Scheme of Studies for BS Food Science and Technology

Nature of the Course	Course No.	Title of Course	Credit Hours
	First Semester		
CORE-I	SC-105	Mathematics	3(3+0)
CORE-II	ENG-101	English: Reading and Writing I	3(3+0)
CORE-III	PS-100	Pakistan Studies	2(2+0)
GEN-I	SC-108	Essentials of Microbiology	3(2+1)
GEN-II		Choose anyone from the list	3
FOUN-I	FST-101	Essentials of Food Science and Technology	3(2+1)
		Total Credit Hours	**17**
Second Semester			
CORE-IV	ENG-102	English: Reading and Writing II	3(3+0)
CORE-V	SC-104	Computer, Digital and Information literacy	3(2+1)
CORE-VI	IS-201 IS-202	Islamic Studies OR Ethics	2(2+0) 2(2+0)
GEN-III		Choose anyone from the list	3
GEN-IV		Choose anyone from the list	3
FOUN-II	FST-102	Unit Operations in Food Processing	3(3+0)
		Total Credit Hours	**17**
Third Semester			
CORE-VII	ENG-201	Business Communication Skills	3(3+0)
CORE-VIII	SC-103	Fundamentals of Research & Statistics	3(3+0)
GEN-V	ID-411	Entrepreneurship and Marketing	3(3+0)
GEN-VI		Choose anyone from the list	3
FOUN-III	FST-201	Post-Harvest Technology	3(2+1)
FOUN-IV	FST-202	Basics of Agriculture	3(3+0)
		Total Credit Hours	**18**
Fourth Semester			
CORE-IX	ENG-202	English: Soft Skill and Emotional Intelligence	3(3+0)
GEN-VII		Choose anyone from the list	3
FOUN-V	FST-203	Fundamentals of Human Nutrition	3(3+0)
FOUN-VI	FST-204	Food Analysis	3(1+2)
FOUN-VII	FST-205	Food Service Management	3(3+0)
MAJ-I	FST-206	Food Microbiology	3(2+1)
		Total Credit Hours	**18**
Fifth Semester			
FOUN-VIII	FST-301	Food Laws and Regulations	3(3+0)
FOUN-IX	FST-302	Food Chemistry	3(3+0)
MAJ-II	FST-303	Fruits and Vegetables Processing	3(2+1)

MAJ-III	FST-304	Dairy Technology	3(2+1)
MAJ-IV	FST-305	Food Safety and Toxicology	3(3+0)
MAJ-V	FST-306	Cereal Technology	3(2+1)
		Total Credit Hours	**18**
Sixth Semester			
FOUN-X	FST-307	Food Quality Management	3(3+0)
MAJ-VI	FST-308	Beverage Technology	3(2+1)
MAJ-VII	FST-309	Bakery Products Technology	3(2+1)
MAJ-VIII	FST-310	Food Biotechnology	3(2+1)
ELEC-I		Choose anyone from the list	2
ELEC-II		Choose anyone from the list	3
		Total Credit Hours	**17**
Seventh Semester			
MAJ-IX	FST-401	Instrumental Techniques in Food Analysis	3(1+2)
MAJ-X	FST-402	Technology of Edible Oils and Fats	3(2+1)
MAJ-XI	FST-403	Food Industrial Waste Management	3(3+0)
ELEC-III		Choose anyone from the list	3
ELEC-IV		Choose anyone from the list	3
		Total Credit Hours	**15**
Eighth Semester			
MAJ-XII	FST-419	Research Project and Scientific Writing	2(1+1)
MAJ-XIII	FST-420	Internship	6(0+6)
		Total Credit Hours	**8**

Total Credit hours: 128

*Quran Studies is mandatory in all semesters, it's a noncredit course based on Pass/Fail evaluation.

List of Elective Courses

Nature of Course	Course Code	Name of Subjects	Cr. Hrs
ELEC-I	FST-311	Food Packaging	2(2+0)
	FST-312	Food Plant Layout	2(2+0)
ELEC-II	FST-313	Food Product Development	3(2+1)
	FST-314	Sensory Evaluation of Foods	3(2+1)
ELEC-III	FST-404	Poultry, Fish and Egg Processing	3(2+1)
	FST-405	Meat Technology	3(2+1)
ELEC-IV	FST-406	Confectionary and Snack Foods	3(2+1)
	FST-407	Sugar Technology	3(2+1)

*The fresh arrival books/suggested readings will be consulted if available

List of General Courses

ID-203	**Professional Practices and Ethics**	**3(3+0)**
SC-103	Biochemistry	3(3+0)
HDFS-102	Life Span Development	3(3+0)
RFM-301	Essentials of Management	3(3+0)
HDFS-302	Health and Wellness	3(3+0)

Curriculum for BS Food Science and Technology

Code	Course Title	Credit Hour	Semester
ENG-101	**English Reading and Writing I**	**3(3+0)**	1

Course Objectives

The specific objectives include:

- To enhance language skills and develop English reading and writing
- To activate and reinforce grammar and pronunciation

Course Outcomes

After completing this course, students will be able to:

- Understand and comprehend the diversity of text
- Express their ideas effectively in writing using a variety of sentence structure

Course Contents

Theory

Getting to know your textbook: Parts of a textbook, Scanning, Discourse Study: Textbook structure, Word study: Words which substitute for other words, self- study. Application

Choosing what to read: Reading with a purpose, Prediction, Discourse study: Chapter structure, Word study: Dealing with unfamiliar word, Word study: Building an academic vocabulary. Application

The Spirit of Enquiry: Surveying a text, Discourse study: Linking words, Self-study, Word study: Using immediate context, Word study: Collocations. Application

The Developing World: Reading for important points, Discourse study: Linking words, Self-study, Word study: Using immediate context, Word study: Using collocations. Application

The Natural World: Making inferences, Note-taking: Linear notes, Self-study, Discourse study: Identifying text structure, Word study: Building an academic vocabulary, academic words and related forms and application

Writing: Precise writing, paraphrasing text, Comprehension skills, Summary writing**,** understanding plagiarism while writing your own work

Recommended Books

1. Christine, M., Boutine, Brinand S. & Grellet F. (1987). *Writing intermediate.* Oxford University Press. (Illustrated edition).
2. Glendinning, E. H. & Holmstorm, B. (2008). *Study reading: A course in reading skills for academic purposes* (2nd ed.). Cambridge University Press.
3. Kumar, S. K., & Nagarajan, H. (2005). *Learn correct English: Grammar, composition and usage* (1st ed.). Pearson Educaion.
4. Thompson, A. J., Martinet. (2016). A. V*., Practical English grammar* (4th ed.). India: Oxford University Press.
5. Wren, P. C. (2016). *High school English grammar and composition.* New Delhi: Blackie Elt Books

Code	Course Title	Credit Hour	Semester
PS-100	Pakistan Studies	2(2+0)	1

Course Objectives

The specific objectives include:

- A deliberate academic discussion in order to create amicable and united bond of a nation on the basis of ideology of Pakistan.
- To elaborate the strategic and geographical significance of Pakistan for the whole global
- To highlight all important past events that caused the formation of Pakistan.
- To emphasize on the financial, social and political problems faced by Muslims in united . India.
- To make a clear assessment on the confronted issues faced by the Muslims In international politics

Course Outcomes

After completing this course, students will be able to:

- Students will be able to identify the factors that led to the demand of a separate state for Muslims of Sub-continent
- A better understanding of importance of national integration will be inculcated
- Students will be enabled to critically evaluate the challenges facing Pakistan in the contemporary conditions
- An academic understanding of the importance of good citizenship for the success of the democratic process will be developed

Course Contents

Course Objectives

Learning Outcome

Theory

Pakistan: The Early Years (1947-58)

Ayub Era: 1958-1969

Yahya Regime: 1969-1971

Zulfiqar Ali Bhutto Government: 1971-1977

Zia Regime: 1977-88

Democratic Governments: 1988-99

Musharraf's Regime: 1999 -2008

Pakistan People's Party rule: (2008-2012)

Cultural and Geographical features of Pakistan

Recommended Books

Pakistan's stand on issues: Kashmir, Palestine, Terrorism, Human Rights

Code	Course Title	Credit Hour	Semester
SC-108	Essentials of Microbiology	3(2+1)	1

Course Objectives

The specific objectives include:

- Understand the nature and characteristics of microorganisms
- Explain the methods of microbial eradication
- Describe the general nature of relationship between human and microorganisms

Course Outcomes

After completing this course, students will be able to:

- Describe the characteristics and interactions between microorganisms and the human body

Course Contents

Theory

Introduction to Microbiology: Definition and Types of Microorganisms**,** Morphological, biochemical and physiological characteristics (Bacteria**,** Yeast, Fungi-Rhizopus, Aspergillus and Penicillium)

Sterilization and Disinfection: Definition**,** Use of Physical and Chemical disinfectants**,** Nutrition and Growth of Microorganisms**,** Nutritional requirements including: Vitamins, and other growth factors**,** Growth Phases in Culture Medium**,** Types of Culture Medium**,** Respiration Bacteria

Pathogenic and Non-Pathogenic Microbial flora: Normal microbial flora of human body**,** General attributes and virulence factors of bacteria causing infections, Exotoxins, enterotoxins, endotoxins, neurotoxins, Host Parasite Relationship

Bacterial Diseases: Tuberculosis and Typhoid

Viral Diseases: Aids**,** Dengue fever**,** Hepatitis**,** Respiratory tract infections, Infections of eye, ear and skin, influenza, corona virus and meningitis

Harmful Microbial Interactions with Human, Entry of pathogens into the host, Mechanism of bacterial pathogenicity**,** Colonization and growth, Host factors for infection and innate resistance to infection

Practical: Isolation, Identification and Characterization of microorganisms (Bacteria**,** Yeast**,** Moulds)**,** Gram staining of curd Bacteria**,** Preparation of culture medium

Recommended Books

1. Abd-Alla, M. H. (2012). *Introduction to basic bacteriology*. Place of publication not identified: Lap Lambert Academic Publ Moise,
2. A. M. R. (2017). *The gut microbiome: exploring the connection between microbes, diet, and health*. Santa Barbara, CA: Greenwood, an imprint of ABC-CLIO, LLC
3. Ray, B. and A. Bhunia. 2013. Fundamentals of Food microbiology, 5th ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA
4. Tortora, G. J., Funke, B. R., & Case, C. L. (2016). *Microbiology: an introduction*. Boston: Pearson
5. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2011). *Prescotts microbiology: Joanne M. Willey, Linda Sherwood, Lansing M. Prescott*. Dubuque, IA: McGraw-Hill

Code	Course Title	Credit Hour	Semester
FST-101	Essentials of Food Science and Technology	3(2+1)	1

Course Objectives

The specific objectives include:

- General overview of food science and technology
- Discuss the future role of food technologist, developments and innovation in food science and technology

Course Outcomes

After completing this course, students will be able to:

- Define food science. Recognise it as multidisciplinary, integrating knowledge from different fields applied to the study of foods. Main areas of speciality as well as potential career of food scientist
- Know global food problems and their root causes
- Describe food components, with emphasis on protein, carbohydrates and lipid.
- Describe the principal causes of food deterioration and basic techniques to preserve food

Course Contents

Theory

Introduction: Food science and technology, food processing and preservation; Food safety and security; Food sources and global food situation; Food constituents and their functions: Water, carbohydrates, lipids, proteins, vitamins and minerals; Food classification based on perishability and pH; Spoilage agents in food: Enzymes, microorganisms, insects, rodents, birds and physical factors; Principles of food preservation; Preparatory operations in food processing; Food preservation techniques: High temperature: Pasteurization, sterilization and canning; Low temperature: Refrigeration and freezing; Removal of moisture: Drying and dehydration; Use of chemical additives; Fermentation techniques: Alcoholic, acetic and lactic; Irradiation technology; Food packaging and labelling.

Practical

Bottling/canning of selected fruits and vegetables; Dehydration of fruits and vegetables; Blanching of fruits and vegetables; Preparation and evaluation of various fruit/vegetable products: jams, jellies, squashes, juices, pickles etc; Production of vinegar.

Recommended Books

1. Rehman, M.S. 2020. Handbook of Food Preservation. 3rd Ed, CRC Press Taylor & Francis Group, Boca Raton, FL, USA.
2. Awan, J.A. 2018. Food Processing and Preservation. Unitech Communications, Faisalabad, Pakistan.
3. Awan, J.A. 2018. Food Science and Technology. Unitech Communications, Faisalabad, Pakistan.
4. Khetarpaul, N. 2005. Food Processing and Preservation. Daya Publishing House, New Delhi, India.
5. Zahoor, T., M. S. Butt. 2017. Handbook of Food Science and Technology. ISBN 978-969-8237-97-4: © University of Agriculture, Faisalabad, Pakistan.

Code	Course Title	Credit Hour	Semester
ENG-102	**English Reading and Writing II**	**3(3-0)**	2

Course Objectives

- To develop an appreciation of how the formal elements of language and genre shape meaning.
- To identify and extract the main ideas and details from reading text.
- To paraphrase, summarize and relate what they read in coherent writing

Course Outcomes

After completing this course, students will be able to:

- write and appreciate meaningful text
- identify the important details in a given text
- write with accuracy, precision and coherence

Course Contents

The Physical World: Reading graphics, Discourse Study: Marking Text Structure, Spider notes, Word study: Using the wider context, academic words and related forms. Application

The Individual and Society: Critical Reading, Discourse Study: Forms of Argument 1.
Word Study: Maximizers and minimizers. Application

Work: Critical reading: Comparing viewpoints, Discourse study: Forms of Argument 2.
Word study: Emphasizing and distancing, Word study; Connotations. Application.

Creative Writing: Writing a paragraph (unified and coherent), topic sentence writing.

Essay Writing: Introduction: Beginning, middle and ending, Types of essays.
Mastering Writing and Presentation Basics, Writing Effective Messages, Writing good news and neutral messages, Bad news messages, Persuasive messages and short proposal.

Writing Skills: Dialogue writing, Paragraph writing (unified and coherent), Topic sentence writing, Academic writing, Formal letters. Job applications, filing a complain

Recommended Books

1. Fitikides, T.J. (2002). *Common mistakes in English* (6th ed.). Harlow, England: Pearson Education Limited.
2. Glendinning, E. H., & Holmstorm, B. (2008). *Study reading: A course in reading skills for academic purposes* (2nd ed.). Cambridge, U.K: Cambridge University Press.
3. Ngoh, G. I. (2006). *Understand and communicate Book 3: An English course for secondary schools.* FEP International (Pvt) Ltd.
4. Patel, R. (2016). *Essentials of English grammar and communication.* Biogreen Books.
5. Brown, E. K., & Miller, J. (2016). *A critical account of English syntax, grammar, meaning, text.* Edinburgh University Press.
6. Heinrichs, J. (2017). *Thank you for arguing: What Aristotle, Lincoln, and Homer Simpson can teach us about the art of persuasion*. Three Rivers Press (CA).
7. Carter, R., McCarthy, M. (2006). *A comprehensive guide spoken and written English grammar and usage*. Cambridge University Press
8. Cullen, P., French, A., Jakeman, V. (2014). *The official Cambridge guide to IELTS.*
9. Sabharwal, A. (2016). *Learning english grammar.* Wisdom Press

Code	Course Title	Credit Hour	Semester
SC-104	**Computer, Digital and Information Literacy**	**3(2+1)**	1

Course Objectives

- To make students computer literate
- To make students understand uses of computer in different aspects of life
- To make students aware of Digital and Cyber world dynamics
- To inculcate information literacy skills among students
- To make students understand how and why information is produced
- To enable students to search, evaluate, organize information efficiently and use it ethically

-

Course Outcomes

After completing this course, students will be able to:

- To use computer efficiently and effectively by having knowledge of different applications software(Ms.Word, Ms Excel, Ms Ppt, Adobe Photoshop)
- To distinguish between types of information sources(books, reference sources, journals)
- To develop effective search strategies(smart online searching)
- To use information legally and effectively (understands copyright and intellectual property)
- To research for their topic or assignment and understand how to manage information retrieved in a search

Course Contents

Theory

Basics of Computer Hardware: Define Computer System**,** Hardware**,** Computer Architecture**,** Processor**,** Memory**,** Storage**,** Binary concept**,** Computer peripherals**,** Input and output devices, storage devices

Computer Software: Definition of software, Difference between system and Application software**,** Operating system concept, Productivity softwares**,** MS Word**,** Spread sheet software, Databases**,** Multimedia Applications**,** Mobile Applications

Introduction to Operating System: Definition and Functions**,** Evolution of Operating system**,** Types of Operating System

Multimedia: Introduction to Multimedia and Multimedia Computer System**,** Multimedia Components**,** Text**,** Images**,** Audio**,** Video**,** Animation**,** Multimedia Applications

Internet: Introduction**,** Information searching on the Interne**,** E-Mail**,** Dark side of Social Networking**,** Social and Business Networking**,** E-Commerce**,** Online Education**,** Cloud computing**,** Advantages and Disadvantages of Cloud computing**,** Cloud Storage System

Network Topologies: Bus network, Star Network, Ring network, completely connected network, Hybrid network and multipoint network, LAN, MAN and WAN

Introduction to Information Literacy: What is Information literacy, Need and importance of becoming information literate, How to find information effectively and efficiently, Basic and Advanced searching techniques, Using databases Primary, secondary and tertiary sources, Evaluating information source for authenticity, Managing Found sources: saving; using citation managers, Using collaboration tools for group projects, Using information source ethically, What is plagiarism and how to avoid it?

PRACTICAL:

Note: Part A is compulsory; a choice can be made between B-I and B-II

Part-A

Microsoft Office: M.S Word**;** Files, Folders, Paragraph, page for matting, Bullets and numbering**,** Header and footer**,** Tables and columns**;** M.S Excel**,** Layout, formatting and customizing data**,** Formulas, functions**,** Charts and Printing; M.S Power Point, Lay out of slides, formatting and arranging data**,** Formulas and Functions**,** Animations

Practical Exercises**:** Internet/ Information Literacy, Search creating and checking E-mail, Downloading and Uploading, Smart Online Searching

Part B-I

Adobe Photo Shop

Introduction to Adobe Photoshop

Concepts Of Vectors And Raster Based Objects

Basic Image Manipulation: Bitmap images, Image size and resolution setting, Creating new images, Placing files

Selection Tools: Using the Marquee Tools, Exploring the Lasso Tool, Creating Selection using the magic Wand tool, Using colour range to create selection, Creating selection using extractions, Transforming a selections, Copy, pasting and moving a selection

Text: Text Basics, Entering Text, Selecting Text, Editing the bounding Box, Creating a type selection, Checking for spelling errors

Color Modes: Color modes and models, Color mode conversion, Foreground and background colour, Color management, Modification Of Objects, Painting tools, Blending Modes, Brush Settings

Layers: Using Layers and layer set, Creating Layers and Layer sets, Moving layer Content with move tool and Locking Layers

Part B-II

AutoCAD Software: Introduction to AutoCAD Software

Basic Drawing Tools: Lines, Circles, Rectangles**,** Polar Tracking**,** Erasing Objects**,** Creating a Simple Drawing

Basic Image Manipulation: Move and Copy**,** Rotate and Scale**,** Mirror, Grip Editing

Text: Text Basics**,** Entering Text**,** Selecting Text**,** Modifying Text**,** Adding Leaders**,** Creating Tables

Hatching: Creating Hatches**,** Modifying Hatches

Blocks: Defining Blocks**,** Using Block, Reusing Blocks

Dimensions: Linear Dimensions**,** Radial and Angular Dimensions**,** Editing Dimensions

Printing: Printing Layouts, Printing from Model Space

Recommended Books

1. Aslam, M., Tauqeer, S. R. *Computer studies.* Aikman Series.
2. Saeed, Imran, Raza,A., *The Concepts of Information Technology*.
3. Sinha, P.K. *Computer fundamentals.* (Latest Ed.). New Delhi: B.P.B. Publishers.
4. Waheed, A. *Computer studies*. Seneca Publishing Company, Urdu Bazar Lahore.
   Tyner, K. (2014). *Literacy in a Digital World: Teaching and Learning in the Age of Information*. Routledge.

Code	Course Title	Credit Hour	Semester
IS-200	Islamic Studies	2(2+0)	

اغراض و مقاصد

طالبات میں اسلامی نکتہ نظر سے آدابِ معاشرت کی اہمیت کا شعور پیدا کرنا۔

بچیوں میں خوراک، لباس، گھر اور بچوں سے متعلقہ امور کو اسلامی تعلیمات کی روشنی میں انجام دینے کی صلاحیت اجاگر کرنا۔

خواتین میں حقوق و فرائض ، اہم شرعی مسائل اور اکتساب و انفاق سے متعلق اسلامی احکام کا درست علم بہم پہنچ

اغراض و مقاصد:

- طالبات میں اسلامی نکتہ نظر سے آدابِ معاشرت کی اہمیت کا شعور پیدا کرنا۔

- بچیوں میں خوراک، لباس، گھر اور بچوں سے متعلقہ امور کو اسلامی تعلیمات کی روشنی میں انجام دینے کی صلاحیت اجاگر کرنا۔
- خواتین میں حقوق و فرائض ، اہم شرعی مسائل اور اکتساب و انفاق سے متعلق اسلامی احکام کا درست علم بہم پہنچانا۔

ثمرات و نتائج:

1. طالبات میں گھریلو اور معاشرتی معاملات میں درست اسلامی تعلیمات سے شناسائی کا حصول۔
2. شرعی مسائل مثلا نکاح و طلاق، مہر، رضاعت اور عدت کا فہم و ادراک۔

مال و دولت کے حصول اور اخراجات میں حلال و حرام کی تمیز پیدا کرنا

عنوانات:

قرآن مجید اور ہمارے فرائض
منتخب قرآنی آیات اور اخلاقِ حسنہ
خوراک
لباس
عائلی زندگی قرآن و سنت کی روشنی میں
اکتساب و انفاق کے اسلامی احکام
1. قرآن اور سائنس

مجوزہ کتب:

پروفیسر فرح یعقوب ،اسلام اور ہوم اکنامکس، ستمبر 2017، دار السیاف غزنی سٹریٹ اردو بازار لاہور۔
مسز ناہید قریشی، تعلیماتِ اسلامی ، اگست 2016 ، م-ن
ڈاکٹر سیدہ کلثوم کرامت ،غذا، لباس، اولاد، بیوت، فنون،مدخول و مصاریف نساء فی ضوء القرآن،1983،م-ن

Code	Course Title	Credit Hour	Semester
FST-102	Unit Operations in Food Processing	3(3+0)	2

Course Objectives

The specific objective includes:

- To provide knowledge of unit operations that are integral to food processing

Course Outcomes

After completing this course, students will be able:

- Learn and gain skills on processes and unit operations commonly used in food processing

Course Contents

Theory

Introduction: Units, dimensions, conversion; Energy and mass balance: Heat transfer fundamentals – conduction, convection and radiation; Mass balance equations and Pearson's Law; drying and evaporation, use of low temperature, Rheology of food products: Stress, deformation and other aspects; Transport of fluids through pipes: Laminar and turbulent regimes; Circulation of fluid through porous beds; Darcy's law: Permeability, porosity; Filtration: Fundamentals, equipment, maintenance problems, prospects; Separation processes by membranes.

Recommended Books

1. Earle, R.L. 2013. Unit Operations in Food Processing (2nd edition). Pregamon Press, New York USA.
2. Gustavo, A and V. Barbosa-Canovas. 2002. Unit Operations in Food Engineering. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
3. McCabe, W.L., J.C. Smith and P. Harriott. 2005. Unit Operations of Chemical Engineering. McGraw Hill Inc., New York, NY, USA.
4. Singh, R.P. and Heldman, D.R. 2013. Introduction of food engineering (Food Science & Technology). Academic Press, USA.
5. Zhang, H.Q., Barbosa-Canovas G.V., Bala Balasubramaniam V.M. , Dunne C.P., Farkas, D.F. and Yuan J.T.C. 2011. Nonthermal processing technologies for food. John Wiley & Sons, IFT Press. USA

Code	Course Title	Credit Hour	Semester
ENG-201	Business Communication Skills (English)	3(3+0)	3

Course Objectives

The specific objectives include:

- To train students to understand format requirements and structured information
- To facilitate students to articulate subject matter lucidly
- To help them manage business communication in verbal and written form
- To develop and enhance their skills for any possible future ventures in practical fields

Course Outcomes

After completing this course, students will be able to:

- Understand and communicate effectively with diversity of individuals and communities in various situations

Course Contents

Understanding Communication at the Workplace: Forms of formal communications: Memos, letters, notices, calls for meetings and interviews,

Writing Effective Reports: Researching and writing reports. Writing short reports. Memo writing.

Developing Additional Business Communication Skills: Communicating orally, communicating in the job search, Business text with precision, Memo, Sales letter, calls for meetings, Taking Notes and Minutes of Meeting, Presentation, PowerPoint PPT, Video/Online meetings.

Digital Communication.

Effective Communication, Writing Business Emails, E-Safety, Social media messages, usage and feedback, Context development, Blogging. Netiquettes

Recommended Books

1. Cook, D., & Cooper, N. (Eds.). (2006). *Teaching information literacy skills to social sciences students and practitioners: a casebook of applications*. Assoc of Cllge & Rsrch Libr.
2. Hamilton, C. Creel, B. (2010). *Communicating for success* (1st ed.). Pearson Higher Education.
3. Lesikar, R. V., Flatley, M. E., Rentz, K., & Pande, N. (2008). *Business communication: Making connections in a digital world*. McGraw-Hill.
4. Sullivan, J. (2016). *Simply said: Communicating better at work and beyond* (1st ed.). New Jersey: John Wiley & Sons, Inc.

Code	Course Title	Credit Hour	Semester
FST-201	Post-Harvest Technology	3(2+1)	3

Course Objectives

The specific objective includes:

- To provide an understanding on chemical and physical changes in foods (fruits and vegetables) during postharvest stages

Course Outcomes

After completing this course, students will be able:

- Explain the physiology, biochemistry and various technologies during development, production and involved relevant to shelf life
- Analyze various aspects of quality control and evaluation
- Indicate significance and importance of postharvest technology and practices to maintain the quality

Course Contents

Theory

Postharvest technology: Introduction, production, losses, causes, trade; Fruit ripening: Changes during ripening, recommended conditions, commercial practices, water loss, respiration activity; Harvesting and handling methods; Maturity assessment of different fruits and vegetables; Ripening process: Respiration, climacteric and non-climacteric patterns, pectic substances, ripening conditions; Post harvest physiology of fruits and vegetables; Post harvest treatments: Coatings, curing, vapor heat treatment, hot water treatment, degreening; Storage: Refrigerated, CA, hypobaric, MAS; Packaging: Types, design, modified atmospheric packaging, recycling; Cold chain: Packing house operations, transportation; Safety and quality of fruits and vegetables; Post harvest technology of cereals: Harvesting, threshing, drying, storage and handling; New developments in postharvest technology.

Practical

Determining harvest maturity of different fruits and vegetables; Grading and sorting; Applications of different post-harvest techniques; Changes in physical and chemical quality parameters of fruits during storage - weight loss, acidity, TSS, vitamin C degradation, firmness, color changes; Effect of packaging materials on stored fruits and vegetables; Effect of different chemicals - anti-sprouting, anti-ripening.

Recommended Books

1. Chakraverty, A., A.S. Mujumdar, G.S.V. Raghavan and H.S. Ramaswamy. 2003. Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices, Marcel Dekker, Inc., New York, NY, USA.
2. Thompson, A.K. 2003. Fruit and Vegetables Harvesting, Handling and Storage. Blackwell Science Pub., Cambridge, UK.
3. Wim, J. (ed.) 2002. Fruit and Vegetable Processing: Improving Quality. Woodhead Publishing Ltd., Abington, Cambridge, UK.

Siddiqui, M.W. 2016. Eco-Friendly Technology for Postharvest Produce Quality. Academic Press, Cambridge, Massachusetts, United States.

Code	Course Title	Credit Hour	Semester

FST-202	Basic Agriculture	3(2+1)	3

Course Objectives

The specific objective includes:

- To provide the basic knowledge and background about Pakistan's Agriculture.

Course Outcomes

After completing this course, students will be able to:

- Define and describe the concept of agriculture, its branches and their relationship with allied disciplines
- Describe the significance of agriculture sector in the country's Economy
- Understand the Agro-Ecological zones of Pakistan and the impact of climatic factors on agricultural productivity
- Measure land area and to demonstrate agriculture tools and implements

Course Contents

Theory

Agriculture - history, importance, branches, allied sciences; Salient features of Pakistan's agriculture; Climate of Pakistan, its major characteristics and impact on crop production; Land resources and their utilization in Pakistan; Water resources of Pakistan, surface and ground water, canal system of Pakistan; Problems of Pakistan's agriculture.

Practical

Measurement of land: Conventional and metric system; Identification and use of hand tools and implements; Recording weather data, types of thermometers and their uses; Techniques and instruments for measuring rainfall, light, atmospheric humidity, etc.; Identification of various soil types; Determination of soil moisture contents, saturation percentage, field capacity and wilting point; Field visits.

Recommended Books

1. Arnon, I. 1992. Agriculture in Dry Lands: Principles and Practices. Elsevier Sci. Pub., London.
2. Cheema, Z.A. and M. Farooq. 2007. Agriculture in Pakistan. Allied Book Centre, Urdu Bazar Lahore, Pakistan.
3. Khan, S. R. A. 2001. Crop Management in Pakistan with Focus on Soil and Water. Directorate of Agri. Information, Punjab, Lahore, Pakistan.
4. Nazir, M.S. 1994. Crop Production. National Book Foundation, Islamabad, Pakistan.

   Somani, L.L. 1993. Recent Advances in Dry Land Agriculture. Part 2, Scientific Publishers, Jodhpur, India

Code	Course Title	Credit Hour	Semester
ENG-202	Soft Skills and Emotional Intelligence	3(3+0)	4

Course Objectives

The specific objective includes:

- To train students to acquire necessary social skills in order to think critically and intelligently and express themselves in a desired manner at workplace, with family, friends and in society

Course Outcomes

After completing this course, students will be able to:

- Exercise their cognitive abilities which will build their confidence
- Communicate effectively
- Manage their negative emotions intelligently and learn to understand others with empathy

Course Contents

Creative and Critical Thinking; Positive thinking; Confidence building; Problem solving and decision making

Communication Skills: Effective Listening; Verbal and Non-verbal at Interpersonal, Group, Virtual and Mass level

Speaking Skills: Formal, Semi-formal and Informal Communication, Giving Interviews

Emotional Intelligence: Conflict resolution and negotiation; Working as a team member and a leader; Giving and taking criticism in a positive manner; Stress management; Anger management; time management; Empathy and Rapport

Recommended Books

1. Bolton, R. (2009). *People skills*. Simon and Schuster.
2. Bradberry, T., & Greaves, J. (2009). *Emotional Intelligence 2.0*. Talent Smart.
3. Covey, S. R. (2005). The 7 habits of highly effective people: Powerful lessons in personal change.
4. Fanning, M. M. P., & Davis, M. (2018). *MESSAGES: The Communications Skills Book*. Read how you want Com Limited.
5. Goleman, D. (2005). *Emotional intelligence: Why it can matter more than IQ*. Bloomsbury Publishing.
6. Leal, B. C. (2017). *4 essential keys to effective communication in love, life, work-anywhere* (1st ed.). CreateSpace Independent Publishing Platform
7. McKay, M., Davis, M., & Fanning, P. (2009). *Messages: The communication skills book*. New Harbinger Publications.
8. Tarafder, S. K. (2009*). How to learn flawless English: Both spoken and written*. APH Publishing Corporation

Code	Course Title	Credit Hour	Semester
FST-203	Fundamentals of Human Nutrition	3(3+0)	4

Course Objectives

The specific objective includes:

- To provide knowledge on the basic principles of Human Nutrition

Course Outcomes

After completing this course, students will be able:

- The student will know and explain the role of nutrients in human health and nutrition
- Understanding the fate of nutrient that is absorption, digestion and metabolism in human body
- Correlate the disorders related to non-optimal consumption of nutrients

Course Contents

Introduction: Definitions, food, nutrients, diet, balanced diet, food groups, food guide pyramid, meal planning; Eating food: Smell, taste, satiety; Water: Functions, sources, regulation in body, dietary requirements, content in food; Carbohydrates: Types, role in body, dietary fiber, sweeteners, dietary requirements, content in food; Fats and oils: Types, functions, dietary requirements, content in food, fat substitutes; Proteins: Amino acids, protein synthesis, classification, functions, quality of proteins, dietary requirements, content in foods; Vitamins: Classification, role in body, content in food; Mineral elements: Types, requirements, sources, functions; Digestion: Alimentary tract, digestive juices, secretions; Absorption and metabolism of nutrients: Carbohydrates, protein, lipids; Diet related health disorders: Malnutrition, obesity, coronary diseases, diabetes, lactose and gluten intolerance, dental caries – symptoms, causes, prevention.

Recommended Books

1. Awan, J.A. 2018. Elements of Food and Nutrition. Unitech Communications, Faisalabad, Pakistan.
2. Bamji, M.S., K. Krishnaswamy and G.N.V. Brahmam. 2009. Textbook of Human Nutrition. 3rd Ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
3. Eastwood, M. 2013. Principles of Human Nutrition. 2nd Ed. John Wiley & Sons, Inc., NY, USA.
4. Geissler, C. and H. Powers. 2011. Human Nutrition. 12th Ed. Churchill Livingstone, London, UK.

   Gibney, M.J., S.A. Lanham-New, A. Cassidy and H.H. Vorster. 2009. Introduction to Human Nutrition. 2nd Ed. Wiley-Blackwell, A John Wiley & Sons, Ltd., The atrium, Chichester, West Sussex, U.K

Code	Course Title	Credit Hour	Semester
FST-204	Food Analysis	3(1+2)	4

Course Objectives

The specific objective includes:

- To give basic knowledge on instrumental methods of chemical analysis and train students to perform practical on real samples to get acquainted with instrumentation and equipment

Course Outcomes

After completing this course, students will be able:

- Proficiency in professional sampling and sample treatment prior to analysis
- Capability of treatment and evaluation of the results of analysis
- Understand and capability of performing basic chemical processes in an analytical process
- Capability of performing experiment on basic analytical instruments

Course Contents

Food analysis: Significance; Sampling: Techniques, preparation, preservation; Physical properties and analysis of foods and food products: Appearance, texture, specific gravity, refractive index, rheology; Chemical analysis: Significance; Proximate analysis: Moisture, ash, proteins, lipids, carbohydrates, fiber, NFE, acidity, pH, sugars, mineral elements, vitamins – significance, methods; Chromatography: basic concepts, principles and types; Spectroscopy: Principles and Types: UV-VIS, Atomic emission, atomic absorption; Sensory evaluation of foods: Attributes, difference and preference tests, consumer acceptance; Analytical data: Evaluation, interpretation, statistical applications.

Practical

Lab safety requirements; Preparation and standardization of laboratory solutions; Sampling, Determination of specific gravity refractive index, moisture, ash, crude protein, crude fat, crude fiber, NFE, pH and acidity; Determination of mineral elements through UV-Vis, flame photometer and

atomic absorption spectrophotometer; Paper, thin layer & liquid chromatography; Identification of compounds through HPLC, Sensory evaluation of foods

Recommended Books

1. Awan, J.A. and S.U. Rehman. 2018. Food Analysis Manual. Unitech Communications, Faisalabad, Pakistan.
2. AOAC (Association of Official Analytical Chemists). 2019. Official methods of analysis of AOAC. Association of Official Analytical Chemists, Arlington, USA
3. Nielsen, S.S. 2010. Food Analysis. 4th Ed. Springer Science & Business Media, London, UK.
4. Nollet L.and F. Toldra. 2015. Handbook of Food Analysis. 3rd Ed. CRC Press, USA
5. Pico Y. 2012. Chemical Analysis of Food: Techniques and Applications. Academic Press, Elsevier Inc, USA

Code	Course Title	Credit Hour	Semester
FST-205	Food Service Management	3(3+0)	4

Course Objectives

The specific objectives include:

- To develop better understanding in food service management.
- Recognise functions and explain basic principles applied in food service management.

Course Outcomes

After completing this course, students will be able to:

- Demonstrate the skills and knowledge required to critically evaluate the provision and management of food services.
- Apply a sound knowledge and application of the principles and practice food service and management
- Perform task in food service management with quality standards.
- Discover and deepen their identity through the different task of food service management.

Course Contents

Food service management: Introduction, position, manage and leverage a successful food service operation; The compilation of management practices: Tools and techniques, essential approaches; Food service industry: History, segmentation and managerial implication, menu planning and development, recipe standardization, costing and analysis, food supply chain management, distribution channels, supplier selection, purchasing, equipment selection, forecasting, storage management, product inventory management, human resource management, customer services, marketing; Food safety: GMP, HACCP

Recommended Books

1. Barron, C.W., T. Power and D.R. Reynolds. 2012. Introduction to Management in the Hospitality Industry. 10th Ed. John Wiley Sons Inc., Hoboken, NJ, USA.
2. Raske, L. 2017. Foodservice Management Fundamentals. Scitus Academics, Valley Cottage, NY, USA.
3. Reynolds, D.R. 2013. Foodservice Management Fundamentals. John Wiley Sons Inc., Hoboken, NJ, USA.
4. Reynolds, D.R. and K.W. McClusky. 2013. Study Guide to Accompany Foodservice Management Fundamentals. John Wiley Sons Inc., Hoboken, NJ, USA.

Walker, J.R. 2008. Study Guide to Accompany the Restaurant: From Concepts to Operations. 5th Ed. John Wiley Sons Inc., Hoboken, NJ, USA

Code	Course Title	Credit Hour	Semester
FST-206	**Food Microbiology**	**3(2+1)**	4

Course Objectives

The specific objective includes:

- To understand the microbial interactions and their role in raw and processed foods

Course Outcomes

After completing this course, students will be able:

- Acquire skills related to the microbiological food control through appropriate and targeted applications of physical chemical and biological treatments
- The use and microbial monitoring of foods especially fermented foods

Course Contents

Food microbiology: Introduction and scope; Morphological, cultural and physiological characteristics: Molds, yeasts and yeast like fungi, bacteria; Important microbial genera in foods: Bacteria, moulds, yeasts, viruses - general, morphological, cultural and physiological characteristics; Factors affecting the growth and survival of microorganisms in food: Intrinsic, extrinsic and implicit; Contamination and spoilage of perishable, semi perishable and stable foods: Sources, transmission, microorganisms; Food microbiology and public health: Food-borne infections, intoxications; Microbiological risk assessment; Microbiology in food sanitation: Food sanitizers and pathogen reduction - a case study.

Practical

Isolation, identification and characterization of microorganisms: Morphology, biochemical; Enumeration of microorganisms in food and water samples (total count, viable count, MPN); Examination of foods for pathogenic organisms (*Escherichia coli*, Coliform, *Salmonella* and *Listeria* monocytogenes).

Recommended Books

1. Brown, M. and M. Stringer. 2010. Microbiological Risk Assessment in Food Processing. Woodhead Publishing Ltd. Cambridge, UK.
2. Jay, J.M. 2012. Modern Food Microbiology. CBS. Pub. and Distributors, New Delhi.
3. Lund, B, T.Barid- Parker and G. Gould. 2010. The Microbiological Safety and Quality of Foods. Vol. I & II Aspen Publishers, Inc., Frederick.
4. Matthews, K.R., K.E. Kniel and T.J. Montville. 2017. Food Microbiology: An Introduction. 4th Ed. ASM Press, Washington, USA.
5. Ray, B. and A. Bhunia. 2018. Fundamental Food Microbiology. 5th Ed. Taylor & Francis Books, India

Code	Course Title	Credit Hour	Semester
FST-301	**Food Laws and Regulations**	**3(3+0)**	5

Course Objectives

The specific objective includes:

- To examine laws, regulations, and policies that govern food regulation locally and internationally

Course Outcomes

After completing this course, students will be able to:

- Knows national and international food laws
- Apply key principles of food law to food industry
- Have understanding of issues related to regulation of food

- Recognize the critical role laws and regulation play in protecting food safety and in fostering a healthy food industry

Course Contents

Pakistan Standards and Quality Control Authority: Functions, authorities, standards; Pure Food Rules - 2007: Definitions, significant features, enforcement, amendments; Food inspector and public analyst: Qualifications, duties, powers; Food adulteration: Adulterants, health hazards, methods of detection; Food labelling: Perspectives on nutrition labelling; Islamic food laws and regulations: Sources, principles, lawful foods, unlawful foods; Consumer laws in Pakistan; International food laws: Introduction; The World Trade Organization (WTO); The agreement on the application of sanitary and phytosanitary measures; GATT; Codex Alimentarius: General, procedural manual, standards, codes, legal force.

Recommended Books

1. Meulen, B. and M. Velde. 2008. European Food Law Handbook. Academic Publishers, Wageningen, The Netherlands.
2. Prabhaakar, K. 2017. A Practical Guide to Food Laws and Regulations. Bloomsburry, India.
3. PSQCA (Pakistan Standards and Quality Control Authority). 2010. Standards for Different Food Items. PSQCA, Karachi, Pakistan.
4. Riaz, M.N. and M.M. Chaudhary. 2004. Halal Food Production. CRC Press Taylor & Francis Group, Boca Raton, FL, USA.
5. The Punjab Pure Food Rules – 2011. The Punjab Weekly Gazette. Government Printing Press, Lahore, Pakistan.

Code	Course Title	Credit Hour	Semester
FST-301	Food Chemistry	3(3+0)	5

Course Objectives

The specific objectives include:

- To develop students understanding of how food components contributes to overall quality of foods
- To enable students to evaluate and explain how the complex nature of food may result in a multitude of desired and undesired reactions which are controlled by variety of parameters

Course Outcomes

After completing this course, students will be able to:

- Describe reactions and mechanisms important in food chemistry
- Describe the chemistry of most important food components, including their properties and reactions
- Demonstrate knowledge on the relationship of chemical markers and key chemical compounds that relate flavour and color attributes to thermal processing

Course Contents

Water: types, properties, structure, water activity, effect on shelf life of food. Biopolymers: classification, structure, physical, chemical and functional properties, caramelization, Maillard reaction, dietary fiber. Lipids: classification, structure, fatty acids, properties, rancidity, emulsifiers. Mineral elements: introduction, chemical and functional properties. Vitamins: classification, properties, structure, stability. Colours and pigments: functions, properties, stability. Flavours: characteristics – taste and other saporous substances, aromatic compounds. Enzymes: nature, functions, classification.

Recommended Books

1. Belitz, H.D., W. Groschm and P. Schieberle. 2013. Food Chemistry. Springer Verlag, Heidelberg, Germany.
2. Damodaran, S., K.L. Parkin and O.R. Fennema. 2017. Fennema's Food Chemistry. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
3. David L. Nelson and Michael M. Cox Lehninger. 2005. Principles of Biochemistry (4th ed.)
4. DeMan, J.M. Finley J.W., Hurst., W.J and C.Y. Lee 2018. Principles of Food Chemistry. Springer Verlag, Heidelberg, Germany.
5. Wong., D.W.S., 2018. Mechanism and Theory in Food Chemistry. Springer Verlag, Heidelberg, Germany.

Code	Course Title	Credit Hour	Semester
FST-303	Fruits and Vegetables Processing	3(2+1)	5

Course Objectives

The specific objectives include:

- To acquire basic knowledge in the field of fruit and vegetable processing
- To discuss the application of fruits and vegetable processing and preservation, principles and technologies for processing, prevention, shelf life extension and value addition of fruits and vegetables products in terms of safety, nutritional and dietary quality and wholesomeness

Course Outcomes

After completing this course, students will be able to:

- Describe the general properties of fruits and vegetables and their importance
- Choose the most appropriate method for the fruits and vegetables processing and preservation
- Differentiate between the different types of fruit and vegetables disorders i.e. physiological, chemical and biological in terms of causes and disadvantages
- Understand the harvesting process, to indicate the importance of grading and to distinguish the different types and benefits of packaging of fruits and vegetables
- Determine indicators of ripening and senescence processes and factors affecting them

Course Contents

General properties of fruits and vegetables: Chemical composition, nutritional aspects, structural features, choice of processing technologies; Maintaining post-harvest quality of fruits and vegetables: Quality criteria, quality deterioration – measurement and maintenance; Spoilage factors (chemical, enzymatic, biological) and their control; General procedures for fruits and vegetables preservation: An overview; New technologies for processing of fruits and vegetables: Minimal processing technology, modified atmosphere packaging, edible coatings**.** Nonthermal techniques: high pressure processing, ultrasound, ultraviolet irradiation, pulsed electric field, cold plasma – introduction, applications, impact on bacteria, enzymes, product quality; Future trends in fruits and vegetables processing.

Practical

Preparation of fruits and vegetables products: Dried, frozen and canned; Quality evaluation of the products during storage; Manufacturing of pickle, juice concentrate, ready to serve juices, squashes, syrups and fruit candies; Use of edible coating for fruits and vegetables; Visit to fruit and vegetable processing units.

Recommended Books

1. Awan, J.A and S.U. Rehman. 2018. Food Preservation Manual. Unitech Communications, Faisalabad, Pakistan.
2. Dauthy, M.E. 1995. Fruit and Vegetable Processing. FAO Agricultural Services Bulletin No. 119. Food and Agriculture Organization of the United Nations, Rome, Italy.
3. Siddiq, M., & Uebersax, M. A. (Eds.). (2018). Handbook of vegetables and vegetable processing. John Wiley & Sons.

4. Sirivastava, R.P. and K. Sanjeev. 2002. Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co., Lucknow, India.
5. Sinha, N.K., Sidhu, J.S., Barta, J, James, Wu S. B., Cano, M.P. 2012. Handbook of Fruits and Fruit Processing, Second Edition, John Wiley & Sons.

Code	Course Title	Credit Hour	Semester
FST-304	Dairy Technology	3(2+1)	5

Course Objectives

The specific objective includes:

- To teach the undergraduate students about milk: from farm through reception, analysis, manufacturing and final product quality and storage. Students' gains hands on experience with respect to production of selected dairy products and through industry visits and practical become familiar with raw material handling, production procedures and quality control of the finished products

Course Outcomes

After completing this course, students will be able:

- Know milk composition along with factors affecting it.
- Explain processes in milk and milk products production
- Able to explain the quality operations in the milk processing unit

Course Contents

Milk: Production statistics, importance, standards, major constituents. Factors influencing raw milk quality. Milk handling: cooling, collection, transportation, reception. Unit operations in fluid milk processing: Cream separation, bactofugation, microfiltration, thermization, standardization, homogenization, pasteurization, sterilization, UHT, aseptic packaging, storage, distribution. Dairy products manufacturing: Technology and chemistry involved in evaporated, condensed and powder milks, butter, yogurt, cheese, ice cream, khoa, desi ghee. Milk by-products: dried whey, butter milk and casein.

Practical

Sampling of milk and milk products. Reception tests: sensory test, sedimentation, pH, acidity, lactometer reading, clot on boiling, alcohol precipitation test, standard plate count, reductase test, phophataase test. Physico-chemical and microbiological analysis of milk and milk products. Tests for milk adulterants. Visit to commercial dairy farms and milk processing plants.

Recommended Books

1. Alfa Laval/Tetra Pak. 2015. Dairy Processing Handbook. Tetra Pak Processing System, Lund, Sweden.
2. Chandan, R.C., A. Kilara and N. Shah. 2008. Dairy Processing and Quality Assurance, John Wiley & Sons Inc., New York, NY, USA.
3. Walstra P., J.T.M. Wouters and T.J. Guerts. 2006. Dairy Science & Technology. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
4. Wehr, H.M. and J.F. Frank. 2004. Standard Methods for the Examination of Dairy Products. 17th Ed. American Public Health Association (APHA), Washinton, DC., USA.
5. Winton A.L. and K.B. Winton. 2006. Milk and Milk Products. Agrobios, Agro House, New Delhi, India.

Code	Course Title	Credit Hour	Semester
FST-305	Food Safety and Toxicology	3(3+0)	5

Course Objectives

The specific objectives include:

- To provide knowledge of chemical constituents of food stuffs that occur as toxicants, naturally occurring contaminants or intentionally /unintentionally introduced into food during processing.
- To provide knowledge on the basis of food safety and hygiene
-

Course Outcomes

After completing this course, students will be able:

- Differentiate between natural constituents that are toxicants and natural contaminates that act as toxicant
- Differentiate between the various types of toxicants, chemistry, their mode of actions, significance, food sources and possible detoxification methods
- Understand and implement the food safety and quality management systems related to food industry

Course Contents

Toxicology: Definition, dose-response, absorption, translocation, storage excretion, food toxicology; Toxicity by naturally occurring food toxins: Plant origin, accidental toxicity, haemagglutinins, goitrogens, cyanogens, lathyrogens, others; Animal origin – honey, quail, eggs, milk, meat, fish; Toxicity by extraneous chemicals: Agricultural chemicals, food processing, packaging, additives, adulterants; Toxicity from water; Microbial toxins: Mycotoxins, moulds, mushrooms; Bacterial food intoxication; Bacterial food infections; Food allergy and intolerance; Systems for food safety surveillance: GMP, TQM, HACCP and FSMS-ISO22000:2018.

Recommended Books

1. Awan, J.A. and F.M. Anjum. 2019. Food Toxicology. Unitech Communications, Faisalabad, Pakistan.
2. Cliver, D.O., M. Potter and H.P. Riemann. 2011. Foodborne Infections and Intoxications. 3rd Ed. Elsevier, Amsterdam, Netherlands.
3. ISO (International Organization for Standardization). 2018. Food Safety Management Systems Requirements for an Organization in the Food Chain. Case Postale, Geneva, Switzerland.
4. Metcalfe, D.D., H.A. Sampson and R.A. Simon. 2011. Food Allergy: Adverse Reactions to Foods and Food Additives. 4th Ed. John Wiley & Sons, Perth, WA, Australia.
5. Shibamoto, T. and L. Bjeldanes. 2009. Introduction to Food Toxicology. 2nd Ed. Academic Press, London, UK.

Code	Course Title	Credit Hour	Semester
FST-306	Cereal Technology	3(2+1)	3

Course Objectives

The specific objectives include:

- To introduce students to some of the major cereals, their importance, composition and nutrition
- To teach students about principle of cereal processing, quality evaluation and their utilization
- To teach students about the rheological properties of dough and their interpretation

Course Outcomes

After completing this course, students will be able to:

- Understand the basic principle of processing and utilization of major cereals
- Understand the rheological properties of dough and their application

Course Contents

Cereal grains: Importance, production, structure, composition, nutrition; Grain grades and grading; Storage: Methods, types, role of temperature and moisture, safe storage methods; Dry milling process: Cleaning, tempering, conditioning; Grinding process: Types of grinding machines; Sieving process: Principles, types of sifters; Flour treatment and quality assessment; Rheology of doughs and batters; Maize - wet milling: Production of starch, oil, protein; Rice: Drying, milling, parboiling; Processing of rice, oats and other cereals; Malting and brewing; Production of breakfast cereals and snack foods; Potential uses of cereals.

Practical

Cereal grains; Grading & Physical tests; Milling of cereal grain through different mills; Tests for flour quality assessment; Visit to wheat, maize and rice processing industries.

Recommended Books

1. Delcour, J.A. and R.C. Hoseney. 2010. Principles of Cereal Science and Technology. American Association of Cereal Chemists Inc, St. Paul, MN, USA.
2. Dendy, A.V.D and B.J. Dobraszcyzyk. 2001. Cereals and Cereal Products: Technology and Chemistry. Aspen Publishers, NY. USA.
3. Karel, K. and G.P. Joseph. 2000. Handbook of Cereal Science and Technology. Marcel Dekker, New York, NY, USA
4. Sergio, O.S. 2010. Cereal Grains Properties, Processing and Nutritional Attributes. CRC Press, Taylor & Francis Group, FL, USA.
5. Wrigley, C., I. Batey and D. Miskelly, 2017. Cereal Grains Assessing and Managing Quality, Second Edition. Woodhead Publishing, USA.

Code	Course Title	Credit Hour	Semester
FST-307	Food Quality Management	3(3+0)	6

Course Objectives

The specific objective includes:

- To develop students understanding about various quality parameters as well as methods employed to ensure quality standards

Course Outcomes

After completing this course, students will be able to:

- Discuss quality management standards and frame works
- Outline the key regulatory issues that ensure food safety and quality
- Explain quality management system that ensure integrity through the food chain

Course Contents

Food quality management: History, importance, systems; Good manufacturing practices (GMP): Personal cleanliness, buildings and facilities, sanitary operations, sanitary facilities and controls, equipment and utensils, production and process control, warehousing and distribution, traceability and recall; Hazard analysis and critical control points (HACCP) system: History, prerequisites, preliminary steps, principles; Food Safety Management Systems (FSMS) – ISO22000:2005; Codex Alimentarius Commission (CAC) guidelines for food quality management.

Recommended Books

1. CAC (Codex Alimentarius Commission). 2018. Codex Alimentarius Commission – Procedural Manual. 26th Ed. Joint FAO/WHO Food Standards Programme. FAO, Rome, Italy.
2. IFT (Institute of Food Technologists). 2013. Food & Drink – Good Manufacturing Practice: A Guide to its Responsible Management. 6th Ed. Wiley-Blackwell, A John Wiley & Sons, Ltd., The atrium, Chichester, West Sussex, U.K.
3. ISO (International Organization for Standardization). 2018. Food Safety Management Systems – Requirements for an Organization in the Food Chain. Case Postale, Geneva, Switzerland.
4. Lelieveld, H.L.M., M.A. Mostert and J. Holah. (eds.). 2005. Good manufacturing practices in the food industry. In: Handbook of Hygiene Control in the Food Industry. Woodhead Publishing Ltd., Abington, Cambridge, UK.
5. Motarjemi, Y and H. Leliveld. 2014. Food Safety Management: A Practical Guide for the Food Industry. Academic Press, Elsevier Inc., Burlington, MA, USA.

Code	Course Title	Credit Hour	Semester
FST-308	Beverage Technology	3(2+1)	6

Course Objectives

The specific objective includes:

- To gain knowledge on process involved in beverage technology and fermentation process involved in making beverages

Course Outcomes

After completing this course, students will be able to:

- Understand various concepts, principles and procedure involved in processing of beverages
- Understand various unit operations involved in food beverage manufacturing
- Know the quality control steps in beverage preparation

Course Contents

Beverage industry in Pakistan; Beverages: Classification – still, carbonated, alcoholic; Beverage ingredients: Water, fruit components, sweeteners, flavourings, colorings, preservatives; Manufacture of soft drinks and fruit juices: Mixing, pasteurization, homogenization, filling, packing and storage.

Carbonation: History, CO_2, gas volume; Soft drinks and fruit juices: Ingredient specifications, manufacturing problems, changes in color, appearance, flavour; Packaging: Types, interactions; Shelf life Issues: Microbiological problems; Bottled water: Legislation, water treatment, filling, quality issues; Fermented beverages: Introduction, types, role of microorganisms; Regulations and standards; Statuary requirement: Labelling, nutrition claims.

Practical

Water treatment and analysis; Preparation and preservation of fruit pulps and juice concentrates; Formulation and preparation of carbonated beverages; Analysis of beverages: Chemical, microbiological, sensory; Manufacture of fermented beverages and synthetic drinks; Visit to beverage industries.

Recommended Books

1. Ashurst, P. R. 2016. Chemistry and technology of soft drinks and fruit juices. John Wiley and Sons.
2. Ashurst, P.R. and R. Hargitt. 2009. Soft Drink and Fruit Juice Problems Solved. Woodhead Publishing. Ltd., Abington, Cambridge, UK.
3. Holzapfel, W. 2015. Advances in Fermented Foods and Beverages. Woodhead Publishing, Sawston, United Kingdom, Cambridge, United Kingdom

4. Paquin, P. (Ed.). 2009. Functional and speciality beverage technology. Elsevier.
5. Shachman, M. 2000. The Soft Drinks Companions: A Technical Handbook for the Beverage Industry. CRC Press Taylor & Francis Group, Boca Raton, FL, USA.

Code	Course Title	Credit Hour	Semester
FST-321	**Bakery Products Technology**	**3(2+1)**	6

Course Objectives

The specific objective includes:

- To study the fundamental of baking science and develop the skill of sustainable business

Course Outcomes

After completing this course, students will be able:

- Identify and explain baking terms, ingredients, equipment and tools
- Implementation of clean food handling practices using contemporary guidelines
- Hands on training and production of baked products using commercial equipments

Course Contents

Science of bakery product: Emulsions, oils & fats, proteins, starch, water; Raw materials: Grains, milling; Types of flours: Chorleywood bread flour, patent, soft, wholemeal, brown and low moisture flours; Leavening agents; flour treatments, food starch excluding flour, fats, emulsifiers, colors, flavors, antioxidants, sugars, dairy ingredients, gums and gelling agents; Bread making: Chemistry of dough development, making of bread, types of breads,; Products other than bread: Pastry, biscuits, wafers, cakes, doughnuts and other chemically leavened products; Dietetic bakery products; Quality control aspects in bakery products.

Practical

Preparation of breads, pastry, biscuits, wafers, cakes and chemically leavened products; Effect of different ingredients on quality of bakery products; Visit to different baking plants.

Recommended Books

1. Cauvain, S.P. 2012. Bread Making; Improving Quality. CRC Press., Boca Raton Boston, NY, USA.
2. Cauvain, S.P. 2006. Baked Products: Science, Technology and Practice. Willey Blackwell, NJ, USA.
3. Edward, W.P. 2007. The Science of Bakery Products. The Royal Society of Chemistry, Cambridge, UK.
4. Zhou, W. and Y. H. Hui. 2014. Bakery Product Science and Technology. 2nd Ed. Blackwell Pub. Co., London, UK.
5. Pyler, E.J. 2010. Baking science and technology. Vol-I & II. Sosland Pub. Co., Kansas, USA

Code	Course Title	Credit Hour	Semester
FST-310	**Food Biotechnology**	**3(2+1)**	6

Course Objectives

The specific objectives include:

- To providing the students with basic knowledge about the applications of Biotechnology in the food industry and in food-related sectors.
- The fundamentals of the production of fermented foods, and the new biotechnological strategies for obtaining and transforming food products.

Course Outcomes

After completing this course, students will be able to:

- To describe the applications and current situation of Biotechnology in relation to foods, and will be aware of the advantages and limitations of novel food products obtained through biotechnological approaches.
- To know the fundamentals of microbial and enzymatic control in foods.
- To know the characteristics of raw material and industrial processes applied to obtain the most relevant fermented foods.
- To analyse the characteristics of foods made of genetically modified organisms and explain the most relevant scientific advances in this field

Course Contents

Biotechnology and Food Biotechnology: Introduction, history; Microbial metabolism; Metabolic and biochemical engineering: Bacteria based products and processes, Yeast based products and processes, Metabolites, range of fermentation processes, components of fermentation processes; Isolation and preservation of industrially important microorganisms; Industrial fermentations: Media, design and types of fermenters, process variables in fermentation, recovery, purification of fermentation products; Production of organic acids, enzymes, amino acids, single cell proteins, carotenoids and fermented food products; Microbial genetics: Conjugation, transduction, transformation; Genetic engineering, GMO in food biotechnology; Legal and social aspects of food biotechnology.

Practical

Isolation, purification and maintenance of yeast and bacterial cultures; Aerobic and anaerobic fermentation and production of various fermented food products

Recommended Books

1. Lee, B.H. 2014. Fundamentals of Food Biotechnology. Seond Edition, John Wiley and Sons, Ltd. West Sussex, UK.
2. Montet, D. and R.C. Ray. 2015. Fermented Foods, Part 1: Biochemistry and Biotechnology, Ist Edition. CRC Press, New York.
3. Borem, A., F.R. Santos and D.E. Bowen, 2004. Understanding Biotechnology. Pearson Education Inc., Upper Saddle River, NJ, USA.
4. El-Mansi, F.M.T., C.F.A. Bryee, A.L. Demain and A.R. Allman. 2007. Fermentation Microbiology and Biotechnology. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
5. Shetty, K., G. Paliyath, A. Pometto and R.E. Levin. 2005. Food Biotechnology. Marcel Dekker Inc., New York, NY, USA.

Code	Course Title	Credit Hour	Semester
FST-311	**Food Packaging**	**2(2+0)**	6

Course Objectives

The specific objective includes:

- To educate students about basic principles and types of packaging and to use it in the processing, preservation, distribution and promotion of food products,

Course Outcomes

After completing this course, students will be able to:

- To understand the purpose and principles of food packaging.
- To develop an understanding of major packaging materials used in food packaging.
- To evaluate the suitability of packaging material for a particular type of food.
- To understand the operations involved in packaging material manufacture.
- To gain knowledge of the legal, environmental and quality aspects associated with packaging materials and operations used in the food industry.

Course Contents

Food packaging: Introduction, needs, functions, systems, development; Packaging types: Primary, secondary, tertiary, quaternary; Packaging materials: Rigid containers, flexible packaging; Properties of food packaging: Physical, chemical; Packaging guidelines: Retail containers, shipping containers; Factors influencing design and selection of packaging materials: Product, distribution, marketing, packaging operation, cost; Printing processes: Inks, adhesives; Filling and labelling; Safety and legislation; Novel food packaging techniques; Food labelling: Importance, types, methods.

Recommended Books

1. Arvanitoyannis, I., A. Bouletis and D. Ntionias. 2014. Application of modified atmosphere packaging on quality of selected vegetables. Springer, New York, USA.
2. EIRI board consultants and engineers. 2007. Handbook of Packaging Technology. Engineers India Research Institute, New Delhi, India.
3. Lee, D.S., K.M. Yam and L. Piergiovanni. 2008. Food Packaging Science and Technology. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
4. Robertson, G.L. 2006. Food Packaging: Principles and Practices. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
5. Yam, K.L. and D.S. Lee. 2012. Emerging Food Packaging Technologies-Principles and Practices. Woodhead Publishing, Cambridge, UK.

Code	Course Title	Credit Hour	Semester
FST-312	**Food Plant Layout**	**2(2+0)**	6

Course Objectives

The specific objective includes:

- To impart knowledge on plant layout and sanitation of food industries

Course Outcomes

After completing this course, students will be able to:

- Understand theoretical aspects to be considered for site selection, layout selection and design considerations for a food plant
- Know the procedure required for plant sanitation and can demonstrate efficient strategies for waste management

Course Contents

Food processing industry: Introduction, investment; Plant location and layout: Significance, location analysis, selection criteria - freedom from pollution, availability of potable water, raw material, labour and energy supply, communication facilities, facilities for waste disposal; Building design and construction: Floors, drains, walls, doors, windows, ceiling, ventilation, lighting, auxiliary facilities; Food plant equipment: Requirements, design, construction, choice of material, layout; Plant cleaning: Soil types, methods, detergents, water conditioners; Sanitizing: Chemical, heat, irradiation; Cleaning methods – CIP, dismantling cleaning; Pests: Types, inspection, control; Waste management: Fluid and solid wastes.

Recommended Books

1. Arvanitoyannis, I.S. 2008. Waste Management for the Food Industries. Elsevier Academic Press, New York, NY, USA.
2. Awan, J.A. and S.U. Rehman. 2018. Food Plant Layout and Sanitation. Unitech Communications, Faisalabad, Pakistan.
3. Baker, C.G.J. 2013. Handbook of Food Factory Design. Springer Verlag, Heidelberg, Germany
4. Hui, Y.H. 2014. Plant Sanitation for Food Processing and Food Service. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
5. Leliveld, H.L.M., M.A. Mostert and J. Holah. 2005. Handbook of Hygiene Control in Food Industry. Woodhead Publishing Ltd., Abington Hall, Abington, Cambridge, UK.

Code	Course Title	Credit Hour	Semester
FST-313	Food Product Development	3(2+1)	6

Course Objectives

The specific objective includes:

- To enable students for development of a new food product including generation of concepts, consumer panel testing, development of prototypes, process optimization and consumer testing

Course Outcomes

After completing this course, students will be able to:

- Students will be able to identify the processes and stages required to bring a new food product from conception to commercialization
- Develop a protocept, prototype of a new product that has a high probability that it could be produced commercially

Course Contents

Theory

Food product development: Process, strategy, design, development, commercialization, evaluation; Key to new product success and failure; Consumer in food product development: Consumer behavior, food choices, sensory needs, consumer role; Preference mapping and food product development: Conducting trials, analyzing, recent developments; Case study of consumer-oriented food product development: Reduced-calorie foods, consumer trends and healthy eating, marketing and technological challenges, success factors; Case study: Reduced-calorie on-the-go beverages; The ethics of food production and consumption.

Practical

Food product development projects: Strategy, design, development, commercialization, launch and evaluation; Practical aspects and sensory evaluation techniques; Chemical and instrumental quality analysis.

Recommended Books

1. Aramouni, F., K. Deschenes. 2018. Methods for Developing New Food Products; An Instructional Guide. 2nd Ed. DEStech Publication Inc. PA, USA.
2. Earle, M., R. Earle and A. Anderson. 2001. Food Product Development. Woodhead Publishing Ltd., Abington, Cambridge, UK.
3. Earle, M. and R. Earle. 2007. Case Studies in Food Product Development. Woodhead Publishing Ltd., Abington, Cambridge, UK.
4. Frewer, L. and H. Trijp. 2007. Understanding Consumers of Food Products. Woodhead Publishing Ltd., Abington, Cambridge, UK.
5. Lyon, D. H., M. A. Francombe and T. A. Hasdell. 2012. Guidelines for Sensory Analysis in Food Product Development and Quality Control. Springer-Verlag New York Inc. NY, USA

Code	Course Title	Credit Hour	Semester

FST-314	Sensory Evaluation of Foods	3(2+1)	6

Course Objectives

The specific objective includes:

- To enable students to develop their skills in applying sensory methods to product development and communicating sensory messages

Course Outcomes

After completing this course, students will be able to:

- Demonstrated ability to identify solutions to problems related to the sensory analysis of food and to apply upon the theoretical concepts presented in lectures

Ability to use terminology appropriate to the field of sensory analysis, correctly and contextually

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Course Contents

Introduction: Overview, physiological and psychological foundations; General requirements for sensory testing; Organization and evaluation of sensory evaluation program; Measurement: Difference, discrimination testing, scaling, threshold methods, descriptive analysis; Effective texture evaluation; Color and flavour evaluation; Special problems related to sensory science; Consumer field tests and questionnaire design; Statistical procedures.

Practical

Taste, odor identification, trigeminal sensations, taste modifiers; Use of sequential testing in selecting judges; Training of panelists by difference tests such as triangle test, paired comparison test, duo-trio test; Color, threshold determination, just noticeable difference; R-Index rating and ranking; Category scaling, determining an ideal level of an ingredient; Magnitude estimation; Descriptive analysis of different foods; Consumer test and analysis.

Recommended Books

6. Findlay C. 2019. A Practical Guide to Sensory and Consumer Evaluation. Woodhead Publishing, Cambridge, UK
7. Kemp, S.E., T. Hollywood and J. Hort. 2009. Sensory Evaluation: A Practical Handbook. John Wiley & Sons Inc., New York, NY, USA.
8. Mahony M.O. 2018. Sensory Evaluation of Food: Statistical Methods and Procedures. Marcel Dekker Inc., New York, USA
9. Lawless, H.T. and H. Heymann. 2013. Sensory Evaluation of Food: Principles and Practices. Kluwer Academic Publishers, Norwell, MA, USA.
10. Rogers L. 2017. Sensory Panel Management: A Practical Handbook for Recruitment, Training and Performance. Woodhead Publishing, Cambridge, UK

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Code	Course Title	Credit Hour	Semester
FST-401	Instrumental Techniques in Food Analysis	3(1+2)	7

Course Objectives

The specific objective includes:

- To give basic knowledge on instrumental methods of chemical analysis and train students to perform practical on real samples to get acquainted with instrumentation and equipment

Course Outcomes

After completing this course, students will be able to:

- Proficiency in professional sampling and sample treatment prior to analysis
- Capability of treatment and evaluation of the results of analysis
- Understand and capability of performing basic chemical processes in an analytical processes
- Capability of performing experiment on basic analytical instruments

Course Contents

Introduction, significance; Instrumental techniques: Principles, instrumentation, applications; Sample preparation; Micro extraction and Supercritical fluid extraction techniques; Chromatography: Basic principles: TLC, Column chromatography, GC, HPLC, LCMS, Spectroscopy: UV-VIS, atomic emission and absorption, Infrared spectroscopy, NMR; Electrophoresis: Types, principles, applications, Instruments to use for food colour and flavour analysis, recent updates in instrumentation

Practical

Sample extraction techniques, Estimation of food components using UV-VIS spectrophotometer; Mineral analysis by flame photometer and atomic absorption spectrophotometer; Determination of organic acids by chromatography; Determination of volatile compounds by gas chromatography, Identification of food components by FTIR; Protein characterization by electrophoresis.

Recommended Books

1. AOAC (Association of Official Analytical Chemists). 2019. Official methods of analysis of AOAC. Association of Official Analytical Chemists, Arlington, USA
2. Awan, J.A. and S.U. Rehman. 2018. Food Analysis Manual. Unitech Communications, Faisalabad, Pakistan.
3. Nielsen, S.S. 2010. Food Analysis. 4th Ed. Springer Science & Business Media, London, UK.
4. Nollet L.and F. Toldra. 2015. Handbook of Food Analysis. 3rd Ed. CRC Press, USA
5. Pico Y. 2012. Chemical Analysis of Food: Techniques and Applications. Academic Press, Elsevier Inc, USA
6. Winton, A. and K.B. Winton. 2006. Techniques of Food Analysis. Agrobios Publishing Co., Jodhpur, India.

Code	Course Title	Credit Hour	Semester
FST-402	Technology of Edible Oils and Fats	3(2+1)	7

Course Objectives

The specific objective includes:

- To study the processing technologies, associated factors and utilization of fat and oil in fortification program

Course Outcomes

After completing this course, students will be able to:

- Evaluate the role of processing in the quality of oil/fat
- Recommend the use of by products in the oil/fat industry
- Evaluate nutritive value of oils and fats
- Plan the use of combined processes in the modified fat production

Course Contents

Edible oils and fats: Importance, sources, production, uses; Characteristics of oils and fats: Physical, chemical; Oil bearing materials: Pre-treatment, storage; Extraction methods: Rendering, Mechanical solvent extraction; Processing: Degumming, refining, bleaching, deodorization, fractionation, winterization, hydrogenation, inter esterification, esterification, emulsification; Spoilage factors: Oxidative and hydrolytic rancidity – chemistry, prevention - use of antioxidants; Manufacture of frying oils, margarine, mayonnaise; By-products of fats and oils industry and their uses.

Practical

Extraction of oils and fats (Mechanical and solvent); Determination of physical and chemical constants: Color, cold test, melting point, adulterant (Qualitative test), specific gravity, solid fat index, refractive index, Free fatty acids (FFA%), peroxide value, iodine value, saponification value; Visit to oil and fat industries.

Recommended Books

1. Akoh, C.C. and D.B. Min. 2008. Food Lipids: Chemistry, Nutrition and Biotechnology. 3rd Ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
2. AOCS. 2009. Official Methods and Recommended Practices of AOCS. American Oil Chemists Society, Urbana, IL, USA.
3. Hamm, W., Hamilton R.J. and Calliauw, G. 2013. Edible oil processing. Jhon Wiley & Sons Ltd, West Sussex, UK.
4. O'Brien, R.D. 2010. Fats and oils: formulating and processing for application, 3rded. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA
5. Shabbir M.A., M.R. Khan and N. Siraj. 2017. Rudiments of Edible Oils and Fats. Handbook of Food Science and Technology. ISBN 978-969-8237-97-4: © University of Agriculture, Faisalabad, Pakistan

Code	Course Title	Credit Hour	Semester
FST-403	Food Industrial Waste Management	3(3+0)	7

Course Objectives

The specific objective includes:

- To impart the knowledge regarding various types of waste generated from various food processing industries and their effective treatment and disposal management

Course Outcomes

After completing this course, students will be able to:

- Fully understand food waste, its menace and potentials
- To explain and apply the technical knowledge of waste management in food industry
- Apply different methods of safe disposal of industrial food waste

Course Contents

Food industrial wastes: types; sources and characteristics of food processing wastes. Waste disposal and physical, chemical and biological treatments. BOD, COD, Bio processing in food waste treatment. Management of waste by products: sugar, fruits and vegetable, meat, fish, oil and fat, dairy and cereals. Recovery of materials from effluents by different systems. Utilization of food industry wastes. ISO Environmental Standards.

Recommended Books

1. Arvanitoyannis, L.S. 2008. Waste management for the food industries. Elsevier Academic Press, Oxford, USA.
2. Barceló, D. and M. Petrovic. 2008. Emerging Contaminants from Industrial and Municipal Waste: Removal Technologies. Springer, Heidelberg, Germany
3. Kosseva, M. and C. Webb. 2013. Food Industry Wastes: Assessment and Recuperation of Commodities. Academic Press, UK.
4. Waldron, K. 2008. Handbook of waste management and co-product recovery in food processing. CRC press, New York, USA.
5. Wang, L. K., Hung, Y. T., Shammas, N. K., Wang, M. H. S., & Chen, J. P. 2018. Handbook of Advanced Industrial and Hazardous Wastes Management. CRC Press.

Code	Course Title	Credit Hour	Semester
FST-404	Poultry, Fish and Egg Processing	3(2+1)	7

Course Objectives

The specific objective includes:

- To impart the knowledge regarding quality aspects of poultry, fish and egg during processing and preservation.

Course Outcomes

After completing this course, students will be able to:

- Understand the mechanisms involved for the processing of poultry meat
- To explain the socio-economic and nutritional importance of fish industry
- To know the grading systems and quality characteristics of egg industry

Course Contents

Theory

Poultry industry in Pakistan; Factors affecting poultry meat quality: Breed, age, sex, genotype, rearing conditions and practices; Bird selection: Weight, quality; Primary poultry processing: Live-bird supply, stunning, slaughtering, scalding, plucking, evisceration, giblet harvesting, whole-carcass and cuts packaging; Portioning and deboning operations; Preservation: Canning, drying, chemical treatments, irradiation; Packaging: Materials, selection; Quality assurance: Parameters, drug and feed residues;
Eggs: Identification, grading, composition, quality characteristics, handling, storage; Egg processing: Drying, freezing - whole, white, yolk; Functional properties and applications in food processing; Quality control during processing.

Practical

Slaughtering and dressing of poultry; Poultry cuts; Tests for freshness of poultry and eggs; Grading of poultry meat and eggs; Preparation and preservation of poultry and egg products; Visit to poultry and egg processing plants.

Recommended Books

1. Barbut, S. 2016. The Science of Poultry and Meat Processing. University of Guelph.
2. Biswas, A. K. and p. K. Mandal. 2014. Textbook of Poultry, Egg and Fish Processing Technology. Studium Press (India) Pvt.Ltd.
3. Hester.P. 2017. Egg Innovations and Strategies for Improvements. Elsevier Science.
4. Mead, G.C. 2004. Poultry Meat Processing and Quality. Woodhead Publishing Ltd., Abington, Cambridge, UK.
5. Sim, J.S., S. Nakai and W. Guenter. 2000. Egg Nutrition and Biotechnology. CABI Publishing, New York, NY, USA

Code	Course Title	Credit Hour	Semester
FST-405	Meat Technology	3(2+1)	7

Course Objectives

The specific objectives include:

- To provide the students with an insight on the current meat production status in Pakistan
- To familiarize the students with basic principles and technological procedures of meat processing
- To familiarize the students with fundamental procedures in curing and smoking meats

Course Outcomes

After completing this course, students will be able to:

- Understand the principles and concept of processing meat and meat products
- Understand the principles of harvesting animals for human consumption
- Understand the current terminologies in the processed meat industry and about safe handling of meat

Course Contents

Meat animals: Status in Pakistan; Slaughtering process: Pre-slaughtering care and handling of meat animals, stunning methods, bleeding methods; Meat carcass: Dressing, post-mortem changes, carcass evaluation; Factors affecting quality of meat; Preservation of beef and lamb: Chilling, canning,

dehydration, curing, salting, smoking, irradiation; Properties of meat: Physical, chemical, and microbiological; Nutritive value of raw and processed meat; Quality assurance and safety in meat industries; Halal authenticity of meat and meat products; Emerging technologies in meat processing.

Practical

Identification of meat cuts; Tests for freshness of meat; Meat grading and quality testing; Preservation of meat: Aging, canning, dehydration, smoking, curing; Preparation of meat products; Visit to abattoir and meat processing plants.

Recommended Books

1. Brown, M. 2000. HACCP in the Meat Industry. Woodhead Publishing Limited, Cambridge, England.
2. Cummins, E.J. and J.G. Lyng. 2016. Emerging Technologies in Meat Processing. John Wiley and Sons, New York, USA.
3. Khan, M.I. and M.S. Butt. 2016. An Introductory Test on Meat Processing. F. Tech. Communication, Faisalabad, Pakistan.
4. Khan, M.I. and A. Sameen. 2019. Animal Sourced Foods for Developing World; Preservation, Nutrition and Safety. CRC Press, USA.
5. Kerry, J., J. Kerry and D. Ledward. 2007. Meat Processing: Improving Quality. Woodhead Publishing Ltd., Abington, Cambridge, UK.

Code	Course Title	Credit Hour	Semester
FST-406	Confectionery and Snack Foods	3(2+1)	7

Course Objectives

The specific objectives include:

- To provide the knowledge on confectionery and snake food. To provide information about significance of confectionary and snack food and overview of confectionary indusrty in Pakistan.
- To learn different classification and manufacturing processes of different confectionery and snack foods with specifications and provide knowledge about packaging and quality of confectionery and snack foods

Course Outcomes

After completing this course, students will be able:

- Knowledge about significance and healthy aspects of confectionary and snake food in our daily life
- Status of confectionery and snack foods industries in Pakistan
- Knowledge about the manufacturing of various sugar confections, snack food and bakers products
- Importance of packaging and quality maintenance of confectionery and snack food

Course Contents

Confectionery: Significance, classification, industries in Pakistan; Sugar confectionery: Ingredients, manufacturing, high boiled sweets, caramel, toffee, fudge, gums; Sugar free confectionery: Need, ingredients, manufacture; Chewing gum technology; Chocolate confectionery; Snack foods: History, status, manufacture, potato, nuts, cereal, meat and fish based; Puffed and baked snacks; Seasonings: Ingredients, formulations, applications; Quality control; Packaging.

Practical

Preparation of candy, toffee, chocolates and other sugar-based confectionery; Manufacture of potato chips, fried legumes, nuts, nuggets, extruded snacks; Visit to confectionery and snack food industries

. **Recommended Books**

1. Joachim, H., R. Hofberger, and R.W. Hartel. 2018. Confectionery Science and Technology. Springer International Publishing, Basel, Switzerland.
2. Lusas, W. and L.W. Rooney. 2001. Snack Food Processing. Technomic Pub. Co., Lancaster, UK.
3. Matz, S. A. 2012. Snack food technology. Springer Science and Business Media.
4. Minifie, B. 2012. Chocolate, cocoa and confectionery: science and technology. Springer Science and Business Media.
5. Panda, H. 2009. The Complete Technology on Snack Foods. National Institute of Industrial Research, New Delhi, India.

Code	Course Title	Credit Hour	Semester
FST-407	Sugar Technology	3(2+1)	7

Course Objectives

The specific objectives include:

- To familiarize students with chemical and physical properties of sugar
- To give concept of sugar production technology, its quality and by products

Course Outcomes

After completing this course, students will be able to:

- Understand the processing of sugar including production, refinement, and packaging of sugar from sugar cane and sugar beet
- Describe the process steps involved in juice extraction
- Identify cane handling and know and explain operational and performance indicator parameters in extraction unit

Course Contents

Sugar industry in Pakistan; Sugarcane and sugar beet: Production, quality; Indigenous technology for small scale sugar production: Gur, khund, shaker; Raw sugar manufacturing: Unit operations, juice extraction, purification, heating, evaporation, crystallization, crystallization in motion; Refining: Affination, clarification, decolorisation, crystallization, centrifugation, drying, bagging, storage; Factors affecting sugar processing; Quality criteria: Raw and refined sugar; Specialty sugar products: Brown or soft sugar, liquid sugar; Sugar industry byproducts and their uses.

Practical

Analysis of sugar cane, sugar beet for TSS, pH, fiber, ash and polarization; Extraction and clarifications of raw juice; Analysis of sugar and its intermediate products; Inversion of sugar; Visit to sugar industries.

Recommended Books

1. Asadi, M. 2007. Beet Sugar Handbook. John Wiley & Sons, Inc., New York, NY, USA.
2. Chen, J.C.P. 2007. Meade-Chen Cane Sugar Handbook. John Wiley & Sons, Inc., New York, NY, USA.
3. Jenkin, J.H. 2013. Introduction to Cane Sugar Technology. Elsevier Academic Press, New York, NY, USA.
4. Huget, E., 2014, Handbook of Cane sugar Engineering. Elsevier Academic Press, New York, NY, USA.
5. Pyne, J.H., 2013. Unit Operations in Cane Sugar Production. Elsevier Academic Press, New York, NY, USA.

Code	Course Title	Credit Hour	Semester
FST-419	Research Project and Scientific Writing	2(1+1)	8

Course Objectives

The specific objective includes:

- To familiarize students with research proposal, scientific writing and presentation of data

Course Outcomes

After completing this course, students will be able to:

- Write scientific documents, research findings and presentation of data
- Use of statistical software to process research data

Course Contents

Types of scientific presentations; Collection of literature: Printed and electronic sources; Managing literature; Citation & References; Initiating write up; Writing scientific documents: Synopsis, research proposal, articles, internship report; Poster & Oral presentations.

Practical

Exercises in collecting literature from different sources on assigned topics; Organizing and analysis of collected material through software; endnote, Mendeley; Writing synopsis/proposal, short communication; Delivering oral presentation.

Recommended Books

1. Awan, J.A. and K. A. Awan 2019. Scientific Presentations. Unitech Communications, Faisalabad, Pakistan.
2. Blackwell, J. and J. Martin. 2011. A Scientific Approach to Scientific Writing. Springer Science & Business Media.
3. Khalil, S.K. and P. Shah. 2007. Scientific Writing and Presentation for Crop Sciences. Higher Education Commission, Islamabad, Pakistan.
4. Lindsay, D.R. 2011. Scientific Writing. Csiro Publishing. Australia

Code	Course Title	Credit Hour	Semester
FST-420	**Internship**	**6(0+6)**	8

Course Contents

Every student will undertake practical training in an approved food industry or research organization; The student will maintain a daily dairy duly signed by the industrial/research supervisor; At the end of the internship, the student will submit a written report; He/she will be evaluated by a committee on the basis of his/her performance in the industry/research organization, final written report and oral presentation

General Courses

Code	Course Title	Credit Hour	Semester
ID-203	Professional Practices and Ethics	3(3+0)	1

Course Objectives

The specific objectives include:

- Define the various roles of food scientist within the organizational contexts of their professional practice
- Demonstrate and apply the relevant legal and ethical codes to their practice
- Demonstrate clinical skills in developing a therapeutic relationship including confidentiality and risk assessment
- Write clear, concise, and relevant reports and keep appropriate records of their work

Course Outcomes

After completing this course, students will be able to:

- Get a concept about the profession starting from education, training to good food practices and the importance of behaviour modifications for better health

Course Contents

Theory

Introduction to Professional Practices and Ethics. Definition and different segments of professional practices and ethics. The 'scientist-professional' model and evidence-based practice. Professional ethics and codes of conduct. Legislation relating to the professional practices of food science. Joining together: Team approach; Evidence based practice; Use of reflection in advancing practice. Record keeping, report writing, and practice management. The organizational contexts for the practice of food science. Personal health and safety. Negotiation and conflict resolution skills. Public safety including assessing and managing risk. Food allergies and food intolerance: Immunological basis, symptoms, risk factors for the development of food allergy, food intolerance, diagnosis, treatment, natural history of food allergy, food allergy in infancy, diet and prevention of allergic disease.

Recommended Books

1. Clark, J.P. & Ritson, C. eds. (2013). *Practical ethics for food professionals: ethics in research, education and the workplace* (Vol. 52). John Wiley & Sons.
2. Pence, G.E. ed. (2001). *The ethics of food: a reader for the twenty-first century.* Rowman & Littlefield Publishers.
3. Hartel, R.W. & Klawitter, C.P. (2008). *Careers in food science: From undergraduate to professional*. New York, NY: Springer.
4. Sandler, R.L. (2014). *Food ethics: the basics.* Routledge.
5. Kathleen, M. L., Krause's Food & the Nutrition Care Process. 12th Edition.

Code	Course Title	Credit Hour	Semester
HDFS-302	Health and Wellness	3(3+0)	4

Course Objectives

The specific objective includes:

- To develop the knowledge and skills students need to make healthy decisions that allow them and their family to stay active, safe, and informed.
- To develop students' nutritional habits and their impact on a healthy lifestyle

Course Outcomes

After completing this course, students will be able to:

- Developed in themselves, as well as create awareness among masses about a healthy lifestyle
- Learned strategies for making healthy choices

Course Contents

Introduction to Health: Concept of health & wellbeing, Health related concepts, Determinants of health, Models of health

Biology and Family Health: Multifactorial inheritance and disorders, Gender and genetics in health disparities, Ethical, legal and social implications (ELSI), Families' adaptation to chronic illnesses

Families' Health Choices: Behaviour patterns in the family, Nature of family health behaviors, Family health promotions- "Health Work"

Social Determinants: Health disparities among families**,** Infant mortality**,** Cardiovascular disease (CVD)**,** Obese & overweight, Immunizations & mental illness**,** Discrimination, stigmatization, and health**,** Health education: Families, schools, and communities collaborations

Environmental Exposures and Global Family Health: The global burden of infectious disease, The global reach of pollution**,** Internal environmental exposures: Imbalances in biological flora**,** External environmental exposures, The global tobacco epidemic

Work Environments and Global Family Health: Women in the workplace**,** Psychosocial work environment**,** Work-to-family and family-to-work conflicts

Recommended Books

1. David J. Anspaugh & Hamrick, Michael H & Rosato, Frank D (2003). *Wellness concepts and applications* (5th ed.). Boston McGraw-Hill
2. Donatelle, R. J., & Davis, L. G. (2011). *Health: The basics*. Benjamin Cummings.
3. Bomar, P. J. (2003). *Promoting health in families: Applying family research and theory to nursing practice*. Elsevier Health Sciences.
4. Danielson, C. B., Hamel-Bissell, B., & Winstead-Fry, P. (1993). *Families, health & illness: perspectives on coping and intervention*. Mosby Inc
5. Craft-Rosenberg, M., & Pehler, S. R. (Eds.). (2011). *Encyclopedia of family health* (Vol. 1). SAGE Publications
6. Grochowski, J. (2013). *Families and Health*. SAGE Publications.
7. Bradshaw, T., & Mairs, H. (Eds.). (2017). *Health Promotion and Wellbeing in People with Mental Health Problems*. Sage.
8. Kail, R. V. (2013). *Human development* (6th ed.). Australia: Wadsworth