Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BE-331	**Title of the Course**	UNIT OPERATIONS IN FOOD PROCESSING	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	5th	**3**	**1**	**0**	**4**
Pre-Requisite	BE-238	**Co-requisite**	None				
Course Objectives	This course is aimed to impart basic knowledge about components of different process equipment and unit operation associated with them.						

Course Outcomes	
CO1	Be well versed with food process engineering calculations
CO2	Explain the principles of different types of material handling equipments and their application.
CO3	Acquire knowledge on importance of size reduction and energy requirement
CO4	Explain mechanism of crystallization, distillation and leaching process
CO5	Explain the principles of mixing and homogenization.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Cleaning and Conveying**	Preliminary unit operation: Cleaning, sorting and grading – aims, methods and applications, physical properties of food materials. Conveying and Handling: Various unit operations in post-harvest handling, study of different conveying systems like belt conveyors, chain conveyors, screw conveyors, pneumatic conveyors, vibrating and oscillating conveyors, bucket elevators – their selection, operation and maintenance.	8	1
2	**Size Reduction and Sieve Analysis**	Theory of commination, size reduction laws- calculation of energy required during size reduction, size reduction equipment's: Crushers–grinders, ultrafine grinders, cutters, size enlargement. Effects of size reduction on sensory characteristics and nutritive value of food. Sieving, separation based on size (mesh size), Types of screens: stationary screens – grizzlies, gyrating screens, vibratory screens, and effectiveness of screens.	8	2
3	**Mixing and Homogenization**	Mixing & Agitation: Measurement of mixing, rate of mixing, liquid mixing, mixing equipments-liquid mixer, powder & particle mixer, dough & paste mixer, jet mixer, static mixer, purpose of agitation, agitated vessels – impellors, propellers & turbines, kneading, Homogenization - Principle & equipment.	8	3
4	**Separation Process**	Filtration-principle of filtration; types of filtration. Equipment- filter press, rotary drum, shell & leaf filter, vacuum filter, centrifugal filter, filter media, filter aid, filter cake.	8	4
5	**Other Unit Operations**	Ultrafiltration, membrane filtration, reverse osmosis. Sedimentation- Stoke's law. Free and hindered settling. Crystallization, nucleation, crystal growth.	8	5

Reference Books:

1. Sahay, K.M. and Singh, K. K. 1998. Unit Operations of Agricultural Processing, Kalya Publishers, Ludhiana.
2. Mcabe W. L. and Smith J. C. 2005. Unit operations of chemical engineering. McGraw Hill Publication.
3. GeanKoplis C. J. (3rd Edition). Transport processes in unit operations. Prentice Hall of India.
4. P.Fellows. 2000. Food processing technology. Principles and practice. Ellis Horwood England and V C H publishers Germany.

e-Learning Source:

1. https://onlinecourses.nptel.ac.in/noc22_ag08/preview
2. http://ecoursesonline.iasri.res.in/course/view.php?id=172
3. https://www.classcentral.com/course/swayam-thermal-operations-in-food-process-engineering-theory-and-applications-14333
4. https://www.youtube.com/watch?v=fIX-nOHHExs

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	1	1	3	3	1	1	1	1	2	1	3	3	1	3			
CO2	1	1	1	3	3	1	1	1	1	2	1	3	3	1	3			
CO3	1	1	1	3	3	1	1	1	1	2	1	3	3	1	3			
CO4	1	1	1	3	3	1	1	1	1	2	1	3	3	1	3			
CO5	1	1	1	3	3	1	1	1	1	2	1	3	3	1	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BE332	**Title of the Course**	Post-Harvest Physiology, Handling, And Storage Of Fruits And Vegetables	**L**	**T**	**P**	**C**
Year	III	**Semester**	V	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	This course deals with the post-harvest physiology of horticultural commodities, e.g., tubers, fruits, and vegetables. Control of post-harvest losses (Prevention of moisture losses, mechanical damage, injuries, microbial infection, etc.). Post-harvest quality changes and their evaluation in fruits and vegetables. Refrigeration and cooling systems.						

Course Outcomes	
CO1	To study the composition and nutritive value of important fruits and vegetables.
CO2	To understand the process of respiration and biosynthesis of ethylene.
CO3	To understand the physiology of ripening.
CO4	To Understand the postharvest handling and losses
CO5	To understand the various storage technology to reduce post harvest losses.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction and Composition	Composition and nutritive value of important fruits and vegetables. Post-harvest changes in fruits and vegetables. Factors responsible for changes in color, texture, and flavor after harvest.	8	CO1
2	Respiration	Respiration and water loss; Physiology of respiration. Factors affecting rate of respiration. Respiratory quotient and calculations based on Q10. Loss of water from harvested horticultural crops. Biosynthesis of ethylene- it is regulation and action on harvested fruits. Role of ethylene in fruit ripening. Various controlling agents are used to regulate ethylene action.	8	CO2
3	Physiology	Ripening process; Fruit maturation and ripening. Physiological changes occur during the ripening of fleshy fruits. Climacteric and non-climacteric fruits. Climacteric drift with special reference to apple and avocado. Non-ripening mutants of tomato.	8	CO3
4	Post-Harvest Handling and Losses	Post-harvest handling and transportation of fruits and vegetables; Its Importance and Need. Perishable and durable crops, post-harvest losses in fruits and vegetables. Maturity indices for harvesting- Cooling of products and methods of transportation.	8	CO4
5	Storage Technology	Storage systems for fruits and vegetables; Types of storage; zero energy cool chamber, low-temperature storage, hypobaric storage, modified atmospheric storage, controlled atmospheric storage.	8	CO5

Reference Books:

1. Kadar AA.1992. *Post-harvest Technology of Horticultural Crops.2nd* Ed. University of California.
2. Pantastico B. 1975. *Post-Harvest Physiology, Handling, and Utilization of Tropical and Subtropical Fruits and Vegetables.* AVI Publ.
3. Salunkhe DK, Bolia HR & Reddy NR. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables.* Vol. I. *Fruits and Vegetables.* CRC.
4. Thompson AK. 1995. *Post-Harvest Technology of Fruits and Vegetables. Blackwell* Sci.
5. Verma LR. & Joshi VK. 2000. *Post-Harvest Technology of Fruits and Vegetables.* Indus Publ.
6. Lloyd, A. &Penizer, R. 1998. *Handling, transportation, and storage of fruits and vegetables,* AVI Publications.

e-Learning Source:

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	3	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	2	2	2	3	3	3	1	1	2	3	3	3	3
CO3	3	2	2	2	3	2	3	3	1	1	2	3	3	3	3
CO4	3	3	2	2	3	2	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BE-333	**Title of the Course**	Cereal and Legume Technology	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	5th	**2**	**1**	**0**	**3**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	This subject is aimed to impart the basic knowledge about the nutritional value and properties of different cereals and legumes.						

Course Outcomes	
CO1	Understand basic composition & structure of food grain.
CO2	Understand the basics of milling operations.
CO3	Learn processing of food grains into value added products.
CO4	Learn to manage by products utilization.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	General introduction, production and utilization trends. Structure of different grains- Wheat, Rice, Barley, Oat, Corn, beans, peas and Millets. Chemical composition of cereals and pulses.	8	1
2	Wheat	Wheat: Types and physicochemical characteristics; wheat milling -products and byproducts; Flour milling, extraction rate and milling systems (Flow diagrams). Improvers and bleachers used in flour. Significance of ingredients used in bakery products like bread, biscuits, cake etc. and preparation method of the same.	8	2
3	Rice	Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Parboiling of paddy. Rice bran oil and its properties.	8	3
4	Other Cereals and Legumes	Wet and dry milling of maize. Preparation of oat flakes, porridge (dalia) and oat meal. Pearling and Malting of Barley. Technology of other cereals. Legumes: composition, anti-nutritional factors, processing and storage. Processing of legumes for protein concentrates and isolates. Milling of pulses.	8	4

Reference Books:

Chakrabarty MM. 2003. *Chemistry and Technology of Oils and Fats*. Prentice Hall.

Dendy DAV & Dobraszczyk BJ. 2001. *Cereal and Cereal Products*. Aspen.

Hoseney RS. 1994. *Principles of Cereal Science and Technology*. 2nd Ed. AACC.

Kay DE. 1979. *Food Legumes*. Tropical Products Institute.

e-Learning Source:

Legume Science - Wiley Online Library

Cereal Chemistry - Wiley Online Library

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**	**3**			
CO2	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**	**3**			
CO3	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**	**3**			
CO4	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**	**3**			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BE334	**Title of the Course**	Dairy Product Technology	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**2**	**1**	**0**	**3**
Pre-Requisite	**BE 242**	**Co-requisite**	**BE-337**				
Course Objectives	The objective is to impart valuable training and guidance to the students on packaging, processing, transportation, storage and distribution of dairy products.						

Course Outcomes	
CO1	Understand the technology of concentrated and dried milk
CO2	To gain knowledge about chemistry, technology and microbiology of Fat rich dairy products
CO3	To understand technology of frozen and traditional dairy products
CO4	Understand the hygiene and sanitation in dairy processing plant

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Concentrated and Dried Milk Technology	Concentrated and dried milk products- Basic technology of concentration and drying. Manufacture of concentrated milk, bulk condensed milk, canned evaporated milk, sweetened condensed milk and recombined concentrated milk. Manufacture of skim milk powder, whole milk and high fat milk powder. Changes affecting structure and quality of concentrated and dried milk products. Microbiology of concentrated and dried milk products. Nutritive value of concentrated and dried milk products	8	1
2	Fat Rich Dairy Products Technology	Cream, butter, margarine, spreads and cheeses- Handling of cream, processing of single, double, and coffee, whipped, scalded, dried and frozen creams. Chemistry and microbiology of cream and its application in non-dairy products. Chemistry, technology and microbiology of butter, margarine, spreads. Nutritive value of cream based milk products.	8	2
3	Frozen and Traditional Dairy Products Technology	Frozen and Indian dairy products- Ice cream-role of ingredients, technology of ice creams, low fat frozen desserts, sherbets and ices. Phsico-chemical nature of ice cream and microbiology of ice creams. Scope if Indian dairy products. Manufacture of Dahi, Srikand, Panir, Ghee, Khoa and Channa.	8	3
4	Hygiene and Sanitation	Dairy hygiene and sanitation-Introduction to hygiene and sanitation, CIP and COP scheduling, deposit formation, cleaning and disinfection. Legal standards for milk and milk products.	8	4

Reference Books:

1. Smit, Gerrit. 2003. Dairy processing: improving quality, Woodhead publishing limited, England.
2. De, Sukumar. 1991. Outlines of dairy technology, Oxford university press, Delhi.
3. Varnam, A.H., Sutherland, J.P. 1994. Milk and milk products, Chapman and Hall, New York, USA
4. Walstra, P., Geurts, T.J., Noomen, A., Jellema, A., Boekel, M.A.J.S. 1999. Dairy Technology: Principles of milk properties and processes, Marcel Dekker Inc, New York.

e-Learning Source:

Journal of Dairy Science

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	2	1	2	1	1	1	1	1	1	1	2	3	3	2	3			
CO2	2	1	2	1	1	1	1	1	1	1	2	3	3	2	3			
CO3	2	1	2	1	1	1	1	1	1	1	2	3	3	2	3			
CO4	2	1	2	1	1	1	1	1	1	1	2	3	3	2	3			

1- 2Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2021							
Course Code	BE 335	**Title of the Course**	FOOD ADDITIVES AND INGREDIENTS	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	2	1	0	3
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The objective is to impart knowledge about various categories of food additives their functions, permissible limits to be used in various food products.						

Course Outcomes	
CO1	Understand the role of food additives in manufacturing of food products, safety evaluation and regulation
CO2	To acquire knowledge regarding chemistry, applications, and International numbering system for food additives
CO3	To understand the role of coloring, flavoring, chelating, stabilizing, and thickening agents & their interactions.
CO4	To understand role of various ingredients in food production and their chemistry

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Additives in food processing and preservation**	Additives in food processing and preservation - classification and their functions. Safety and quality evaluation of additives and contaminants, acute and chronic studies, NOAEL, ADI, LD50. Indirect food additives. GRAS and naturally occurring compounds.	8	CO1
2	**Classification of Additives**	Various additives such as preservatives, antioxidants, antimicrobials, colors, flavor, emulsifiers, humectants, hydrocolloids, sweeteners, acidulants, anticaking agents, buffering salts etc. with respect to chemistry, food uses and functions in food formulations acids, bases and buffers. International numbering system for Food Additives.	8	CO2
3	**Food colorants**	Food colorants: Introduction; Natural & Synthetic food colorants; Classification of Food colorants; Impact on health. Pigments: Importance; Chelating agents- Naturally & synthetic; Mode of action of chelating agents; Applications of antioxidants and chelating agents, Stabilizers, thickeners, Bleaching & maturing agents, Taste and Flavoring agents: Introduction; Classification of flavors- natural & synthetic; Flavor enhancer/ Potentatior	8	CO3
4	**Ingredients used in food production Ingredients used in food production**	Ingredients used in food production e.g. sugar, starches/modified starches, fibres, proteins/protein hydrolysates and fats etc and their technology of production and application. Sugars and Sweeteners: Sugars, syrups, sugar alcohols, potent sweeteners, sugar products, caramelization. Sweetener chemistry related to usage in food products.	8	CO4

Reference Books:

1. Branen, A. F. et al, Food Additives; Marcel Dekker.
2. George, A. B., Encyclopedia of food and color additives, Vol III; CRC Press.
3. Nakai, S. and Modler, H. W, Food proteins. Processing Applications; Wiley
4. Inteaz Ali, Food Quality Assurance-Principles and Practices; CHIPS, Texas.

e-Learning Source:

https://drive.google.com/open?id=1a73lvsoXtlJTUsLjl7YHXRXnkdI8g5fl&authuser=0

https://drive.google.com/open?id=1a73lvsoXtlJTUsLjl7YHXRXnkdI8g5fl&authuser=0

https://drive.google.com/open?id=1qnjA06Zo1uossjurOsg79m1q9jgxp04K&authuser=0 ,
https://drive.google.com/open?id=1c5h633il_54EKG5z_WI_O6xFu5kIOoRF&authuser=0

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO4	PSO5	PSO6	PSO7
CO1	2	2	3	2	2	2	2	2	1	1	2	2	2	3	2			
CO2	2	3	2	2	2	2	2	2	2	1	2	2	2	2	2			
CO3	3	3	1	2	1	2	2	2	2	2	2	2	3	3	3			
CO4	2	3	3	2	2	2	3	1	1	2	2	3	2	3	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**BE-336**	**Title of the Course**	**Cereal and legume technology lab**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	5th	**0**	**0**	**6**	**3**
Pre-Requisite	None	**Co-requisite**	BE333				
Course Objectives	The objective of the lab is to determine the various physicochemical characteristics of the cereals and legumes						

Course Outcomes	
CO1	Students will learn the proximate analysis of cereals
CO2	Students will learn to develop different types of bakery products
CO3	Students will get the industrial exposure for better understanding of subject
CO4	Students will learn the quality control testing of bakery
CO5	Students will learn the protein extraction from legumes

Unit No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Proximate analysis	Determination of physical characteristics of cereals. Determination of moisture content of different cereal grains. Determination of crude fibre in wheat flour. Determination of ash of flour	12	1
2	Product development	Preparation and evaluation of Bread, cookies and cakes.	9	2
3	Visit to an Industry	Visit to local roller flour mill. Visit to local rice hulling unit.	6	3
4	Quality control	Determination of gluten. Determination of sedimentation value of the Maida. Cooking quality of rice. Determination of alcoholic acidity of the sample of the wheat flour/Maida	12	4
5	Isolation of protein	Protein isolation and extraction soybeans and legumes.	3	5

Reference Books:

Kay DE. 1979. *Food Legumes*. Tropical Products Institute.

Kent NL. 1983. *Technology of Cereals*. 4th Ed. Pergamon Press.

Kulp K & Ponte GJ. 2000. *Handbook of Cereal Science and Technology*. 2nd Ed. Marcel Dekker.

e-Learning Source:

Cereal Chemistry - Wiley Online Library

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	2	1	3	1	2	1	1	1	1	1	3	3	3	3			
CO2	1	2	3	1	1	2	1	1	1	1	1	3	3	3	3			
CO3	1	2	1	1	1	2	3	1	1	1	1	3	3	3	3			
CO4	1	2	1	3	1	2	1	1	1	1	1	3	3	3	3			
CO5	1	2	1	3	1	2	1	1	1	1	1	3	3	3	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:	2020-2021						
Course Code	BE 337	**Title of the Course**	DAIRY PRODUCT TECHNOLOGY LAB	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**0**	**0**	**6**	**3**
Pre-Requisite	None	**Co-requisite**	**BE-334**				
Course Objectives	The lab is designed to train the students in understanding manufacturing principles and various quality parameters including microbiological and biochemical analysis of various dairy products.						

Course Outcomes	
CO1	Understand role of various ingredients in manufacturing of various dairy products
CO2	To determine quality evaluation of various dairy products.
CO3	Gain Knowledge on production of dairy products.

Unit No.	**Title of the Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Flavored milk**	Preparation of flavored milk.	6	CO1, CO2
2	**Cream processing**	Cream separation, neutralization and ripening.	6	CO1, CO2
3	**Butter**	Preparation of butter.	6	CO1, CO2
4	**Khoa**	Preparation of Khoa.	6	CO1, CO2
5	**Paneer**	Preparation of Paneer (cottage cheese).	6	CO1, CO2
6	**Ice cream**	Preparation of common varieties of ice-cream.	6	CO1, CO2
7	**Milk Product analysis**	Quality evaluation of milk and milk products.	6	CO3
8	**Industrial Visit**	Visit to different milk processing plants to learn about milk condensing and drying operations.	6	CO3

Reference Books:

Miller, D.D. and Yeung, C.K., 2022. Food chemistry: A laboratory manual. John Wiley & Sons.

Aggarwala, A.C. and Sharma, R.M., 1961. A laboratory manual of milk inspection. A laboratory manual of milk inspection., (4th edition).

e-Learning Source:

https://www.fssai.gov.in/upload/uploadfiles/files/MILK_AND_MILK_PRODUCTS.pdf

https://fssai.gov.in/upload/uploadfiles/files/Guidance_Document_Milk_14_03_2019.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	2	1	2	1	1	1	1	2	1	2	2	2	3	3			
CO2	1	3	2	2	1	1	1	1	1	1	1	2	2	3	3			
CO3	2	3	2	2	2	1	1	1	1	1	2	2	3	3	3			
CO4																		
CO5																		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21						
Course Code	BE338	**Title of the Course**	Food Biotechnology	**L**	**T**	**P**
Year	III	**Semester**	V	**3**	**1**	**0**
Pre-Requisite	None	**Co-requisite**	None			
Course Objectives	The course is designed to equip the students with the knowledge of new varieties of foods and crops being developed develop hybrid and GM food through knowledge of gene expression and DNA recombinant technology as well a patenting issues related to the food biotechnology.					

Course Outcomes	
CO1	The student will gain basic knowledge of GMOs/GMCs, role of microorganism in food biotechnology and their various applications in sector.
CO2	The student will gain the fundamental aspects of gene expression and enzymes involved in rDNA technology.
CO3	The student will acquire basic knowledge of molecular level vectors used as genetic engineering tool for development of new plant variet
CO4	The student will be able to apply the knowledge for production of GMO/GMC in food, agriculture and industrial sector, and understan regulatory aspects of food biotechnology.
CO5	The student will gain basic knowledge of IPR (patent, design, copyright and Geographical indication), significance of IPR and how to c patent or filing process of patent.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Map C**
1	Introduction to Food Biotechnology	Signification of DNA and RNA in GMO/GMC, Role of microorganism in food biotechnology	8	C
2	Concepts of Genetic Engineering	Basic concept of gene expression and gene complexity in prokaryotes and eukaryotes,Enzymes involved in r-DNA technology	8	C
3	Molecular Methods and Production	Cloning vectors for production of GMO/GMC, production of genetically modified organisms and crops using vectors (eg: Bt. Cotton, Bt. Brinjal etc.) Developmental technique for new plant varieties.	8	C
4	Applications of Food Biotechnology	Applications of GMO/GMC in food, agriculture and industrial sector, Regulatory and Social aspects of Food Biotechnology	8	C
5	IPR	Basic concept of IPR (patent with patenting step, copy right, trademarks, GI and PBR), Indian patent Act and PCT, TRIP, Infringement, GEAC, RCGM	8	C

Reference Books:

1. Principles of gene manipulation-Old and Primrose
2. Molecular Cloning (Vol 1,2,3)-Sambrook and Russell
3. Food Biotechnology: Dietrich Knorr, Inc. New York and Basel
4. Perry Johnson-Green. Introduction to Food Biotechnology. CRC Press
5. Genetic Engineering by Neelam Pathak and Smita Rastogi
6. Molecular Biology of the gene IV edition by Watson, Hopkin, Roberts et.al
7. Biotechnology by B. D. Singh

e-Learning Source:

http://www.webmd.com/food-recipes/news/20160517/genetically-modified-crops-are-safe-

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2408621/

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3791249/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	1	1	1	2	3	3	3	1			3	2	2	3			
CO2	3	1	1	3	2	3	3	3	1			3	2	2	2			
CO3	3	1	3	3	3	3	3	3	1			3	2	3	3			
CO4	3	1	3	3	2	3	3	3	2			3	2	2	2			
CO5	3	1	3	3	3	3	3	3	3	3		3	2	3	2			

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BE 339	**Title of the Course**	HYGIENE AND FOOD SAFETY	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The objective of this course is to explain the common causes of food borne illness; to outline fundamental microbiological concepts; to describe the characteristics of important food borne pathogens and hazards; to detect and identify food borne pathogens and be able to list the steps in the inspection process; to summarize the procedures to be used in the control of food borne illness; to impart knowledge about sanitation and hygiene.						

Course Outcomes	
CO1	To understand the sources and role of Microorganisms in contamination and spoilage of various foods
CO2	To understand various methods of microbial inactivation
CO3	To learn common causes of food borne illness - viz. physical, chemical and biological and identification through food analysis
CO4	To understand the concept of Hygiene and its role in food quality and lifestyle management
CO5	TO understand the concept of aseptic condition maintenance and its assurance.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Food Spoilage**	Food spoilage: Definition, sources of contamination and microorganisms involved in spoilages of various foods: Milk, Bread, Canned food, Vegetables and fruits, Fruit juices, Meat, Eggs and Fish.	8	CO1
2	**Microbial Destruction Methods**	Physical and chemical means used in destruction of microbes: Definition of sterilization and disinfection, role of heat, filtration and radiation in sterilization, use of chemical agents-alcohol, halogens and detergents.	8	CO2
3	**Food Borne Infections and Intoxications**	Public health hazards due to microbial contamination of foods: Important food borne infections and intoxications due to bacteria, moulds, viruses (Salmonella typhi, Helicobacter pylori, Campylobacter jejuni, Yersinia enterocolitica, Bacillus cereus, Staphylococcus aureus, Clostridium botulinum, Escherichia coli, Mycotoxins, Hepatitis A virus & Rota virus)- Symptoms, mode of transmission and methods of prevention.	8	CO3
4	**Food Hygiene and Sanitation**	General principles of food hygiene, relation to food preparation, personal hygiene. Food handling habits and water sources. Impurities in water supply and treatment	8	CO4
5	**Aseptic condition maintenance**	Method for assessing the in-place cleanability of food processing equipment. Microbiologically safe aseptic packing of food products, method for the assessment of in-line pasteurisation of food processing equipment, method for the assessment of in-line sterilisability of food processing equipment.	8	CO5

Reference Books:

1. Gaston, Ed & Tiffney. 2000. Guide to improving food hygiene.
2. Mountney. J. & Geod. W.A. 2000. Practical food microbiology and Technology (2nd edition)
3. Hobbs. Betty C. 1998. Food Poisoning and food hygiene - (3rd Edition).

e-Learning Source:

https://drive.google.com/drive/folders/0BPOPbAqWqoPfnVDc3lEVnNXZmxrSmtNT21nOGFnRDQ2ZWdPeFVfZWZTXzl0cC1LMmk3b2s?resourcekey=0-81g_wC6VCDeGb8EN_43cfg&usp=sharing

https://drive.google.com/drive/folders/0BPOPbAqWqoPfnVDc3lEVnNXZmxrSmtNT21nOGFnRDQ2ZWdPeFVfZWZTXzl0cC1LMmk3b2s?resourcekey=0-81g_wC6VCDeGb8EN_43cfg&usp=sharing

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**2**			
CO2	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**			
CO3	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**			
CO4	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**3**	**2**	**3**	**3**			
CO5	**1**	**2**	**3**	**2**	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**3**			

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2020-2021							
Course Code	BE349	**Title of the Course**	Sustainable Food Science and Technology	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	V	**2**	**1**	**0**	**3**
Pre-Requisite	BE-238	**Co-requisite**	None				
Course Objectives	**The aim is to give a broad overview and basic understanding of sustainable food processing technology and its role in reducing hunger, creating jobs, and fostering responsible production and consumption cycles.**						

Course Outcomes	
CO1	Understand the effect of food on various diseases and food toxicants
CO2	Gain knowledge about post harvest losses
CO3	To understand the impact of various food products on the environment
CO4	To gain insights about sustainable food systems and problems associated with the food distribution.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Sustainable diets and food safety**	Effect of foods on cardiovascular diseases, diabetes, and constipation. Interface gastrointestinal tract (GIT) and microbiota, Food allergy, Obesity, Mother milk vs infant formula,The birth of food safety - evolutionary theory of food culture, level of toxicity. Human tolerance to poisons - Daily tolerable amount (TDI), environmental hormones - the poison of the century dioxin, environmental hormones - plastics for plasticizers, food, Bacteria, Relationship, - bacteria with food, Toxic substances produced during cooking - polycyclic aromatic hydrocarbons (PAH).	8	1
2	**Postharvest loss prevention**	Postharvest Loss,Food Insecurity, Overview of the Postharvest Supply Chain and the Role of Mechanization, The Economics of Postharvest Loss: Structural Issues, Trends in International Awareness of Postharvest Loss, A Prevention Framework for post-harvest losses.	8	2
3	**Food and Our Environment**	Role of fertilizers and pesticides on the environment, the role of animal meat on our planet,the impact of Seafood and Egg Consumption on our planet, the role of paddy in global warming, Packaging, and Reducing Food Waste.	8	3
4	**Future Food problems**	Sustainable Food Systems, Wasted Food, Food Shortage, Production limiting factors, Vulnerability to famines, Food shortage or distribution problem	8	4

Reference Books:

1. Food and Chemical Toxicology: Food and Chemical Toxicology | Journal | ScienceDirect.com by Elsevier
2. Food Security: Food Security | Home (springer.com)
3. Food Policy: Food Policy | Journal | ScienceDirect.com by Elsevier
4. Journal of Agricultural and Food Chemistry: About the Journal (acs.org)
5. Journal of Agricultural and Food Chemistry: About the Journal (acs.org)
6. Food processing technology principles and practices; P. Fellows; CRC Press, Boca RatonBoston New York Washington, DC
7. Norman N. Potter and Joseph H. Hotchkiss, Food Science

e-Learning Source:

Sustainability | An Open Access Journal from MDPI

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	1	2	2	2	1	1	3	1	2	1	2	3	3	3	2			
CO2	1	2	2	2	1	1	3	1	2	1	2	3	3	3	2			
CO3	1	2	2	2	1	1	3	1	2	1	2	3	3	3	2			
CO4	1	2	2	2	1	1	3	1	2	1	2	3	3	3	2			

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:							
Course Code	**BE-340**	**Title of the Course**	**Meat, fish, and poultry technology**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	6th	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	BE345				
Course Objectives	Through this course, students will learn the scientific principles involved in the processing of meat, fish, and poultry.						

Course Outcomes	
CO1	Understand the importance of meat, poultry, and fish industry.
CO2	Understand the slaughtering techniques of animals.
CO3	Understand the processing methods of meat and meat products.
CO4	Understand the processing of poultry and eggs.
CO5	To understand the fish processing methods.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Sources of meat and meat products in India, its importance in national economy. Per capita consumption of meat, poultry and fish. Present status of meat, poultry and fish industries in India. Chemical composition and microscopic structure of meat.	8	1
2	Slaughtering Techniques	Methods of slaughtering & meat processing- Pre-slaughter care, Antemortem inspection of meat animals. Methods of stunning, slaughtering and dressing of meat animals and poultry birds Post mortem examinations of meat-Rigor mortis. Packaging and shelf life of meat.	8	2
3	Processing Methods	Methods of meat tenderization. Meat curing- types and factors affecting quality of cured meats. Preparation of smoked meats, pickled meats, sausages and hamburgers. Methods of meat preservation- refrigeration, refrigeration, thermal processing and dehydration.	8	3
4	Poultry and Egg	Poultry products- Structure, composition, nutritive value and functional properties of eggs. Grading of eggs. Factors affecting egg quality and measures of egg quality. Preservation of eggs by different methods- freezing, dehydration and coating.	8	4
5	Fish Processing	Fish products- Types of fish, composition, structure, post mortem changes in fish. Handling of fresh water fish. Nutritional quality of fish. Canning of fish.	8	5

Reference Books:

Lawrie, R. A. 1975. Lawrie's Meat Science. 2nd Edn. Pergamon Press. Oxford UK.

G. C. Mead. 2004. Poultry Meat Processing and Quality. CRC Press

A K Biswas and P K Mandal. 2014. Textbook of Poultry, Egg and Fish Processing Technology. Studium Press India Pvt Ltd

e-Learning Source:

Meat Science; https://www.journals.elsevier.com/meat-science

Animal Science Journal; http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1740-0929

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO2	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO3	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO4	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO5	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2021							
Course Code	BE 341	**Title of the Course**	Bakery and Confectionery Technology	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	2	1	0	3
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	This course will help the students in understanding the status of bakery and confectionary industries in India. They will also learn about the technologies behind bakery and confectionary products and the innovations in this sector.						

Course Outcomes	
CO1	Impart knowledge on principles of baking.
CO2	Introduce baking techniques to produce bread, biscuits and cakes.
CO3	Familiarize with various packaging materials used in food industry.
CO4	Demonstrate the role of ingredients and processes in the production of bakery and confectionery products.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction and Regulation**	Status of bakery industry in India & Govt. Licensing Policy. Raw material for bakery products and their PFA specification. Flour, sugar, shortening, yeast, salt, emulsifiers, oxidants and reducing agents. Structure and function of wheat proteins (gluten). Manufacturing techniques, uses & functionality of vital wheat gluten.	8	CO1
2	**Bread and Other Similar Products**	Different types of bread and preparation of bread using different methods. Quality evaluation of bread. Preparation of rusks, buns and pizza bases.	8	CO2
3	**Soft Wheat Products**	Cakes, their types, methods of preparation of different cakes. Cake faults and their remedies. Technology of manufacture, Types and quality evaluation of Biscuits, cookies, crackers and Muffins.	8	CO3
4	**Confectionary Products**	Different ingredients used in candy, fruit butter and chocolate. Technology of manufacture, quality parameters of Liquorice paste, aerated confectionery, Lozenges, sugar panning and Chewing gum,-Quality aspects. Bakery Plant - Layout, setting up of units and hygienic conditions, operation and maintenance.	8	CO4

Reference Books:

1. Bernrd. Minife. W. Chocolate, Cocoa and Confectionary. Edition 2003; Springer Science & Business Media
2. Mathur. R.B.L. Handbook of cane sugar technology, Edition 1999; CBS Publishers.
3. Faridi Hamed. The Science of Cookie and Cracker Production. Edition 2003; Springer US.
4. Matz. Bakery Engineering and Technology, Vol I and II, CBS Publishers, New Delhi.

e-Learning Source:

https://www.youtube.com/watch?v=2kttVyakHN4, https://www.youtube.com/watch?v=QvR6YLTFGeI

Course Articulation Matrix: (Mapping of COs with POs and PSOs)-

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	2	2	1	1	2	2	2	3	2
CO2	2	3	2	2	2	2	2	2	2	1	2	2	2	2	2
CO3	3	3	1	2	1	2	2	2	2	2	2	2	3	3	3
CO4	2	3	3	2	2	2	2	1	1	2	2	2	2	3	3

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**BE-343**	**Title of the Course**	**Food Plant Layouts**	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	6th	**2**	**1**	**0**	**3**
Pre-Requisite	BE-238	**Co-requisite**	None				
Course Objectives	To impart knowledge on plant layout and design of food industries. By the end of course, the students will acquire knowledge on theoretical aspects to be considered for sites, layout selection and design considerations for a food plant.						

Course Outcomes	
CO1	Provide a basis in selecting a location as well as plant layout with respect to material handling, space utilization, future expansion etc.
CO2	Understand fixed costs, variable costs, inputs and machinery involved in planning and functioning of an industry.
CO3	Understandtheimportanceofavailabilityofrawmaterialandfacilitiesforproduction of goods.
CO4	Integrate man, materials and machinery for optimum production.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Plant Layout**	Plant Location and Layout-Concept and factors governing plant location. Location economics-comparison of rural vs urban plant sites, plant site selection guide. Classes of layout problems, objectives, principles and types of layouts – process layout, product layout, combination layout, fixed position layout; methods and tools of plant and factory layouts; plant layout procedures.	10	1
2	**Layout of Different Food Industries and Network Analysis Process**	Layouts of different types of food and fermentation industries – canning, dairy, bread, biscuit, beer, tomato processing, rice mill and wheat mill. Network Analysis of Processes-Basic terms, objectives and advantages of network analysis, various network techniques, PERT and CPM techniques, smoothing.	10	2
3	**Cost Analysis**	Factory Building and Cost Analysis- Considerations in building design, types of factory buildings, building construction materials for floors, walls, roofs, etc. Fixed cost, variable cost, depreciation, methods of economic analysis, profitability analysis of a plant.	10	3
4	**Plant Maintenance**	Plant Maintenance-Objectives and importance of maintenance, types of maintenance – corrective or breakdown maintenance, scheduled maintenance, preventive maintenance and predictive maintenance.	10	4

Reference Books:

1. Peters, M.S. and Timmerhaus,K.D. Plant Designs and Economics for Chemical Engineers 4th Edition. McGraw Hill.
2. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas (2005) Food Plant Design, Taylor and Francis
3. Apple, J.M. (2000). Plant Layout and Material Handling. Willey eastern Pub.
4. Sahay, K.M. and Singh, K. K. (1998) Unit Operations of Agricultural Processing, Kalya Publishers, Ludhiana.

e-Learning Source:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=529
2. https://www.igmpiindia.org/industry-certificate-in-Food-Plant-Layout-and-Design.html
3. https://www.youtube.com/watch?v=kbbPtK7EQ9Y
4. https://link.springer.com/chapter/10.1007/978-1-4615-0725-3_1

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	2	2	1	2	2	2	1	3	2	2
CO2	3	2	2	1	2	2	2	1	2	2	2	1	3	2	2
CO3	3	2	2	1	2	2	2	1	2	2	2	1	3	2	2
CO4	3	2	2	1	2	2	2	1	2	2	2	1	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2021							
Course Code	BE 344	**Title of the Course**	Fruit and Vegetable Technology	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	3	1	0	4
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To learn about the different techniques involved in the processing of fruits and vegetables.						

Course Outcomes	
CO1	Acquire knowledge on methods of processing and preservation of fruits and vegetables.
CO2	Understand the changes occurring in fruits and vegetables in relation to processing methods.
CO3	Demonstrate the manufacture, preservation and packaging of jam, jelly, marmalade, pickles and preserves.
CO4	Become familiar with freezing and dehydration of fruits and vegetables.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Basic Processing of Fruits and Vegetables**	Indian and global scenario of Fruit and Vegetable production and processing. Preparing fruits and vegetables for processing; Basic steps in pre-processing; Blanching, Peeling etc and their importance in processing. History of canning, types of cans. Methods and steps involved in canning of fruits and vegetables. Calculation of vacuum in cans. Difference between canning and bottling. Spoilage of canned foods. Retortable pouches and retort processing.	8	CO1
2	**Fruit and Vegetable Products**	Fruit products; Definition, formulation, preparation and FPO standards of fruit juices, squashes and cordials, fruit syrups and nectar, pulp, jams, jellies, marmalades and juice powders.	8	CO2
3	**Ready to use Products**	Tomato products and pickles; Preparation, formulation and FPO standard for tomato juice, tomato puree, paste, ketchup, sauce, chutney. Pickeling process, types of pickels and spoilage of pickles.	8	CO3
4	**Techniques based preservation of Fruits and Vegetables**	General methods of freezing fruits and vegetables, their packaging and storage. Advantages and disadvantages of freezing. Drying of fruits and vegetables; Sun drying, its advantages and disadvantages. Dehydration of fruits and vegetables. Osmo dehydration of fruits and vegetables. Problems faced by Fruit and Vegetable processing industry	8	CO4

Reference Books:

1. Girdhari Lal & Sidappa. Fruits and vegetable preservation, ICAR (New Delhi).
2. Srivastava. 2000. Preservation of fruits and vegetable, IBD Co. Lucknow.
3. Khader Vijaya. 2000. Preservation of fruits and vegetable, Kalyani Publication.
4. Verma. L. R. & Joshi. V. K. 2000. *Post harvest technology of fruits and vegetables.* Indus Publishing.

e-Learning Source:

https://www.youtube.com/watch?v=k-KHRJkVaGI, https://www.youtube.com/watch?v=HrpMUaM3Lrw, https://www.youtube.com/watch?v=drqVnUq5oag, https://www.youtube.com/watch?v=3qEwfIif89U https://www.youtube.com/watch?v=o-5b2TnsuAk

Course Articulation Matrix: (Mapping of COs with POs and PSOs)-

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	3	2	2	1	2	2	2	2	2	3	2
CO2	3	3	2	2	2	2	2	2	2	2	2	2	3	3	3
CO3	2	3	2	2	3	2	2	2	2	2	2	2	2	2	3
CO4	3	3	3	2	3	2	2	1	2	2	2	2	2	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**BE-345**	**Title of the Course**	**MEAT, FISH, AND POULTRY TECHNOLOGY LAB**	**L**	**T**	**P**	**C**
Year	**3rd**	**Semester**	6th	**0**	**0**	**6**	**3**
Pre-Requisite	None	**Co-requisite**	**BE-340**				
Course Objectives	To perform different experiments involved in meat, fish, and poultry industries.						

Course Outcomes	
CO1	Able to perform the proximate analysis of meat and meat products.
CO2	Able to perform the microbial analysis of meat and meat products.
CO3	Able to perform the quality tests of egg, meat and fish
CO4	The students will get exposure of meat industry.
CO5	

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Proximate analysis	Moisture analysis of meat and meat products. Fat content of meat products. Protein content of meat and meat products	9	1
2	Microbial analysis	Total plate count of meat samples Yeast and mold count of meat samples	9	2
3	Quality	Measures of egg quality. Sensory analysis of meat/fish/poultry products. Develop HACCP for meat processing	9	3
4	Visit	Visit to meat, fish and poultry processing industries	9	4

Reference Books:

G. C. Mead. 2004. Poultry Meat Processing and Quality. CRC Press

A K Biswas and P K Mandal. 2014. Textbook of Poultry, Egg and Fish Processing Technology. Studium Press India Pvt Ltd

e-Learning Source:

Meat Science; https://www.journals.elsevier.com/meat-science

Animal Science Journal; http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1740-0929

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO2	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO3	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO4	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			
CO5	1	1	2	1	1	1	2	2	1	1	1	3	3	3	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2021							
Course Code	BE 346	**Title of the Course**	Fruit and Vegetable Technology Lab	**L**	**T**	**P**	**C**
Year	**III**	**Semester**	VI	**0**	**0**	**6**	**3**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	To perform experiments relevant to fruit and vegetable processing industries.						

Course Outcomes	
CO1	Understand the role of processing in terms of shelf life, safety, nutritional and economic value of fruit and vegetables.
CO2	Assess the role in pre- and post-harvest changes in fruits and vegetables on product quality.
CO3	Gain knowledge on production, preservation and packaging of jam, jelly, marmalade, pickles, and candies.

Unit No.	**Title of Experiment**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fruit juices	Preparation of fruit juices.	3	CO1, CO2
2	Squashes	Preparation of squashes.	3	CO2, CO3
3	Jam	Preparation of jams.	3	CO2, CO3
4	Jellies, Marmalades	Preparation of jellies, marmalades etc.	3	CO2, CO3
5	Pickles	Preparation of pickles	3	CO2, CO3
6	Tomato Products	Preparation of tomato puree, paste and ketchup	3	CO2, CO3
7	Dehydration & Drying	Dehydration and sun drying of fruits and vegetables.	3	CO1, CO3
8	Organoleptic evaluation	Organoleptic evaluation of fruit and vegetable products prepared in class practical.	3	CO2
9	Industrial Visit	Visit to a local fruit processing plant.	1	CO1, CO2, CO3

Reference Books:

1. Girdhari Lal & Sidappa. Fruits and vegetable preservation, ICAR (New Delhi).
2. Srivastava. 2000. Preservation of fruits and vegetable, IBD Co. Lucknow.
3. Khader Vijaya. 2000. Preservation of fruits and vegetable, Kalyani Publication.
4. Verma. L. R. & Joshi. V. K. 2000. *Post harvest technology of fruits and vegetables.* Indus Publishing.

e-Learning Source:

https://www.youtube.com/watch?v=id1Op4Rfgyc, https://www.youtube.com/watch?v=hI2pKiJ9ZLQ

Course Articulation Matrix: (Mapping of COs with POs and PSOs)-

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	3	3	2	1	1	1	1	2	2	3	3
CO2	2	2	1	2	2	3	2	1	1	1	1	3	3	3	3
CO3	2	3	3	2	3	2	1	2	2	1	1	2	2	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	BE 347	**Title of the Course**	Fermentation Technology	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	6th	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	The objectives of this course are to introduce students to basic concepts of fermentation technology, introduce students to local and foreign fermented foods and provide students with information about the importance or advantages of fermented foods						

Course Outcomes	
CO1	The students will learn about the basics fermentation and difference in primary and secondary metabolites.
CO2	The students will learn about the Design of fermenter, Aerobic and anaerobic fermentation and kinetics in in Batch, Fed batch and continuous mode of reaction.
CO3	The students will learn about the role of Mass transfer in fermenter and fermentation processes.
CO4	The students will learn about the Industrial microbes and their role in Alcoholic Beverages and Fermented Vegetables.
CO5	The students will learn about the cereal based fermented food like production of Baker's Yeast, Idli, Dosa, Dhokla, Soy sauce, Tofu, Tempeh, Natto etc.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Fermentation**	Definition and brief history of fermentation, Primary and secondary metabolite, Raw material availability, quality processes and pre-treatment of raw materials.	8	CO1
2	**Design and kinetics**	Design of fermenter, Aerobic and anaerobic fermentation. Biomass, Substrate and product kinetics in kinetics in Batch, Fed batch Continuous mode of reaction.	8	CO2
3	**Mass transfer in fermenter**	Role of diffusion in Bioprocessing, Convective mass transfer, Gas-liquid mass transfer, Oxygen uptake in cell cultures, Factor affecting cellular oxygen demand, Oxygen transfer in bioreactors, Measurement of volumetric oxygen transfer coefficient, Oxygen transfer in large bioreactor.	8	CO3
4	**Alcoholic Beverages and Fermented Vegetables**	Fermentative Production of Beer, Wines, Cider and Vinegar. Fermented Vegetables (Pickles, Saurkarnt).	8	CO4
5	**Cereal based Fermented Food**	Production of Baker's Yeast, Cereal based fermented food: Idli, Dosa, Dhokla, Soy sauce, Tofu, Tempeh, Natto.	8	CO5

Reference Books:

1. Handbook of Indigenous Fermented Foods, K.H. Steinkrus, Marcel Dekker, 1996, Reprint: 1997.
2. Outlines of Dairy Technology, Sukumar De, Oxford University Press, 1980, Reprint: 2001.
3. Industrial Microbiology, Prescott & Dunn, CBS Publishers, Reprint: 2004.

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1		1	2	1	1			3	3	2	1
CO2	2	2	1	2		1	2	1	1			3	3	2	1
CO3	2	2	1	1		1	2	1	1			3	2	2	1
CO4	2	2	1	1		1	2	1	1			3	3	2	1
CO5	2	2	1	1		1	2	1	1			3	3	2	1

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2020-21							
Course Code	**BE-348**	**Title of the Course**	**Food and Nutrition**	**L**	**T**	**P**	**C**
Year	3rd	**Semester**	6th	**3**	**1**	**0**	**4**
Pre-Requisite	None	**Co-requisite**	None				
Course Objectives	After completing this course, the students will be able to discuss human nutrition for healthy adults. Discuss the role of diet in causing and preventing various diseases, particularly chronic diseases. Describe methods used to assess nutrition status. Explain how dietary recommendations are formulated.						

Course Outcomes	
CO1	Understand the basic of food and nutrition and its requirement in humans
CO2	Understand the energy vales of importance food components carbohydrate, proteins, fat, minerals, vitamins and water in food.
CO3	Understand the immunity, infection and nutrition.
CO4	Understand the nutritional quality of diet and its requirements.
CO5	Understand the emerging concepts in human nutrition.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Nutrient Requirements – Macronutrients**	Historical perspective of nutrient requirements, methods of assessment of nutrient needs – a critical review, critical evaluation of sensitive methods and derivations of requirements and recommended dietary allowances of macronutrients for all age groups.	8	1
2	**Energy Values**	Energy values of carbohydrates and dietary fibre, proteins and amino acids, lipids, water, critical evaluation of national and international nutrient allowances; factors affecting the nutritional requirements.	8	2
3	**Nutrition, Immunity and Infection**	Host defense mechanisms and nutrients essential in the development of immune system, effect of Infections on the nutritional status of an individual, nutrient deficiencies and excesses affecting the immuno-competence and susceptibility to infections, operational implications.	8	3
4	**Nutritional Quality of Diets**	Ways of enhancing nutritional quality of diets, assessment of protein quality, dietary diversification, bioavailability of nutrients, nutrient losses during cooking and processing.	8	4
5	**Emerging Concepts in Human Nutrition**	Ongoing nutrition transition and its implications, changing trends in life style patterns in population groups and their implications, nutrigenomics, nutraceuticals, bioactive compounds.	8	5

Reference Books:

5. Carolyn D. Berdanier, (2014) Handbook of Nutrition and Food, Third Edition, CSC Press.
6. David A. Bender, (2014) A dictionary of food and nutrition, Oxford University Press.
7. Joshi, S.A. (2000) Nutrition and dietetics, Tata McGraw Hill and Co.
8. Sunetra Roday. (2018). Food Science and Nutrition, Oxford University Press.

e-Learning Source:

5. https://iuns.org/iuns-publications/nutrition-e-learning/
6. https://www.elearningcollege.com/learn/diet-and-nutrition-short-course
7. https://in.coursera.org/browse/health/nutrition
8. https://onlinecourses.swayam2.ac.in/cec19_ag02/preview

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	1	2	2	1	2	2	2	1	3	1	3
CO2	2	2	2	1	1	2	2	1	2	2	2	1	3	1	3
CO3	2	2	2	1	1	2	2	1	2	2	2	1	3	1	3
CO4	2	2	2	1	1	2	2	1	2	2	2	1	3	1	3
CO5	2	2	2	1	1	2	2	1	2	2	2	1	3	1	3

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**