier, W. C. and Weshoff, D. C. (2015). Food Microbiology: Tata McGraw Hill Publication, New Delhi.
- Adam, M. R. & Moss, M. O. (2008). Food Microbiology: Royal Society of Chemistry, Cambridge.
- James, M. J. (2005). Modern Food Microbiology (5th ed.): CBS Publishers, New Delhi.
- Stanier, R.Y. (1996). General Microbiology (5th ed.): MacMillan, Hampshire.
- Creager, J. G., Black, J. G. & Davison, V. E. (1990). Microbiology: Principles & Applicants. Prentice Hall, New Jersey.
- Frazier, W. C. & Westhoff, D. C. (1995). Food Microbiology (4th ed.). TMH, New Delhi.

<b>SEMESTER I</b> <b>Course Type: Discipline Specific course (DSC-A2)</b> <b>Course Code: 24BFT0102P</b> <b>Course Title: Introduction to Food Microbiology Lab</b> <b>Category: Practical</b> <b>Mode: Lab Practical and Assignments</b> <b>Hours per week:0+0+2</b> <b>Credits: 1</b> <b>Examination Duration: 3 Hours</b>	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i> <b>Max. Marks: 30 (Internal: 10; External: 20)</b>  The internal assessment will be based on assignment/quiz/class test etc. and class participation of 05 Marks each. External evaluation will be based on submission of practical records (05 Marks), viva-voce (05 Marks) and lab performance (10 Marks).  The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand basic preparation of media and instruments
L2	CO2	Identify different types of micro-flora
L3	CO3	Enumeration of microflora using various methods
L4	CO4	Develop different fermented products

#### List of Practicals:

- Guidelines for safety in a microbiology lab.
- Introduction to types of equipment commonly used in the microbiology laboratory.
- Cleaning and sterilization of glassware used in the microbiology laboratory.
- To study different parts of a microscope.
- Preparation of media with nutrient agar, PDA, and special media.
- Preparation of nutrient broth.
- To perform pour plate, spread plate, and streak plate methods for isolation and enumeration of micro-organisms.
- To stain the given bacteria by Gram's staining method.
- To demonstrate acid-fast staining.

#### Recommended Readings:

- Frazier, W. C. and Weshoff, D. C. (2015). Food Microbiology: Tata McGraw Hill Publication, New Delhi.
- Adam, M. R. & Moss, M. O. (2008). Food Microbiology: Royal Society of Chemistry, Cambridge.
- James, M. J. (2005). Modern Food Microbiology (5th ed.): CBS Publishers, New Delhi.

<b>SEMESTER I</b> <b>Course Type: Minor Course MIC-1</b> <b>Course Code: 24 MIN0124T</b> <b>Course Title: Fundamentals of Food Science</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours per week:4+0+0</b> <b>Credits: 4</b> <b>Examination Duration: 3 Hours</b>	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i> <b>Max. Marks: 100 (Internal: 30; External: 70)</b>  Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.  <b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand the basic concepts, terminology, status and scope of food science
L2	CO2	Understand functions, role and classification of food
L3	CO3	Recognize different food preservation and cooking techniques
L4	CO4	Apply new innovative product methodology with the application of appropriate techniques and packaging system.

#### UNIT-I

Introduction to food: definitions, types, functions, classifications (based on perishability, source, nutritive value, origin), properties. Other relevant areas of food science (Food Technology, Food Science, Food Engineering, Food Preservation, Food Processing etc.). Food Spoilage: definitions, types and factors responsible. Scope, status and current trends in food science and food processing industries

#### UNIT-II

Principles and methods (significance, classification, merits, demerits and applications) of food preservation: Blanching, pasteurization, sterilization, drying, dehydration, freezing, chilling, evaporation, concentration, fermentation, preservatives: natural antimicrobial methods

#### UNIT-III

Thermal processing of foods: objectives, limitations. Moist heat methods (boiling, simmering, poaching, stewing, steaming and pressure cooking), dry heat methods (air as medium of cooking-grilling or broiling, toasting, pan broiling or roasting and baking; fat as a medium of cooking). Non-thermal methods (principles, mechanism, advantages and disadvantages): HPP, ozone packaging, MAP, hurdle, irradiation

#### UNIT-IV

New food product development- need, factors influencing and steps in food product development. Food Packaging- definition, classification on the basis of mode, type of material used, different types of food and food products, functional properties.

#### Recommended books:

- Norman N. P., and Joseph H. H., (1997) Food Science 5th edition, CBS Publication, New Delhi.
- Shakuntala Manay N. (2022) Food: Facts and Principles 5 th edition, New Age International Publisher, New Delhi.
- IARI online study material - <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=20030>
- Gordon W. Fuller., (2011) New Food Product Development 3th edition, CRC Press, Taylor and Francis Group, New York.

<b>SEMESTER I</b> <b>Course Type: Minor Course MIC-1</b> <b>Course Code: 24 MIC0124T</b> <b>Course Title: Fundamentals of Food Science</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours per week:2+0+0</b> <b>Credits: 2</b> <b>Examination Duration: 2Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 50 (Internal: 15; External: 35)</b>  <b>Note for Paper Setters:</b> Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.  <b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short question covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of 15 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand the basic concepts, terminology, status and scope of food science
L2	CO2	Understand functions, role and classification of food
L3	CO3	Recognize different food preservation and cooking techniques
L4	CO4	Apply new innovative product methodology with the application of appropriate techniques and packaging system.

#### UNIT-I

Introduction: definitions, types, functions, classifications and properties. Food Preservation, and Food Processing etc.). Food Spoilage: definitions, types and factors responsible. Principles and methods of food preservation: Blanching, pasteurization, sterilization, drying, dehydration, freezing, chilling, evaporation, concentration, fermentation, preservatives: natural antimicrobial methods.

#### UNIT-II

Thermal processing of foods: Moist heat methods (boiling, simmering, poaching, stewing, steaming and pressure cooking), dry heat methods (grilling or broiling, toasting, pan broiling or roasting and baking). Non-thermal methods: HACCP, hurdle, cold processing. New food product development and role of Food Packaging

#### Recommended books:

- Norman N. P., and Joseph H. H., (1997) Food Science 5th edition, CBS Publication, New Delhi.
- Shakuntala Manay N. (2022) Food: Facts and Principles 5 th edition, New Age International Publisher, New Delhi.
- IARI online study material - <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=20030>
- Epppathshala online study material - <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iWHzbXYGExXDS52DSnAzdQ=>
- Gordon W. Fuller., (2011) New Food Product Development 3th edition, CRC Press, Taylor and Francis Group, New York.

<b>SEMESTER I</b> <b>Course Type: Multidisciplinary Course MDC-1</b> <b>Course Code: 24MDC0116T</b> <b>Course Title: Food Processing and Preservation</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Credits: 3+0+0</b> <b>Contact Hours/Week: 3</b> <b>Examination Duration: 2.5 Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 75 (Internal: 25; External: 50)</b>  <i>Note for Paper Setters:</i> Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and attendance will be 05 marks each.  <i>Note:</i> The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Remember causes of food spoilage and principles of different techniques used in processing and preservation of foods
L2	CO2	Understand the importance of processing and preservation of foods
L3	CO3	Operate and maintain various equipments used in processing of foods
L4	CO4	Evaluate the changes and problems related to the processing and preservation of foods
L5	CO4	Develop new products for value addition and innovative technologies for enhancing the shelf life of foods

#### UNIT-I

Food preservation: introduction, history and principles. Thermal Processing: Heat penetration, types of heat treatments and effects on foods, heat resistance of microorganisms, thermal death curve. Preservatives: Uses and effects of class I and class II preservatives in foods.

#### UNIT-II

Refrigeration, chilling and freezing: theory, principles, methods, systems, application and changes in foods during low temperature storage. Intermediate Moisture (IM) Foods: principles, characteristics, advantages and problems. Canning of foods.

#### UNIT-III

Drying, dehydration and concentration: theory, principles, methods, systems, equipments, application and changes in foods during drying/concentration. Ionizing Radiation and microwave: Source; Equipment; Mechanism of preservation, Dose determination, Effect on food.

#### Recommended Readings:

- Zeuthen, P. & Bogh- Sprensen, L. (2003). Food Preservation Techniques: CRC Press, Boca raton.
- Fellows, P.J. (2009). Food Processing Technology: Principles and Practice, Woohed Publishing.
- Brennan, J.G. (2012). Food Processing Handbook, Wiley-VCH.
- Khetarpaul, N.(2005). Food Processing and Preservation, Daya Publications.
- Sivasankar, B. (2014). Food Processing & Preservation, Prentice Hall of India, New Delhi.
- Norman W. Desrosier; (2018). The Technology of food preservation, Medtech, New Jersey.

<b>SEMESTER I</b>  <b>Skill Enhancement Course (SEC) SEC-1</b> <b>Course Code: 24SEC0116P</b> <b>Course Title: Processing of Fruits and Vegetables Lab</b> <b>Mode: Lab Practicals and Assignments</b> <b>Hours per week:0+0+6</b> <b>Credits: 3</b> <b>Examination Duration: 3 Hrs.</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 75 (Internal: 25; External: 50)</b>  <b>Note for Paper Setters:</b> The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voce (10Marks) and written exam with lab performance (30 Marks). The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.
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RBT Level	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Define factor affecting post-harvest physiology, composition, nutritive value and composition of fruits and vegetables
L2	CO2	Select best suitable maturity and operating conditions for attaining quality products
L3	CO3	Apply theoretical knowledge of fruits and vegetables at the industrial level to broaden applications by producing value added products
L4	CO4	Evaluate quality parameters of different processed products
L6	CO6	Create problem solving strategies and methods in accordance with the current and future prospects of fruits and vegetables

**List of Practicals:**

- Sampling techniques and preparation of test sample
- Demonstration of various food processing equipments
- Assessment of adequacy of blanching, pasteurization for different foods
- Dehydration of food and preparation of concentrate and powder
- Preparation of tomato ketchup, puree, paste and their preservation
- Preparation of pickles and chutneys
- Preparation and packaging of jam, jelly and marmalades and determination of TSS
- Determination of moisture, total solids and pH
- Preparation of fruit juices, squashes and cordial
- Prepare and preserve (murabba), candy, fruit bar, toffee, candy, and glazed fruit/ vegetables
- Determination of reducing and total sugars
- Physical and chemical evaluation of canned/ bottled foods
- Estimation of preservatives in food sample
- Preparation of the sugar syrup of different degree brix
- Preservation of fermented vegetable products
- Preparation of frozen foods
- Visit to local fruit and vegetables processing industries

**Recommended Readings:**

- FSSAI (2016). Manual of Methods of Analysis of Foods of Fruit and Vegetable Products. Food Safety and Standards Authority of India, Ministry of Health and Family Welfare Government of India New Delhi.
- FSSAI. (2012). Fruits and vegetables products. Manuals of methods of analysis of Foods. Lab manual 5.
- Giridharlal, S. and Tandon, G. L. (2009). Preservation of fruits and vegetables. ICAR, New Delhi.
- Srivastava. P., R., and Kumar, S. (2017). Fruit and vegetable preservation - 3rd Edition. International Publishers, Delhi.
- Ranganna, S. (2017). Handbook of Analysis and Quality Control for Fruit and Vegetable. 2nd Edition. McGraw Hill Education.



<b>SEMESTER I</b> <b>Course Type: Value Added Course VAC-1</b> <b>Course Code: 24VAC0117T</b> <b>Basics of Food Processing and Preservation</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Credits: 2+0+0</b> <b>Examination Duration: 2 Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 50 (Internal: 15; External: 35)</b> <b>Note for Paper Setters:</b> Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.  <b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short question covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of 15 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Remember causes of food spoilage and principles of different techniques used in processing and preservation of foods
L2	CO2	Understand the importance of processing and preservation of foods
L3	CO3	Operate and maintain various equipments used in processing of foods
L4	CO4	Evaluate the changes and problems related to the processing and preservation of foods
L5	CO4	Create new products for value addition and innovative technologies for enhancing the shelf life of foods

### UNIT-I

Food preservation: introduction, history and principles. Thermal Processing: Heat penetration, types of heat treatments and effects on foods, heat resistance of microorganisms, thermal death curve, Canning of foods, Preservatives: Uses and effects of class I and class II preservatives in foods, Intermediate Moisture (IM) Foods: principles, characteristics, advantages and problems.

### UNIT-II

Refrigeration, chilling and freezing: theory, principles, methods, systems, application and changes in foods during low temperature storage. Drying, dehydration and concentration: theory, principles, methods, systems, equipments, application and changes in foods during drying/concentration. Ionizing Radiation and microwave: Source; Equipment; Mechanism of preservation, Dose determination, Effect on food.

#### Recommended Readings:

- Zeuthen, P. & Bogh- Sørensen, L. (2003). Food Preservation Techniques: CRC Press, Boca raton.
- Fellows, P.J. (2009). Food Processing Technology: Principles and Practice, Wothead Publishing.
- Brennam, J.G. (2012). Food Processing Handbook, Wiley-VCH.
- Khetarpaul, N.(2005). Food Processing and Preservation, Daya Publications.
- Sivasankar, B. (2014). Food Processing & Preservation, Prentice Hall of India, New Delhi.
- Norman W. Desrosier; (2018). The Technology of food preservation, Medtech, New Jersey.

<b>SEMESTER II</b>  <b>Course Type: Discipline Specific Course</b> <b>DSC-A3</b> <b>Course Code: 24BFT0201T</b> <b>Course Title: Basics of Nutrition and Health</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours/week:4+0+0</b> <b>Credits: 4</b> <b>Examination Duration: 3Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 100 (Internal: 30; External: 70)</b>  <b>Note for Paper Setters:</b> Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 10 and 05 marks, respectively.  <b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Understand the processes of digestion, absorption, and metabolism of nutrients and their impact on energy balance.
L2	CO2	Identify the nutritional requirements for different life stages and special populations.
L3	CO3	Utilize dietary guidelines and recommendations to assess and plan balanced diets
L4	CO4	Perform basic nutritional assessments and understand the principles of food safety and hygiene.

#### UNIT-I

Definition and importance of nutrition: Understanding the basic concepts and the role of nutrition in health. Energy balance and weight management: concepts of energy intake and expenditure, basal metabolic rate (BMR) and factors influencing energy requirements.

#### UNIT-II

Macronutrients: Overview of carbohydrates, proteins, and fats; their functions, sources and recommended intake. Water and electrolytes: electrolyte balance and their impact on health. Role of fiber: Types of dietary fiber, their sources and health benefits.

#### UNIT-III

Micronutrients: Nomenclature and classification of vitamins, sources, deficiency disease. Classification of minerals: macro minerals, micro minerals and trace minerals; their roles, sources, and daily requirements and diseases.

#### UNIT-IV

Principles of planning balanced meals. Nutritional requirements for different life stages. Public Health Nutrition: Community nutrition programs, food security and global nutrition challenges. Introduction to functional foods and nutraceuticals.

#### Recommended Readings:

- Joshi S. A., (1992) Nutrition and Dietetics Tata Mc Grow- Hill publishing Company Ltd., New Delhi  
M. Swaminathan, Vol I & II Foods and Nutrition NIN Publications  
Manay S., and Shadksharawamis N., Food: Facts and Principles, New Age International Pvt. Ltd., New Delhi.  
Mann J., and Truswell S., (2007) Essentials of Human Nutrition 3rd Ed. Oxford University Press, 2007.  
Khanna (1997) Textbook of Nutrition and Dietetics, Phoenix Publisher House Pvt. Ltd., New Delhi.  
Eastwood M. S., (2003) Principles of Human Nutrition 2<sup>nd</sup> ed, Blackwell Publishers.

<b>SEMESTER II</b>  <b>Course Type: Discipline Specific</b> <b>Course DSC-A4</b> <b>Course Code: 24BFT0202T</b> <b>Course Title: Food Composition and Analysis</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours/week:3+0+0</b> <b>Credit: 3</b> <b>Examination Duration: 2.5Hours</b>	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i> <b>Max. Marks: 70 (Internal: 20; External: 50)</b>  Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and attendance will be 05 marks each.  <i>Note:</i> The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.
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<b>RBT Level</b>	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Recognize the chemical composition of macro and micro food components.
L2	CO2	Illustrate the physical, chemical and functional properties of various food components
L3	CO3	Classify different methods for qualitative and quantitative analysis of food components
L4	CO4	Distinguish enzyme applications with respect to their category and rate of action
L6	CO6	Propose the appropriate method of food analysis by applying food composition knowledge

### UNIT-I

Constituents of Foods: General Classification and Importance. Nutritive Values of Common Foods. Water: Significance, Structure, Types of Water, Role of Water Activity in Foods.

### UNIT-II

General and functional properties of carbohydrates, proteins, fats, vitamins and minerals. Commercial Sugar & Sugar Products, Commercial Fats & Fat Products, Deterioration of Fats, Enzymes: Introduction, Nomenclature and Classification, Food Enzymes.

### UNIT-II

Introduction to Various Analytical Methods: Sampling, Moisture Content, Crude Fat, Crude Protein, Crude Fiber. Weighing Devices, pH Meters, Calorimetry Gravimetry, Titrimetry.

#### **Recommended Readings:**

- Wang, D. (2012). Food Chemistry: Nova Science Publishers.
- Chopra, H. K. & Panesar, P. S. (2010). Food chemistry: Alpha Science International Ltd, Oxford, U.K.
- Coultate, T. P. (2009). Food: The Chemistry of Its Components (5 ed.): American Chemical Society.
- Newton, D.E. (2009). Food Chemistry: Facts On File, Incorporated.
- Damodaran, S., Parkin, K. L., & Fennema, O. R. (2007). Fennema's Food Chemistry: CRC Press, Taylor and Francis group.

<b>SEMESTER II</b>  <b>Course Type: Discipline Specific</b> <b>Course DSC-A4</b> <b>Course Code: 24BFT0202P</b> <b>Course Title: Food Composition and Analysis</b> <b>Category: Practical</b> <b>Mode: Lab Practical and Assignments</b> <b>Hours/week:0+0+2</b> <b>Credits: 1</b> <b>Examination Duration: 3Hours</b>	<b>Course Assessment Methods:</b>  <i>Note for Paper Setters:</i> <b>Max. Marks: 30 (Internal: 10; External: 20)</b>  The internal assessment will be based on assignment/quiz/class test etc. and class participation of 05 Marks each. External evaluation will be based on submission of practical records (05 Marks), viva-voce (05 Marks) and lab performance (10 Marks). The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.
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RBT Level	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Describe the different methods of food sampling
L2	CO2	Explain the different methods used for food analysis
L3	CO3	Apply the qualitative and quantitative methods of food analysis
L4	CO4	Examine the results of food analysis and use it for further data analysis
L5	CO5	Judge the composition of different food materials

#### List of Practicals

- Introduction to laboratory maintenance/safety measures and familiarization with different type of instruments/equipments in food analysis laboratory
- Study of different sampling techniques for preparation of different food sample
- Introduction to preparation of various solutions commonly used in food analysis
- Determination of moisture content of a food sample
- Methods of sampling for food analysis
- Moisture analysis – oven drying method / moisture meter
- Qualitative test for carbohydrates – Molisch test, Barfoed test, Benedict test. various types of starches, soluble sugars and reducing sugars
- Qualitative/quantitative determination of proteins/ amino acids in different food samples. Methods of protein analysis – Kjeldahl method / Biuret method
- Determination of crude fat of given food sample using Soxhlet extraction method
- Determination of ash content and preparations for mineral estimation of a food sample
- Determination of crude fibre in given food sample

#### Recommended Readings:

- Wang, D. (2012). Food Chemistry: Nova Science Publishers.
- Chopra, H. K. & Panesar, P. S. (2010). Food chemistry: Alpha Science International Ltd, Oxford, U.K.
- Coultate, T. P. (2009). Food: The Chemistry of Its Components (5 ed.): American Chemical Society.
- Newton, D.E. (2009). Food Chemistry: Facts On File, Incorporated.

<b>SEMESTER II</b>  <b>Course Type: Minor Course MIC-2</b> <b>Course Code: 24MIN0224T</b> <b>Course Title: Basics of Nutrition and Health</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours/week:4+0+0</b> <b>Credits: 4</b> <b>Examination Duration: 3Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 100 (Internal: 30; External: 70)</b>  <b>Note for Paper Setters:</b> Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and attendance will be 10 and 05 marks, respectively.  <b>Note:</b> The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two questions from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.
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RBT Level	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Understand the processes of digestion, absorption and metabolism of nutrients and their impact on energy balance
L2	CO2	Identify the nutritional requirements for different life stages and special populations
L3	CO3	Utilize dietary guidelines and recommendations to assess and plan balanced diets
L4	CO4	Perform basic nutritional assessments and understand the principles of food safety and hygiene

#### **UNIT-I**

Definition and importance of nutrition: Understanding the basic concepts and the role of nutrition in health. Energy balance and weight management: concepts of energy intake and expenditure, basal metabolic rate (BMR) and factors influencing energy requirements.

#### **UNIT-II**

Macronutrients: Overview of carbohydrates, proteins, and fats; their functions, sources and recommended intake. Water and electrolytes: electrolyte balance and their impact on health. Role of fiber: Types of dietary fiber, their sources and health benefits.

#### **UNIT-III**

Micronutrients: Nomenclature and classification of vitamins, sources, deficiency disease. Classification of minerals: macro minerals, micro minerals and trace minerals; their roles, sources, and daily requirements and diseases.

#### **UNIT-IV**

Principles of planning balanced meals. Nutritional requirements for different life stages. Public Health Nutrition: Community nutrition programs, food security and global nutrition challenges. Introduction to functional foods and nutraceuticals.

#### **Recommended Readings:**

- Joshi S. A., (1992) Nutrition and Dietetics Tata Mc Grow- Hill publishing Company Ltd., New Delhi
- M. Swaminathan, Vol I & II Foods and Nutrition NIN Publications.
- Manay S., and Shadksharawamis N., Food: Facts and Principles, New Age International Pvt. Ltd., New Delhi.
- Mann J., and Truswell S., (2007) Essentials of Human Nutrition 3rd Ed. Oxford University Press, 2007.
- Khanna (1997) Textbook of Nutrition and Dietetics, Phoenix Publisher House Pvt. Ltd., New Delhi.
- Eastwood M. S., (2003) Principles of Human Nutrition 2 ed, Blackwell Publishers.

<b>SEMESTER II</b>  <b>Course Type: Minor/Vocational Courses MIC-2</b> <b>Course Code: 24MIC0224T</b> <b>Course Title: Basics of Nutrition and Health</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours/week:2+0+0</b> <b>Credits: 2</b> <b>Examination Duration: 2 Hours</b>	<b>Course Assessment Methods:</b>  <b>Max. Marks: 50 (Internal: 15; External: 35)</b>  <b>Note for Paper Setters:</b> Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.  <b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short question covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of 15 marks.
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RBT Level	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Understand the processes of digestion, absorption and metabolism of nutrients and their impact on energy balance
L2	CO2	Identify the nutritional requirements for different life stages and special populations
L3	CO3	Utilize dietary guidelines and recommendations to assess and plan balanced diets
L4	CO4	Perform basic nutritional assessments and understand the principles of food safety and hygiene

#### UNIT-I

Understanding the basic concepts and the role of nutrition in health. Energy balance: concepts of energy intake and expenditure, basal metabolic rate (BMR). Public Health Nutrition: Community nutrition programs, food security and global nutrition challenges.

#### UNIT-II

Macronutrients: Overview of carbohydrates, proteins and fats; their functions and sources. Micronutrients: Nomenclature, classification of vitamins and minerals, sources, their roles, daily requirements and deficiency disease. Role of water and dietary fibre in human health.

#### Recommended Readings:

- Joshi S. A., (1992) Nutrition and Dietetics Tata Mc Grow- Hill publishing Company Ltd., New Delhi
- M. Swaminathan, Vol I & II Foods and Nutrition NIN Publications.
- Manay S., and Shadksharawamis N., Food: Facts and Principles, New Age International Pvt. Ltd., New Delhi.
- Mann J., and Truswell S., (2007) Essentials of Human Nutrition 3rd Ed. Oxford University Press, 2007.
- Khanna (1997) Textbook of Nutrition and Dietetics, Phoenix Publisher House Pvt. Ltd., New Delhi.
- Eastwood M. S., (2003) Principles of Human Nutrition 2 ed, Blackwell Publishers.

<b>SEMESTER II</b>  <b>Course Type: Multidisciplinary</b> <b>Course MDC-2</b> <b>Course Code: 24MDC0216T</b> <b>Course Title: : Food Packaging and Labelling</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Hours/week:3+0+0</b> <b>Credits: 3</b> <b>Examination Duration: 2.5 Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 75 (Internal: 25; External: 50)</b>  <i>Note for Paper Setters:</i> Two mid-term exams each of 15 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for assignment and class participation will be 05 marks each.  <i>Note:</i> The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.
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RBT Level	<b>Course Outcomes:</b> After the completion of the course, the students will be able to:	
L1	CO1	Understand the basic concepts, terminology, status and scope of food packaging & labeling
L2	CO2	Understand functions, role and classification of food
L3	CO3	Recognize different food packaging techniques
L4	CO4	Apply new innovative product methodology with the application of appropriate techniques and packaging system

### UNIT-I

Introduction of food packaging: types, functions, application and selection criteria. Polymers: Introduction, types and classification. Packaging materials: Different forms of packaging, rigid, semi-rigid, flexible forms of packaging. Current status, scope and future challenges of packaging materials.

### UNIT-II

Paper: Introduction, composition, manufacturing process. Types of papers and paper-based packaging materials. Glass: Introduction, manufacturing processes, types. Metal packaging materials, types, characteristics and container making processes.

### UNIT-III

Recent advances in food packaging: active packaging, intelligent packaging, modified atmosphere packaging, aseptic packaging, Biodegradable plastics, edible gums and Coatings. CA and MA, Retort pouches, Methods of food storage: principles, types and methods and applications. Food Labeling: Introduction and types of food labeling.

#### Recommended books:

- Gordon L. Robertson, Food Packaging: Principles and Practice, Third Edition, 2013.
- Gordon L. Robertson, Food Packaging and Shelf Life: A Practical Guide, 2010.
- Ruben Hernandez, Susan E. M. Selke, John Culter, John D. Culter, Plastics Packaging: Properties, Processing, Applications, and Regulations, 2000.
- Walter Soroka, Fundamentals of Packaging Technology-Fourth Edition.

<b>SEMESTER II</b> <b>Course Type: Skill Enhancement Course (SEC-2)</b> <b>Course Code: 24SEC0216P</b> <b>Course Title: Food Safety &amp; Analysis Lab</b> <b>Category: Practical</b> <b>Mode: Lab Practical and Assignments</b> <b>Hours/Week: 0+0+6</b> <b>Credits: 3</b> <b>Examination Duration: 3 Hours</b>	<b>Course Assessment Methods:</b>  <b>Note for Paper Setters:</b> <b>Max. Marks: 75 (Internal: 25; External: 50)</b> The internal assessment will be based on mid-term exam (10 Marks), assignment/quiz/class test etc. (10 Marks) and class participation of 05 marks. External evaluation will be based on submission of practical records (10 Marks), viva-voce (10 Marks) and written exam with lab performance (30 Marks). The internal examination will be conducted by the course coordinator. The external examination will be conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Illustrate the different methods of food sampling
L2	CO2	Explain the different methods used for food analysis
L3	CO3	Identify the various food adulterants using qualitative and quantitative methods of food analysis
L4	CO4	Evaluate the results of food analysis and use it for further data analysis

**List of Practicals:**

- Techniques of sampling
- Detection of adulteration in food products viz. honey, other sweetening agents, spices (whole and powder), pulses, oils, cereals, sweets, tea, coffee
- Determination of water hardness and TDS
- Detection and Determination of Coliforms, and E.coli in Foods and Beverages
- Direct Microscopic Count for Sauces, Tomato Puree and Pastes
- Estimation of Yeast and Mould in foods and beverages
- SWAB test to detect the effectiveness of hygiene on various surfaces
- Development of HACCP plan for various food industries
- Testing of heavy metals, additives and pesticides using advanced techniques

**Recommended Readings:**

- Nielson S. S. (2003) *Food analysis*, Kluwer Academic Press.
- Pomeranz Y. J. (2000) *Food Analysis*, Springer Publications.
- James CS (1998). *Analytical chemistry of foods*, BlackicAcad, UK.
- Winton, AL (1999). *Techniques of food analysis*, Allied Science Publication, New Delhi.



<b>SEMESTER II</b> <b>Course Type: Value Added Course VAC-2</b> <b>Course Code: 24VAC0117T</b> <b>Credits: 2</b> <b>Hours/Week: 2</b> <b>Basics of Food Processing and Preservation</b> <b>Category: Theory</b> <b>Mode: Lectures (L)</b> <b>Credits: 2+0+0</b> <b>Examination Duration: 2 Hours</b>	<b>Course Assessment Methods:</b> <b>Max. Marks: 50 (Internal: 15; External: 35)</b> <b>Note for Paper Setters:</b> Two mid-term exams each of 10 marks will be conducted for the internal assessment and marks of the best one will be considered. Weightage for class participation will be 05 marks.  <b>Note:</b> The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short question covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of 15 marks.
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RBT Level	Course Outcomes: After the completion of the course, the students will be able to:	
L1	CO1	Remember causes of food spoilage and principles of different techniques used in processing and preservation of foods
L2	CO2	Understand the importance of processing and preservation of foods
L3	CO3	Operate and maintain various equipments used in processing of foods
L4	CO4	Evaluate the changes and problems related to the processing and preservation of foods
L5	CO4	Create new products for value addition and innovative technologies for enhancing the shelf life of foods

### UNIT-I

Food preservation: introduction, history and principles. Thermal Processing: Heat penetration, types of heat treatments and effects on foods, heat resistance of microorganisms, thermal death curve, Canning of foods, Preservatives: Uses and effects of class I and class II preservatives in foods, Intermediate Moisture (IM) Foods: principles, characteristics, advantages and problems.

### UNIT-II

Refrigeration, chilling and freezing: theory, principles, methods, systems, application and changes in foods during low temperature storage. Drying, dehydration and concentration: theory, principles, methods, systems, equipments, application and changes in foods during drying/concentration. Ionizing Radiation and microwave: Source; Equipment; Mechanism of preservation, Dose determination, Effect on food.

#### Recommended Readings:

- Zeuthen, P. & Bogh- Sprensen, L. (2003). Food Preservation Techniques: CRC Press, Boca raton.
- Fellows, P.J. (2009). Food Processing Technology: Principles and Practice, Woohed Publishing.
- Brennam, J.G. (2012). Food Processing Handbook, Wiley-VCH.
- Khetarpaul, N.(2005). Food Processing and Preservation, Daya Publications.
- Sivasankar, B. (2014). Food Processing & Preservation, Prentice Hall of India, New Delhi.
- Norman W. Desrosier; (2018). The Technology of food preservation, Medtech, New Jersey.