

## **Scheme & Syllabus of** **Bachelor of Science (Hons) in Food Technology** **B.Sc. (Hons)Food Technology**

### **Batch 2021 onwards**



By

Board of Study Food Engineering

Department of Academics

**IK Gujral Punjab Technical University**

**Vision:**

To create competent professionals those, contribute towards the economic development of the nation by going in line with the policy of Government of India in the field of food processing food safety and security.

**Mission:**

- Development of human resources in the field of food science and technology to serve the cause of nation
- Providing a strong theoretical and practical background across the food science discipline with an emphasis on developing sustainable resources to cater food and nutrition related challenges
- Development of human resources in the area of clinical nutrition and research to contribute effectively in making India healthy
- Create favorable environment for innovation to translate theoretical knowledge into practical applications
- Inculcating professional ethical values, innovative research capabilities and leadership abilities
- Holistic development of the youth through the process of self evaluation and continuous improvement

**Program Education Objectives:**

1. To make the students competent in developing the foods of the future by utilizing technologies such as dehydration, freezing, irradiation, fermentations, applications of enzymes in food processing, food product development, nutraceuticals, nutritional and functional foods.
2. To keep students abreast with the rapid developments reported within technology and biological science that is creating completely new ways of developing various processed food.
3. To impart an understanding of modern food processing and profound knowledge of technology associated with the development of healthy and safe foods.
4. To motivate and enable students of BSc. Food Science & Technology to opt for higher levels of learning viz. post-graduate program, doctoral programs by research in this interdisciplinary field with the view of developing highly skilled professionals to work in Industry and academia.

**Program Outcomes:**

1. To impart knowledge of various areas related to Food Science and Technology
2. To enable the students to understand food composition and its physico- chemical, nutritional, microbiological and sensory aspects,
3. To familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,
4. To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.
5. To impart an understanding of modern food processing and profound knowledge of technology associated with the development of healthy and safe foods.

**Mapping of Program Outcomes with Program Education Objectives:-**

<b>PO \ POE</b>	<b>POE1</b>	<b>POE2</b>	<b>POE3</b>	<b>POE4</b>
<b>PO1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>
<b>PO2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>PO3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>
<b>PO4</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>PO5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

## **Bachelors of Science (Hons) in Food Technology: B.Sc. (Hons) Food Technology**

It is a Under Graduate (UG) Programme of 4 years duration (8 semesters)

**Eligibility for Admission:** A Candidate who has passed Plus Two (Science) or Plus Two arts with food preservation /food science and technology vocational subject of the Punjab School Education Board / C.B.S.E. / I.C.S.E. with 40% marks or any other equivalent examination.

### **Courses & Examination Scheme:**

#### **Semester First**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT111-21	Introduction to Food Science	4	0	0	40	60	100	4
BSFT112-21	Technology of Food Preservation	4	0	0	40	60	100	4
BSFT113-21	Lab - Introduction to Food Science	0	0	4	30	20	50	2
BSFT114-21	Lab - Technology of Food Preservation	0	0	4	30	20	50	2
	GE -1*	4	0	0	40	60	100	4
	GE -1 Lab*	0	0	4	30	20	50	2
BTHU103-18	English	1	0	0	40	60	100	1
BTHU104-18	English (Lab)	0	0	2	30	20	50	1
HVPE101-18	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE102-18	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	--	25*	25*	1
	Mentoring and Professional Development	0	0	1	25*	---	25*	1
	<b>Total</b>	<b>16</b>	<b>0</b>	<b>16</b>	<b>345</b>	<b>405</b>	<b>750</b>	<b>25</b>

\* The student is required to register for Generic Elective Courses of his/her choice from any department other than the parent department. The credit of the subject should be as highlighted in a scheme where as the marks scheme for Generic Elective Courses can be depend on subject selected by the students from other department.

-The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only.

**Semester Second**

**I.K. Gujral Punjab Technical University**  
**B.Sc. (Hons) Food Technology, Batch 2021 onwards**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT121-18	Food and Nutrition	4	0	0	40	60	100	4
BSFT122-18	Post-harvest management of Fruits & Vegetables	4	0	0	40	60	100	4
BSFT123-18	Lab - Food and Nutrition	0	0	4	30	20	50	2
BSFT124-18	Lab-Post-harvest management of Fruits & Vegetables	0	0	4	30	20	50	2
-	*SEEC-1	0	0	2	30	20	50	2
-	**GE -2 Theory	4	0	0	40	60	100	4
-	**GE – 2 Lab	0	0	4	30	20	50	2
EVS102-18	Environmental Science	2	0	0	40	60	100	2
MPD 202-18	***Mentoring and Professional Development	0	0	1	25	--	25	1
<b>Total</b>		<b>14</b>	<b>0</b>	<b>15</b>	<b>305</b>	<b>320</b>	<b>625</b>	<b>23</b>

\* The student is required to register anyone from Skill Enhancement Elective Course.

\*\* The student is required to register for Generic Elective Courses of his/her choice from any department other than the parent department. The credit of the subject should be as highlighted in a scheme whereas the marks scheme for Generic Elective Courses can depend on subject selected by the students from other department.

\*\*\* Mentoring and Professional Development course will have internal evaluation only.

### **Semester Third**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT211-21	Food Microbiology	4	0	0	40	60	100	4
BSFT212-21	Food Chemistry-I	4	0	0	40	60	100	4
BSFT213-21	Technology of Fruits, Vegetables and Plantation Crops	4	0	0	40	60	100	4
BSFT214-21	Lab - Food Microbiology	0	0	4	30	20	50	2
BSFT215-21	Lab - Food Chemistry-I	0	0	4	30	20	50	2
BSFT216-21	Lab- Technology of Fruits, Vegetables and Plantation Crops	0	0	4	30	20	50	2
	GE -3 Theory	4	0	0	40	60	100	4
	GE – 3 Lab	0	0	4	30	20	50	2
BMPD302-18	Mentoring and Professional Development	0	0	1	25*	--	25	1
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>17</b>	<b>335</b>	<b>340</b>	<b>675</b>	<b>27</b>

**Note:** \* Mentoring and Professional Development course will have internal evaluation only.

### **Semester Fourth**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT221-21	Technology of Cereals, Pulses and	4	0	0	40	60	100	4
BSFT222-21	Food Chemistry-II	4	0	0	40	60	100	4
BSFT223-21	Technology of Meat, Fish & Poultry	4	0	0	40	60	100	4
BSFT224-21	Lab - Technology of Cereals, Pulses and Oilseeds	0	0	4	30	20	50	2
BSFT225-21	Lab - Food Chemistry-II	0	0	4	30	20	50	2
BSFT226-21	Lab- Technology of Meat, Fish & Poultry	0	0	4	30	20	50	2
	SEEC-2	0	0	2	30	20	50	2
	GE -4 Theory	4	0	0	40	60	100	4
	GE – 4 lab	0	0	4	30	20	50	2
BMPD402-18	Mentoring and Professional Development	0	0	1	25*	--	25	1
	<b>Total</b>	<b>18</b>	<b>0</b>	<b>17</b>	<b>335</b>	<b>340</b>	<b>675</b>	<b>27</b>

**Note:** \* Mentoring and Professional Development course will have internal evaluation only.

**Important Notes: -**

1. The department will offer the Generic Elective Courses for the students of other department.
2. Theory courses will be of 04 hours and practical will be of 04 hours duration per week. For all lecture courses, one credit per lecture/week/semester will generally be adopted. One laboratory hour per week per semester will be assigned half credit.
3. No elective course will be run unless the number of students registered for the elective course is five or more.
4. The student is required to register for Generic Elective Courses of his/her choice from any department other than the parent department.



# SEMESTER

# FIRST

## BSFT111-21: INTRODUCTION TO FOOD SCIENCE

Total Marks: 100

L	T	P
4	0	0

### Course Objectives:

- To study the structure, composition, nutritional quality and post -harvest changes of various plant foods.
- To impart basic knowledge regarding processing aspects of different foods
- To study the structure and composition of various animal foods.

### UNIT I

**Introduction:** - Introduction to food science, food technology and food engineering. Status of food industry in India and abroad.

Nutrients and functions of food viz. Carbohydrates, Protein, Lipids, Vitamins, Minerals. Changes in nutrients during processing and storage of food.

**Water:** Physical properties of water and Ice, chemical, nature, structure of the water molecule. Absorption phenomena, types of water solutions and collidative properties; Free and bound water; Water activity and Food spoilage; Freezing and Ice structure.

### UNIT II

**Food Dispersions-** Introduction, structure and stability of different types of food dispersions

#### **Composition and nutritive value of plant foods**

**Cereals and millets:** General outline, Composition & Nutritive value, Structure of wheat and Rice, Changes during cooking and germination of cereals and millets grains.

**Pulses:** Composition, Nutritive value, Antinutritional factors Changes during cooking, Factors affecting and changes during processing of pulses-soaking, germination, decortications, cooking and fermentation.

### UNIT III

#### **Composition and nutritive value of plant foods**

**Nuts & Oilseeds:** Composition, sources of proteins and oil, classification of lipids, types of fatty acids, Processing of oil seeds - Soya bean, coconut; Protein isolates; Texturized vegetable protein. Rancidity- Types- hydrolytic and oxidative rancidity and its prevention.

**Fruits & Vegetables:** Composition, Classification, Nutritive value, Vegetable Cookery, Changes during maturing, Ripening, storage and cooking of fruits and vegetables. Climacteric, Non climacteric fruits, Concept of enzymatic browning.

**Spices & herbs:** Definition, Classification, Chemical composition, use of spices & herbs. Overview of essential oils and oleoresins.

## UNIT IV

### **Composition and Nutritive Value of Flesh Foods**

**Eggs:** Structure, Composition, Nutritive value of egg, Grading Changes during cooking & storage.

**Fish:** Composition, Nutritive value of fish, effect of different processing.

**Meat:** Structure, composition, types and nutritive value of meat, effect of different processing

### **Composition and Nutritive Value of dairy products**

**Milk:** Definition, composition, nutritive value of milk and milk products; An overview of types of market milk and milk products; changes during processing like pasteurization and homogenization and storage of milk and milk products

### **Health Foods**

**Health foods: Concept of** Nutraceuticals, Functional foods, Prebiotics, Probiotics, organic foods, GM foods

#### ***Recommended Readings:***

1. Deman JM, Principles of Food Chemistry, Van Nostrand Reinhold, NY
2. Meyer LH, Food Chemistry, CBS Publication, New Delhi
3. Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi
4. Potter NH, Food Science, CBS Publication, New Delhi
5. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press
6. De Sukumar, Outlines of Dairy Technology, Oxford Publishers
7. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi
8. Bawa A.S., O.P Chauhan et al. Food Science. New India Publishing agency
9. Roday S., Food Science, Oxford Publication
10. Srilakshmi B., Food Science, New Age Publishers

### **Course Outcomes:**

CO1: To understand physico-chemical properties of macro and micro nutrients in food.

CO2: To understand classification and composition of food sources of plant and animal origin.

CO3: To access the nutritional values of different food sources.

CO4: To evaluate and understand the influence of processing on various food components.

CO5: To study the utilization of different food sources.

### **Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	1	1	1	1	1
PO2	1	1	1	1	1
PO3	3	3	3	1	3
PO4	3	3	3	3	3
PO5	2	3	1	3	1

## BSFT112-21: TECHNOLOGY OF FOOD PRESERVATION

Total Marks: 100

L	T	P
4	0	0

### Course Objective:

- To impart knowledge on the causes of food spoilage and principles of different techniques used in processing and preservation of foods.
- To identify and select preservation methods appropriate for specific foods and to learn the effects of preservation methods on the quality of food

### UNIT I

Scope and importance of food preservation, Historical developments in food processing. Types of foods and causes of food spoilage. Definition of shelf life, perishable foods, semi perishable foods, shelf stable foods. Principles of Food Preservation

**Food Microbiology:** microorganisms associated with foods- bacteria, yeast and mold, Importance of bacteria, yeast and molds in foods. Classification of microorganisms based on temperature, pH, water activity, nutrient and oxygen requirements, typical growth curve of micro-organisms. Food infection, food intoxication.

### UNIT II

#### Food Preservation by Low temperature

**Freezing and Refrigeration:** Introduction to refrigeration, cool storage and freezing, definition, principle of freezing, freezing curve, changes occurring during freezing, types of freezing i.e. slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food.

#### Food Preservation by high temperature

Thermal Processing- Introduction, classification of Thermal Processes, Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time, Lethality concept, characterization of heat penetration data, Thermal process Calculations; Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.

### UNIT III

#### Food Preservation by Moisture control

**Drying and Dehydration** - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve,; Effect of food properties on dehydration, change in food during drying ,drying methods and equipments air convection dryer, tray dryer, tunnel dryer ,continuous belt dryer , fluidized bed dryer, spray dryer, drum dryer, vacuum dryer ,freeze drying ,foam mat drying.

**Evaporation** – Definition, factors affecting evaporation, names of evaporators used in food industry.

### UNIT IV

#### Ambient-Temperature Processing

**Separation processes:** Principles and methods of: washing, filtration, sedimentation, sieving and centrifugation

#### Food Preservation by Irradiation

Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of

action, uses of radiation processing in food industry, concept of cold sterilization.

**Food Preservation by Preservatives:** Uses and effects of class I and class II preservatives in foods.

***Recommended Readings:***

1. Sivasankar, B. *Food processing and preservation*: Hall of India Pvt., New Delhi.
2. Fellows, P. J.. *Food processing Technology: Principles and Practice*: Woodhead Publishing.
3. Brennan, J. G. *Food Processing Handbook*: Weinheim: Wiley-VCH.
4. Zeuthen, P. & Bogh- Sprensen, L. *Food Preservation Techniques*: CRC Press, Boca Raton.
5. Desrosier NW and Desrosier JN, *The Technology of Food Preservation*, CBS Publication, New Delhi
6. Paine FA and Paine HY, *Handbook of Food Packaging*, Thomson Press India Pvt Ltd, New Delhi
7. Potter NH, *Food Science*, CBS Publication, New Delhi
8. Ramaswamy H and Marcott M, *Food Processing Principles and Applications* CRC Press
9. Rao PG, *Fundamentals of Food Engineering*, PHI Learning Pvt Ltd, New Delhi
10. Toledo Romeo T, *Fundamentals of Food Process Engineering*, Aspen Publishers.
11. Vonloesecka, H. W. *Drying and Dehydration of Foods*: Allied, Bikaner.
12. B. Srilakshmi, *Food science*, New Age Publishers.
13. Bawa. A.S, O.P Chauhan et al. *Food Science*. New India Publishing agency.
14. Frazier WC and Westhoff DC, *Food Microbiology*, TMH Publication, New Delhi.

**Course Outcomes:**

1. To impart knowledge on the causes of food spoilage.
2. To learn principles of different techniques used in processing and preservation of foods.
3. To identify and select preservation methods appropriate for specific foods.
4. To learn the effects of preservation methods on the quality of food.
5. To learn different permitted food additive used in food industry.

**Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	1	1	1	1	1
PO2	1	3	2	3	3
PO3	1	1	1	1	1
PO4	2	2	1	1	1
PO5	3	1	1	2	1

**BSFT113-21: INTRODUCTION TO FOOD SCIENCE (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Objectives:** To impart basic knowledge regarding the quantitative and qualitative evaluation of different foods

**Course Content**

1. Orientation to working in a food analysis lab.
2. Identification of different non-perishable commodities-cereals, millets and their by-products.
3. Quality evaluation/inspection of different foods. i. Spices and Condiments ii. Pulses iii. Nuts and oilseeds iv. Tea and coffee
4. Study of different types of browning reactions: enzymatic and non enzymatic.
5. To Study the germination of cereals and pulses.
6. Study of fermentation and dextrinization.
7. To study gelatinization behavior of various starches
8. Identification of pigments in fruits and vegetables and influence of pH on them
9. To study the concept of gluten formation of flour.
10. Estimation of reducing sugar by Fehlings procedure
11. Estimation of salt content in brine
12. Preparation of brix solution and checking by hand refractometer
13. Application of colloidal chemistry to food preparation
14. Demonstration of the Soxhlet method for determination of fat content
15. Determination of acidity of water
16. Determination of alkalinity/ hardness of water
17. Demonstration of the Kjeldahl's method for estimation of protein content
18. Quality inspection of animal foods.

**Course Outcomes:**

CO1: To acquaint the students to the work in the food analysis laboratory.

CO2: Introduction to fundamentals of food processing and evaluation.

CO3: Evaluation of composition and functionality of food products.

CO4: Explaining different methods used for food analysis.

CO5: Evaluation of food products by qualitative and quantitative methods.

**Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	1	1	1	1	1
PO2	3	1	1	1	1
PO3	3	1	1	1	1
PO4	1	1	1	1	1
PO5	3	1	1	2	1

**BSFT114-21: TECHNOLOGY OF FOOD PRESERVATION (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Objective:**

- To understand the effect of various preservation techniques on the quality and safety of food products.
- To design and evaluate a processing procedure used to preserve a food product.

**Course Contents**

1. Sampling techniques and preparation of test samples.
2. Concept of shelf life of different foods
3. To study the concept of Asepsis and sterilization
4. Determination of pH of different foods using pH meter.
5. Study quality characteristics of foods preserved by drying/dehydration/ freezing.
6. To perform pasteurization of fluids using different methods.
7. To perform blanching of different plant foods.
8. Pickling and curing of foods,
9. Determination of sodium chloride in brine,
10. Determination of moisture content in fresh and dried food samples,
11. Effect of pH on microbial stability of food,
12. Dehydration of foods
13. Use of chemical preservatives in food
14. Preservation of food by canning (Fruit/Vegetable/meat)
15. Cut-out analysis of canned food
16. Comparison of conventional and microwave processing of food

**Course Outcomes:**

1. To understand the sampling techniques and preparation of test samples.
2. To understand the effect of various preservation techniques on the quality and safety of food products.
3. To design and evaluate a processing procedure used to preserve a food product.
4. To understand the physical and chemical evaluation of thermally processed food.
5. To understand and utilize different food preservation techniques.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>PO1</b>	1	1	1	1	1
<b>PO2</b>	1	1	1	1	1
<b>PO3</b>	1	1	1	1	1
<b>PO4</b>	2	1	1	1	1
<b>PO5</b>	3	2	2	2	1

**BTHU103-18: ENGLISH**

Total Marks: 100

L	T	P
1	0	0

**Course Objectives:**

The objective of this course is to introduce students to the theory, fundamentals and tools of communication.

**UNIT- I**

**Introduction**

- Theory of Communication
- Types and modes of Communication

**UNIT- II**

**Language of Communication**

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

**UNIT- III**

**Reading and Understanding**

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
- Literary/Knowledge Texts

**UNIT- IV**

**Writing Skills**

- Documenting
- Report Writing
- Making notes
- Letter writing

**Recommended Readings:**

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

**Course Outcomes:**

- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.



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- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

**BTHU104-18: ENGLISH (LAB)**

Total Marks: 100

L	T	P
2	0	0

**The objective of this course is to introduce students to the theory, fundamentals and tools of communication.**

**Interactive practice sessions in Language Lab on Oral Communication**

- Listening Comprehension
- Self Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue
- Effective Communication/ Mis- Communication
- Public Speaking

***Recommended Readings:***

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Practical English Usage*. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Course Outcomes:**

- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions and business office environments, important reading skills as well as writing skills such as report writing, note taking etc.

**HVPE101-18: HUMAN VALUES, DE-ADDICTION AND TRAFFIC RULES**

Total Marks: 100

L	T	P
3	0	0

**UNIT- I**

**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

**UNIT- II**

**Understanding Harmony in the Human Being - Harmony in Myself!**

1. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
2. Understanding the needs of Self (‘I’) and ‘Body’ - *Sukh* and *Suvidha*
3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*- Practice Exercises and Case Studies will be taken up in Practice Sessions.

**UNIT- III**

**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

1. Understanding harmony in the Family- the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;  
Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
3. Understanding the meaning of *Vishwas*; Difference between intention and competence
4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
5. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj*), Universal Order (*Sarvabhaum Vyawastha* )- from family to world family!- Practice Exercises and Case Studies will be taken up in Practice Sessions.

**UNIT- IV**

**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature

3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.

### **UNIT- V**

#### **Implications of the above Holistic Understanding of Harmony on Professional Ethics**

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
  - a) Ability to utilize the professional competence for augmenting universal human order,
  - b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
  - c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
  - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  - b) At the level of society: as mutually enriching institutions and organizations

#### ***Recommended Readings:***

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
4. Susan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers*, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.
12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
13. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

#### **Relevant CDs, Movies, Documentaries & Other Literature:**

1. Value Education website, <http://uhv.ac.in>
2. Story of Stuff, <http://www.storyofstuff.com>
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

**HVPE102-18: HUMAN VALUES, DE-ADDICTION AND TRAFFIC RULES (LAB/  
SEMINAR)**

Total Marks: 25

L	T	P
0	0	1

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

**MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
0	0	1

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A (Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B (Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

# SEMESTER SECOND

**I.K. Gujral Punjab Technical University**  
**B.Sc. (Hons) Food Technology, Batch 2021 onwards**  
**BSFT121-18: FOOD AND NUTRITION**

Total Marks: 100

L	T	P
4	0	0

### Course Objective

- To develop scientific awareness about linkage between food, nutrition and health
- To understand importance of balanced diet and source of various nutrient like carbohydrates, protein, vitamin etc.
- To develop ability for planning the meals and methodology of healthy cooking
- To understand legality of labeling and Guidelines of codex and FSSAI

### UNIT I

**INTRODUCTION TO FOOD AND NUTRITION:** Basic terms used in study of food and nutrition, BMI and Nutritional Status, Understanding relationship between food, nutrition and health.

**BALANCED DIET:** Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups, Food Pyramid.

### UNIT II

**NUTRIENTS:** Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption of the following in brief: Energy, Carbohydrates, lipids and proteins

### UNIT III

**NUTRIENTS:** Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption of the following in brief: Fat soluble vitamins-A, D, E and K; Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C; Minerals – calcium, iron, iodine, fluorine, copper and zinc

### UNIT IV

**CONCEPTS OF MEAL PLANNING:** Factors affecting meal planning, understanding specific considerations for planning meal for different groups of people.

**METHODS OF COOKING:** Dry, moist, frying and microwave cooking, Advantages, disadvantages and the effect of various methods of cooking on foods.

**NUTRITIONAL LABELING:** Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines.

#### ***Recommended Readings:***

1. Bamji MS, Krishnaswamy K, Brahman GNV (2009). Textbook of Human Nutrition, 3<sup>rd</sup> Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi, (2005), Dietetics, Revised 5th edition. New Age International Ltd.
4. Wardlaw MG, Paul M Insel Mosby 1996). Perspectives in Nutrition, Third Edition.
5. Codex Guidelines on Nutrition Labelling (CAC/GL 2\_1985) (Rev.1\_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation, 1993.
6. Food Safety and Standards Authority of India portal, Government of India
7. Gopalan, C., (1990). NIN, ICMR. Nutritive Value of Indian Foods.
8. Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd.
9. Introduction to Human Nutrition ed. Gibney et al, Blackwell Publishers, 2005
10. Khanna K, Gupta S, Seth R, Mahna R, Rekhi T (2004). The Art and Science of Cooking: A Practical Manual, Revised Edition. Elite Publishing House Pvt Ltd.



11. NIN, ICMR (1990). Nutritive Value of Indian Foods.
12. Seth V, Singh K (2005). Diet planning through the Life Cycle: Part 1. Normal Nutrition. A Practical Manual, Fourth edition, Elite Publishing House Pvt Ltd.
13. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians.

**Course outcomes**

- To be practice oriented nutritionist
- To manage advisory role as meal planner
- To have scientific cooking methodologies as per nutritionist guidelines
- To understand labeling content for Food products

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4
PO1	1	1	1	1
PO2	1	1	1	1
PO3	2	1	1	1
PO4	2	2	2	1
PO5	1	1	1	1

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**BSFT122-18: POST-HARVEST MANAGEMENT OF FRUITS & VEGETABLES**

Total Marks: 100

L	T	P
4	0	0

**Course Objective**

- Acquire knowledge on various management technologies on pre-harvest of fruits and vegetables.
- Acquire knowledge on various management technologies on post-harvest of fruits and vegetables.
- To study the different ripening stages of fruits and vegetables
- To understand the techniques of processing & preservation of fruits and vegetables.

**UNIT I**

Present status of post harvest technology in India.

Importance and role of post harvest technology.

Post harvest losses of fruits and vegetables and factors affecting the post harvest losses. Post harvest changes in fruits and vegetables Harvesting methods – manual and mechanical.

**UNIT II**

Maturity indices of fruits and vegetables-Importance of maturity indices, determination of harvest maturity Climacteric and Non climacteric fruits, Fruit ripening and changes, Ethylene biosynthesis.

**UNIT III**

Cleaning, Sorting & Grading of fruits and vegetables

Post harvest physical and chemical treatments to enhance the shelf life of fruit and vegetables.

**UNIT IV**

Transportation methods of fruits and vegetables Storage of fruits and vegetables Post harvest diseases of fruits and vegetables, Post harvest loss assessment and loss reduction.

***Recommended Readings:***

1. Preservation of fruits and vegetables by Girdhari Lal, Sidappa G S and Tandon G L, 1960, ICAR, New Delhi.
2. Food facts & principles by Shanuntala Manay N & Shadoksharaswamy N, 1996, New Age World Publisher, CA.
3. Food Science by Potter, N.N., CBS Publisher, New Delhi.

**Course Outcomes:**

- Understanding on the post-harvest losses and role of post-harvest technology.
- Knowledge on fruit and vegetable physiology, composition and various nutritional changes in fruits and vegetables.
- Understanding the maturity indices and quality criteria of fruits and their intervention in processing.
- Gaining knowledge on post-harvest techniques, packaging and storage interventions for shelf-life extension of fresh produce.

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4
PO1	1	1	1	1
PO2	2	2	2	2
PO3	3	2	2	2
PO4	1	1	1	1
PO5	2	2	2	2

**BSFT123-18: FOOD AND NUTRITION (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objectives**

- Practical exposure of students in the area of food, their sources and nutritional value.
- To acquaint the students regarding concept of food assimilation, nutrition through lifecycle, and malnutrition.
- To understand the concept of nutritious snacks, convenience foods and nutrition labelling.
- To acquire knowledge about meal planning for different age group.

**Course Content**

1. Identification of food sources for various nutrients using food composition tables.
2. Record diet of self-using 24 hour dietary recall and its nutritional analysis.
3. Introduction to meal planning, concept of food exchange system.
4. Planning of meals for adults of different activity levels for various income groups.
5. Planning of nutritious snacks for different age and income groups.
6. Preparation of nutritious snacks using various methods of cooking.
7. Nutritional labeling of food products.
8. Estimation of BMI and other nutritional status parameters.

**Course Outcome:**

- Determination of various food nutrients, sources, and associated deficiencies,
- Understanding about concept of nutritious snack, their preparation for different income groups.
- Understanding the concept of nutrition labelling.
- Understanding about food assimilation and malnutrition.

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4
PO1	1	1	1	1
PO2	1	1	1	1
PO3	2	1	1	1
PO4	2	2	2	1
PO5	1	1	1	1

**BSFT124-18: POST-HARVEST MANAGEMENT OF FRUITS & VEGETABLES (LAB)**

Total Marks: 100

L	T	P
4	0	0

**Course objectives**

- Practical exposure of students in the area of post-harvest technology of fruits and vegetables.
- To acquaint the students regarding effects of pre-processing treatments on shelf-life of fruit.
- To understand the techniques of processing & preservation of fruits and vegetables.
- To study the different ripening stages of fruits and vegetables

**Course Content**

1. Analyze the maturity stages of fruits and vegetables.
2. To study the effect of pre-packing of fruits and vegetables.
3. To study the effect of pre-cooling of fruits and vegetables.
4. To study the ripening of fruits and vegetables.
5. To study the shelf life of fruits and vegetables at low- temperature.
6. To study the different types of spoilage in fruits and vegetables.
7. To determine the optimum temperature for storage of different fruits and vegetables.
8. To study the effect of wax coating on shelf life of fruits and vegetables.
9. Visit to a cold store and controlled atmosphere storage.

**Course Outcomes:** On completion of the course the students are expected to:

- Determine and understand the maturity indices of fruits and vegetables.
- To understand the effect of pre-cooling and pre-packaging of fruits and vegetables.
- To acquire knowledge about the types of spoilage and shelf life of fruits and vegetables.
- To understand the effects of optimum temperature, wax coating and control atmosphere storage.

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4
PO1	1	1	1	1
PO2	1	1	1	1
PO3	2	1	1	1
PO4	3	2	2	1
PO5	1	1	1	1

**EVS102-18: ENVIRONMENT STUDIES**

Total Marks: 100

L	T	P
2	0	0

**UNIT- I**

**Introduction to environmental studies**

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

**UNIT- II**

**Ecosystems**

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems:
  - a) Forest ecosystem
  - b) Grassland ecosystem
  - c) Desert ecosystem
  - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**UNIT- III**

**Natural Resources : Renewable and Non-renewable Resources**

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

**UNIT- IV**

**Biodiversity and Conservation**

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

**UNIT- V**

**Environmental Pollution**

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

**UNIT- VI**

**Environmental Policies & Practices**

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture

- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

## UNIT- VII

### Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

## UNIT- VIII : Field work

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site--Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems--pond, river, Delhi Ridge, etc.

### Recommended readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.

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**MPD202-18: MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
0	0	1

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A**  
**(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B**  
**(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.



# SKILL ENHANCEMENT ELECTIVE COURSES

## **BSCSEC-101-21: ENTREPRENEURSHIP DEVELOPMENT**

Total Marks: 50(30 Internal + 20 external)

L	T	P
0	0	2

### **Course Objectives**

- Evaluation and development and of entrepreneurial skills
- Business opportunity Identification and learning of assessment techniques
- Preparation of food business plan
- SWOT Analysis for food business

### **UNIT I**

**ENTREPRENEURIAL DEVELOPMENT:** Case studies of successful entrepreneurs; Exercises on ways of sensing opportunities – sources of idea, creating efforts, SWOT Analysis; Entrepreneurial skill assessment test; Techniques of development of entrepreneurial skills, positive self image and locus of control

### **UNIT II**

**FOOD BUSINESS MANAGEMENT:** Case studies of Food Processing Business and its aspects; Business opportunity Identification and Assessment techniques; Business Idea Generation and evaluation exercise; Market Assessment study Analysis of competitive situation; SWOT Analysis for business and for competitors; Preparation of business plan; Preparation of project report; Methods of Arrangement of inputs – finance and material.

### **Recommended Readings**

1. Vasant Desai (2012) Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai
2. Vasant Desai (2011) The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai
3. D. David and S Erickson (1987) Principles of Agri Business Management, Mc Graw Hill Book Co., New Delhi.
4. Acharya S S and Agarwal N L (1987) Agricultural Marketing in India, Oxford & ISH Publishing Co., New Delhi.
5. David H. Holt (2002) Entrepreneurship – Anew Venture Creation, Prentice Hall of India, New Delhi.
6. Phill Kottler (1994) Marketing Management, Prentice Hall of India Private Limited, New Delhi.
7. Chandra, Prasanna (1996) Projects, Planning, Analysis, Selection, Implementation and Review, Tata McGraw-Hill Publishing Company Limited, New Delhi.

### **Course Outcomes:**

- To help the students to become the food entrepreneur.
- To develop the ability to entrepreneurial skills.
- To develop the skills related to Business feasibility analysis such as technical Feasibility, economic Feasibility, organizational feasibility and legal Feasibility.
- To able to develop Food Processing Business plan.

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**Mapping of Course Outcomes with Program Outcomes:**

CO	CO1	CO2	CO3	CO4
PO				
PO1	1	2	1	1
PO2	3	3	3	3
PO3	3	3	1	2
PO4	3	3	2	2
PO5	3	2	2	2

# SEMESTER THIRD

## BSFT211-21: FOOD MICROBIOLOGY

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To understand the role and significance of microbes of different categories, microbial inactivation and environmental factors that affect them in foods.

### UNIT I

**Introduction to Food Microbiology:** History and Development of Food Microbiology; Definition and Scope of food microbiology, Inter-relationship of microbiology with other sciences

**Characteristics of Microorganisms in Food:** Types of microorganisms associated with food, their morphology and structure; Significance of spores in food microbiology

### UNIT II

**Microbial Growth in Food:** Bacterial growth curve and microbial growth in food; Factors affecting the growth of micro-organisms in food: Intrinsic and extrinsic factors; Biochemical changes caused by micro-organisms

**Microbial Food Spoilage:** Sources of Microorganisms in foods, Some important food spoilage microorganisms; Spoilage of specific food groups- Milk and dairy products, Meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products.

### UNIT III

**Food Fermentations:** Fermentation—definition and types; Microorganisms used in food fermentations; Dairy Fermentations-starter cultures and their types, concept of probiotics, Fermented Foods-types, methods of manufacture for vinegar, sauerkraut, tempeh, miso, soya sauce, beer, wine and traditional Indian foods

**Foodborne Diseases:** Types – foodborne infections, foodborne intoxications and toxic infections; common and Recent Examples

**Cultivation of Micro-organisms:** Pure culture technique; Methods of isolation and cultivation; Enumeration of Microorganisms- qualitative and quantitative

### UNIT IV

**Control of Microorganisms in Foods:** Principles and methods of preservation; Physical Methods of Food Preservation- Dehydration, Freezing, Cool Storage, Heat Treatment (esp. thermobacteriology), Irradiation, Biopreservatives esp. Bacteriocins, Introduction to Hurdle concept and Non Thermal methods

**Trends in Food Microbiology:** Rapid Methods of Detection, Recent Advances

#### **Recommended readings:**

1. Frazier, W. C. and Weshoff, D. C. (2015). *Food Microbiology*: Tata McGraw Hill Publication, New Delhi.

2. Adam, M. R. & Moss, M. O. (2008). *Food Microbiology*: Royal Society of Chemistry, Cambridge.
3. James, M. J. (2005). *Modern Food Microbiology* (5<sup>th</sup> ed.): CBS Publishers, New Delhi.
4. Stanier, R.Y. (1996). *General Microbiology* (5<sup>th</sup> ed.): MacMillan, Hampshire.
5. Creager, J. G., Black, J. G. & Davison, V. E. (1990). *Microbiology: Principles & Applications*. Prentice Hall, New Jersey.
6. Garbutt, John. *Essentials of Food Microbiology*, Arnold, London, 1997
7. Pelczar MJ, Chan E.C.S and Krieg, Noel R. *Microbiology*, 5th Ed., TMH, New Delhi, 1993

**Course Outcomes:**

1. Understand the principles involving food spoilage and preservation involving microorganisms and explain why microbiological quality control programmes are necessary in food production.
2. Ability to identify the characteristics of important pathogens and spoilage microorganisms in foods.
3. Understand the role and significance of intrinsic and extrinsic factors on growth of microorganisms in foods and differentiate which organisms would be likely to grow in a specific food product.
4. Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated killed or made harmless in foods and identify ways to control microorganisms in foods.
5. Describe the beneficial role of microorganisms in fermented foods and in food processing.

**Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	2	2	2	2	1
PO2	1	1	1	1	1
PO3	1	2	2	2	1
PO4	1	1	2	1	2
PO5	1	2	1	2	2

## BSFT212-21: FOOD CHEMISTRY – I

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To acquaint the students about chemistry, properties and effects of processing on food components.

### UNIT I

**Introduction to Food Chemistry:** Definition, Composition of food

**Water:** Definition of water in food, Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging, Water activity and shelf-life

### UNIT II

**Lipids:** Classification of lipids, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-reichert meissel value, polenske value, iodine value, peroxide value, saponification value. Effect of frying on fats; Changes in fats and oils- rancidity, lipolysis, flavor reversion; Auto-oxidation and its prevention; Technology of edible fats and oils- Refining, Hydrogenation and Interesterification, Fat Mimetics

**Proteins:** Protein classification and structure; Nature of food proteins (plant and animal proteins); Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation); Functional properties of proteins eg. organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming. Effect of different processing on proteins.

### UNIT III

**Carbohydrates:** Classification (mono, oligo and poly saccharides); Structure of important polysaccharides( starch, glycogen, cellulose, pectin, hemicellulose, gums); Chemical reactions of carbohydrates –oxidation, reduction, with acid & alkali; Modified celluloses and starches. Effect of different processing on carbohydrates.

### UNIT IV

**Vitamins:** Structure, Importance and Stability; Water soluble vitamins; Fat soluble vitamins, Effect of different processing on vitamins.

#### ***Recommended readings:***

1. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York, 1996
2. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002
3. Wong, Dominic WS, Food Enzymes, Chapman and Hall, New York, 1995
4. Potter, N.N. and Hotchkiss, J.H, Food Science, 5th Ed., Chapman & Hall, 1995
5. DeMan, J.M., Principles of Food Chemistry, AVI, New York, 1980

#### **Course Outcomes:**

1. Students shall be aware of the underlying chemistry, properties and effects of processing on food components.
2. Understanding of food components reactions and their impact on sensory, nutritional, and functional properties of foods.
3. Ability to identify the structure of food constituents and relate the structure to the constituents function and importance in foods with respect to food quality, nutrition, safety, processing, etc.

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4. Ability to explain influence of factors such as temperature, pH, ionic characteristic and strength, bonding, etc. on chemical changes in food systems and judge how to adjust these conditions to improve or minimize chemical and biochemical deterioration of food systems.
5. Ability to integrate chemistry and biochemistry principles into real-world food science and nutritional problems.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>PO1</b>	1	2	1	3	1
<b>PO2</b>	3	2	1	3	1
<b>PO3</b>	3	3	1	2	1
<b>PO4</b>	3	2	2	3	1
<b>PO5</b>	1	2	2	2	1



**BSFT213-21: TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop knowledge regarding biochemistry and physiology of fruits and vegetables and their role in pre- and post-harvest changes in product quality.

**UNIT 1**

**INTRODUCTION:** Importance of fruits and vegetable, history and need of preservation, reasons of spoilage, method of preservation (short & long term). Classification and composition of fruits and vegetables and their nutritional significance. Physical and chemical indices of fruit maturity, crop maturity and ripening

**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.

**UNIT II**

**FRUITS BEVERAGES:** Introduction, Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), preservation of fruit juices (pasteurization, chemically preserved with sugars, freezing, drying, tetra-packing, carbonation), processing of squashes, cordials, nectars, concentrates and powder.

**JAMS, JELLIES AND MARMALADES:** Introduction, Jam: Constituents, selection of fruits, processing & technology, Jelly: Essential constituents( Role of pectin, ratio), Theory of jelly formation, Processing & technology, defects in jelly, Marmalade : Types, processing & technology, defect

**UNIT III**

**PICKLES, CHUTNEYS AND SAUCES:** Processing , Types, Causes of spoilage in pickling.

**TOMATO PRODUCTS:** Selection of tomatoes, pulping& processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.

**DEHYDRATION OF FOODS AND VEGETABLES:** Sun drying & mechanical dehydration, process variation for fruits and vegetables, packing and storage.

**UNIT IV**

**SPICES:** Processing and properties of major and minor spices, essential oils & oleoresins, adulteration.

**TEA, COFFEE AND COCOA:** Processing, Variety and Products.

**Recommended Readings:**

1. Jongen, W. (2002). *Fruit and vegetable processing: Improving Quality*: Woodhead Publishing, Boca raton.
2. Thompson, A. K. (1996). *Post-harvest Technology of Fruit and Vegetables*: Blackwell, Australia.
3. Thompson, A. K. (2003). *Fruits and Vegetables- Harvesting, Handling and Storage*: Blackwell, Oxford.
4. Verma, L. R. & Joshi, V. K. (2000). *Post-harvest Technology of Fruits and Vegetables*: Indus, New Delhi.
5. Srivastava, R. P. & Kumar, S. (2001). *Fruit and Vegetable Preservation– Principles and Practices (3 ed.)*: International Book distributing Co., Lucknow (India).
6. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi
7. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India
8. Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers
9. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Second edition.
10. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

**Course Outcomes:**

1. The students shall be able to understand Biological, Chemical & Physical Properties of Fruits & Vegetables.
2. The students shall be able to understand Technologies involved in Processing, Preservation & Value- Addition of Fruits & Vegetables.
3. Students shall be able to understand Industrial Processes for Commercial Production of Jams, Jellies, Marmalade, Fruit Juices, Concentrates, Fruit Juice Powder, Dehydrated Fruits, and Canning of Fruits & Vegetables.
4. Students shall be able to understand Basics of New Food Products Development & Ideas Generation for Product Development.
5. Students shall be able to understand Basics of By Product Utilization & Waste Utilization related to Fruits & Vegetables.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>PO1</b>	1	1	1	1	1
<b>PO2</b>	1	1	1	1	1
<b>PO3</b>	2	1	2	3	1
<b>PO4</b>	3	2	3	1	2
<b>PO5</b>	3	1	1	1	1

**BSFT214-21: FOOD MICROBIOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To understand the microbial techniques and to develop skills related to microbial quality evaluation of foods using various techniques.

**Course Content**

1. Introduction to the Basic Microbiology Laboratory Practices and Equipment's
2. Functioning and use of compound microscope
3. Cleaning and sterilization of glassware
4. Preparation and sterilization of nutrient broth
5. Cultivation and sub-culturing of microbes
6. Preparation of slant, stab and plates using nutrient agar
7. Morphological study of bacteria and fungi using permanent slides
8. Simple staining
9. Gram's staining
10. Standard Plate Count Method
11. Microbiology of raw and processed foods:
  - a. Microbiological analysis of food products-
    - i. Bacterial count,
    - ii. Yeast and mold count,
    - iii. Coliform count,
    - iv. Standard plate count of milk and direct microscopic count of milk,
    - v. Reductase Test (MBRT).
  - b. Microbiological testing of water-
    - i. Quantitative test,
    - ii. Bacteriological quality testing (MPN).

**Course Outcomes:**

1. Acquire the practical skills for the sampling of foods to carry out microbial analysis.
2. Ability to carry out various sterilization techniques and to identify the most suitable technique for specific food.
3. Ability to isolate and identify common food borne microbial pathogens.
4. Understand microbiological analysis methods for food products and ability to analyze different foods for presence of hazardous microorganisms using food microbiology technology.
5. Ability to interpret microbiological analysis of food products.

**Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	1	2	2	1	1
PO2	1	2	1	1	1
PO3	3	1	2	1	2
PO4	3	2	1	1	1
PO5	3	1	1	1	1

**BSFT215-21: FOOD CHEMISTRY – I (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:**

To enable students to learn basic principles and procedure of starch, sugar and fat analysis.

**Course Content**

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR.
4. Determination of refractive index and specific gravity of fats and oils.
5. Determination of smoke point and percent fat absorption for different fat and oils.
6. Determination of percent free fatty acids
7. Estimation of saponification value
8. Estimation of reducing and non-reducing sugars using potassium ferricyanide method.
9. Estimation of starch content.
10. Estimation of salt content in brine
11. Estimation of salt content in butter
12. Estimation of protein in any food product
13. Estimate the ascorbic acid in any juice
14. Estimation of iodine value
15. Estimation of peroxide value

- Course Outcomes:**
1. Acquire the practical skills for the chemistry, properties and effects of additives on GTR.
  2. Ability to carry out refractive index, specific gravity, smoke point, fat absorption for different fats and oils.
  3. Ability to isolate and identify free fatty acids, saponification value, reducing and non-reducing sugars.
  4. ability to estimate the salt content in different food

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4
PO1	2	2	2	2
PO2	1	1	1	1
PO3	2	3	3	3
PO4	3	3	3	3
PO5	2	2	2	2

## BSFT216-21: TECHNOLOGY OF FRUITS, VEGETABLES AND PLANTATION CROPS

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To enable students to learn the evaluation of the quality of fruit and vegetables.

### Course Content

1. Estimation of total soluble solids (TSS).
2. Estimation of pH and acidity of product.
3. Estimation of brix: acidity ratio.
4. Estimation of ascorbic acid and effect of heat treatment on it
5. To study the steps of can making process.
6. Preparation and evaluation of pectin products.
7. Adulteration of spices.
8. Dehydration of fruits and vegetables.
9. Rehydration of fruits and vegetables.
10. Preparation and evaluation of sauce
11. Preparation and evaluation of Ketchup
12. Preparation of fruit juice products, Squash
13. Preparation and evaluation of pickle
14. Preparation and evaluation of Jam

### **Course Outcomes:**

1. Ability to assess the quality of fruit and vegetables.
2. Ability to establish the quality specifications for the processing of fruit and vegetables.
3. Ability to develop various fruit and vegetable products with quality assurance and safety.
4. Understand principles and methods of preservation of fruits and vegetables.
5. To develop proficiency skill in preserving fruits and vegetables into various products.

### **Mapping of Course Outcomes with Program Outcomes:**

CO PO	CO1	CO2	CO3	CO4	CO5
PO1	1	1	1	1	1
PO2	1	1	1	2	2
PO3	1	1	1	1	1
PO4	1	1	1	1	1
PO5	2	1	1	1	1

**BMPD302-18 MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A (Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B (Outdoor Activities)**

5. Sports/NSS/NCC
6. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

# SEMESTER FOURTH

## BSFT221-21: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS

Total Marks: 100

L	T	P
4	0	0

**Course Objective:** To create knowledge about the processing and quality evaluation of cereal grains.

### UNIT I

**TECHNOLOGY OF CEREALS:** Present status and future prospects of major cereals and millets in India and world, Morphology, composition, nutritive value and properties of various food grains including cereals, pseudocereals, millets and other coarse grains.

**Wheat-** varieties and quality characteristics, milling process- conditioning and tempering, equipments in wheat milling- disc mill, hammer mill, roller mill, functionality in bakery products, Extruded wheat products, pasta products

**Paddy-** threshing, drying and storage, parboiling processes- drying, milling operations, precleaners, shellers and hullers, separators, polishers, rice mill yields and losses at different stages of milling, processed rice products.

### UNIT II

**Corn** – Milling (wet & dry) , cornflakes, corn flour

**Barley-** Milling (pearl barley, barley flakes & flour)

**Oats** – Milling ( oatmeal, oatflour & oatflakes )

**Sorghum and millets** – Traditional & commercial milling ( dry &wet ) Rye and triticale—milling (flour),uses

### UNIT III

#### TECHNOLOGY OF OILSEEDS:

Introduction, Extraction of oil and refining, Sources of protein (defatted flour, protein concentrates and isolates), properties and uses, protein texturization, fibre spinning

### UNIT IV

#### TECHNOLOGY OF PULSES

Pulses in India and world, Morphology, composition, nutritive value, Milling of pulses, Dry milling, Wet milling, Improved milling method

#### **Recommended Readings:**

1. Kent, N.L. 2003. Technology of Cereal, 5th Ed. Pergamon Press.
2. Chakraverty. 1988. Post Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd.
3. Marshall, Rice Science and Technology. 1994. Wadsworth Ed., Marcel Dekker, New York.
4. Manay, S. and Sharaswamy, M. 1987. Food Facts and Principles. Wiley Eastern Limited.



**Course Outcomes:**

1. Student will acquire the understanding of the technology for Wheat Milling & Wheat based Food Products.
2. Student will acquire the understanding of the technology for Rice Milling & Rice based other Food Products.
3. Student will acquire the understanding of working of equipments related to Wheat & Rice Milling along with equipments related to Wheat based & Rice based Food Products.
4. Student will be able to understand technology for Milling of Corn & Corn based other Food Products along with equipments.
5. Student will be able to understand technology for Oil Extraction & Oil Seed Processing along with equipments.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>PO1</b>	1	1	1	1	1
<b>PO2</b>	1	1	2	1	1
<b>PO3</b>	1	1	1	1	1
<b>PO4</b>	2	2	2	2	2
<b>PO5</b>	1	2	2	2	2

## BSFT222-21: FOOD CHEMISTRY – II

Total Marks: 100

L	T	P
4	0	0

**Course Objective:** To acquaint the students about chemical processes within food products particularly minerals, pigments, enzymes and flavors.

### UNIT 1

**Minerals:** Major and minor minerals; Metal uptake in canned foods; Toxic metals

**Natural Food Pigments:** Introduction and classification; Food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

### UNIT II

**Enzymes:** Introduction, classification, General characteristics, Enzymes in food processing, Industrial Uses of Enzymes, Immobilized enzymes

**Browning Reactions in Food:** Enzymatic browning, Non – Enzymatic browning, Maillard reaction, Caramelization reaction, Ascorbic acid oxidation

### UNIT III

**Flavour:** Definition and basic tastes; Chemical structure and taste; Description of food flavours; Flavour enhancers

### UNIT IV

**Physico-chemical and nutritional changes occurring during food processing treatments:** Drying and dehydration, Irradiation, Freezing, Canning

#### *Recommended Readings:*

1. deMan, John M., Principles of Food Chemistry ,3rd Ed., Springer 1999
2. Desrosier, Norman W. and Desrosier.,James N.,The technology of food preservation , 4th Ed.,Westport, Conn. : AVI Pub. Co., 1977.
3. Fennema, Owen R, Food Chemistry, 3rd Ed., Marcell Dekker, New York,1996
4. Fuller, Gordon W, New Product Development From Concept to Marketplace, CRC Press,2004.
5. Whitehurst and Law, Enzymes in Food Technology, CRC Press, Canada, 2002

#### **Course outcome:**

1. Students should be capable for optimizing food processing through understanding and chemical processes involved in enzymes, minerals and pigments.
2. Students have understanding and application of maillard reaction, caramelization and flavor enhancing mechanism.
3. Students will be introduced to food processing treatments like drying, irradiation, freezing and canning in terms of chemistry involved in the techniques.
4. Students will develop integrating chemical processes with technology to achieve skills in food industry.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>
<b>PO1</b>	1	1	1	2
<b>PO2</b>	2	1	1	1
<b>PO3</b>	1	2	1	2
<b>PO4</b>	1	1	1	1
<b>PO5</b>	2	1	1	1

## BSFT223-21: TECHNOLOGY OF MEAT, FISH AND POULTRY

Total Marks: 100

L	T	P
4	0	0

**Objective:** This course shall educate students about the significance and necessity of organized animal products sector, humane slaughtering of animals and poultry and value addition of meat, poultry, egg and fish.

### UNIT I

**Introduction:** Livestock and poultry population in India, Development of meat and poultry industry in India and its need in nation's economy, Glossary of live market terms for animals and birds. Structure, composition and nutritive value of meat. Conversion of muscle into meat. Factors affecting meat quality. Post-mortem changes in meat, thaw rigor, cold shortening, pre-rigor processing.

**Meat quality:** Effects of feed, breed and environment on production of meat animals and their quality Meat Quality-color, flavor, texture, Water-Holding Capacity(WHC), Emulsification capacity of meat

### UNIT II

**Slaughter process:** Slaughter, inspection and grading, Antemortem examination of meat animals, slaughter of buffalo, sheep/ goat, poultry, pig A Generic HACCP model, dressing of carcasses, post-mortem examination of meat

**Preservation of meat:** Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, and RTE meat products, meat curing. Sausages-processing, types and defects

### UNIT III

**Introduction:** Status of fishery industry in India.

**Chilling and Freezing of fish:** Relationship between chilling and storage life, MAP, general aspects of freezing, freezing systems (air blast freezing, plate or contact freezing spray or immersion freezing, freezing on board, onshore processing, changes in quality in chilled and frozen storage, thawing.

**Fish Curing and Smoking:** Drying and salting of fish, water activity and shelf-life, salting process, salting methods (brining, pickling, kench curing, gaspe curing), types of salts, dried and salted fish products- pindang, fishwood, dried shrimp. Preservation by smoking, smoke production, smoke components, quality, safety and nutritive value of smoked fish, processing and equipment, pre-smoking processes, smoking process control. Traditional chimney kiln, modern mechanical fish smoking kiln, examples of smoked and dried products.

**Canning of fish:** Principles of canning, classification based on pH groupings, effect of heat processing on fish, storage of canned fish, pre-process operations, post process operations, cannery operations for specific canned products.

**Fermented fish:** Flowchart of Indigenous products- Fish sauce and Paste

**Concept of other Sea foods:** Crabs, lobsters, prawns, shrimps, shell- fish.

### UNIT IV

**Egg Industry and Egg Production Practices** The egg industry, its techniques of working, General management, structure, composition and nutritive value of egg and its products.

**Preservation of eggs:** Refrigeration and freezing, thermal processing, dehydration, coating.

**Quality identification of shell eggs:** Factors affecting egg quality and measures of egg quality.

**By-products of meat, fish and egg industry:** Utilization of meat, fish and egg industry by-products: importance, food and non-food applications Manufacture of Natural casings, Surimi-Introduction, fish muscle proteins, the surimi process, traditional and modern surimi production lines, quality of surimi products, comparison of surimi and fish mince products. Fish protein concentrates (FPC), fish protein extracts (FPE), fish protein hydrolysis (FPH)

***Recommended Readings:***

1. Lawrie R A, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England, 1998
2. Parkhurst & Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997
3. Pearson & Gillet Processed Meats, 3 Ed, CBS Publication, New Delhi, 1997
4. Shai Barbut, Poultry Products Processing, CRC Press 2005
5. Stadelman WJ, Owen J Cotterill Egg Science and Technology, 4th Ed. CBS Publication New Delhi, 2002
6. Hall GM, Fish Processing Technology, VCH Publishers Inc., NY, 1992
7. Sen DP, Advances in Fish Processing Technology, Allied Publishers Pvt. Limited 2005
8. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London, 1994

**Course Outcome:**

1. Student shall know about the significance & necessity of organized animal product sector.
2. Students shall acquire the ability of value- addition to Meat, Poultry, Egg & Fish.
3. Student shall be well versed with processing, preservation & quality control of Meat, Egg & Fish in Food Industry.
4. Student shall be well versed with manufacturing practices of egg based, fish based and meat based by products & their processing techniques.
5. Student will be having broad knowledge of status & scope of Meat, Egg, & Poultry industry world wide.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>	<b>CO5</b>
<b>PO1</b>	2	2	1	1	1
<b>PO2</b>	1	1	1	1	2
<b>PO3</b>	2	1	1	1	1
<b>PO4</b>	2	2	1	1	2
<b>PO5</b>	2	1	1	1	1

**BSFT224-21: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Objective:** To familiarize the students with quality tests of wheat flour and yeast with reference to bread processing and to equip them with the necessary skills for bread, biscuits and cookies processing.

**Course Content**

1. Estimation of different physicochemical characteristics of cereals grains.
2. Milling of different cereals grains.
3. Milling quality evaluation of wheat grains.
4. Functional quality test of wheat flour-
  - a. Wet & dry gluten content
- b. SDS sedimentation maltose value
- c. Falling number values of wheat flour
- d. Dough raising capacity of yeast.
  4. Estimation of Pelenske Value of flour.
  5. Estimation of Potassium Bromate in flour.
  6. Fermenting power of yeast.
  7. Cooking characteristics of rice.
  8. Test baking of bread, biscuits and cake.
  9. Effect of parboiling treatment on the milling quality of rice.
  10. Effect of degree of polishing on the milling quality of rice.

**Course Outcomes:**

1. Student shall be well versed with Processing Techniques of Cereals.
2. Student shall be well versed with quality parameters of cereals.
3. Student will be able to understand practical implication of Milling of Wheat & Rice.
4. Student will be able to get acquaintance with machinery being utilized in Milling of Wheat & Rice.
5. Student will be able to understand Lab SOPs for above.

**Mapping of Course Outcomes with Program Outcomes:**

CO \ PO	CO1	CO2	CO3	CO4	CO5
PO1	1	1	2	2	1
PO2	2	1	2	2	1
PO3	1	1	2	2	1
PO4	1	1	1	1	1
PO5	2	1	2	3	1

**BSFT225-21: FOOD CHEMISTRY – II (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:**

Students shall understand the quality analysis methods and new product development concept.

**Course Content**

1. Estimation of total ash
2. Estimation of minerals -demo
3. Determination of thermal inactivation time of enzymes in fruits and vegetables.
4. Estimation of crude fiber
5. To determine effect of temperature on taste
6. Extraction and analysis of pigments (Chlorophyll, Lycopene, Carotenoids)
7. Extend of non-enzymatic browning by extraction methods.
8. Extraction of polyphenols from foods by different methods
9. Estimation of total phenolic content
10. Estimation of total flavonoid content
11. Estimation of total antioxidant activity
12. Estimation of ferric reducing power

**Course Outcomes:** 1. Ability to isolate and identify the different pigments present in different food products.  
2. Ability to isolate and identify polyphenols.  
3. ability to estimate the mineral content in different food  
4. Ability to determine the effect of temperature on tase.

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>
<b>PO1</b>	2	2	2	2
<b>PO2</b>	1	1	1	1
<b>PO3</b>	2	3	3	3
<b>PO4</b>	3	3	3	3
<b>PO5</b>	2	2	2	2

**BSFT226-21: TECHNOLOGY OF MEAT, FISH AND POULTRY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objectives:**

1. To understand the importance of livestock, egg and poultry industry.
2. To describe structure, composition and nutritional quality of animal products.
3. To illustrate the processing technology and value addition of meat, fish and poultry products.

**Course Content**

1. Quality evaluation of fish/prawn.
2. Subjective evaluation of Fresh Fish.
3. Cut out examination of canned fish (Sardine, Mackerel, Tuna).
4. Fish product formulation/canning.
5. Estimation of moisture content of meat.
6. Cutout analysis of canned meats/retort pouches.
7. Estimation of protein content of meat.
8. Analysis of frozen meat/meat emulsion products.
9. To study shelf-life of eggs by different methods of preservation.
10. Evaluation of eggs for quality parameters (market eggs, branded eggs).
11. To perform freezing of yolk/albumen.
12. Meat/Egg product formulation.

**Course Outcomes:**

1. Understand the technology for quality evaluation and formulation of fresh, canned fish.
2. Student shall be well versed with quality parameters of eggs, meat and meat products.
3. Student will be able to understand practical implication of above products.
4. Prepare various value-added products

**Mapping of Course Outcomes with Program Outcomes:**

<b>CO PO</b>	<b>CO1</b>	<b>CO2</b>	<b>CO3</b>	<b>CO4</b>
<b>PO1</b>	1	1	1	1
<b>PO2</b>	2	1	2	2
<b>PO3</b>	1	1	2	1
<b>PO4</b>	2	1	2	2
<b>PO5</b>	1	1	1	2



**BMPD402-18 MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A (Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B (Outdoor Activities)**

7. Sports/NSS/NCC
8. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department

# DISCIPLINE SPECIFIC ELECTIVES

**BSCDSE-101-21 FOOD SAFETY**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To understand the concept of food safety, types of hazards, causes and their management.

**UNIT I**

**Introduction to Food Safety:** Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Foods

**Food Hazards of Physical and Chemical Origin:** Introduction, Physical Hazards with common examples, Chemical Hazards (naturally occurring, environmental and intentionally added), Packaging material as a threat, Impact on health, Control measures

**Food Hazards of Biological Origin:** Introduction, Indicator Organisms, Food borne pathogens: bacteria, viruses and eukaryotes, Seafood and Shell fish poisoning, Mycotoxins

**UNIT II**

**Management of hazards:** Need, Control of parameters, Temperature control, Food storage

**Hygiene and Sanitation in Food Service Establishments:** Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene

**UNIT III**

**Food Safety Management Tools:** Basic concept, Prerequisites- GHPs ,GMPs, HACCP, introduction about ISO 9000, 22000, 14000 series

TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis, Accreditation and Auditing

**UNIT IV**

**Microbiological criteria:** Microbiological standards and limits ( for processed food, water), Sampling, Basic steps in detection of food borne pathogens, Water Analysis

**Food laws and Standards:** Indian Food Regulatory Regime, Global Scenario, Other laws and standards related to food

**Recent concerns:** New and Emerging Pathogens, Genetically modified foods \ Transgenics, organic foods, Newer approaches to food safety.

**I.K. Gujral Punjab Technical University**  
**B.Sc. (Hons) Food Technology, Batch 2021 onwards**

***Recommended readings:***

1. Singh, S. P. (2009). Food Safety, Quality Assurance and Global Trade: Concerns and Strategies: International Book Distributing Co. Lucknow.
2. Metha, R. & George, J. (2005). Food Safety regulation concerns and trade: A Developing Country Perspective.
3. Pomeranz, Y. & Meloan, R. (1995). Food Analysis: Theory and Practice: AVI Publication, New York.
4. Askar, A. & Treptow, H. (1993). Quality assurance in Tropical Fruit Processing.
5. Mahindru, S. N. (2000). Food Safety: A Techno-legal Analysis: Tata Mc, India.
6. Lawley, R., Curtis L. and Davis, J. The Food Safety Hazard Guidebook, RSC publishing, 2004
7. De Vries. Food Safety and Toxicity, CRC, New York, 1997
8. Marriott, Norman G. Principles of Food Sanitation, AVI, New York, 1985
9. Forsythe, S J. Microbiology of Safe Food, Blackwell Science, Oxford, 2000
10. Forsythe, S.J. The Microbiology of Safe Food, second edition, Wiley- Blackwell, U.K., 2010
11. Mortimore S. and Wallace C. HACCP, A practical approach, Chapman and Hill, London, 1995
12. Blackburn CDW and Mc Clure P.J. Food borne pathogens. Hazards, risk analysis & control. CRC Press, Washington, U.S.A, 2005

**Course outcome**

1. Determination of various type of hazards (biological, chemical, physical).
2. Understanding different factors that contribute to food-borne illness and proper application of food handling techniques that will eliminate possible food-borne illness.
2. Understanding the concept and importance of hygiene, and sanitation
3. Understanding about food safety management tools (GHPs, GMPs, HACCP, ISO series) and laws.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	1
	PO4	1	1	1	2
	PO5	1	2	1	1

**BSCDSE-102-21 FOOD SAFETY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To understand about the examination, analysis of food safety hazards and their management.

**Course Content**

1. Preparation of different types of media (complex, differential and selective)
2. Enumeration of aerial microflora using PDA
3. Identification of Molds by lactophenol blue staining
4. Negative Staining
5. Microbiological Examination of food
6. Bacteriological Analysis of Water by MPN method
7. Assessment of surface sanitation by swab and rinse method
8. Assessment of personal hygiene
9. Implementation of GHP
10. Implementation of HACCP

**Course outcome**

1. Understanding about different media preparation
2. Understanding the microbiological examination of food.
3. Understanding the importance of personal hygiene maintenance.
4. Understanding personal hygiene procedures with regard to food handling

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	1	1	1
	PO3	1	1	1	1
	PO4	1	2	2	1
	PO5	1	1	1	1

## BSCDSE-103-21 FOOD QUALITY MANAGEMENT

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To teach understanding about importance of quality in food sector, deteriorating factors and management strategies.

### UNIT I

**Food Quality Management:** Introduction to food quality management – Definition of quality, quality concepts, quality perception, quality attributes. Concepts of quality management: Objectives, importance and functions of quality control and quality assurance; Quality management systems in India. Quality in the Agri- food production chain-Techno-managerial approach, food quality relationship and food quality management functions. Dynamics on the agri- food production chain, core developments in food quality management.

### UNIT II

**Contamination in Food Chain:** Contamination in Food: Physical, chemical contaminants (heavy metals, pesticide residues, antibiotics, agrochemicals, veterinary drug residues, environmental pollutants, radionuclides, solvent residues, chemicals) and Natural toxins. Contaminants formed during processing & packaging – nitrosamines, acrylamide, alloys, benzene, dioxins and furans, persistent organic pollutants, polymers, etc. Chemicals from processing such as fumigants, autoxidation products, carcinogens in smoked foods,; intentional and unintentional additives.

### UNIT III

**Food Additives:** Risk assessment studies- Safety and quality evaluation of additives and contaminants, Acute and chronic studies, NOEL, ADI, LD<sub>50</sub>. Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives. Antimicrobial agents. -Nitrites, sulphides, sulphur dioxide, sodium chloride, hydrogen peroxide. Antioxidants - Introduction, mechanism of action, natural and synthetic anti- oxidants, technological aspect of antioxidants. Sweeteners- Introduction, importance, classification- natural and artificial, chemistry, technology and toxicology, consideration for choosing sweetening agents. Colors- Introduction, importance, classification- natural, artificial, and natural identical, FD&C Dyes and Lakes. Use of plant tissue culture, polymeric colors etc for color

### UNIT IV

**Basic principles and application of processing techniques:** High fructose corn syrup, cryogenic freezing, supercritical fluid extraction, fat mimetics, flavour encapsulation, use of nano technology in foods etc.

### *Recommended Readings*

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1. Pieterneel A, Luning, Willem J. Marcelis, Food Quality Management Technological and Managerial principles and practices, Wageningen, 2009.
2. Brannen and et al., Food Additives, Marcel Dekker, New York, 1990
3. Jones JM, Food Safety, Eagan Press, 1992
4. Shapton DA and Shapton NF, Principles and Practices for the safe processing of Foods. CRC Press, 1998
5. DeMan, 3<sup>rd</sup> edition, Principles of Food Chemistry, Springer, 2007.
6. Carol E. Steinhart, M. Ellin Doyle, Food Safety, Food Research Institute, Marcel Dekker, Inc., New York : 1995

**Course outcome**

1. Understand various areas of Food Safety & Quality
2. Understand about the quality assessments of food products.
3. Comprehend food quality managements systems.
4. Implementation of food safety & quality assurance.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	1	1	1
	PO3	1	1	2	1
	PO4	1	1	1	1
	PO5	1	1	1	2

**BSCDSE-104-21 FOOD QUALITY MANAGEMENT (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop understanding about analysis and estimation of different quality deteriorations in different foods.

**Course Content**

1. Qualitative tests for hydrogenated fats, butter, and ghee.
2. Quality inspection of various food stuffs- cereals, pulses, spices and condiments etc.
3. Estimation of sulphur dioxide in foods
4. Chromatographic estimation of colour.
5. Analysis of edible common salt for moisture content, MIW and total chlorides.
6. Estimation of ammonia nitrogen in water.
7. Estimation of benzoic acid/ sorbic acid in foods.

**Course outcome**

1. Understand the practical application of food safety and quality assurance in raw and processed foods.
2. Apprehend the quality assessment of food products using various instruments.
3. Perceive the sensory evaluation techniques.
4. Comprehend the detection methods of the adulterants in food products.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	2	1	1
	PO5	1	2	2	1



## BSCDSE-105-21 BAKERY TECHNOLOGY

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To create knowledge about the processing and quality evaluation of bakery products.

### UNIT I

**BAKERY INDUSTRY:** Current status, growth rate, and economic importance of Bakery Industry in India. Product types, nutritional quality and safety of products, pertinent standards & regulations.

**BREAD, BUNS AND PIZZA BASE:** Ingredients & processes for breads, buns, pizza base, Equipments used, product quality characteristics, faults and corrective measures

### UNIT II

**CAKES:** Ingredients & processes for cakes, Equipments used, product quality characteristics, faults and corrective measures. Different types of icings.

### UNIT III

**BISCUITS, COOKIES & CRACKERS:** Ingredients & processes, Equipments used, product quality characteristics, faults and corrective measures.

### UNIT IV

**MODIFIED BAKERY PRODUCTS:** Modification of bakery products for people with special nutritional requirements e.g. high fibre, low sugar, low fat, gluten free bakery products.

**BREAKFAST CEREALS, MACARONI PRODUCTS AND MALT:** Production and quality of breakfast cereals, macaroni products and malt.

#### ***Recommended Readings:***

1. Dubey, S.C. (2007). Basic Baking 5th Ed. Chanakya Mudrak Pvt. Ltd.
2. Raina et.al. (2003). Basic Food Preparation-A complete Manual. 3rd Ed. Orient Longman Pvt. Ltd.
3. Manay, S. & Shadaksharaswami, M. (2004). Foods: Facts and Principles, New Age Publishers.
4. Barndt R. L. (1993). Fat & Calorie – Modified Bakery Products, Springer US.
5. Samuel A. Matz (1999). Bakery Technology and Engineering, PAN-TECH International Incorporated.
6. Faridi Faubion (1997). Dough Rheology and Baked Product Texture, CBS Publications.
8. Samuel A. Matz (1992). Cookies & Cracker Technology, Van Nostrand Reinhold

#### **Course outcome**

1. Understanding about bakery products.
2. Understanding about appropriate equipment for the production of baking goods.
3. Understanding about various ingredients, and their uses.
4. Understanding about baking techniques utilizing safe and hygienic working practices.

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Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	1	1
	PO3	1	1	1	1
	PO4	1	1	1	1
	PO5	1	2	2	1

**BSCDSE-106-21 BAKERY TECHNOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop understanding about production of different bakery products and equipments involved.

**Course Content**

1. Preparation of pizza base and assessment of its quality
2. Preparation of bread and assessment of its quality
3. Preparation of buns and assessment of quality
4. Preparation of butter cake and assessment of its quality.
5. Preparation of sponge cake with icing and assessment of its quality.
6. Preparation of cookies and assessment of quality.
7. Preparation of biscuits and assessment of quality.

**Course outcome**

1. Understanding about proper production stages for different products.
2. Understanding fundamental baking techniques.
3. Understanding about interpreting recipes for the intended outcome.
4. Understanding bakeshop terminology appropriately.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	1	1
	PO3	1	2	1	1
	PO4	1	1	1	1
	PO5	1	1	1	2

## BSCDSE-107-21 FOOD PACKAGING

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop understanding about importance, factors affecting, types of packaging in food relam.

### UNIT I

**Introduction to Food Packaging:** Packaging Functions and Requirements,, Printing of packages .Barcodes & other marking, Labeling Laws Glass: Composition, Properties, Methods of bottle making, Types of closures. Introduction to smart and intelligent packaging

### UNIT II

**Food Packaging Materials:** Paper and paper-based materials, corrugated fiber board (CFB). Plastics, formation- Injection molding, Blow molding, Types of plastics, Lamination, Biodegradable plastics, Edible packaging and Bio-composites. Environmental Concerns- recycling and disposal of plastic waste. Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC), types of can, metallic films, lacquers

### UNIT III

**Package Designing for Foods:** Package design for fresh horticultural produce and animal foods, dry and moisture sensitive foods, frozen foods, fats and oils, thermally processed foods and beverages.

### UNIT IV

**Testing and Regulatory Aspects of Food Packaging:** Testing Procedures for Packaging Materials- thickness, tensile strength, puncture resistance, bursting strength, seal strength, water vapor permeability, CO<sub>2</sub> permeability, oxygen permeability, grease resistance, Testing Procedures for Packaged Foods - Compatibility and shelf life studies, evaluation of transport worthiness of filled packages. Food Packaging Laws and Regulations.

**Packaging Machinery and Systems:** Bottling machines, Cartoning systems, Seal and Shrink packaging machine; Form, Fill and Sealing machine (FFS).

Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems; Retort packaging, Active and Intelligent packaging systems

#### **Recommended readings:**

1. Robertson GL, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group,2012
2. Paine FA and Paine HY, A Handbook of Food Packaging, Blackie Academic and Professional, 1992
3. Coles R, McDowell D, Kirwan MJ Food Packaging Technology. Blackwell, 2003

#### **Course outcome**

1. Comprehend advance knowledge on the properties and production of various packaging materials.
2. Understand the concept of package designing for foods.

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3. Learn about consumer response about new packaging systems and safety and legislative requirements
4. Acquaint about food-package interaction between package-flavor, gas storage systems for food storage, recycling and use of green plastics for reducing the pollution and their effect on food quality.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	1	1
	PO5	1	1	2	1

**BSCDSE-108-21 FOOD PACKAGING (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** The course aims to develop the student's practical knowledge in packaging of foods

**Course Content**

1. Testing of physical/mechanical properties of food packaging material .
2. Testing of thermal shock resistance of glass .
3. Gas/Vacuum packaging of foods and shelf life studies.
4. Determination of Water Vapor Transmission rate of Packaging Material.
5. Edible packaging of Food Samples.
6. Study of Sorption Isotherm for Food Package Design.
7. Packaged food cut-out analysis.
8. To study the operation of FFS machine.

**Course outcome**

1. Understand different types of food packaging materials.
2. Aware of symbols used in food industries.
3. Understand the role and effectiveness of various packaging systems.
4. Shelf life evaluation of packaged foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	3	1	1
	PO5	1	1	3	1

## BSCDSE-109-21 NUTRACEUTICALS AND FUNCTIONAL FOODS

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To teach basic understanding of the concepts of nutraceuticals and functional foods and their use for managing chronic diseases.

### UNIT I

**Introduction:** Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario.

### UNIT II

**Nutraceuticals:** Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and synbiotics, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

### UNIT III

**Functional Foods:** Cereal and cereal products, Milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods. Formulation and fabrication of functional foods.

### UNIT IV

**Legal Aspects:** Stability of nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to nutraceuticals and functional foods.

**Recommended readings:**

1. Wildman REC, Handbook of Nutraceutical and Functional Foods, CRC Press 2001
2. Ghosh D et al, Innovations in Healthy and Functional Foods, CRC Press 2012
3. Pathak YV, Handbook of nutraceuticals Volume 2, CRC Press 2011
4. Various journals of food technology, food science and allied subjects.

**Course outcome**

1. Acquire knowledge on various bio molecules showing health benefits.
2. Understand various physiological and biochemical aspects of life threatening and chronic diseases.
3. Apply their knowledge regarding extraction, isolation, characterization and application of nutraceuticals in food industries.
4. Identify various aspects about safety, quality and toxicology of food products including, nutraceutical and functional foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program	Course Outcome (CO)				
		CO1	CO2	CO3	CO4

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Outcome (PO)	PO1	1	1	1	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	3	1
	PO5	1	3	2	1



**BSCDSE-110-21 NUTRACEUTICALS AND FUNCTIONAL FOODS (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop practical knowledge about analysis of important compounds and development of new functional products.

**Course Content**

1. Identification of various nutraceuticals and functional foods available in the market
2. Estimation of chlorophyll content of green vegetable
3. Determination of lycopene in fruit/vegetable
4. Determination of total pectin in plant material
5. Estimation of crude fibre/dietary fibre content in cereals and their products
6. Estimation of anthocyanins in food sample
7. Preparation and evaluation of probiotic/prebiotic foods

**Course outcome**

1. Acquire knowledge on various nutraceutical components and their health benefits.
2. Understand various extraction and estimation methods of nutraceuticals.
3. Apply their knowledge regarding extraction, isolation, characterization and application of nutraceuticals in food industries.
4. Study and demonstrate various aspects regarding safety, quality and toxicology of food products including, nutraceutical and functional foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	2	1	1
	PO3	1	1	1	2
	PO4	1	2	1	1
	PO5	1	1	3	2

## **BSCDSE-111-21 FOOD PLANT SANITATION**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop knowledge and importance of food plant sanitation.

### **UNIT I**

**Food Plant Layout and Equipment Design:** General principles of food plant Design and layout ,Design of food processing equipments :Size Reduction, mixing, separation, extraction, filtration, centrifugation, distillation and, gas absorption equipments.

### **UNIT II**

**Warehousing and Cold Chain Management:** Food hygiene and safety in transportation, with a focus on warehouse storage and refrigerated ships- Safe food storage at shopping outlets: use of coolers/chillers/freezers, length of time in storage ,Design of warehouses. Scope of Cold Chain for enhancing marketing potentials of perishables in domestic and international markets, Principles of Cold Chain Creation and Management. Physicochemical changes in stored products during storage, Air tight, Non-air tight, Under ground, Conventional & Modern storage structures for fruits, vegetables, meat and marine products. Aerated, refrigerated and controlled atmospheric storage. Layout and Design of storage structures, economics of storage structures

### **UNIT III**

**Food Plant Hygiene and Sanitation:** Waste disposal, Control methods using Physical and Chemical Agents, Pest and Rodent Control, ETP Design and Layout. Food storage sanitation, transport sanitation and water sanitation.  
By-products utilization obtained from dairy plant, egg& poultry processing industry and meat industry.

### **UNIT IV**

Wastewater and solid waste treatment: - Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

#### ***Recommended Readings:***

1. Norman G. Marriott and Robert B. Gravani. (2006). Principles of Food Sanitation, 5th edition
2. Rao, D. G. (2010). Fundamentals of Food Engineering, PHI learning Private Ltd.
3. Fellows P. (2000). Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC
4. James A (2013) The supply chain handbook, distribution group.
5. FAO, US (1984) Design and operations of cold store in developing

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**Course outcome**

1. Understanding about how the contamination of food can occur in a food service establishment.
2. Understanding about the effect and consequences of food borne illness.
3. Apprehending about sound practices to prevent the possibility of food poisoning.
4. Identify measures/procedures that will reduce or eliminate accidents in food preparation and service areas.
5. Gain knowledge of plant designing and layout.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	1	1	1
	PO3	1	1	3	1
	PO4	1	1	2	2
	PO5	1	2	1	1

**BSCDSE-112-21 FOOD PLANT SANITATION (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop understanding and practical implementation regarding food plant sanitation.

**Course Content**

1. Design and layout of various food processing systems and food service areas.
2. Design and layout of cold storage and warehouse.
3. Determination of physico-chemical properties of wastewater.
4. Preparation of a sanitation schedule for food preparation area.
5. Testing of sanitizers and disinfectants.
6. Study of Phenol coefficient of sanitizers.
7. Determination of BOD (biological oxygen demand)/ COD in waste water.
8. Study of waste water treatment system/ETP.

**Course outcome**

1. Understanding about the concept of design and layout of cold storage and warehouse.
2. Understanding about the characteristics/properties of refuse.
3. Understanding suitable methods of solid and liquid waste disposal and state their advantages
4. Identify potential hazards of improper waste disposal

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	3	1	1
	PO3	1	1	1	2
	PO4	3	1	3	1
	PO5	1	3	2	1

SKILL  
ENHANCEMENT  
ELECTIVE  
COURSES

## **BSCSEC-101-21 ENTREPRENEURSHIP DEVELOPMENT**

Total Marks: 50(30 Internal + 20 external)

L	T	P
0	0	2

**Course objective:** Purpose of the course is that the students acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities

### **UNIT I**

**ENTREPRENEURIAL DEVELOPMENT:** Case studies of successful entrepreneurs; Exercises on ways of sensing opportunities – sources of idea, creating efforts, SWOT Analysis; Entrepreneurial skill assessment test; Techniques of development of entrepreneurial skills, positive self image and locus of control

### **UNIT II**

**FOOD BUSINESS MANAGEMENT:** Case studies of Food Processing Business and its aspects; Business opportunity Identification and Assessment techniques; Business Idea Generation and evaluation exercise; Market Assessment study Analysis of competitive situation; SWOT Analysis for business and for competitors; Preparation of business plan; Preparation of project report; Methods of Arrangement of inputs – finance and material.

#### **Recommended Readings**

1. Vasant Desai (2012) Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai
2. Vasant Desai (2011) The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai
3. D. David and S Erickson (1987) Principles of Agri Business Management , Mc Graw Hill Book Co., New Delhi.
4. Acharya S S and Agarwal N L (1987) Agricultural Marketing in India, Oxford & ISH Publishing Co., New Delhi.
5. David H. Holt (2002) Entrepreneurship – Anew Venture Creation, Prentice Hall of India, New Delhi.
6. Phill Kottler (1994) Marketing Management, Prentice Hall of India Private Limited, New Delhi.
7. Chandra, Prasanna (1996) Projects, Planning, Analysis, Selection, Implementation and Review, Tata McGraw-Hill Publishing Company Limited, New Delhi.

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**Course outcome**

1. Understand theories of entrepreneurship and business development
2. Understand the key resources required to develop an existing business such as ideas and finance, launch a new venture, or initiate a business enterprise
3. Understanding to state, understand and evaluate the key factors needed to develop a successful business
4. Understand the central role of opportunity recognition and marketing to business development • Understand the creation of business sustainability

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	2	1	1
	PO3	1	3	1	2
	PO4	1	1	1	1
	PO5	1	3	1	1

## **BSCSEC-102-21 FOOD PRODUCT DEVELOPMENT (LAB)**

Total Marks: 50(30 Internal + 20 external)

L	T	P
0	0	2

**Course objective:** Students will gain a wide range of knowledge and skills that can be applied for the improvement or development of food products to satisfy consumers' changing demands and to improve business related outcomes

### **PROJECTS**

**Development of New Product:** Definition, Importance , objectives & Need of product development, Reasons of failure, Types and Steps of product development ,Product development Tools and their use

#### **Projects on:**

1. Market and literature survey to identify the concepts of new products based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods.
2. Screening of product concept on the basis of techno-economic feasibility.
3. Development of prototype product and Standardization of formulation process.
4. Proximate Analysis of New Product
5. Packaging, labeling and shelf-life studies
6. Cost analysis and Final Project Report

Each team/group of students would develop a food product on the basis of above mentioned lines /steps and would submit a project report

#### **Recommended Readings**

1. Fuller, Gordon W. 2004. New Product Development- From Concept to Marketplace, CRC Press.
2. Anil Kumar, S., Poornima, S.C., Abraham, M.K. & Jayashree, K. 2004. Entrepreneurship Development. New Age International Publishers.
3. Moskowitz, Howard and Saguy, R. I. Sam 2009. An Integrated Approach to New Food Product, CRC Press.

#### **Course outcome**

1. Understanding the role of food trends in the new product development process.
2. Understanding about designing a food product through the application of knowledge of food ingredients and functional foods.
4. Understanding about designing and applying packaging to food products and evaluate product quality and sensory properties.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	2
	PO2	1	1	1	1
	PO3	2	2	1	1
	PO4	3	1	2	1
	PO5	1	1	1	2



**BSCSEC-103-21 FOOD FERMENTATION TECHNOLOGY (LAB)**

Total Marks: 50(30 Internal + 20 external)

L	T	P
0	0	2

**Course objective:** Develop understanding about different technical, biochemical and microbial systems involved in various food and beverage fermentations.

**Course Content**

1. Food Fermentation Technologies.
2. Study of a Bio fermentor – its design and operation, Down Stream Processing and Product recovery.
3. Starter cultures.
4. Production of Baker's Yeast
5. Production of yoghurt using DIV cultures
6. Development of a fermented food/drink utilizing plant products /animal products or byproducts as substrate

***Recommended Readings***

1. Industrial Microbiology by Prescott & Dunn, CBS Publications, New Delhi.
2. Industrial Microbiology by L.E. Casida, New Age Publications, New Delhi.
3. Principle of Fermentation Technology by Whittaker and Stanbury, Aditya Books Pvt.Ltd.
4. Handbook of Indigenous Fermented Foods by K.H. Steinkrus
5. Food Microbiology by Adams and Moss, Panima Publication Corporation, Delhi.
6. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi V. K. & Pandey, A., Sanjanya Books 1999.
7. Essentials of Food Microbiology. Edited by John Garbutt. Arnold International Students Edition. 1997
8. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood. Elsevier Applied Science Publication. 1997
9. Principles of Fermentation Technology by Stanbury, P.F., Whitekar A. and Hall. 1995., Pergamon. McNeul and Harvey. (AC) NEW

**Course outcome**

1. Puts emphasis on the basic engineering principles of Fermentation Technology.
2. Understanding about application of fermentation in food and biotechnological industry.
3. Understanding fermentation – dairy, meat, fruit and vegetable products
4. Combine theoretical knowledge and practical skills to reproduce existing products

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	2	1
	PO3	2	1	1	2
	PO4	3	3	2	1
	PO5	1	1	1	1

**BSCSEC-104-21 CONFECTIONARY TECHNOLOGY (LAB)**

Total Marks: 50(30 Internal + 20 external)

L	T	P
0	0	2

**Course objective:** To develop understanding about production, ingredients and equipments involved in confectionary technology.

**Course Content**

Sugars- Types and sources, methods of preparation of sugars, jaggery, khandsari, raw and refined sugar. Principles of sugar cookery, crystalline and non-crystalline candies.

Confectionary Products: Cake icings, hard-boiled candies, toffees, fruit drops, chocolates and other confections- ingredients, equipment's & processes, product quality parameters, faults and corrective measures.

1. Determine the effect of heat on sugar solution and perform the thread and cold water test.
2. To study the process of inversion, melting and caramelization in sucrose.
3. Preparation of fondant, fudge and brittles.
4. Preparation of *Shakarpara* and *Chhana murki*.
5. Preparation of candy and toffee and to perform quality assessment tests.
6. Preparation of cake decorations.

**Recommended Readings:**

1. Raina et.al. (2003). Basic Food Preparation-A complete Manual. 3rd Ed. Orient Longman Pvt. Ltd.
2. Manay, S. & Shadaksharaswami, M. (2004). Foods: Facts and Principles, New Age Publishers.
3. Beckett S.T. (2009). Industrial Chocolate Manufacture, Blackwell Publishing Ltd.
4. Minifie B.W. (1999). Chocolate, Cocoa and Confectionary, Aspen Publication.
5. Mohini Sethi, Eram Rao (2011) Food science- Experiments and applications, 2<sup>nd</sup> ed., CBS publishers & Distributors pvt ltd.

**Course outcome**

1. Understand about significance and healthy aspects of confectionery and snack food in our daily life.
2. Understand status of confectionery and snack foods industries.
3. Knowledge about the manufacturing of various sugar confections, bakers' confections and snack foods.
4. To know about importance of packaging and quality maintenance of confectionery and snack foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	2	3	2	2
	PO4	1	1	1	1
	PO5	1	1	1	1

**BSCSEC-105-21 PROJECT AND TECHNICAL REPORT (LAB)**

Total Marks: 50 (30 Internal + 20 external)

L	T	P
0	0	2

**Course objective:** To develop understanding technical report writing.

**Course Content**

Introduction: Project - definition, features, types, infrastructure creation-a special type of projects, significance of infrastructure in economic development, Project Identification: Idea generation, Project screening, Feasibility study. The advantages and disadvantages of starting your business. Project Appraisal : technical appraisal, marketing appraisal, legal and environment appraisal, financial appraisal-cost estimation of the project and Detailed project report – introduction. Arrangement of funds

**Projects & technical report on:**

1. Screening of product concept on the basis of techno-economic feasibility.
2. Development of prototype product and Standardization of formulation process.
3. Proximate Analysis of New Product
4. Final Project Report

Each team/group of students would develop a technical project report on the basis of above mentioned lines /steps and would submit a project report

**Recommended Readings:**

1. John Kao, Creativity & Entrepreneurship
2. P. Chandra, Projects planning analysis selection implementation & review
3. P.Gopalkrishnan & V.E. Ramamoorthy, Text book of Project management
4. N. Singh , Project management & control, (Himalaya pub.)
5. B.M. Patel , Project management , (Vikas Pub.) 2000

**Course outcome**

1. Understanding about the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks.
2. Understanding about producing a set of documents related to technology and writing in the workplace.
3. Understanding about basic components of definitions, descriptions, process explanations, and other common forms of technical writing.
4. Students will be familiar with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	1	1
	PO5	1	1	1	1

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# GENERIC ELECTIVE (FOR OTHER DEPARTMENT STUDENTS)

## BSCGE-101-21 FOOD PROCESSING AND PRESERVATION

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop understanding about techniques, and modern tools necessary food processing and preservation operations

### UNIT I

#### FOOD PROCESSING OPERATIONS:

**Refrigeration and Freezing:** Requirements of refrigerated storage - controlled low temperature, air circulation and humidity, changes in food during refrigerated storage, progressive freezing, changes during freezing; Freezing methods -direct and indirect, still air sharp freezer, blast freezer, fluidized freezer, plate freezer, spiral freezer and cryogenic freezing.

**Dehydration:** Normal drying curve , effect of food properties on dehydration ,change in food during drying, drying methods and equipments air convection dryer, tray dryer, tunnel dryer ,continuous belt dryer , fluidized bed dryer, dryer, drum dryer, vacuum dryer ,freeze drying ,foam mat drying.

**Thermal Processing of Foods:** Classification of thermal processes, Principles of thermal processing, commercial canning operations, Aseptic Processing, UHT.

**Irradiation and microwave heating:** Principles, Dosage, Applications of Irradiation, Mechanism of microwave heating and applications.

### UNIT II

**TECHNOLOGY OF COLLOIDS IN FOOD:** Characteristics, sols, gels, pectin gels, colloidal sols, stabilization of colloidal system, syneresis, emulsions, properties of emulsions, formation of emulsion, emulsifying agents, food foams, formation stability and destruction of foam, application of colloidal chemistry to food preparation.

### UNIT III

**WATER DISPOSAL AND SANITATION:** Waste water ,hardness of water, break point chlorination, physical and chemical nature of impurities, BOD, COD, waste water treatment, milk plant sanitation, CIP system, sanitizers used in food industry.

#### MINIMAL PROCESSING AND HURDLE TECHNOLOGY

### UNIT IV

**FOOD ADDITIVES, CONTAMINANTS AND REGULATIONS:** Food Additives - Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives, Chemical, technological and toxicological aspects. Contamination in Food- : Physical, chemical (heavy metals, pesticide residues, antibiotics, veterinary drug residues, dioxins, environmental pollutants, radionuclides, solvent residues, chemicals) Natural toxins. Food Laws and Regulations- Codex, HACCP, ISO, FSSA etc.

**Recommended Readings:**

1. Potter NH,1998, Food Science, CBS Publication, New Delhi
2. Ramaswamy H and Marcotte M,2009, Food Processing Principles and Applications CRC Press
3. Deman JM,2007, Principles of Food Chemistry, 3rd ed. Springer
4. Manay NS and Shadaksharaswamy M,1987, Food-Facts and Principles, New Age International (P) Ltd. Publishers, New Delhi

**Course outcome**

1. To impart knowledge on the causes of food spoilage.
2. To learn principles of different techniques used in processing and preservation of foods.
3. To identify and select preservation methods appropriate for specific foods and learn the effects of preservation methods on the quality of food.
4. To learn different permitted food additive used in food industry.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	2	1	1
	PO3	1	1	1	3
	PO4	2	2	3	1
	PO5	1	1	1	3

## BSCGE-102-21 FOOD PROCESSING AND PRESERVATION (LAB)

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop skill and knowledge regarding food preservation and processing operations.

**Course Content**

- 1 Canning of foods
- 2 Preservation of food by the process of freezing
- 3 Drying of food using Tray dryer/other dryers
- 4 Estimation of Chemical Oxygen Demand (Demonstration)
- 5 Preparation of brix solution and checking by hand refractometer
- 6 Analysis of water
- 7 Minimal Processing of food
- 8 Application of colloidal chemistry in food preparation

**Course outcome**

1. To impart knowledge on the principles of different techniques used in processing and preservation of food.
2. Identification and selection of preservation methods appropriate for specific foods and to learn the effects of preservation methods on the quality of food.
3. Understanding the concept of heat and chilling based preservation approaches.
4. Understanding, implementation and effect analysis of minimal processing on different foods.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	2	1
	PO3	1	2	1	2
	PO4	1	2	2	1
	PO5	1	1	1	2

## BSCGE-103-21 CHEMISTRY OF FOOD

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To acquaint the students about chemistry of various foods.

### UNIT I

**Introduction:** Introduction to Food Chemistry, Composition of food

**Water :** Definition of water in food, Structure of water and ice, Types of water, Role of water activity

**Lipids:** Classification of lipids, Physical and chemical characteristics, Chemical deterioration of fats and oils (auto oxidation, rancidity, lipolysis, flavor reversion)

### UNIT II

**Proteins:** Protein classification and structure, types of food proteins (plant and animal proteins), Physicochemical and functional properties of proteins

**Carbohydrates:** Classification, Structure and Chemical reactions of carbohydrates

### UNIT III

**Vitamins:** Types (Water soluble vitamins and Fat soluble vitamins)

**Flavour:** Definition and basic tastes, Description of some common food flavors.

**Minerals:** Major and minor minerals, Toxic minerals in food

### UNIT IV

**Natural Food Pigments:** Introduction and classification, Types of food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments, caramel)

**Browning Reactions in Food:** Types, Enzymatic and Non enzymatic Browning and their control measures

**Enzymes:** Introduction, classification, General characteristics, Important enzymes in food processing

**Physico-chemical and nutritional changes occurring during food Processing**

**New Food Product Development:** Introduction, need, objectives and types

### *Recommended Readings:*

1. DeMan, John M.1982. Principles of Food Chemistry ,3rd Ed., Springer



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2. Desrosier, Norman W. and Desrosier., James N. 1977. The technology of food preservation , 4th Ed., Westport, Conn. : AVI Pub. Co.
3. Fennema, Owen R 1996. Food Chemistry, 3rd Ed., Marcell Dekker, New York,
4. Whitehurst and Law. 2002. Enzymes in Food Technology, CRC Press, Canada
5. Wong, Dominic WS. 1985. Food Enzymes, Chapman and Hall, New York
6. Potter, N.N. and Hotchkiss, J.H. 1995. Food Science 5th Ed., Chapman & Hall

**Course outcome**

1. Students are expected to understand and be able to control the major chemical and biochemical (enzymatic) reactions that influence food quality with emphasis on food industry applications.
2. To understand how the properties of different food components and interactions among these components modulate the specific quality attributes of food systems
3. To understand the principles that underlines the biochemical/enzymatic techniques used in food analysis
4. Chemistry relating to major and minor components of food, their nutritional, physiological, sensory, flavor and microbiological aspects.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	2	1	1
	PO3	1	3	3	2
	PO4	1	2	1	1
	PO5	1	1	1	2

**BSCGE-104-21 CHEMISTRY OF FOOD (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop knowledge regarding analysis and estimation of chemical components critical in food realm.

**Course Content**

1. Preparation of primary and secondary solutions
2. Estimation of moisture content
3. Determination of gelatinization temperature range (GTR) of different starches and effect of additives on GTR
4. Determination of percent free fatty acids
5. Estimation of Peroxide Value
6. Estimation of Total Ash
7. Estimation of Protein Content

**Course outcome**

1. Ability to use terminology, appropriate to the field of food chemistry, correctly and contextually.
2. Experimental planning, the preparation of reagents and use of basic instrumentation (spectrophotometers, viscometers, color meters, chromatographic apparatus etc), the collection of experimental data and its presentation, analysis and interpretation
3. Capacity to formulate foods that are designed to address and contribute to reducing community health concerns.
4. Learning chemical aspect of major and minor components of food

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	3
	PO2	1	1	1	1
	PO3	1	2	2	2
	PO4	1	3	2	1
	PO5	1	3	1	1

## BSCGE-105-21 SENSORY EVALUATION OF FOOD

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To acquaint the students about sensory analysis of various foods.

### UNIT I

**Taste:** Introduction and importance of taste; Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands; Mechanism of taste perception; Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami; Factors affecting taste quality, reaction time, taste modification, absolute and recognition; threshold Taste abnormalities; Taste measurement

### UNIT II

**Odour:** Introduction, definition and importance of odour and flavor; Anatomy of nose, physiology of odour perception; Mechanism of odour perception; Odour classification, chemical specificity of odour. Odour measurement using different techniques – primitive to recent techniques. Merits and demerits of each method. Olfactory abnormalities

### UNIT III

**Colour:** Introduction and importance of colour. Dimensions of colour and attributes of colour, appearance factors, gloss etc. Perception of colour. Colour abnormalities; Measurement of colour; Munsell colour system, CIE colour system, Hunter colour system, spectrophotometry and colorimetry etc.

### UNIT IV

**Texture:** Introduction, definition and importance of texture, Phases of oral processing, Texture perception, receptors involved in texture perception, Texture classification, Texture measurement – basic rheological models, forces involved in texture measurement

### Recommended Readings

1. Rao E. S. (2013). Food Quality Evaluation, Variety Books.
2. Amerine, Pangborn & Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.
3. Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999
4. deMan J. (2007). Principles of Food Chemistry, 3rd ed., Springer. 62
5. Brannen and et al.,(1990)Food Additives, Marcel Dekker,New York,1990

### Course outcome

1. To understand about sensory evaluation scales (Hedonic rating, Ranking difference, Triangle test).
2. To understand about importance and evaluations of taste, odor, color and texture.
3. To understand benefits and limitations (scientific and ethical) of the sensory evaluation of food and be able to recommend, justify and critique commonly used methods of sensory analysis.
4. Understanding about modern tools viz. e-nose, e-tongue

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Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	2	1	2
	PO4	1	2	1	1
	PO5	1	2	2	1

## **BSCGE-106-21 SENSORY EVALUATION OF FOOD (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To understand the practical knowledge about sensorial analysis methods.

### **Course Content**

1. Training of sensory panel.
2. To perform recognition and sensitivity tests for four basic tastes.
3. To perform analytical tests of sensory evaluation.
4. Recognition tests for various food flavors, flavor defects in milk.
5. Sensory evaluation of milk and milk products.
6. Texture evaluation of various food samples- crispies/ cookies/ biscuits/ snack foods
7. Measurement of color by using Tintometer/ Hunter Colour Lab etc.
8. Qualitative tests for hydrogenated fats, butter, ghee
9. Platform tests for milk
10. Quality evaluation of various food stuffs- cereals, pulses, honey, jaggery, sugar, tea, coffee etc.

### **Course outcome**

1. Understanding about identification solutions to problems related to the sensory analysis of food and to apply and expand upon the theoretical concepts presented in lectures.
2. Understanding about conceptualizing food formulations that meet specified sensory requirements and which are intended to contribute to reducing community health concerns.
3. Understanding about implementation of a test plan.
4. Practical application in various raw and processed products.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	2	1	2
	PO4	3	2	2	1
	PO5	1	2	1	2

## BSCGE-107-21 FOOD MICROBIOLOGY AND FOOD SAFETY

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To understand the role and significance of microbes of different categories, microbial inactivation and environmental factors that affect them in foods.

### UNIT I

**Introduction to Food Microbiology:** History and Development of Food Microbiology, Definition and Scope of food microbiology

**Types of Microorganisms in Food:** Classification and Nomenclature, Morphology and Structure Importance in food (bacteria, fungi and viruses ) Significance of spores

**Microbial Growth in Food:**Bacterial growth curve, Factors affecting the growth of micro organisms in food

### UNIT II

**Microbial Food Spoilage:** Sources of Microorganisms in foods, Some important food spoilage bacteria, Spoilage of some specific food groups

**Food Fermentations:**Fermentation –definition and types, Microorganisms used in food fermentations, Fermented Foods-types, methods of manufacture for vinegar, sauerkraut, yoghurt , soya sauce, wine and traditional Indian foods

**Food borne Diseases:**Types – food borne infections, food borne intoxications and toxin infections, Origin, symptoms and prevention of some commonly occurring food borne diseases

### UNIT III

**Enumeration techniques & control of microorganisms in foods:**Qualitative and quantitative methods-conventional as well as rapid, Principles and methods of preservation (thermal and non thermal),Introduction to Hurdle Technology

**Introduction to Food Safety:**Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety

### UNIT IV

**Hygiene and Sanitation in Food Service Establishments:**Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control, Personnel Hygiene

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**Food Safety Management Tools:** Basic concept, Prerequisites, HACCP, ISO series, TQM and Risk Analysis

***Recommended Readings:***

1. Frazier William C and Westhoff, Dennis C. 2004 Food Microbiology, TMH, New Delhi,
2. Jay, James M. 2000 Modern Food Microbiology, CBS Publication, New Delhi,
3. Garbutt, John. 1997 Essentials of Food Microbiology, Arnold, London,
4. Pelczar MJ, Chan E.C.S and Krieg, Noel R 1993 Microbiology, 5th Ed., TMH, New Delhi
5. Lawley, R., Curtis L. and Davis, J., 2004 The Food Safety Hazard Guidebook, RSC publishing.
6. De Vries, 1997, Food Safety and Toxicity, CRC, New York,
7. Marriott, Norman G., 1985, Principles of Food Sanitation, AVI, New York,
8. Forsythe, S J, 1987, Microbiology of Safe Food, Blackwell Science, Oxford, 2000 65 & Sons; USA,

**Course outcome**

1. Understand the principles involving food spoilage and preservation involving microorganisms and explain why microbiological quality control programmes are necessary in food production.
2. Ability to identify the characteristics of spoilage causing and beneficial microorganisms in foods.
3. Understand the role and significance of intrinsic and extrinsic factors on growth of microorganisms in foods and differentiate which organisms would be likely to grow in a specific food product.
4. Identify the conditions under which the important pathogens and spoilage microorganisms are commonly inactivated killed or made harmless in foods and identify ways to control microorganisms in foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	2	1	1
	PO5	1	2	1	1

## BSCGE-108-21 FOOD MICROBIOLOGY AND FOOD SAFETY (LAB)

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop practical knowledge among students regarding microbiological analysis for ensuring food safety.

### Course Content

1. Introduction to the Basic Microbiology Laboratory Practices and Equipments
2. Preparation and sterilization of nutrient broth and media
3. Morphological study of bacteria and fungi using permanent slides
4. Simple staining and Gram's staining
5. Standard Plate Count Method
6. Bacteriological Analysis of Water
7. Assessment of surface sanitation by swab/rinse method
8. Assessment of personal hygiene
9. Scheme for the detection of food borne pathogens
10. Implementation of FSMS – HACCP, ISO: 22000

### **Course outcome**

1. Acquire the practical skills for the sampling of foods to carry out microbial analysis.
2. Ability to carry out various sterilization techniques and to identify the most suitable technique for specific food.
3. Ability to isolate and identify common food borne microbial pathogens.
4. Understand microbiological analysis methods for food products and ability to analyze different foods for presence of hazardous microorganisms using food microbiology technology.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	1
	PO2	1	1	1	1
	PO3	1	1	3	3
	PO4	1	2	1	1
	PO5	1	2	1	1



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**BSCGE-109-21 FOOD ENGINEERING AND PACKAGING**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop understanding about the techniques, principles, factors affecting the process of food engineering and packaging.

**UNIT I**

**Unit Operations and Processes:** Introduction, Units and Dimensions, Heat Transfer-Conduction, Convection and Radiation, Mass transfer-Diffusion, membrane separation processes, Steam generation and Boilers, Evaporation, Drying and dehydration, Refrigeration, Freezing, Psychometrics and Fluid flow.

**Unit II**

**Separation and Size Reduction Processes:** Principles and equipments used in separation Extraction, sedimentation, filtration, centrifugation, Size reduction – Milling, grinding and mixing of foods

**Unit III**

**Introduction to Food Packaging:** Course objectives and functions of food packaging, Requirements for effective food packaging, Types of packaging Materials, General properties of packaging materials

**Unit IV**

**Packaging of Foods:** Packaging of fresh produce and processed foods, Aseptic packaging, Advances in food packaging

**Recommended Readings:**

1. Paine FA and Paine HY, 1992 A Handbook of Food Packaging, Blackie Academic Professional,
2. Rao CG. 2006, Essentials of food process engineering. B S publications
3. Rao DG, 2010, Fundamentals of food engineering. PHI learning private Ltd.
4. Robertson GL, 2012, Food Packaging – Principles and Practice, CRC Press Taylor and Francis Group
5. Singh RP and Heldman DR, 1993, 2003, 2009, 2nd, 3rd and 4th Ed., Introduction to food engineering. Academic press.

**Course outcome**

1. To determine suitable methods of processing techniques for a chosen food.
2. To understand the operations involved in packaging material manufacture.
3. To develop an understanding of major packaging materials used in food packaging.
4. Understanding about packaging for different foods with respect to engineering aspect.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	2
	PO3	1	1	1	2
	PO4	1	2	1	1
	PO5	1	2	1	2

**BSCGE-110-21 FOOD ENGINEERING AND PACKAGING (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To impart practical knowledge regarding food engineering process and packaging.

**Course Content**

1. Study the dehydration process
2. Study the freezing characteristics of foods
3. Study the process of evaporation
4. To design layout of a food plant
5. Determination of viscosity of foods
6. Identification of packaging materials
7. Testing of packaging materials
8. Demonstration of vacuum/gas packaging of foods

**Course outcome**

1. To understand the purpose and principles of food packaging
2. To impart knowledge of various areas related to food processing and packaging.
3. To evaluate the suitability of packaging material for a particular type of food.
4. Practical application on designing packaging for different foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	1
	PO2	1	1	3	1
	PO3	1	1	1	3
	PO4	1	2	2	1
	PO5	1	2	3	1

## BSCGE-111-21 TECHNOLOGY OF PLANT AND ANIMAL FOODS

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To impart knowledge regarding processing and preservation of plant and animal origin foods.

### UNIT I

**Technology of Fruits and Vegetables:** Introduction and importance of fruit and vegetable preservation, history and need of preservation. Canning and bottling of fruits and vegetables: Selection of fruits and vegetables, process of canning, containers of packing, spoilage in canned foods. Fruits beverages: Introduction, process and preservation of fruit juices. Jams, jellies and marmalades: Processing and technology, defects in jelly. Pickles, chutneys and sauces: Processing, types, causes of spoilage in pickling. Tomato products: Selection of tomatoes, processing of tomato juice, tomato puree, paste, ketchup, sauce and soup, Dehydration of Fruits and Vegetables.

### UNIT II

**Technology of cereals, legumes and oilseeds:** Wheat - Types, milling, flour grade. Rice – Variety, milling, parboiling. Corn – Variety, milling, Millets - milling. Pulses- Dry and wet milling, Oilseeds- Extraction of oil and refining.

**Spices & Plantation Products:** Spices - Processing and properties of important spices. Tea and Coffee: Processing

### UNIT III

**Dairy and Fish Technology :** Dairy – FSSAI Definition of Milk, Types of Market Milk, Physico-chemical properties of milk, processing of Milk, Concept of Filtration, Clarification, Homogenization, Pasteurization, Introduction to various Milk Products: Butter, ghee, flavored milk, yoghurt, dahi, shrikhand, icecream, condensed milk, milk powder, channa, paneer, cheese (cheddar). Fish – Classification of fish (fresh water and marine), composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical, Methods of Fish Preservation chilling, freezing, Drying, salting, smoking.

### UNIT IV

**Meat, Poultry and Egg Technology:** Meat and Poultry – Definition of carcass, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat, Concept of an abattoir, Process of slaughtering in an abattoir. Egg – Structure and composition of hen's egg, egg proteins, characteristics of fresh egg, deterioration of egg quality. Preservation of eggs, Refrigeration and freezing, thermal processing, egg powder

#### **Recommended Readings:**

1. Girdharilal, Siddappa, G.S and Tandon, G.L., 1998, Preservation of fruits & Vegetables, ICAR, New Delhi
2. Kent.N.L, 2003 , Technology of Cereal, 5th Ed. Pergamon Press
3. Chakraborty, 1988, Post Harvest Technology of Cereals, Pulses and Oilseeds, revised ed., Oxford & IBH Publishing Co. Pvt Ltd,
4. Marshall, 1994, Rice Science and Technology, Wadsworth Ed., Marcel Dekker, New York, 1994
5. H. Faride, 1997, The Science of Cookie and Cracker Production, CBS Publication, New Delhi, 1997
6. W B Cruse. 2007, Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India
7. Manay, S. 2004, & Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers,
8. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
9. De Sukumar, . 2007, Outlines of Dairy Technology, Oxford University Press, Oxford.
10. Lawrie R A, 1998, Lawrie's Meat Science, 5th Ed, Woodhead Publisher, England,
11. Shai Barbut, 2005., Poultry Products Processing, CRC Press 2005.
12. Stadelman WJ, Owen J Cotterill, 2002, Egg Science and Technology, 4th Ed. CBS Publication New Delhi
13. Hall GM, 1992, Fish Processing Technology, VCH Publishers Inc., NY, 1992

**Course outcome**

1. Understanding about sources, significance and classification of plant and animal source foods.
2. Understanding about methods of processing and preservation of different plant and animal foods.
3. Understanding about nutritive composition of plant and animal foods.
4. Understanding about the standards and regulations associated with different food categories.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	1
	PO2	1	1	2	1
	PO3	2	1	1	3
	PO4	2	1	2	1
	PO5	1	2	2	1

## **BSCGE-112-21 TECHNOLOGY OF PLANT AND ANIMAL FOODS (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To develop understanding about estimation and analysis of plant and animal foods.

### **Course Content**

- 1 Physical Characteristics of Wheat
- 2 Estimation of gluten content of flour
- 3 Estimation of degree Brix:Acid ratio
4. Estimation of percent Ascorbic acid
5. Platform tests in milk (Acidity, COB, specific gravity)
6. Evaluation of eggs for quality parameters (market eggs, branded eggs)
7. Cut out examination of canned fish (Sardine, Mackerel, and Tuna)/Meat.
- 8 To prepare casein and calculate its yield.

### **Course outcome**

1. Understanding about nutritive composition of different plant and animal source foods.
2. Understanding and application of processing and preservation methods.
3. Understanding about qualitative evaluation of foods concerning safety.
4. Understanding about packaging of processed plant and animal foods.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	1	1
	PO3	2	1	1	2
	PO4	1	1	2	2
	PO5	1	2	2	1

### **Note:**

1. For the Generic elective (GE) to be chosen by Food Technology students, it is recommended that subjects like Biochemistry, Biology, Chemistry, Maths & statistics, Biostatistics, Physics be chosen as they are synergistic to the curriculum. However, students are free to pick up any of the Generic Elective Courses offered by other

departments.

2. If no other department offer generic elective\*, student can choose any subject from following Generic Elective Courses which will be taught by subject faculty of respective department

# **GENERIC ELECTIVE**

## BSCGE-201-21 INTRODUCTION TO BIOLOGY

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To make students understand the biological concepts related to evolution, life on earth, genetics, living systems.

### UNIT I

**Biological systems, evolution and biodiversity:**

- a. Introduction to concepts of biology: Themes in the study of biology; A closer look at ecosystem; A closer look at cell; The process of Science; Biology and everyday life
- b. Evolutionary history of biological diversity : Early earth and the origin of life; Major events in the history of life; Mechanism of Macroevolution; Phylogeny and the tree of life
- c. Classifying the diversity of life : Kingdoms of Life –Prokaryotes, Eukaryotes, Archaea
- d. Darwinian view of life and origin of species: Darwin's theory of evolution; The evolution of populations; Concepts of species; Mechanism of speciation

### UNIT II

**Biological systems, evolution and biodiversity:**

- e. Genetic approach to Biology: Patterns of inheritance and question of biology; Variation on Mendel's Law; The molecular basis of genetic information; The flow of genetic information from DNA to RNA to protein; Genetic Variation; Methodologies used to study genes and gene activities; Developmental Detecting macromolecules of genetics; Model organisms for the genetic analysis; Distinction between Phenotype and Genotype

### UNIT III

**Chemical context of living systems**

- a. Chemistry of life: The constituents of matter; Structure of an atom; The energy level of electron; The formation and function of molecules depend on chemical bonding between atoms; Chemical reaction make or break chemical bonds
- b. Water and life: The water molecule is polar; Properties of water; Ionization of water

### UNIT IV

**Chemical context of living systems**

- c. Carbon and life: Organic chemistry-the study of carbon compounds; What makes carbon special? Properties of organic compounds
- d. Structure and function of biomolecules

**Recommended Readings:**

- 1. Campbell, N.A. and Reece, J. B. (2008) Biology 8th edition, Pearson Benjamin Cummings, San Francisco.
- 2. Raven, P.H et al (2006) Biology 7th edition Tata McGrawHill Publications, New Delhi
- 3. Griffiths, A.J.F et al (2008) Introduction to Genetic Analysis, 9th edition, W.H. Freeman & Co. NY

**Course outcome**

- 1. Understand the basic concepts, principles, and their applications to biological systems.
- 2. Understand the chemistry of carbon and analyze the potential for biology based on other elements.
- 3. Understanding about molecular basis of genetic information; genetic variation.
- 4. To understand structure and function of bio-molecules.



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Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	3	1	2
	PO4	2	1	1	1
	PO5	2	2	1	1

## **BSCGE-202-21 INTRODUCTION TO BIOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective: To understand the practical analysis associated with fundamentals of biology**

### **Course Content**

1. To learn a) use of microscope b) principles of fixation and staining.
2. Preparation of Normal, molar and standard solutions, phosphate buffers, serial dilutions
3. Use of micropipettes
4. Separation of A) amino acids B) chloroplast pigments by paper chromatography.
5. To perform gram staining of bacteria.
6. To study the cytochemical distribution of nucleic acids and mucopolysaccharides in cells/tissues from permanent slides.
7. To perform quantitative estimation of protein using the Lowry's method. Determine the concentration of the unknown sample using the standard curve plotted.
8. To separate and quantify sugars by thin layer chromatography.
9. To raise the culture of *E. coli* and estimate the culture density by turbidity method. draw a growth curve from the available data.
10. Isolation of genomic DNA from *E.coli*.

### **Course outcome**

1. Develop learning about working with microscope and preparation of normal, molar and standard solutions, buffers.
2. Develop learning about quantitative estimation of sugars, proteins.
3. Understanding about paper chromatography
4. Understanding about culturing and isolation concepts.

Formulation of Course Outcomes-Program Outcomes matrix					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	1	1
	PO5	1	1	1	1

## BSCGE-203-21 MATHEMATICS AND STATISTICS

Total Marks: 100

L	T	P
4	0	0

**Course objective:** To develop knowledge among students about statistical analysis of problems

### UNIT I

**Calculus:** Successive differentiation, Mean Value Theorems and applications, Indeterminate forms, Introduction to anti-derivatives, Definite Integrals, Ordinary Differential equations.

### UNIT II

**Matrices:** Eigen values, Cayley Hamilton Theorem, Applications of Matrices in solving system of equations.

### UNIT III

**Basic Statistics:** Scope of statistics in food industries, errors, precision and threshold. Descriptive measures-Measures of central tendency, dispersion, skewness and kurtosis. Axiomatic approach to probability, Applications of Bayes Theorem, Random variables, Probability distributions, Mathematical expectation and variance, Binomial, Poisson and Normal distributions.

### UNIT IV

**Applied Statistics:** Correlation and Regression, Sampling distributions, Standard error, Type I and Type II errors, Hypothesis testing- Large sample tests for means and proportions, Student's t- test, F-test, Chi square test, ANOVA (one way and two way).

### **Recommended Readings:**

1. Introduction to Mathematics for Life Scientists, by E.Batschelet, Third edition, Springer International Edition.
2. Applied Calculus for the Managerial, Life and Social sciences by S.T.Tan, Fifth edition, Thomson Learning.
3. Biostatistics: a Foundation for Analysis in the Health Sciences, by Wayne W Daniel, Seventh edition, John Wiley and Sons
4. Biostatistical Analysis by J.H. Zar, Fourth edition, Pearson Education.

### **Course outcome**

1. Understanding calculus.
2. Understanding about basic statistics and its scope in food industry.
3. Understanding matrices system and basic statistics
4. Understanding about applied statistics – t-test, F-test, Chi square test, ANOVA (one way & two way)

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	1	3	1
	PO3	2	1	1	2
	PO4	1	2	2	1
	PO5	1	1	1	1

## SCGE-204-21 MATHEMATICS AND STATISTICS (LAB)

Total Marks: 50

L	T	P
0	0	4

**Course objective:** To introduce and develop knowledge about practical aspect of statistical application in research

### Course Content

Software labs using mathematical and statistical software such as Mathematical or Matlab, SPSS or Minitab

1. Exploring and sketching functions using derivatives.
2. Finding definite integrals.
3. Analysing the solutions of ordinary differential equations.
4. Presentation of Data by frequency tables, Graphs and Diagrams.
5. Computation of Measures of central tendency.
6. Computation of Measures of Dispersion.
7. Computation of raw and central moments, and measures of skewness and kurtosis.
8. Computation of correlation coefficient and Fitting of lines of Regression ( Raw and Frequency data ).
9. Analysing and interpreting a given data set by using hypothesis tests.
10. Performing one way and two way ANOVA.

### **Course outcome**

1. Development of statistical reasoning, formulate a problem in statistical terms, perform exploratory analysis of data by graphical and other means, and carry out a variety of formal inference procedures.
2. Understanding about important theoretical results and understand how they can be applied to answer statistical questions.
3. Understanding about computation of central tendency, dispersion, measures of skewness and kurtosis.
4. Understanding about performing two way ANOVA

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	1	1
	PO5	1	2	2	2

## BSCGE-205-21 BIOCHEMISTRY

Total Marks: 100

L	T	P
4	0	0

**Course objective:** The Course objective of this course is to provide exposure to the students on cells, structural and functional units of living organisms, and their intricate organization

### UNIT I

**Biomolecules:** Over view of amino acids, proteins and carbohydrates.

Lipids- Fatty acids, triacyl glycerols; glycerophospholipids, sphingolipids, sterols.

Nucleic acids- Nucleotides, Nitrogenous Bases- Purines and Pyrimidines; tautomers of bases, nucleotide derivatives, nucleotides as regulating molecules, different types of DNA and RNA

### UNIT II

**Enzymes Classification- Kinetics and Control:** The Michaelis-Menten equation-derivation and physiological significance, the double reciprocal plots, kinetics of multisubstrate reactions, enzyme inhibition, turn over number of enzymes, *Regulatory enzymes:* General properties of allosteric enzymes, theories of allosteric regulation, regulation by covalent modification, kinetics, multienzyme complexes, negative and positive cooperativity, zymogens, isoenzymes, abzymes, ribozymes. *Mechanisms* of enzymes- catalysis, specificity, reactions rate, equilibrium, interaction between an enzymes and substrate, role of binding energy, acid base and covalent catalysis, lock and key & induced fit theories.

**Coenzymes:** Classifications (metabolite derived/vitamin derived) function of various types , structure of  $\text{NAD}^+$ ,  $\text{NADP}^+$ , FAD & FMN,

**Metabolism and Bioenergetics:** Principles of bioenergetics-Standard free energy change, experimental measurement of  $\Delta G$ , ATP and other reaction molecules, metabolic roles of ATP-Phosphoryl group transfer, nucleotidyl group transfer, biological oxidation- reduction reactions. General scheme of studying metabolic pathways, their local and global regulatory agents, energetics, disorders associated with the malfunctioning of pathways.

### UNIT III

#### METABOLIC PATHWAYS

**Carbohydrates metabolism:** Glycolysis, alcoholic and lactic acid fermentation, pasteur effect, gluconeogenesis, cori cycle, glucose-alanine cycle, futile cycle. TCA cycle, HMP shunt, glycogenolysis & glycogen synthesis.

*Disorders associated with defects in carbohydrate metabolism-* a brief account on fructose intolerance, lactose intolerance, lactic acidosis, disorders related to glycogen metabolism, genetic deficiency of Glucose-6-phosphate dehydrogenase, Galactosemia, pentosuria, Diabetes Mellitus (NIDDM and IDDM)

**Lipid metabolism:** Mobilization of triglycerides, metabolism of glycerol, -oxidation of saturated, mono- unsaturated and poly-unsaturated fatty acids, even and odd chain fatty acids. Ketone bodies *Biosynthesis* of fatty acids, fatty acid elongation and desaturation, biosynthesis of triacylglycerols.

*Disorders associated with defects in Lipid metabolism:* Refsum's disease, Gaucher's disease, Niemann Pick's disease, Tay Sach's disease

### UNIT IV

**Metabolism of amino acids:** Assimilation of Ammonia: its incorporation in glutamate, glutamine and alanine as nitrogen carrier, regulation of glutamate dehydrogenase and glutamine synthetase, transamination reactions-role of pyridoxal phosphate, nitrogen excretion and *urea cycle*. *An overview of* degradation pathways of amino acids with detailed pathway

of phenylalanine and branched chain amino acids.

*Disorders associated with defects in protein and amino acid metabolism:* \_disorder associated with deficiency of Urea cycle enzymes, Phenylketonuria, Alcaptonuria, Maple syrup urine disease, tyrosinemia

**Metabolism of Nucleotides:** Brief outline of *Denovo* synthesis of purines and pyrimidines, salvage pathway, reduction of ribonucleotides to deoxyribonucleotides, degradation of purines and pyrimidines, nucleotide analogs as chemotherapeutic agents.

*Disorders associated with defects in nucleotide metabolism-* Gout, Lesch Nyhan Syndrome, SCID, Orotic aciduria.

**Electron-transport chain (ETC) and oxidative phosphorylation:** Constituents of ETC & their sequence (Complex I-IV) & location, inhibitors of ETC, chemiosmotic theory, ATP synthase complex- structure and function, dicarboxylic acid shuttle, glycerol phosphate shuttle, P:O ratio, regulation of oxidative phosphorylation.

***Recommended Readings:***

1. Lehningers Principles of Biochemistry by David L. Nelson and Michel M. Cox. Publisher: WH Freeman; Edition V..
2. Biochemistry by Lubert Stryer. Publisher:WH Freeman; Edition VI.
3. Harper's illustrated Biochemistry by Robert K. Murray, David A Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell, P. Anthony Weil. Publisher: McGraw Hill; Edition 28.
4. Biochemistry by Donald Voet and Judith Voet. Publisher: John Wiley and sons; Edition: II
5. Biochemistry by Mary K.Campbell & Shawn O.Farrell. Publisher: Cenage Learning. Edition

**Course outcome**

1. Understand the fundamental energetics of biochemical processes, chemical logic of metabolic pathways
2. Understanding about structure, functions and the mechanism of action of enzymes. Learning kinetics of enzyme catalyzed reactions and enzyme inhibitions and regulatory process. Exposure of wide application of enzymes.
3. Understanding about metabolic pathways – carbohydrate metabolism, lipid metabolism, metabolism of amino acids, and metabolism of nucleotides.
4. Understanding about the structure and properties of nucleic acids

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	2	2	1
	PO2	1	2	1	2
	PO3	1	1	1	2
	PO4	1	3	2	1
	PO5	1	3	1	1

**BSCGE-206-21 BIOCHEMISTRY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis

**Course Content**

1. Separation of biomolecules by electrophoresis.
2. Qualitative analysis of sugars.
3. To study the principle of spectrophotometer and verify Beer's law.
4. Quantitative estimation of DNA/RNA.
5. Quantitative estimation of protein using spectrophotometer.
6. To plot absorption spectrum of DNA and protein and find  $\lambda_{max}$ .
7. To perform biochemical assay of an enzyme under optimal conditions.
- 8 To study the effect of pH/temperature/heavy metals/ on the activity of enzymes (any one factor).
9. To determine  $K_m$  and  $V_{max}$  of an enzyme.
10. Case studies related to metabolic disorders  
Gierke's/Galactosemia, Phenylketonuria

**Course outcome**

1. Understand the principles of various fields of chemistry and biology (organic chemistry, analytical chemistry, biochemistry, genetics, metabolism, and molecular biology).
2. Understanding fundamental principles behind electrophoresis and apply them practically.
3. Quantitative determination of sugars
4. Understanding instrumentation and applications of spectroscopy, chromatography and sedimentation techniques.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	1
	PO2	1	1	1	1
	PO3	1	1	1	1
	PO4	2	2	2	1
	PO5	1	1	1	1

**BSCGE-207-21 CHEMISTRY**  
**(CREDITS: THEORY – 4 PRACTICAL - 2)**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** Understand the principles of various fields of chemistry (organic, inorganic, physical, analytical, and biochemistry).

**UNIT I**

**Periodic Table:** Atomic, ionic and covalent radii, ionization energy, electronegativity and its scales, electron affinity, Lanthanide contraction, Inert pair effect.

**Chemical bonds and molecules:** General characteristics of ionic & covalent bonds, van der Waal forces of attraction (ion- dipole, dipole-dipole, dipole-induced dipole, and dispersion forces), polar covalent bond, hydrogen bond, effects of hydrogen bonding on physical properties, structure of water, metallic bond, lattice energy, Fajan's rule, bond length, bond angle, concept of resonance, dipole moment.

**UNIT II**

**Organic reactions and their mechanisms:** Types of reactions - addition, elimination, substitution & rearrangement. Mechanism of  $S_N1$  and  $S_N2$  reactions (stereochemistry, nature of substrate, nucleophile and leaving group). Keto-enol tautomerism and its distinction from resonance. Structure and stability of reactive carbon species - carbonium ion, carbanion, free radical, carbenes.

Electronic effects in molecules (inductive, hyperconjugation and resonance effects); cleavage of covalent bonds – homolysis and heterolysis. Markownikoff and anti- markownikoff orientation; Electrophilic mono and disubstitution in benzene. Reaction mechanisms of Claisen condensation, Reimer-Tiemann reaction, Aldol condensation, Hoffman bromamide rearrangement, Cannizzaro reaction, Friedel Craft reaction, Pinacol-pinacolone rearrangement, Beckmann rearrangement.

**UNIT III**

**Chemical equilibrium :**Reversible reactions, law of mass action, equilibrium constant, ionic equilibrium, theory of indicators, factors influencing equilibrium states, relation between  $K_p$  &  $K_c$ , buffer solution, hydrolysis of salt, pH,  $K_{sp}$ , common ion effect and its applications in mixture analysis.

**Electrochemistry :**Standard electrode potential, electrochemical series, Nernst equation, Indicator & reference electrodes, pH & its measurements by glass electrode. Potentiometric determination of pH.

**UNIT IV**

**Stereochemistry:**Optical isomerism: Optical activity, polarimeter, specific rotation, enantiomerism, D & L designation, R & S sequence rules. Diastereoisomers, Isomers of tartaric acid, Geometrical Isomerism: Definition, nomenclature – E and Z

**Polynuclear Hydrocarbons and Heterocyclic Compounds :** Naphthalene, anthracene and phenanthrene (Structure, Huckle's rule, aromaticity, mechanism of substitution). Furan, pyrrole, thiophene, pyridine. (Synthesis, aromaticity, mechanism of substitution, acidity and basicity )

**Recommended Readings:**

1. J.D.Lee, Concise Inorganic Chemistry, ELBS.
2. J.E.Huheey, Inorganic Chemistry-Principles of Structure and Reactivity, Pearson Publication.
3. Shriver and Atkins, Inorganic Chemistry, Oxford Publication.



4. Satya Prakash, G.D. Tuli, S.K. Basu and R.D. Madan, Advanced Inorganic Chemistry, S. Chand Publication.
5. Morrison and Boyd, Organic Chemistry, Prentice-Hall Publication.
6. I.L.Finar, Volume I, II, Organic Chemistry, ELBS.
7. V.K. Ahluwalia and R.K. Parashar, Organic Reaction Mechanisms, Second edition, Narosa Publication.
8. S.P. Bhutani, Selected topics in Organic Chemistry, Volume 1, Vishal Publication.
9. K.L. Kapoor, A textbook of Physical Chemistry Volume 1 and 3, Macmillan Publication.

### Course outcome

1. Understanding about periodic table, chemical bonding.
2. Understanding about organic reactions and their mechanisms.
3. Understanding about the concept of stereochemistry, electrochemistry and chemical equilibrium
4. Understanding about the functional groups, their importance and functionality – carboxylic acids, alcohols, phenols, aldehydes & ketones, carbohydrates, amides, nitro compounds and primary amines

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	2	1	1
	PO3	1	1	2	2
	PO4	1	2	1	1
	PO5	1	1	1	1

## BSCGE-208-21 CHEMISTRY (LAB)

Total Marks: 50

L	T	P
0	0	4

**Course objective:** Students will gain an understanding of: chemical reactions and strategies to balance them; the relative quantities of reactants and products.

### Course Content

1. To estimate iron(II) ions by titrating with potassium dichromate, using diphenylamine indicator.
2. To estimate copper(II) ions or potassium dichromate iodometrically by titrating with sodium thiosulphate.
3. To determine surface tension of a liquid using a stalagmometer.
4. To determine viscosity of a liquid using an Ostwald viscometer.
5. To analyze the following functional groups in the given organic compound: Carboxylic acids, alcohols, phenols, aldehydes & ketones, carbohydrates (monosaccharides), amides, nitro compounds and primary amines.

### **Recommended Readings:**

1. Vogel's Textbook of Quantitative Chemical Analysis, G.F. Jeffry, J. Basset, J. Mendham and R.C. Denny, Longman Publication.
2. Comprehensive Practical Organic Chemistry, V.K. Ahluwalia and Sunita Dhingra, University Press.
3. Senior Practical Physical Chemistry, B.D. Khosla, V.C. Garg and Adarsh Gulati, R. Chand Publication

### **Course outcome**

1. Understanding about basic chemistry lab skills.
2. Understanding about working equipments and apparatuses of chemistry lab.
3. Understand the principles of various fields of chemistry (organic, inorganic, physical, analytical, and biochemistry).
4. Understanding about the concept of chemical formulation preparations.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	2	1	1
	PO5	1	1	1	1

## **BSCGE-209-21 INTRODUCTION TO COMPUTERS**

Total Marks: 100

L	T	P
4	0	0

**Course objective:** This course will develop knowledge regarding computer concepts, including fundamental functions and operations of the computer

### **UNIT I**

**FUNDAMENTAL OF COMPUTER :** Introduction to computer, Applications of computer. Components of computer. Primary and Secondary storage. Number systems.

**INTRODUCTION TO WINDOWS :** Parts of window screen (Desktop, Window, Icons), Start menu, Taskbar, settings, application & document window, anatomy of a window (Title bar, minimize, maximize button, control box, scroll bars, scroll buttons, scroll boxes), Window explorer (expansion, collapsing of directory tree, copying, moving, deleting files, folder, creating folders), About desktop icons (recycle bin, my computer, network neighbourhood, briefcase ), folder, shortcut creation, setting of screen saver, color settings , wallpaper, changing window appearance.

### **UNIT-II**

**MS-WORD :** Introduction to MS-word, Parts of window of word (Title bar, menu bar, status bar, ruler), Creation of new document, opening document, insert a document into another document. Page setup, margins, gutters, font properties, Alignment, page breaks, header, footer, deleting, moving replace, a filing text in document. Saving a document, spell checker, printing a document, creating a table, entering editing text in tables, changing format of table, height width of row or column Editing, deleting, rows, Columns in table . Borders, shading, Templates, Wizards Drawing objects, mail merge.

### **UNIT-III**

**MS-POWER POINT :** Introduction, elements of Power Point Package, starting Power Point, Exploring Power Point menus, starting a new slide, Adding Titles, Text and Art, Moving text area and resizing text box starting a slide show, saving a presentation, printing slides, opening an existing presentation, Inserting and deleting slides in a presentation, changing text and correcting error, checking spelling, adding header and footer, closing a presentation, To quit from Power Point views, slide setup, setting up slide show, setting transistors and slide timings, Automatic slide show, Formatting and Enhancing text, Slide with graph.

### **UNIT IV**

**MS-Excel /spreadsheet:** Basics of Spreadsheet/MS-excel, Parts of window of excel, Manipulation of cells; Formulas and Functions; Functions, and Formatting. Graphics and charts, Editing of Spread Sheet, printing of Spread Sheet.

#### ***Recommended Readings:***

1. Goel, A. (2010). New Delhi: Dorling Kindersly (India) Pvt. Ltd. Computer Fundamentals.
2. Kapoor, V. K. (2006). Introduction to Computers and Information System. New Delhi: Sultan Chand & Sons.
3. ITL Education Solutions Limited, R. a. (2011). Fundamentals of Computers. Delhi: Dorling Kindersley (India) Pvt. Ltd.
4. Madan, S. (2012). Fundamentals of Computers and Information System. New Delhi: Scholar Tech Press.
5. Mohan, P. (2010). Fundamentals of Computers. Mumbai: Himalaya publishing House.
6. Murthy, C. S. (2010). Fundamentals of Computers. New Delhi: Himalaya Publishing House.
7. Suri, R. K., Rajput, N., & Verma, S. (2005). Introduction to Computers and Information System. Delhi: Sun India Publications.
8. Tiwari, H. N., & Jain, H. C. (2012). Fundamentals of Computer and Information System. New Delhi: International Book House Pvt. Ltd.
9. Vallabhan, S. V. (2009). Introduction to Computer Applications in Business. Delhi: Sultan Chand & Sons.

#### **Course outcome**

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1. Understanding about use of Internet Web resources
2. Solve common business problems using appropriate Information Technology applications and systems.
3. Understanding about categories of programs, system software and applications.
4. Describe various types of networks network standards and communication software.
5. Understand MS-WORD, MS-POWER POINT, MS-EXCEL and its use.

Formulation of Course Outcomes-Program Outcomes matrix .					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	1	1
	PO2	1	3	2	1
	PO3	1	1	1	2
	PO4	1	2	2	1
	PO5	1	1	1	1

## **BSCGE-210-21 INTRODUCTION TO COMPUTERS (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course objective:** The fundamental aim of this course is to teach students the basics of computing in terms of Windows, Word, MS-POWER POINT, MS-Excel.

### **Course Content**

#### **WINDOW:**

1. Change the Background of the Desktop and also set the screen saver.
2. Create a Folder RAMAN and also create a Folder MOHAN with in the RAMAN folder.
3. Create a short cut of MS-Word on the desktop.
4. Delete some files from the MOHAN folder and also recall these files from the Recycle Bin. Empty the remaining recycle bin.
5. Copy some files from the C drive to floppy drive A using the Windows Explorer facility.

#### **MS-WORD:**

1. Create a document files, save it and print it.
2. Spell check the created document file.
3. Create a Table and sort the data within the table.
4. Mail Merge a invitation to your friends.
5. Apply border to a particular paragraph and shade it 10% with Background yellow colour.

#### **MS-POWER POINT:**

1. Create a presentation, save it and print it.
2. Format a presentation with changing the fonts and size and selecting text style and colours.
3. Creat a graph ; add titles, axes and legends to a graph.
4. Add a Clipart picture to a chart.

#### **MS-EXCEL:**

1. Create a document files, save it and print it.
2. Spell check the created document file.
3. Create a Table and sort the data within the table.
4. Apply border to a particular paragraph and shade it 10% with Background yellow colour.
5. Use of formula

### **Course outcome**

1. Understanding about components of applications software in the areas of word processing, spreadsheets, database management, presentation graphics, data communications, and Internet
2. Use operating system software in the Windows environment
3. Use software packages in word processing, spreadsheets, database management, and graphics
4. Understand about Web browsers, search engines and e-mail.

Formulation of Course Outcomes-Program Outcomes matrix.					
Program Outcome (PO)	Course Outcome (CO)				
		CO1	CO2	CO3	CO4
	PO1	1	1	2	2
	PO2	1	1	1	1
	PO3	1	1	1	2
	PO4	1	1	1	1
	PO5	1	1	1	1

### **Semester Fifth**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT311-21	Food Engineering	4	0	0	40	60	100	4
BSFT312-21	Oil & Fat Processing Technology	4	0	0	40	60	100	4
BSFT313-21	Lab- Food Engineering	0	0	4	30	20	50	2
BSFT314-21	Lab - Oil & Fat Processing Technology	0	0	4	30	20	50	2
XXXXXX	DSE -1 Theory	4	0	0	40	60	100	4
XXXXXX	DSE -1 Lab	0	0	4	30	20	50	2
XXXXXX	DSE -2 Theory	4	0	0	40	60	100	4
XXXXXX	DSE -2 Lab	0	0	4	30	20	50	2
BSFT319-21	In Plant Training Seminar	0	0	6	0	25	25	1
BMPD502-21	Mentoring and Professional Development	0	0	1	*25	--	25	1
	<b>Total</b>	<b>16</b>	<b>0</b>	<b>17</b>	<b>305</b>	<b>320</b>	<b>625</b>	<b>26</b>

**Note: \* Mentoring and Professional Development course will have internal evaluation only**

### **Discipline Specific Elective (DSE)**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSCDSE-105-21	DSE-1 Bakery Technology (Theory)	4	0	0	40	60	100	4
BSCDSE-106-21	DSE-1 Bakery Technology (Lab)	0	0	4	30	20	50	2
BSCDSE-107-21	DSE-2 Food Packaging (Theory)	4	0	0	40	60	100	4
BSCDSE-108-21	DSE-2 Food Packaging (Lab)	0	0	4	30	20	50	2

### Semester Sixth

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT321-21	Dairy Technology	4	0	0	40	60	100	4
BSFT322-21	Food Quality and Sensory Evaluation	4	0	0	40	60	100	4
BSFT323-21	Lab- Dairy Technology	0	0	4	30	20	50	2
BSFT324-21	Lab- Food Quality and Sensory Evaluation	0	0	4	30	20	50	2
XXXXXX	DSE -3 Theory	4	0	0	40	60	100	4
XXXXXX	DSE -3 Lab	0	0	4	30	20	50	2
XXXXXX	DSE -4 Theory	4	0	0	40	60	100	4
XXXXXX	DSE -4 Lab	0	0	4	30	20	50	2
BMPD602-21	Mentoring and Professional Development	0	0	1	*25	--	25	1
	<b>Total</b>	<b>16</b>	<b>0</b>	<b>17</b>	<b>305</b>	<b>320</b>	<b>625</b>	<b>25</b>

**Note: \* Mentoring and Professional Development course will have internal evaluation only**

### Discipline Specific Elective (DSE)

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSCDSE-109-21	DSE -3 Nutraceuticals and Functional Foods (Theory)	4	0	0	40	60	100	4
BSCDSE-110-21	DSE -3 Nutraceuticals and Functional Foods (Lab)	0	0	4	30	20	50	2
BSCDSE-111-21	DSE -4 Food Plant Sanitation (Theory)	4	0	0	40	60	100	4
BSCDSE-112-21	DSE -4 Food Plant Sanitation (Lab)	0	0	4	30	20	50	2

# SEMESTER FIFTH



## BSFT311-21: FOOD ENGINEERING

Total Marks: 100

L	T	P
4	0	0

### UNIT I

**Introduction:** Concept of Unit operation, Units and dimensions, Unit conversions, dimensional analysis, Mass and Energy Balance. Related numerical

**Design of food plant:** Important considerations for designing of food plants, Types of layout

**Grinding and mixing:** Principle and equipments used in food industry

### UNIT II

**Fluid Flow in food Processing:** Liquid Transport systems, Properties of Liquids, Newton's Law of Viscosity, Principle of Capillary tube and rotational viscometer, Properties of Non-Newtonian fluids, Flow characteristics, Reynolds Number, Bernoulli's Equation, Concept of Flow Measurement devices,

Related basic numericals

**Refrigeration and Freezing:** Concept and selection of a refrigerant, Description of a Refrigeration cycle, Pressure Enthalpy charts and Tables, Mathematical expressions useful in analysis of vapour compression refrigeration cycle, Numericals based on VCR system, Freon 12 and R-717, superheating and sub cooling, Freezing time calculation using Plank's Equation, Frozen food storage

Related basic numericals

### UNIT III

**Heat and Mass Transfer:** Systems for heating and cooling food products, Thermal Properties of Food, Modes of heat transfer, Application of steady state heat transfer- estimation of conductive heat transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and, design of tubular heat exchanger. Related basic numericals, Fick's Law of Diffusion, Membrane separation systems-Electrodialysis system, Reverse Osmosis, Membrane System, and Ultrafiltration Membrane System, Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices.

### UNIT IV

**Psychrometrics:** Properties of Dry Air, Properties of Water Vapour, Properties of air Vapour mixture, Psychrometric Chart, Related basic numericals

**Steam, Evaporation and Dehydration:** Generation of steam, Construction and functions of fire tube and water tube boilers, Thermodynamics of Phase change, Steam tables, Boiling point elevation Types of evaporations, Design of single effect evaporators, Basic Drying Process, Moisture content on wet basis and dry basis, Dehydration systems, Dehydration system Design. Related basic numericals

***Recommended Readings***

- 1) Rao DG. 2010. Fundamentals of food engineering. PHI learning private ltd.
- 2) Singh RP and Heldman DR.1993, 2003, 2009. Introduction to food engineering. Academic press  
2nd, 3rd and 4th edition.
- 3) Rao C G 2006 Essentials of food process engineering. B S publications
- 4) Fellow P. 1988. Food processing technology

## BSFT312-21: OIL AND FAT PROCESSING TECHNOLOGY

Total Marks: 100

L	T	P
4	0	0

### UNIT I

Sources; chemical composition; physical and chemical characteristics; functional and nutritional importance of dietary oils and fats. Post-harvest handling storage and processing of oilseeds for direct use and consumption.

### UNIT II

Extraction of oil by mechanical expelling and solvent extraction and obtaining deoiled cakes suitable for edible purposes. Processing of other plant sources of edible oils and fats like coconut, cottonseed, rice bran, maize germ, etc.

### UNIT III

**Refining:** Clarification, degumming, neutralization (alkali refining), bleaching, deodorization techniques / processes. Blending of oils.

**Processing of refined oils:** Hydrogenation, fractionation, winterization, inter-esterification etc. for obtaining tailor-made fats and oils.

### UNIT IV

Production of butter oil, lard, tallow, Margarine, Cocoa butter equivalents, shortenings, low fat spreads, peanut butter etc. Speciality fats and designer lipids for nutrition and dietetics, especially by biotechnology.

### *Recommended Readings*

1. Bailey's Industrial Oil & Fat Products, 4th ed. John Wiley & Sons.
2. The Industrial Chemistry of Fats & Waxes 3rd. by Balliere, Tindall & Cox.
3. Handling & Storage of Oilseeds, Oils, Fats & Meal by Paterson, HBW.
4. Modern Technology in the Oils & Fats industry by S.C. Singhal, OTA (I).

**BSFT313-21: FOOD ENGINEERING (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Content**

1. Plant layout design
2. Determination of drying characteristics
3. Determination of viscosity of Newtonian and non Newtonian fluids
4. Study of effect of temperature on viscosity
5. Screen analysis of food sample
6. Study of evaporation process
7. Freezing time calculation
8. Psychrometrics- use and application.

**BSFT314-21: OIL AND FAT PROCESSING TECHNOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Content**

1. Determination of moisture content in fat.
2. Determination of melting point of fat.
3. Determination of specific gravity of fat.
4. Determination of % impurities / gum in fat.
5. Qualitative checking of various adulterants in labs.
6. Extraction of oil from rice brain, pellets and spent wash.
7. Determination of iodine value.
8. Determination of saponification value.
9. Determination of free fatty acids.
10. Determination of unssaponifiable matter.
11. Colour measurement of fat.
12. Determination of RM &P value.
13. Determination of refractive index of fat.
14. Effect of particle size on the amount of oil extracted
15. To visit oil processing industry

**BMPD502-21 MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A**  
**(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B**  
**(Outdoor Activities)**

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

# SEMESTER SIXTH

## BSFT321-21: DAIRY TECHNOLOGY

Total Marks: 100

L	T	P
4	0	0

### UNIT I

Dairy industry in India: scope, strengths and opportunities for dairy industry.

Definition, composition and nutritive value of milk, Environmental and biological factors affecting composition of milk. Physicochemical properties of milk. Milk lipids: chemical properties, structure, fat destabilization, functional properties. Chemical reactions of fat (hydrolysis, auto-oxidation), condition favouring auto-oxidation, prevention, measurement of auto-oxidation. Milk proteins: types, protein precipitation (casein micellar structure and its aggregation). Milk enzymes- catalase, alkaline phosphatase, lipases and proteases, enzymatic and acid coagulation of milk

### UNIT II

**Market milk industry and milk products:** Systems of collection of milk Reception, Platform testing; Brief introduction to Standard milk, Toned milk, Double toned milk, Flavoured milk, Vitamin enriched milk, Reconstituted milk and recombined milk. Legal and ISI standards of milk. Adulteration of milk and its detection. Common preservative used in milk and their detection. Clean milk production. Various stages of processing, Filtration, Clarification, Storage and processing of fluid milk: pasteurization, sterilization, homogenization, UHT processing and aseptic packaging. Standardization of milk.

**Cream:** Different types of cream with their respective fat content, composition of cream, production methods. Factors affecting the richness of cream produced by cream separator. Efficiency of cream separator. Ripening of cream for butter making: natural ripening, ripening with the use of starter cultures. Objects of cream ripening. Various changes during the ripening of cream.

### UNIT III

**Butter :** Types of butter, composition. Preparation of butter. Factors affecting the churnability of cream. Churning theories. Grading of butter, Defects of butter their possible causes and their remedies. Standards of butter and shelf life.

**Cheese:** Classification of cheese. Quality of milk for cheese. Preparation methods of cheddar cheese.

**Indigenous milk products** - dahi, ghee, channa, paneer, shrikhand etc. Utilization of milk industry by-products- importance/need and food applications.

### UNIT IV

**Ice Cream:** Different types of ice creams and their composition. Ingredients used and their role in processing. Manufacturing process. Defects of ice cream, their causes and remedies.

**Condensed and evaporated milk:** Definition, composition & standards. Condensing operations.

**Dried milk products:** Introduction, objects of production, standards and composition. Preparation of dried milk and milk powder by roller and spray drying methods. Packaging and storage. Malted milk powders and infant milk food.



***Recommended readings:***

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford. 2007.
2. Webb and Johnson, Fundamentals of Dairy Chemistry, 3<sup>rd</sup> ed., CBS Publishers, New Delhi 1988
3. Byron, H. W., Arnold, H. J. & John, A. A. (1987). *Fundamentals of Dairy Chemistry* (2<sup>nd</sup> ed.): CBS, Delhi.
4. Atherton, H. V. & Newlander, J. A. (1987). *Chemistry and Testing of Dairy Products* (4<sup>th</sup> ed.): CBS, New Delhi.
5. Wong, N. P. (1988). Fundamentals of Dairy Chemistry (3<sup>rd</sup> ed.): VNR, New York.
6. Cheke, V. & Shepard, A. (1997). Cheese and Buller: Allied, Bikaner.

## BSFT322-21: FOOD QUALITY AND SENSORY EVALUATION

Total Marks: 100

L	T	P
4	0	0

### UNIT I

**Introduction to quality attributes of food:** Appearance, flavor, textural factors and additional quality factors.

### UNIT II

**Gustation:** Introduction and importance of gustation, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands. Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Factors affecting taste quality, reaction time, taste modification, absolute and recognition threshold, Taste measurement- Electronic Tongue; Taste abnormalities

### UNIT III

**Olfaction:** Introduction, definition and importance of odour and flavor; Anatomy of nose, physiology of odour perception; Mechanism of odour perception, Theories of odour classification, chemical specificity of odour. Odour measurement techniques – historical perspective and emphasis on recent techniques- e- nose etc. Olfactory abnormalities

### UNIT IV

**Colour:** Introduction and importance of colour; Dimensions of colour and attributes of colour; gloss etc.; Perception of colour.; Colour Measurement: Munsell colour system, CIE colour system, Hunter colour system, etc.; Colour abnormalities

**Texture:** Introduction, definition and importance of texture; Phases of oral processing; Texture perception, receptors involved in texture perception; Rheology of foods; Texture classification; Texture measurement – basic rheological models, forces involved in texture measurement and recent advances in texture evaluation. Application of texture measurement in cereals, fruits and vegetables, dairy, meat and meat products

### *Recommended Readings*

1. Rao E. S. (2013). Food Quality Evaluation. Variety Books.
2. Pomeranz Y and Meloan CE (2002). Food Analysis – Theory and Practice, CBS Publishers and Distributors, New Delhi.
3. deMan J. (2007). Principles of Food Chemistry, 3<sup>rd</sup> ed., Springer.
4. Meilgard (1999). Sensory Evaluation Techniques, 3<sup>rd</sup> ed. CRC Press LLC, 1999.
5. Amerine, Pangborn & Roessler (1965). Principles of Sensory Evaluation of food, Academic Press, London.

**BSFT323-21: DAIRY TECHNOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Content**

1. Sampling of milk and milk products,
2. Platform tests of milk:
  - a. Organoleptic test,
  - b. Sediment test,
  - c. COB test,
  - d. Alcohol test,
  - e. Alcohol-Alizarin test,
  - f. Titratable acidity and
  - g. pH milk.
3. To estimate milk protein by Folin method.
4. To estimate milk fat by Gerber method
5. Determination of specific gravity of milk,
6. Total solids and solid-not-fat using lactometer,
7. Detection of milk adulterant-
  - a. Added water,
  - b. Starch,
  - c. Cane sugar,
  - d. Neutralizers and
  - e. Preservatives (formalin and hydrogen peroxide),
  - f. Synthetic milk (urea test, detergent test, common salt),
8. To prepare casein and calculate its yield.
9. Alkaline phosphatase test to determine adequacy of pasteurization.
10. Preparation of flavoured milk/. Pasteurization of milk
11. Peroxide value, Iodine value of ghee,
12. Acid value of ghee,
13. Saponification value of ghee,
14. Development of ice cream

**BSFT324-21: FOOD QUALITY AND SENSORY EVALUATION (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Content**

1. Training of sensory panel.
2. To perform sensitivity tests for four basic tastes
3. To perform analytical and affective tests of sensory evaluation.
4. Recognition tests for various food flavors.
5. Sensory evaluation of milk and milk products.
6. Flavor defects in milk
7. Extraction of pigments from various fruits and vegetables and study the effect of temperature and pH
8. Texture evaluation of various food samples- cookies/ biscuits/ snack foods
9. Textural measurement of various food products using Texture Analyzer
10. Measurement of colour by using Tintometer/ Hunter Colour Lab etc.

**BMPD602-21 MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

**Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

**Part – A**  
**(Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

**Part – B**  
**(Outdoor Activities)**

3. Sports/NSS/NCC
4. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

## **Scheme & Syllabus of** **Bachelor of Science (Hons) in Food Technology** **B.Sc. (Hons) Food Technology**

### **Batch 2021 onwards**



By

Board of Study Food Science and Engineering

Department of Academics

**I.K. Gujral Punjab Technical University**

### **Semester Seventh**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT411-21	Spices & Flavor Technology	4	0	0	40	60	100	4
BSFT412-21	Grain storage	4	0	0	40	60	100	4
	SEEC-3	0	0	4	30	20	50	2
BSFT413-21	Spices & Flavor Technology (Lab)	0	0	4	30	20	50	2
BSFT414-21	Grain Storage (Lab)	0	0	4	30	20	50	2
BSFT415-21	In Plant Training Seminar	0	0	6	--	75	75	3
BSFT416-21	Dissertation -I	0	0	8	Satisfactory/Unsatisfactory			4
	Mentoring and Professional Development	0	0	1	25	--	25	1
	<b>Total</b>	<b>8</b>	<b>0</b>	<b>27</b>				<b>22</b>

### **Skill Enhancement Elective Courses (SEEC)**

					Distribution			
		L	T	P	Internal	External		
BSCSEC-103-21	Food Fermentation Technology (Lab)	0	0	4	30	20	50	2
BSCSEC-102-21	Food Product Development (Lab)	0	0	4	30	20	50	2

### **Semester Eighth**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSFT421-21	Food Analysis & Instrumentation	4	0	0	40	60	100	4
BSFT422-21	Food Analysis & Instrumentation (Lab)	0	0	4	30	20	50	2
	DSE -5	4	0	0	40	60	100	4
	Lab- DSE 5	0	0	4	30	20	50	2
BSFT423-21	Seminar	0	0	4	30	20	50	2
BSFT424-21	Dissertation -II	0	0	12	Satisfactory/Unsatisfactory			6
	Mentoring and Professional Development	0	0	1	25	--	25	1
	<b>Total</b>	<b>8</b>	<b>0</b>	<b>25</b>				<b>21</b>

### **Discipline Specific Elective (DSE)**

					Distribution			
		L	T	P	Internal	External		
BSCDSE-101-21	Food Safety	4	0	0	40	60	100	4
BSCDSE-102-21	Food Safety (Lab)	0	0	4	30	20	50	2
BSCDSE-103-21	Food Quality Management	4	0	0	40	60	100	4
BSCDSE-104-21	Food Quality Management (Lab)	0	0	4	30	20	50	2



# SEMESTER SEVENTH

## BSFT411-21: SPICES AND FLAVOR TECHNOLOGY

Total Marks: 100

L	T	P
4	0	0

**Course Objective:** To provide students with comprehensive knowledge of spices and flavor technology, preparing them for the spice and flavor processing industries.

### UNIT I

**Introduction:** Status and scope of spice and flavour processing industries in India; Spices, Herbs and seasonings: sources, production, selection criteria; flavours: commercially available materials, classification on the basis of origin, physical characteristic.

### UNIT II

**Processing technology of Spices:** Chemical composition of spices; processing methods: equipments used in the processing of spices; spice encapsulation; recent developments in production, retention and recovery of spices; effect of processing on spice quality: contamination of spices with microorganisms and insects.

**Spice Essential Oils:** Definition, methods of extraction, isolation, separation equipment's.

### UNIT III

**Flavour Technology:** Essence(flavour) recovery techniques from fruits,spices and herbs along with the equipment used: liquid and Solid flavour production; Flavouring remixing:flavour intensifiers: synthetic flavours; effect of processing on flavour quality.

### UNIT III

**Spice Oleoresins:** Definition, method of extraction, isolation, separation equipment.

**Spices and flavour quality evaluation:** Criteria for assessment of flavour quality; identification of natural food flavours; methods of flavour evaluation (chemical, instrumental, sensory); National and international standards for flavouring materials and flavours.

### *Recommended Readings*

- 1 Peter K.V.2001. Handbook of Spices, Woodhead Publishers,UK.
2. Pruthi, J.S.,1976, Spices and Condiments, NBT India.
3. Reineccius,G, Source book of flavor, CBS
4. Morton,I.D., Macleod ,A.J, Food Flavours, AVI

**Course Outcome:** Upon successful completion of this course, students will be able to:

1. Understand the significance and scope of spice and flavor processing industries, distinguishing between spices, herbs, and seasonings based on production and selection criteria.
2. Analyze the chemical composition of spices and evaluate the impact of processing methods on quality, including recent advancements in spice encapsulation and production techniques.
3. Apply methods of extraction and isolation for spice essential oils and oleoresins, utilizing appropriate equipment.
4. Demonstrate proficiency in essence recovery techniques from fruits, spices, and herbs, employing both liquid and solid flavor production methods.
5. Evaluate spice and flavor quality using sensory, chemical, and instrumental methods, adhering to national and international standards for flavoring materials.

## BSFT412-21: GRAIN STORAGE

Total Marks: 100

L	T	P
4	0	0

**Course Objective:** To provide students with comprehensive knowledge and skills in the principles and practices of grain storage, focusing on understanding the challenges, methods, and technologies employed in ensuring the quality and safety of stored food grains.

### UNIT I

General problems of storage. Sources and detection of infestation in stored food grains.

Causes, types and content deterioration in stored food grains and methods to check them.

### UNIT II

Traditional and modern methods of bag and bulk storage.

Insect pest of stored grain. Chemical, non chemical and integrated methods of controlling stored grain insect pest.

### UNIT III

Toxic contamination in good grains, their ill effects.

Pesticidal contamination tolerance limits, residue and precautions of safe handling of pesticides. Cleaning aeration and drying of stored products at farmers, commercial and Govt. levels.

### UNIT IV

Role of moisture in spoilage of stored grains. Categorization of food grains for storage, Principle of godown sanitation and hygiene.

### *Recommended Readings*

1. Metalf & Lukemann. Introduction of Insect
2. Mollan. Pesticides and Pollution.

**Course Outcome:** Upon successful completion of this course, students will be able to:

1. Identify and address challenges in grain storage, including infestation detection and methods to mitigate deterioration.
2. Evaluate traditional and modern storage techniques, considering their effectiveness and limitations.
3. Implement integrated pest management strategies to control insect pests in stored grains.
4. Assess toxic contaminants in grains, understand pesticide handling precautions, and ensure safe residue management.
5. Apply principles of moisture control, grain categorization, and sanitation for maintaining grain quality and safety in various agricultural settings.

**BSFT413-21: SPICES AND FLAVOR TECHNOLOGY (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Objective:** To provide students with practical skills and theoretical knowledge in the analysis and evaluation of spices and flavors, focusing on essential techniques such as moisture determination, ash content analysis, pungency assessment, adulteration testing, organoleptic evaluation, and identification methods.

**Course Content**

1. Determination of moisture in ground spices.
2. Determination of total ash in spices.
3. Determination of extraneous matter in spices.
4. Determination of pungency rating (Scoville method) in Red Pepper.
5. Adulteration tests for different spices.
6. Organoleptic evaluation of flavours.
7. Identification of Saffron by sulphuric – diphenylamine test.

**Course Outcome:** Upon successful completion of this online lab course, students will be able to:

1. Perform accurate moisture determination in ground spices, ensuring quality control.
2. Conduct precise total ash analysis to assess mineral content and purity of spices.
3. Identify extraneous matter in spices through effective analytical methods.
4. Evaluate pungency using the Scoville method, applying principles of sensory analysis.
5. Conduct adulteration tests on various spices, demonstrating proficiency in detection methods.

**BSFT414-21: GRAIN STORAGE (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Objective:** To provide students with practical hands-on experience in essential techniques and procedures related to grain storage, focusing on quality assessment, pest management, and understanding the factors affecting grain spoilage and shelf life.

**Course Content**

1. To study various insect pests of grains.
2. To study the quality tests for grains.
3. To store the grains and check their shelf life.
4. To study the various pesticides used for grain storage.
5. To study the effect of moisture on spoilage of grains.
6. Visit grain storage godowns.

**Course Outcome:** Upon successful completion of this lab course, students will be able to:

1. Identify and classify insect pests affecting grains through practical observation.
2. Perform quality tests to assess grain properties crucial for storage suitability.
3. Apply proper storage techniques and monitor grain shelf life in controlled conditions.
4. Evaluate the effectiveness of various pesticides used in grain storage through practical application.
5. Investigate the impact of moisture on grain spoilage and apply principles of moisture control in practical scenarios.

## **MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

### **Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

#### **Part – A (Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

#### **Part – B (Outdoor Activities)**

13. Sports/NSS/NCC
14. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

# SEMESTER EIGHTH

## **BSFT421-21: FOOD ANALYSIS & INSTRUMENTATION**

Total Marks: 100

L	T	P
4	0	0

### **UNIT I**

Brief introduction and principles: Spectroscopic techniques using UV/Visible, polarimetry, refractometry, microscopic techniques in food analysis (light microscopy).

Electron microscopy: principle and brief introduction to types of electron microscopy (SEM, TEM): application of electron microscopy in food processing.

### **UNIT II**

Principle and working of Column chromatography, Gas chromatography and High Pressure Liquid Chromatography.

### **UNIT III**

Brief introduction and principles to Separation techniques: ultrafiltration and supercritical fluid extraction.

Brief introduction and principles to Special techniques: surface tension; thermal methods in food analysis (Differential scanning calorimetry).

### **UNIT IV**

Texture analyzer, rheometer, hunterlab, amylograph and farinograph, calorimeter.

### ***Recommended Readings***

1. AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities.
2. Kirk RS & Sawyer R. 1991. Pearson's Chemical Analysis of Foods. 9th Ed. Longman Scientific & Technical.
3. Nielsen S. (Eds.). 1994. Introduction to Chemical Analysis of Foods. Jones & Bartlett.
4. Pomrenz Y & Meloan CE. 1996. Food Analysis - Theory and Practice. 3rd Ed. CBS.
5. Ranganna S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd Ed. Tata-McGraw-Hill.



**BSFT422-21: FOOD ANALYSIS & INSTRUMENTATION (LAB)**

Total Marks: 50

L	T	P
0	0	4

**Course Objective:** To provide students with hands-on experience and theoretical understanding of advanced techniques and instruments used in food analysis, focusing on practical applications such as water activity measurement, spectrometric analysis, chromatography, enzymatic assays, and demonstration of analytical instruments.

**Course Content**

1. Sorption isotherms by measuring water activity in any hygroscopic food material (for instance - biscuits/potato chips/coffee powder).
2. Estimation of tannin/phytic acid/ pigments by spectrometric method.
3. Separation of macromolecules/coal tar dyes by paper chromatography.
4. Separation and identification of carotenoids by column chromatography.
5. Analysis of dietary fibre/glucose by enzymatic method.
6. Demonstration of instruments : GLC, HPLC, Atomic absorption, Flame photometer, Farinograph, UV-Vis spectrophotometer and microscopes.

**Course Outcome:** Upon successful completion of this online lab course, students will be able to:

1. Measure water activity in hygroscopic food materials like biscuits, potato chips, or coffee powder, interpreting sorption isotherms for quality assessment.
2. Estimate tannin, phytic acid, and pigments using spectrometric methods, demonstrating proficiency in quantitative analysis.
3. Perform two-dimensional paper chromatography to separate and analyze macromolecules or coal tar dyes, applying chromatographic principles.
4. Utilize column chromatography for separation and identification of carotenoids, demonstrating understanding of chromatographic techniques.
5. Analyze dietary fiber and glucose content using enzymatic methods, ensuring accurate nutritional assessment of food samples.

## **MENTORING AND PROFESSIONAL DEVELOPMENT**

Total Marks: 25

L	T	P
1	0	0

### **Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

#### **Part – A (Class Activities)**

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

#### **Part – B (Outdoor Activities)**

15. Sports/NSS/NCC
16. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B  
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.