UNIVERSITY OF THE PUNJAB

NOTIFICATION

It is hereby notified that the Syndicate at its meeting held on 17-12-2022 has approved the recommendations of the Academic Council made at its meeting dated 24-11-2022 regarding approval for grant of permission to start B.Sc. (Hons) Food Science & Technology, (Morning 4-Year) Degree Program at the Department of Food Sciences and its Curriculum/Scheme of Studies with effect from the Academic Session 2022-2023.

The Curriculum of B.Sc. (Hons) Food Science & Technology is attached, vide Annexure 'A'.

Sd/-
Shahid Javed
Registrar

Admin. Block,
Quaid-i-Azam Campus,
Lahore.

No. D/ 678 /Acad. **Dated: 25-01-2023.**

Copy of the above is forwarded to the following for information and further necessary action: -

1. The Dean, Faculty of Agricultural Sciences
2. The Chairman, Department of Food Sciences
3. Chairperson, DPCC
4. Controller of Examinations
5. Director (IT) for placement at website.
6. Admin Officer (Statutes)
7. Secretary to the Vice-Chancellor
8. Secretary to the Registrar
9. Assistant Syllabus (with file)

Mazhar
Assistant Registrar (Academic)
for Registrar

CURRICULUM FOR THE DEGREE OF

B.Sc. (Hons.) FOOD SCIENCE AND TECHNOLOGY

(Four Years Program)

DEPARTMENT OF FOOD SCIENCES
UNIVERSITY OF THE PUNJAB, LAHORE

Program Title:	B.Sc. (Hons.) Food Science and Technology
Department:	Department of Food Sciences
Faculty:	Faculty of Agricultural Sciences

1. Department Mission

The Department of Food Sciences is a newly established department in 2021 with the aim to produce well equipped Food Science and Technology graduates to facilitate the advancements in food industries and endure the economic and industrial development of Pakistan. Our mission is to provide to provide an outstanding educational experience and unique research and training opportunities in Food safety and nutritional science, and to develop multidisciplinary and quality-oriented leaders to solve important national and global health problems. We intend to provide a cost-effective processing and storage technology to curtail post-harvest losses and to achieve maximum value addition.

2. Introduction of the Department

The Department of Food Sciences is dedicated to the education of undergraduate, and graduate students in the field of Food Sciences and the study and application of science and technology to further basic knowledge, value addition, foster economic development, and provide a safe, healthful, and high-quality food supply. We intend to provide best learning environment and opportunities to the prospective agricultural graduates to play key role in food production, processing, preservation and allied aspects of its consumption, quality and safety and to produce well equipped Food Science and Technology graduates to facilitate the advancements in food industries and endure the economic and industrial development of Pakistan.

3. Program Introduction

Food Science and Technology is a broad-spectrum science focusing on the application of multidisciplinary subjects like chemistry, biology, and engineering to study the nature, physical and chemical properties associated with food. This field encompasses application of various techniques to ensure safe, nutritious, and wholesome food to the consumer. Studying a versatile curriculum will help to gain knowledge regarding handling, processing, preservation, transportation, and health implications of food on the end user. This program will provide in depth understanding of food composition and analysis, preservation techniques, processing tools, food safety and nutrition. Furthermore, this

degree program will cover courses related to food engineering, food chemistry, food processing, food preservation, food microbiology, post-harvest management, quality management systems, and human nutrition. Pakistan is an agriculture-based economy as its agriculture accounts 21% of the total GDP showing surplus production food resources. However, post-harvest losses of agriculture commodities range from 20-40% causing shortage of food supply and fluctuation in prices. To overcome these losses, food science and technology could play an important role in developing safe, nutritious, wholesome food products to ensure food security in Pakistan. Importance of Food Science and Technology is far more than ever before mainly owing to changed lifestyles, increased food demand and varying trends towards quality end products. This program will be a blend of theoretical and practical knowledge to equip students with current data in this field. This is achieved through providing high quality education and training to our students.

The program comprising of 127 credit hours to be completed in eight semesters. Apart from compulsory and basic courses, this program consists of major and minor courses, including internship and research thesis.

4. Program Objectives

The objective of this degree program to create undergraduates in Food Science and Technology to provide them with wide-ranging theoretical, practical, and methodological competencies. The educational objective of the Food Science and Technology program is to have graduates with knowledge of;

1. Basic Principle of Food Science and Technology:

A broad foundation in Food Science and Technology that stresses scientific reasoning and analytical problem solving with Food perspective.

2. Critical Research Behavior:

Developing the working knowledge of instrumentation and techniques related to Food and be able to use skills to design and conduct independent work.

3. Ethical Knowledge and Team Management:

An understanding of current ethical issues in Food Sciences and be able to apply ethical principles in industries/research laboratories. To provide a contemporary grounding in

professional responsibility and job related skills in order to work in multidisciplinary teams.

4. Fundamental Knowledge:

An ability to know, apply and critically analyze and evaluate concepts related to the Food Science and Technology.

5. Problem Analysis:

An ability to develop problem-solving and critical thinking skills.

6. Formulation and Solution:

Apply the fundamental knowledge in Food Science and Technology in undertaking problems identification, formulation and solution with critical thinking

7. Investigation:

An ability to investigate complex problems in Food Science and Technology field by methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

8. Modern Tool Usage:

An ability to recognize and uses appropriate technologies, such as computer applications in Food Science and Technology laboratory methodologies.

9. Ethics:

An ability to practice professional and ethical attitudes among society.

10. Individual and Team Work:

An ability to acquire personal characteristics and leadership, management, and human relations skills appropriate to professional practice in careers related to Food Science and Technology

11. Communication:

Develop written and oral skills commensurate with the ability to summarize, evaluate, synthesize, and appropriately communicate scientific concepts to a variety of audiences.

12. Project Management:

An ability to demonstrate knowledge and understanding of technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.

13. Technologist and Society:

An ability to demonstrate understanding of the societal, health and safety, issues and the consequent responsibilities relevant to Food Science and Technology.

5. Market Need / Rationale of the Program

This degree program will enable the students to professionally excel in the field of Food Science and Technology through meeting today's market requirements. The students after graduation will be able to demonstrate their expertise in multiple fields which include:

i. Agricultural Provincial & Federal Government Departments
ii. Research Organizations
iii. Multinational and Local Food Industry
iv. Food Testing Laboratories
v. Food Regulatory & Certification Organizations
vi. Food Authorities
vii. Colleges and Universities
viii. Small business development agencies
ix. Dairy Development Sector
x. Hotel Industry
xi. Food Ingredient Suppliers
xii. School Health and Nutrition supervisors in basic health units in different districts of Punjab
xiii. Researchers in research organizations

6. Admission Eligibility Criteria

• Years of Study Completed	12 Years
• Study Program/Subject	B.Sc. (Hons.) Food Science and Technology
• Percentage/CGPA	As per university rules and regulations
• Entry Test (If applicable) with Minimum requirement	No Entry Test (Open Merit) N/A
• Any Other (if applicable)	F. Sc. or equivalent or 50%

7. Duration of Degree Program

Minimum 4 Years/ 8 semesters/ 127 credit hours

8. Assessment Criteria

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 mark

9. Categorization of course as per HEC Recommendation and Difference

mes rs	Category (Credit Hours)				
	Core/ Compulsory	**Basic/Foundation Course**	**Major Elective**	**Minor Electives**	**General/Other**
	• Exercise in Reading, Writing & Comprehension • Elementary Mathmatics • Holy Quran Translation-I	• Essentials of Biochemistry • Basic Agriculture	• Introduction to Food Science & Technology		
2	• Communication Skills & Leadership Development • Introduction to Information and Communication Technologies • Islamic Studies • Holy Quran Translation-II	• General Microbiology	• Food Processing and Preservation		
3	• Introductory Statistics	• Introductory Bioinformatics	• Principles of Human Nutrition		

	• Holy Quran Translation-III	• Marketing and Agribusiness	• Unit Operations in Food Processing • Food Safety and Toxicology		
4	• Applied Statistics • Pakistan Studies • Holy Quran Translation-IV		• Postharvest Technology • Food Biotechnology • Food Chemistry • Food Quality Management		
5	• Holy Quran Translation-V		• Food Process Engineering • Food Analysis • Fruits and Vegetables Processing • Dairy Technology • Cereal Technology • Food Plant Layout and Sanitation		
6	• Holy Quran Translation-VI		• Food Microbiology • Meat Technolog • Community Nutrition & Dietetics • Beverage Technology • Sugar Technology		
7	• Holy Quran Translation-VII		• Food Laws and Regulations • Bakery Products Science & Technology • Technology of Fats and Oils		

			• Food Product Development • Food Packaging • Confectionery and Snack Foods		
3	• Holy Quran Translation-VIII		• Sensory Evaluation of Foods • Research Projects and Scientific Writing • Internship/ Study Project • Seminar		
C Guidelines		YES			
ference (HEC) & PU		Books Readings and course objectives have been revised. So it is different than HEC curriculum. Nevertheless, all the subjects offered as according to HEC Curriculum.			

- Total numbers of Credit hours 127
- Duration 4 years
- Semester duration 16-18 weeks
- Semesters 08
- Course Load per Semester 12-18 Credit Hours
- Number of courses per semester 5-6

10. <u>Curriculum Difference</u>

The designed course of B.Sc. (Hons.) Food Science and Technology have total 127 credit hours as per the requirement of HEC curriculum. Majority of the courses are taken from HEC Scheme of Studies for B.Sc (Hons.) Food Science and Technology, however, the sequence of the courses is changed. Following courses are changed and/ or modified.

Sr. No.	HEC Curriculum	Punjab University Curriculum
	Semester I	
1.	Mathematics-I	Elementary Mathematics

	English-I	Exercise in Reading, Writing & Comprehension
Semester II		
2.	Introduction to Information Technology/ Computer English-II	Introduction to Information and Communication Technologies Communication Skills & Leadership Development
Semester III		
3.	Statistics	Introductory Statistics
Semester V		
4.	Instrumental Techniques in Food Analysis	Food Analysis
Semester VI		
5.	Community Nutrition	Community Nutrition & Dietetics
Semester VII		
6.	Bakery Products Technology	Bakery Products Science & Technology

SCHEME OF STUDIES FOR
B.Sc. (Hons.) FOOD SCIENCE AND TECHNOLOGY
(Four Years Program)

1st Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST – 101	Introduction to Food Science & Technology	3 (2-1)	Major
BCH – 101	Essentials of Biochemistry	3 (3-0)	FC*
AGR – 101	Basic Agriculture	3 (2-1)	FC*
ENG – 101	Exercise in Reading, Writing & Comprehension	3 (3-0)	Comp.**
MATH – 101	Elementary Mathematics	3 (3-0)	Comp.
HQ – 101	Holy Quran Translation-I	[a]0 (0-1)	Comp.
	Total Credit Hrs.	**15**	

*FC = Interdisciplinary Foundation Course **Comp. = Compulsory Course

[a] Zero credit hour course, but mandatory to pass in examination

2nd Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST – 102	Food Processing and Preservation	3 (2-1)	Major
MICR – 102	General Microbiology	3 (2-1)	FC
ENG – 102	Communication Skills & Leadership Development	3 (3-0)	Comp.
CS – 102	Introduction to Information and Communication Technologies	3 (2-1)	Comp.
ISL – 102	Islamic Studies	2 (2-0)	Comp.
HQ – 102	Holy Quran Translation-II	1 (0-1)	Comp.
	Total Credit Hrs.	**15**	

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3rd Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Name of Course	Credit Hours	Type
FST – 201	Principles of Human Nutrition	3 (3-0)	Major
FST – 203	Unit Operations in Food Processing	3 (3-0)	Major
FST – 205	Food Safety and Toxicology	3 (3-0)	Major
BIOT – 201	Introductory Bioinformatics	2 (0-2)	FC
MAB – 201	Marketing and Agribusiness	3 (3-0)	FC
STAT – 201	Introductory Statistics	3 (3-0)	Comp.
HQ – 201	Holy Quran Translation-III	0 (0-1)	Comp.
	Total Credit Hrs.	**17**	

4th Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST – 202	Postharvest Technology	3 (2-1)	Major
FST – 204	Food Biotechnology	3 (2-1)	Major
FST – 206	Food Chemistry	3 (3-0)	Major
FST – 208	Food Quality Management	2 (2-0)	Major
STAT - 202	Applied Statistics	3 (3-0)	Comp.
PS – 202	Pakistan Studies	2 (2-0)	Comp.
HQ – 202	Holy Quran Translation-IV	1 (0-1)	Comp.
	Total Credit Hrs.	**17**	

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5th Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST – 301	Food Process Engineering	3 (2-1)	Major
FST – 303	Food Analysis	3 (1-2)	Major
FST – 305	Fruits and Vegetables Processing	3 (2-1)	Major
FST – 307	Dairy Technology	3 (2-1)	Major
FST – 309	Cereal Technology	3 (2-1)	Major
FST – 311	Food Plant Layout and Sanitation	2 (2-0)	Major
HQ – 301	Holy Quran Translation-V	0 (0-1)	Comp.
	Total Credit Hrs.	**17**	

6th Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST - 302	Food Microbiology	3 (2-1)	Major
FST - 304	Meat Technology	3 (2-1)	Major
FST – 306	Community Nutrition & Dietetics	3 (2-1)	Major
FST – 308	Beverage Technology	3 (2-1)	Major
FST – 310	Sugar Technology	3 (2-1)	Major
HQ – 302	Holy Quran Translation-VI	1 (0-1)	Comp.
	Total Credit Hrs.	**16**	

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7th Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST-401	Food Laws and Regulations	3 (3-0)	Major
FST-403	Bakery Products Science & Technology	3 (2-1)	Major
FST-405	Technology of Fats and Oils	3 (2-1)	Major
FST-407	Food Product Development	3 (1-2)	Major
FST – 409	Food Packaging	3 (2-1)	Major
FST-411	Confectionery and Snack Foods	3 (2-1)	Major
HQ – 401	Holy Quran Translation-VII	0 (0-1)	Comp.
	Total Credit Hrs.	**18**	

8th Semester B.Sc. (Hons.) Food Science & Technology

Course No.	Title of Course	Credit Hours	Type
FST – 402	Sensory Evaluation of Foods	3 (2-1)	Major
FST - 404	Research Projects and Scientific Writing	2 (1-1)	Major
FST - 422	Internship / Study Project	5 (0-5)	Major
FST- 424	Seminar	1 (1-0)	Major
HQ – 402	Holy Quran Translation-VIII	1 (0-1)	Comp.
	Total Credit Hrs.	**12**	
	Grand Total of Credit Hrs.	**127**	

11. Internship and Study Project

a. Internship and Study Project: 5 Credit hours

12. Award of Degree

Date of Preparation: 25.05.2022 Date of Revision: _____

The degree will be awarded as per University of the Punjab rules and regulations. The student has to complete 127 credit hours, Study Project, and internship to qualify for the degree.

13. Faculty Strength

Degree	Area/Specialization	Total
PhD	Food Safety, Food processing, Functional Foods, Food Science, Food Biotechnology	**2**
Total		**2**

14. Present Student Teacher Ratio in Department

11:1

15. NOC from Professional Councils (If Applicable)

Not Applicable

Date of Preparation: 25.05.2022 Date of Revision: _____

Detail of courses semester-wise

FIRST SEMESTER

Course No.	Title of Course	Credit Hours
FST – 101	Introduction to Food Science & Technology	3 (2-1)
BCH – 101	Essentials of Biochemistry	3 (3-0)
AGR – 101	Basic Agriculture	3 (2-1)
ENG – 101	Exercise in Reading, Writing & Comprehension	3 (3-0)
MATH – 101	Elementary Mathematics	3 (3-0)
HQ – 101	Holy Quran Translation-I	[a]0 (0-1)
	Total Credit Hrs.	**15**

FST- 101: INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY 3 (2-1)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To familiarize the students with basics of food science and technology.

Learning Outcomes

After completion of this course, students shall be able to:

1. Acquire knowledge and understanding Food Science with their alliance disciplines
2. Understand the nature of Food and their constituents
3. Understand about Food destroying agents and their remedies to increase the shelf life

Theory

1. **Introduction**
   1.1. Food science, food technology, relationship with other disciplines, career opportunities.

Date of Preparation: 25.05.2022 Date of Revision: _____

2. **Significance of food science and technology**
3. **Global & national food and nutrition situation**
4. **Food industry**
   - 4.1. history
   - 4.2. developments
   - 4.3. important food industries in Pakistan.
5. **Food sources**
   - 5.1. plants
   - 5.2. animals
   - 5.3. marine.
6. **Food constituents and their functions**
   - 6.1. water
   - 6.2. carbohydrates
   - 6.3. lipids
   - 6.4. proteins
   - 6.5. vitamins
   - 6.6. minerals
7. **Classification of foods**
   - 7.1. perishability
   - 7.2. pH
8. **Food spoilage agents**
   - 8.1. enzymes
   - 8.2. microorganisms
   - 8.3. insects
   - 8.4. rodents
   - 8.5. birds
   - 8.6. physical factors.
9. **Principles of food preservation**
   - 9.1. prevention or delay of autolysis
   - 9.2. microorganisms
   - 9.3. pests

9.4. physical defects

10. Food poisoning

10.1. causes and remedies

11. Quality factors in foods

11.1. appearance

11.2. texture

11.3. flavor

12. Food risks and hazards

12.1. hunger

12.2. technology

12.3. world food needs

Practical

1. **Use of laboratory equipments**
2. **Proximate analysis**

2.1. Estimation of moisture, fat, protein, carbohydrates, fiber and ash in food samples.

3. **Physicochemical analysis**

3.1. Determination of specific gravity, soluble solids, pH, acidity, total solids, refractive index and peroxide value.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Date of Preparation: 25.05.2022 Date of Revision: _____

Recommended Books

1. Geoffrey Campbell-Platt, G. (2017). Food Science and Technology. Wiley-Blackwell, USA.

2. Penfield, M.P. & Campbell, A.M. (2014). Experimental Food Science (Food Science and Technology). Academic Press, USA.

3. Awan, J.A. & Rehman, S.U. (2014). Food Analysis Manual. Unitech Communications, Faisalabad, Pakistan.

4. Awan, J.A. (2011). Food Science and Technology. Unitech Communications, Faisalabad-Pakistan.

5. Potter, N.N. & Hotchkiss, J.H. (2007). Food Science. The AVI Publisher, USA.

Date of Preparation: 25.05.2022 Date of Revision: _____

BCH - 101: ESSENTIALS OF BIOCHEMISTRY 3 (3-0)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To provide the basic knowledge about Biochemistry.

Learning Outcomes

After completion of this course, students shall be able to:

1. Understand fundamentals of botany and zoology with special reference to their role in food and nutrition
2. Study plant morphological characteristics and various animal classes through the dissection of representative plants and animals

Theory

1. **Physiochemical principles**
   1.1. hydrogen ion concentration
   1.2. buffer solutions
   1.3. pH and its determination
2. **Structure and function of cell membrane**
   2.1. Movement of materials across the cell membrane
3. **Macromolecule**
   3.1. Carbohydrates
4. **Introduction and classification of carbohydrates**
   4.1. Some important monosaccharides
   4.2. Disaccharides
   4.3. Polysaccharides
5. **Definition and end products of glycolysis, citric acid cycle, proteins and amino acids**
6. **Proteins**
   6.1. Introduction
   6.2. Importance

Date of Preparation: 25.05.2022 Date of Revision: _____

6.3. Classification and properties of proteins

6.4. Structure of proteins (primary, secondary, tertiary and quaternary)

6.5. Special sources of proteins

6.6. Protein metabolism

7. Enzymes

7.1. Introduction

7.2. Classification

7.3. Chemical nature and properties of enzymes

7.4. Factors affecting the enzyme activity

7.5. Mechanism of enzyme action and enzyme kinetics

8. Lipids

8.1. Introduction

8.2. Classification

8.3. Function, metabolism (β-oxidation) of lipids

8.4. Terpenoids, alkaloids

9. Vitamins and hormones

10. Nucleic acids

10.1. Structure and function.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Date of Preparation: 25.05.2022 Date of Revision: _____

Recommended Books

1. Murray, R.K., Granner, D.K., Mayes, P.A. & Rodwell, V.W. (2015). Harper's Illustrated Biochemistry. (30th ed.). McGraw-Hill Education / Medical, USA.

2. Harvey, R.A. & Champe, P.C. (2018). Lippincott's illustrated reviews. Biochemistry. (6th ed.). Lippincott Williams & Wilkins, USA.

3. Nelson, D.L. & Cox, M.M. (2017). Lehningher Principles of Biochemistry. (7th ed.). W.H. Freeman & Company, USA.

4. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. & Martin, K.C. (2016). Molecular Cell Biology. (8th ed.). W.H. Freeman and Company, USA.

Date of Preparation: 25.05.2022 Date of Revision: _____

AGR – 101: BASIC AGRICULTURE 3 (2-1)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To provide the basic knowledge and background about Agriculture.

Learning Outcomes

After completion of this course, students shall be able to

1. Understand the basic knowledge of agriculture and its allied sciences.
2. Basic concepts of potential of Pakistan regarding crop production.
3. Emerging trends in crop management, livestock management, and fisheries.

Theory

1. **Agriculture**
   - 1.1. concept
   - 1.2. history and importance
   - 1.3. branches and allied sciences in agriculture
2. **Salient features and problems of Pakistan's agriculture**
3. **Climate, weather and seasons of Pakistan**
   - 3.1. major characteristics and impact on crop production
4. **Land resources and their utilization**
5. **Crop nutrition**
6. **Water resources**
   - 6.1. surface and ground water
   - 6.2. canal system
7. **Agro ecological zones of Pakistan**

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8. **Farming systems**
9. **Agro-based industries**.

Practical

1. **Land measuring units**
2. **Demonstration of hand tools and tillage implements**
3. **Identificantion**

    3.1. identification of meteorological instruments

    3.2. identification of crop plants, weeds and seeds

    3.3. identification of organic and inorganic fertilizers

4. **Calculation of nutrient-cum-fertilizer unit value**
5. **Demonstration of various irrigation methods**

    5.1. field visits

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Date of Preparation: 25.05.2022 Date of Revision: _____

Recommended Books

1. Abbas, M. A. (2006). General Agriculture. Emporium Urdu Bazar, Lahore.

2. Balasubramaniyan. (2004). Principles and Practices of Agronomy. Agrobios, Jodhpur, India.

3. Khalil, I.A. & Jan, A. (2002). Cropping Technology. National Book Foundation, Islamabad.

4. Khan, S.R.A. (2001). Crop Management in Pakistan with Focus on Soil and Water. Directorate of Agricultural Information, Punjab, Lahore.

5. Nazir, M.S., Bashir, E. & Bantel, R. (1994). Crop Production. National Book Foundation, Islamabad.

6. Qureshi, M.A., Zia, M.A. & Qureshi, M.S. (2006). Pakistan Agriculture Management and Development. A-One Publisher, Urdu Bazar, Lahore.

Date of Preparation: 25.05.2022 Date of Revision: _____

ENG – 101: EXERCISE IN READING, WRITING & COMPREHENSION **3 (3-0)**

Pre-requisite

FSc (Pre-Medical)

Course Objective

To Enhance language skills and develop critical thinking

Learning Outcomes

1. Students will be able to improve their comprehension into English to use it for their academic purpose.
2. Students will be able to improve their every-day conversation on different topics.
3. Functional English will help students acquire presentation skill through creative ability in writing and speaking

Theory

1. **Basics of Grammar**
   - 1.1. parts of speech and use of articles
   - 1.2. sentence structure
   - 1.3. active and passive voice
   - 1.4. practice in unified sentence
   - 1.5. analysis of phrase
   - 1.6. clause and sentence structure
   - 1.7. transitive and intransitive verbs
   - 1.8. punctuation and spelling
2. **Comprehension**
   - 2.1. answers to questions on a given text
3. **Discussion**
   - 3.1. general topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)
4. **Listening**
   - 4.1. to be improved by showing documentaries/films carefully selected by subject teachers

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5. **Paragraph writing**
   5.1. topics to be chosen at the discretion of the teacher
6. **Translation skills**
   6.1. urdu to English
7. **Presentation skills**
   7.1. introduction

Note: Extensive reading is required for vocabulary building

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Grammar

1. Thomson, A.J. & Martinet, A.V. (1997). Exercises 1. Practical English Grammar. (3rd ed.). Oxford University Press.

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. (3rd ed.). Oxford University Press. (1997). ISBN 0194313506

2. Writing

1. Marie-Christine, B., Suzanne, B. & Francoise, G. (1993). Oxford Supplementary Skills. Fourth Impression. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

Date of Preparation: 25.05.2022 Date of Revision: _____

3. Reading/Comprehension

1. Brain, T. & Rod, Ellis. (1992). Oxford Supplementary Skills. Third Impression. ISBN 0 19 453402 2.

MATH – 101: ELEMENTARY MATHEMATICS 3 (3-0)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To prepare the students, not majoring in mathematics, with the essential tools of algebra to apply the concepts and the techniques in their respective disciplines.

Learning Outcomes

At the end of course, students will be able to know:

1. Perform matrix operations.
2. Use systems of linear equations and matrix equations to determine linear dependency or independency.
3. Solve quadratic equations by using the Square Root Property.

Theory

1. **Matrices:**
   - 1.1. introduction to matrices
   - 1.2. types
   - 1.3. matrix inverse, determinants, system of linear equations, Cramer's rule.
2. **Quadratic Equations:**
   - 2.1. solution of quadratic equations
   - 2.2. qualitative analysis of roots of a quadratic equations
   - 2.3. equations reducible to quadratic equations
   - 2.4. cube roots of unity, relation between roots and coefficients of quadratic equations.
3. **Sequences and Series**:
   - 3.1. arithmetic progression
   - 3.2. geometric progression
   - 3.3. harmonic progression.
4. **Binomial Theorem**:
   - 4.1. introduction to mathematical induction

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4.2. binomial theorem with rational and irrational indices.

5. Preliminaries:

5.1. real-number line

5.2. functions and their graphs

5.3. solution of equations involving absolute values

5.4. inequalities.

6. **Limits and Continuity**:

6.1. limit of a function

6.2. left-hand and right-hand limits

6.3. continuity

6.4. continuous functions.

7. Derivatives and their Applications:

7.1. differentiable functions

7.2. differentiation of polynomial

7.3. rational and transcendental functions, derivatives.

8. Integration and Definite Integrals:

8.1. techniques of evaluating indefinite integrals

8.2. integration by substitution, integration by parts

8.3. change of variables in indefinite integrals

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

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Recommended Books

1. Dolciani, M.P., Wooton, W., Beckenback, E.F., Sharron, S. (1978). Algebra 2 and Trigonometry. Houghton & Mifflin, Boston.

2. Kaufmann, J.E. (1987). College Algebra and Trigonometry. PWS-Kent Company, Boston.

3. Swokowski, E.W. (1986). Fundamentals of Algebra and Trigonometry. (6th ed.). PWS-Kent Company, Boston.

4. Anton, H., Bevens, I. & Davis, S. (2005). Calculus: A New Horizon. (8th ed.). John Wiley, New York.

5. Stewart, J. (1995). Calculus. (3rd ed.). Brooks/Cole, USA.

6. Swokowski, E.W. (1983). Calculus and Analytic Geometry. PWS-Kent Company, Boston.

7. Thomas, G.B., Finney, A.R. (2005). Calculus (11th ed.). Addison-Wesley, Reading, Ma, USA.

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SECOND SEMESTER

Course No.	Title of Course	Credit Hours
FST – 102	Food Processing and Preservation	3 (2-1)
MICR – 102	General Microbiology	3 (2-1)
ENG – 102	Communication Skills & Leadership Development	3 (3-0)
CS – 102	Introduction to Information and Communication Technologies	3 (2-1)
ISL – 102	Islamic Studies	2 (2-0)
HQ – 102	Holy Quran Translation-II	1 (0-2)
	Total Credit Hrs.	**15**

FST – 102: FOOD PROCESSING & PRESERVATION 3 (2-1)

Pre-requisite

Fundamental knowledge of food science and technology

Course Objective:

To equip the students with basic techniques of food preservation

Learning Outcomes

At the end of course, students will be able to:

1. Understand handling of raw material at different stages during processing.
2. Different cooling and heating methods in preservation of Food additives and their role in preservation.
3. Understand the storage practices in the area and recommend for better storage techniques.

Theory

1. **Postharvest handling and preparation of foods for food processing**
   - 1.1. introduction
   - 1.2. properties of raw materials
   - 1.3. handling, storage and transportation of raw materials.

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2. Preparatory operations

2.1. cleaning, sorting

2.2. grading

2.3. size reduction

2.4. sulphiting.

3. Thermal processing

3.1. Principles & application – blanching, pasteurization

3.2. Sterilization, HTST, commercial sterilization, UHT, canning.

4. Low temperature preservation

4.1. Principles & application - refrigeration, chill injury, controlled atmospheric storage, modified atmosphere packaging.

5. Freezing

5.1. Methods, changes in foods, freeze burn.

6. Dehydration & drying – significance

6.1. concentration and condensation.

7. Drying systems

7.1. Solar drying, hot air drying, drum drying, spray drying.

8. Chemical preservation

8.1. different chemical additives and their mode of action.

9. Fermentation technology

9.1. Principles, objectives, types - alcoholic, acetic and lactic fermentations.

10. Fermented foods

10.1 Bread, wine, vinegar, yoghurt, sausages, pickles.

11. Food irradiation

11.1. Principles, applications, safety aspect, effect on food properties

Practical

1. Preparatory operation in food processing and preservation

1.1. Canning of selected fruits and vegetables, cold storage, freezing and dehydration of fruits and vegetables.

2. Use of chemicals in preservation of food products

3. Preparation of fermented food products

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3.1. Bread, Vinegar, Pickles etc

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Seydi, Y. (2019). Technological Developments in Food Preservation, Processing, and Storage. Engineering Science Reference, USA.
2. Bhat, R., Alias, A.K. & Paliyat, G. (2012). Progress in Food Preservation. John Wiley & Sons Ltd., USA.
3. Awan, J.A. (2011). Food processing and preservation. Unitech Communications, Faisalabad, Pakistan.
4. Awan, J.A. & Rehman, S.U. (2011). Food Preservation Manual. Unitech Communications, Faisalabad, Pakistan.
5. Heldman, D. (2011). Food Preservation Process Design. Elsevier Corporation, USA.
6. Rahman, M.S. (2007). Handbook of Food Preservation. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

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MICR – 102: GENERAL MICROBIOLOGY 3 (2-1)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To familiarize students about Food borne infections, intoxications and role of proboscis in our daily life.

Learning Outcomes

At the end of course, students will be able to:

1. Understand characteristics and growth requirements of microorganisms
2. To learn about food related microorganism
3. Know about the microbial contamination and factors affecting the growth of microorganisms.

Theory

1. **Microbiology**
   1.1. introduction, historical background, branches.
2. **Significance of microorganisms in food, water and environment.**
3. **Microorganisms**
   3.1. cell structure, prokaryotes, eukaryotes.
4. **Characteristics of microorganisms**
   4.1. bacteria, yeasts, moulds, viruses.
5. **Growth requirements:**
   5.1. cultural, physical, chemical, macro- and micro-nutrients.
6. **Culture media: types, applications**
   6.1. microbial metabolism.
7. **bacterial multiplicatio**n
   7.1. growth curve, continuous culture.
8. **microbial genetics**
   8.1. conjugation, transduction, transformation.

practical:

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1. **Safety in microbiological laboratory.**
   1.1. basic functions and handling of laboratory equipments.
2. **Use of microscope. Sterilization and disinfection of glassware.**
3. **Preparation of culture media.**
4. **Staining of microorganisms and their structures.**
5. **Bacterial cultivation, growth measurement.**
   5.1. characteristics of bacterial colonies.
6. **Bacterial and fungal morphology.**
7. **Micrometry**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended:

1. Tortora, G.J., Funke, B.R. & Case, C.L. (2009). Microbiology: An Introduction. The Benjamine/Cummings Pub. Co, Redwood City, California, USA.
2. Frazier, W.C. & Westhoff, D.C. (2008). Food Microbiology. McGraw Hill Book Co, New York, USA.
3. Awan, J.A. & Rahman, S.U. (2005). Microbiology Manual. Unitech Communications, Faisalabad, Pakistan.
4. Banwart, G.J. (2004). Basic food microbiology, 2 nd ed. CBS Publishers and Distributors, New Delhi, India.

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ENG - 102: COMMUNICATION SKILLS & LEADERSHIP DEVELOPMENT **3 (3-0)**

Pre-requisite

Introductory knowledge about grammer

Course Objective

Enable the students to meet their real life communication needs.

Learning Outcomes

1. Students will be able to improve their comprehension into English to use it for their academic purpose in communication and translation of text from Urdu into English and vice versa.
2. Students will be able to improve their every-day conversation on different topics

Theory

1. **Paragraph writing:**
   1.1. practice in writing a good, unified and coherent paragraph
2. **Essay writing:**
   2.1. introduction, Descriptive, narrative, discursive, argumentative
3. **CV and job application**
4. **Translation skills:**
   4.1. urdu to English
5. **Study skills:**
   5.1. skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension
6. **Academic skills:**
   6.1. letter/memo writing, minutes of meetings, use of library and internet
7. **Presentation skills:**
   7.1. personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

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Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Grammar

1. Thomson, A.J. & Martinet, A.V. (1997). Exercises 1. Practical English Grammar. (3rd ed.). Oxford University Press.

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. (3rd ed.). Oxford University Press. (1997). ISBN 0194313506

2. Writing

1. Marie-Christine, B., Suzanne, B. & Francoise, G. (1993). Oxford Supplementary Skills. Fourth Impression. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

3. Reading/Comprehension

1. Brain, T. & Rod, Ellis. (1992). Oxford Supplementary Skills. Third Impression. ISBN 0 19 453402 2.

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CS – 102: INTRODUCTION TO INFORMATION AND COMMUNICATION TECHNOLOGIES **3 (2-1)**

Pre-requisite

FSc (Pre-Medical)

Course Objectives

This is an introductory course on Information and Communication Technologies. Topics include ICT terminologies, hardware and software components, the internet and world wide web, and ICT based applications.

Learning outcomes

After completing this course, a student will be able to:

1. Understand different terms associated with ICT
2. Identify various components of a computer system
3. Identify the various categories of software and their usage
4. Define the basic terms associated with communications and networking
5. Understand different terms associated with the Internet and World Wide Web.
6. Utilize various web tools including Web Browsers, E-mail clients and search utilities.
7. Use text processing, spreadsheets and presentation tools
8. Understand the enabling/pervasive features of ICT

Theory

1. **Basic Definitions & Concepts**
2. **Hardware**
    2.1.1. computer Systems & Components, Storage Devices
3. **Number Systems**
4. **Software**
    4.1. operating Systems
    4.2. programming and application software

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4.3. introduction to programming

4.4. databases and information systems

4.5. networks, data communication, the internet, browsers and search engines

5. The Internet

5.1. email

5.2. collaborative computing

5.3. social networking

6. E-Commerce, IT Security and other issues

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Peter, N. (2008). Introduction to Computers. 6th International Edition, McGraw Hill, USA.

2. Williams, S. (2015). Using Information Technology: A Practical Introduction to Computer & Communications. (6th ed.). McGraw Hill, USA.

3. Sarah, E., Hutchinson, S. & Swayer, C. (2000). Computers, Communications & Information: A user's introduction. McGraw Hill, USA.

4. Fundamentals of Information Technology by Alexis Leon. (2009). Mathewsleon Leon Press, USA.

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ISL – 102: ISLAMIC STUDIES 2 (2-0)

Pre-requisite

FSc (Pre-Medical)

Course Objectives

This course is aimed at:

1. To provide Basic information about Islamic Studies
2. To enhance understanding of the students regarding Islamic Civilization
3. To improve Students skill to perform prayers and other worships
4. To enhance the skill of the students for understanding of issues related to faith and religious life.

Learning Outcomes

Students will acquire knowledge and understanding the basic information about Islamic Studies.

1. To enhance understanding of the students regarding Islamic Civilization.
2. To improve Students skill to perform prayers and other worships.
3. To enhance the skill of the students for understanding issues related to faith and religious life.

Course outlines

1. **Introduction to Quranic Studies:** Basic Concepts of Quran

   1.1. history of quran

   1.2. uloom-ul -Quran

2. **Study of Selected Text of Holly Quran:**

   2.1. verses of surah al-baqra related to faith (verse no-284-286)

   2.2. verses of surah al-hujrat related to adab al-nabi (verse no-1-18)

   2.3. verses of surah al-mumanoon related to characteristics of faithful (verse no-1-11)

   2.4. verses of surah al-furqan related to social ethics (verse no.63-77)

   2.5. verses of surah al-inam related to ihkam (verse no-152-154)

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3. Study of Selected Text of Holly Quran

3.1. verses of Surah Al-Ihzab related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)

3.2. verses of Surah Al-Hashar (18,19,20) related to thinking, Day of Judgment

3.3. verses of Surah Al-Saf related to Tafakar,Tadabar (Verse No-1,14)

4. Seerat of Holy Prophet (S.A.W) I

4.1. life of Muhammad Bin Abdullah (before Prophethood)

4.2. life of Holy Prophet (S.A.W) in Makkah

4.3. important lessons derived from the life of Holy Prophet in Makkah

5. Seerat of Holy Prophet (S.A.W) II

5.1. life of Holy Prophet (S.A.W) in Madina

5.2. important events of life of Holy Prophet in Madina

5.3. important lessons derived from the life of Holy Prophet in Madina

6. Introduction to Sunnah

6.1. basic concepts of Hadith

6.2. history of Hadith

6.3. kinds of Hadith

6.4. uloom –ul-Hadith

6.5. Sunnah & Hadith

6.6. legal position of Sunnah

7. Selected Study from Text of Hadith

8. Introduction to Islamic Law & Jurisprudence

8.1. basic concepts of islamic law & jurisprudence

8.2. history & importance of islamic law & jurisprudence

8.3. sources of islamic law & jurisprudence

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8.4. nature of differences in islamic law

8.5. islam and sectarianism

9. Islamic Culture & Civilization

9.1. basic concepts of islamic culture & civilization

9.2. historical development of islamic culture & civilization

9.3. characteristics of islamic culture & civilization

9.4. islamic culture & civilization and contemporary issues

10. Islam & Science

10.1. basic concepts of islam & science

10.2. contributions of muslims in the development of science

10.3. quran & science

11. Islamic Economic System

11.1. basic concepts of islamic economic system

11.2. means of distribution of wealth in islamic economics

11.3. islamic concept of riba

11.4. islamic ways of trade & commerce

12. Political System of Islam

13. Basic Concepts of Islamic Political System

14. Islamic Concept of Sovereignty

15. Basic Institutions of Govt. in Islam

16. Islamic History

17. Period of Khlaft-E-Rashida

18. Period of Ummayyads

19. Period of Abbasids

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20. Social System of Islam

21. Basic Concepts of Social System of Islam

22. Elements of Family

23. Ethical Values of Islam

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Hussain, H.H. (1998). An Introduction to the Study of Islamic Law. leaf Publication Islamabad, Pakistan.
2. Ahmad, H. (1993). Principles of Islamic Jurisprudence. Islamic Research Institute, International Islamic University, Islamabad.
3. Mir Waliullah. (1982). Muslim Jurisprudence and the Quranic Law of Crimes. Islamic Book Service.
4. Bhatia, H.S. (1989). Studies in Islamic Law, Religion and Society. Deep & Deep Publications New Delhi.
5. Zia-ul-Haq, M. (2001). Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad.

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THIRD SEMESTER

Course No.	Name of Course	Credit Hours
FST – 201	Principles of Human Nutrition	3 (3-0)
FST – 203	Unit Operations in Food Processing	3 (3-0)
FST – 205	Food Safety and Toxicology	3 (3-0)
BIOT – 201	Introductory Bioinformatics	2 (0-2)
MAB – 201	Marketing and Agribusiness	3 (3-0)
STAT – 201	Introductory Statistics	3 (3-0)
HQ – 201	Holy Quran Translation-III	0 (0-2)
	Total Credit Hrs.	**17**

FST – 201: PRINCIPLES OF HUMAN NUTRITION **3 (3-0)**

Pre-requisite

FSc (Pre-Medical)

Course Objectives

This course will provide:

1. Knowledge about history of nutrition science and the new emerging challenges globally.
2. Basic concepts concerning food and its nutrition throughout life cycle.
3. Understanding to management of nutrition related disorders.

Learning Outcomes

After completing this course students should be able to:

1. Understand nutritional terms, nutrients, their actions and balance in relation to our health.
2. Demonstrate an understanding of fundamental concepts of nutrition in everyday life.
3. Plan balanced diet throughout life cycle.

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Theory

1. **Introduction**
   1.1. definitions, food, nutrients, diet, balanced diet, food groups, food guide pyramid, meal planning.
2. **Eating food**
   2.1. smell, taste, satiety.
3. **Water**
   3.1. functions, sources, regulation in body, dietary requirements, content in food.
4. **Carbohydrates**
   4.1. types, role in body, dietary fiber, sweeteners, dietary requirements, content in food.
5. **Fats and oils**
   5.1. types, functions, dietary requirements, content in food, fat substitutes.
6. **Protein**s
   6.1. amino acids, protein synthesis, classification, functions, quality of proteins, dietary requirements, content in foods.
7. **Vitamins**
   7.1. classification, role in body, content in food.
8. **Mineral elements**
   8.1. types, requirements, sources, functions.
9. **Digestion**
   9.1. alimentary tract, digestive juices, secretions.
10. **Absorption and metabolism of nutrients**
    10.1 carbohydrates, protein, lipids.
11. **Nutrient and dietary deficiency disorders**
    11.1 Malnutrition, obesity, coronary diseases, diabetes, lactose and gluten intolerance, dental caries – symptoms, causes, prevention.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

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Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Geissler, C. & Powers, H. (2010). Human Nutrition. Churchill Livingstone, London, UK.
2. Denis, M.M. & Robert, E.C. & Wildman. (2019). Advanced Human Nutrition. Jones & Bartlett Learning, USA.
3. Awan, J.A. (2007). Elements of Food and Nutrition. Unitech Communications, Faisalabad-Pakistan.
4. Bamji, M.S., Rao, N.P. & Reddy, V. (2004). Textbook of Human Nutrition. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
5. Eastwood, M. (2003). Principles of Human Nutrition. John Wiley & Sons, Inc., New York, USA.
6. Garrow, J.S., James, W.P.T. & Ralph, A. (2000). Human Nutrition and Dietetics. Churchill Livingstone, London, UK.

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FST – 203: UNIT OPERATIONS IN FOOD PROCESSING **3(3-0)**

Pre-requisite

Basic course of Introduction to Food Scienceand Technology

Course Objectives

This course will provide:

1. Basic knowledge of unit operations to be carried out at food industry.
2. Basic concepts of specifications of machinery concerning different operations and processes during manufacturing of food.
3. Technical skills for processing of foods at industry.

Learning Outcomes

After completing this course students should be able to:

1. Elaborate machine design and technical specifications of machinery used in food processing industry.
2. Demonstrate processing steps used in food industry.
3. Perform different processes at industry.

Theory

1. **Introduction**
   1.1. units, dimensions, conversion.
2. **Energy and mass balance**
   2.1. heat transfer fundamentals – conduction, convection and radiation.
3. **Mass balance equations and Pearson‘s Law.**
4. **Air-water mixture**
   4.1. psychrometric charts and their application.
5. **Rheology of food products**
   5.1. stress, deformation and other aspects.
6. **Transport of fluids through pipes**
   6.1. laminar and turbulent regimes.
7. **Circulation of fluid through porous beds.**

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8. **Darcy's law:**
   8.1. permeability, porosity.
9. **Filtration:**
   9.1. fundamentals, equipment, maintenance problems, prospects.
10. **Separation processes by membranes.**
    10.1. Solid-liquid extraction.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. McCabe, W.L., Smith, J.C and Harriott, P. (2016). Unit operations of Chemical Engineering. (7th ed.). McGraw Hill Inc., New York, USA.
2. Earle, R.L. & Earle, M.D. (2004). Unit operations in Food Processing (Web ed.). The New Zealand Institute of Food Science & Technology. Available at: http://www.nzifst.org.nz/unitoperations/.
3. Jeankopolis, C.J. (2004). Transport Processes & Separation Process. Prentice Hall Professional Technical Reference, New Jersey, USA.
4. Gustavo, A & Barbosa-Canovas, V. (2002). Unit Operations in Food Engineering. CRC Press, Taylor & Francis Group, Boca Raton, Florida.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 205: FOOD SAFETY AND TOXICOLOGY 3 (3-0)

Pre-requisite

Basic course of Introduction to Food Scienceand Technology

Course Objectives

This course will provide:

1. Basic knowledge of food safety and toxins produced in food.
2. Basic concepts concerning toxins and their hazards in foods.
3. Knowledge about production of toxins in foods and strategies for their prevention.

Learning Outcomes

After completing this course students should be able to:

1. Have a comprehensive understanding of food toxicants associated with the supply chain.
2. Find food safety hazards and acquaint with strategy to identify, control and report food safety hazards.
3. Demonstrate intrinsic and extrinsic toxicants and strategies to mitigate.

Theory

1. **History and overview of food safety**
   1.1. introduction historical aspects, definitions, scope of the food safety.
2. **Foodborne infectious and microbial agents**
   2.1. types of infectious and microbialents, foodborne infections versus intoxications, foodborne bacteria, viruses, protozoans, foodborne toxic and physical Agents
3. **Basic food toxicology**
   3.1. microbial toxin, plant and animal toxin, agricultural chemicals, adulterants, food additives, packaging materials, toxicants induced during food processing and industrial waste.
4. **Food Safety**
   4.1. principles of preventions.
5. **Risk assessment and hazard analysis of foods**
   5.1. risk analysis and food safety.
6. **The current food safety system**

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6.1. national food control strategy, traceability system.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Food Research Institute. (2020). Food safety. CRC Press. UK
2. Motarjemi, Y. & H. Lelieveld. (2013). Food Safety Management: A Practical Guide for the Food Industry. Elsevier Science, USA.
3. Knechtges, P.L. (2011). Food Safety: Theory and Practice. Jones & Bartlett Learning, USA.
4. Awan, J.A. & Anjum, F.M. (2010). Food Toxicology. Unitech Communications, Faisalabad-Pakistan.
5. Schmidt, R.H. & Rodrick, G.E. (2004). Systems for Food Safety Surveillance and Risk Prevention. In: Food Safety Handbook. John Wiley & Sons, Inc. New Jersey, USA.
6. Helferich, W. & Winter, C.K. (2000). Food Toxicology. Woodhead Publishing Limited, Abington Hall, Abington, Cambridge, UK.
7. Shibamoto, T., Taylor, S. & Bjeldanes, L. (1993). Introduction to Food Toxicology. Academic Press, London, UK.

Date of Preparation: 25.05.2022 Date of Revision: _____

BIOT - 201: INTRODUCTORY BIOINFORMATICS 2 (0-2)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To acquaint the students with bioinformatics tools, databases, algorithms and applications.

Learning Outcomes

After completing this course students should be able to:

1. Have understanding of central topics and concepts within the field of bioinformatics
2. Have a basic understanding of what genome is and how a genome browser can be used to represent and explore genome level data
3. Know types and examples of biological databases and knowledge bases
4. Can explain the theories underlying the most common methods for sequence searches and sequence alignments

Theory

1. **Introduction**
   1.1. computer hardware and software, computer applications for biotechnologists, spreadsheet work, word processing; graphical and statistical analysis packages.
2. **Biocomputing**
   2.1. introduction to string matching algorithms, database search techniques, sequence comparison and alignment techniques, use of biochemical scoring matrices, introduction to graph matching algorithms, genome comparison, prediction and its implication.
3. **Introduction to Bioinformatics**
   3.1. its definition and history, introduction to data mining and its application, database hierarchies, Genomic and Proteomic Sequence Database and their Interpretation (UCSC Genome Database, NCBI, PDB, EcoCyc, DDBJ, SWISS-PROT, TIGR, KEGG etc)
4. **Bioinformatics Tools**

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4.1. repeatmasker, PHRED, PHRAP, BLAST, Prosite/BLOCKS/PFAM, CLUSTALW, Emotif, RasMol, Oligo, Primer3, Molscript, Treeview, Alscript, Genetic analysis software, phylip

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Claverie, J.M. & Notredame C. (2003) Bioinformatics for Dummies. Wiley Editor.

2. Letovsky, S.I. (1999). Bioinformatics. Kluwer Academic Publishers.

3. Baldi, P. & Brunak, S. (1998) Bioinformatics. The MIT Press.

4. Setubal, J. & Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.

5. Lesk, A.M. (2002) Introduction to Bioinformatics. Oxford University Press.

6. Rastogi, S.C., Mendiratta, N. & Rastogi, P. (2004) Bioinformatics: Concepts, Skills & Applications. CBS Publishers & Distributors, New Delhi.

7. Jae, K.L. (2002). Statistical Bioinformatics, John Wiley & Sons Inc.

8. Krawetz, A. & Womble, D. (2002). Introduction to Bioinformatics. (A Theoretical and Practical Approach). Humana Press.

Date of Preparation: 25.05.2022 Date of Revision: _____

MAB – 201: MARKETING AND AGRIBUSINESS 3 (3-0)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To acquaint the students with fundamental knowledge about marketing strategies

Learning outcomes

After completing the course, students will have developed some understanding of concepts, principles and issues in business management.

Theory

1. **Scope and objectives of Agribusiness Management**
   1.1. functions of management
   1.2. forms of business organizations
   1.3. principles and techniques of farm planning, operation and management
2. **Enterprise budgeting, Resource constraints, optimum combinations and alternate business plans.**
   2.1. balance sheet
   2.2. income statement and their analysis
3. **Benefit Cost Analysis**
   3.1. uncertainty and risk in farm business
4. **Risk Management Strategies**
5. **Supply chain management and Relevant Case studies.**
6. **Role of Government in Agribusiness management.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

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The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Kinsey, B. H. (2000). Agri. Business and Rural Enterprise. London: Croom Helm Ltd.

2. Goldberg, R.A., Wilson, L.M., & Austin, J.E. (1974). Agribusiness Management for Developing Countries. Cambridge, MA: Ballinger Publishing Company.

3. Buckett, M. (1981). An Introduction to Farm Organization and Management. Elsevier Science & Technology Books.

4. Kay, R., Edwards, W., & Duffy, P. (2007). Farm Management. (7th ed.). McGraw Hill Education, EU.

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STAT – 201: INTRODUCTORY STATISTICS 3 (3-0)

Pre-requisite

FSc (Pre-Medical)

Course Objective

To equip the students with basic concepts of bio-statistics and experimental design

Learning Outcomes

Upon completion of this course, student will be able to:

1. Select and apply appropriate statistical tests to analyze common biological and health data.
2. Recognize and give examples of different types of data arising in public health and clinical studies.
3. Produce appropriate statistical graphs and descriptive statistics.

Theory

1. **Definition and importance of Statistics in Agriculture**
   - 1.1. different types of data and variables
   - 1.2. frequency distribution
   - 1.3. frequency curve
2. **Definitions and calculations**
   - 2.1. arithmetic mean
   - 2.2. geometric mean
   - 2.3. harmonic mean
   - 2.4. median quantities and mode in grouped and ungrouped data
3. **Mean deviation, Standard deviation and variance, coefficient of variation.**
4. **Sampling**
   - 4.1. probability and non-probability sampling, simple random sampling stratified random sampling systematic sampling error, sampling distribution of mean and difference between two means.
5. **Interference Theory**

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5.1. estimation and testing of hypothesis, type—i and type-ii error, testing of hypothesis about mean and difference between two means using z-test and t-test, paired t-test

5.2. test of association of attributes using x2 (chi-square) testing hypothesis about variance

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended books

1. Sher, M. & Shahid, K. (2010). Introduction to Statistical Theory Part- I (Latest Edition).

2. Crawshaw, J. & Chambers, J. (1994). A Concise Course in A. Level Statistic with world examples.

3. Fran II, Dietrich-II, & Thomes, J. (1986). Keans Basic Statistics: An Inferential Approach. (2nd ed.).

4. Sher, M. & Shahid, K. (2010). Introduction to Statistical Theory Part- II (Latest Edition).

5. Steal, R.G.D. & James, H. (1980). Principles and Procedures of Statistics A Bio-meterial Approach. (2nd ed.).

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FOURTH SEMESTER

Course No.	Title of Course	Credit Hours
FST – 202	Postharvest Technology	3 (2-1)
FST – 204	Food Biotechnology	3 (2-1)
FST – 206	Food Chemistry	3 (3-0)
FST – 208	Food Quality Management	2 (2-0)
STAT - 202	Applied Statistics	3 (3-0)
PS – 202	Pakistan Studies	2 (2-0)
HQ – 202	Holy Quran Translation-IV	1 (0-2)
	Total Credit Hrs.	**17**

FST – 202: POST HARVEST TECHNOLOGY 3 (2-1)

Pre-requisite

Food Processing and Preservation

Course Objectives

The course will provide:

1. Basic knowledge about maturity assessment of different foods and deteriorating factors after ripening and harvesting.
2. Basic concepts concerning postharvest technology of fruits and vegetables.
3. Understanding different techniques to minimize postharvest losses.

Learning Outcomes

Upon completion of this course, students shall be able to:

1. Acquire knowledge and understanding Food Science with their alliance disciplines
2. Understand the nature of Food and their constituents
3. Understand about Food destroying agents and their remedies to increase the shelf life

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Theory

1. **Postharvest technology**
   1.1. introduction, production, losses, causes, trade.
2. **Fruit ripening**
   2.1. changes during ripening, recommended conditions, commercial practices, water loss, respiration activity.
3. **Harvesting and handling methods.**
4. **Maturity assessment of different fruits and vegetables.**
5. **Ripening process:**
   5.1. respiration, climacteric and nonclimacteric patterns, pectic substances, ripening conditions.
6. **Postharvest physiology of fruits and vegetables.**
7. **Postharvest treatments:**
   7.1. coatings, curing, vapor heat treatment, hot water treatment, degreening.
8. **Storage:**
   8.1. refrigerated, CA, hypobaric, MAS.
9. **Packaging:**
   9.1. types, design, modified atmospheric packaging, recycling.
10. **Cold chain**
    10.1. packing house operations, transportation.
11. **Safety and quality of fruits and vegetables.**
12. **Postharvest technology of cereals:**
    12.1. harvesting, threshing, drying, storage and handling.
13. **New developments in postharvest technology.**

Practical

1. **Determining harvest maturity of different fruits and vegetables.**
   1.1. Grading and sorting
2. **Applications of different postharvest techniques.**
3. **Changes in physical and chemical quality parameters of fruits during storage**
   3.1. Weight loss

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3.2. Acidity

3.3. TSS

3.4. Vitamin C degradation

3.5. Firmness

3.6. Color changes

4. **Effect of packaging materials on stored fruits and vegetables.**
5. **Effect of differentchemicals**

5.1. Anti-sprouting and anti-ripening

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Elhadi, Y. (2019). Postharvest Technology of Perishable Horticultural Commodities. Woodhead Publishing.
2. Chakraverty, A., Mujumdar, A.S., Raghavan, G.S.V., Ramaswamy, H.S. (2003). Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., New York, USA.
3. Thompson, A.K. (2003). Fruit and Vegetables Harvesting, Handling and Storage. Blackwell Science Pub., Cambridge, UK.
4. Wim, J. (2002). Fruit and Vegetable Processing: Improving Quality. Woodhead Publishing Ltd., Abington, Cambridge, UK.

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FST – 204: FOOD BIOTECHNOLOGY 3 (2-1)

Pre-requisite

Introductry knowledge about biotechnology

Course Objectives

The course will provide:

1. Basic knowledge on principle of food fermentation
2. Basic knowledge of enzyme technology
3. Understanding of specific process related to food bio processing
4. Basic knowledge of value addition during food manufacturing

Learning outcomes

After completing this course students will be able to:

1. Understand fermentation process and how it enhances nutritional profile of product
2. Describe basic safety aspects of fermentation
3. Describe enzyme action and main classes

Theory

1. **Biotechnology**
   1.1. Introduction
   1.2. history
2. **Microbial metabolism**
3. **Developments in metabolic and biochemical engineering:**
   3.1. metabolites
   3.2. range of fermentation processes
   3.3. components of fermentation processes.
4. **Isolation and preservation of industrially important microorganisms.**
5. **Industrial fermentations:**
   5.1. media
   5.2. design and types of fermenters
   5.3. process variables in fermentation

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5.4. recovery, purification of fermentation products

6. **Production of organic acids, enzymes, amino acids, single cell proteins, carotenoids and fermented food products**
7. **Microbial genetics**
   7.1. conjugation
   7.2. transduction
   7.3. transformation
8. **GMO in food biotechnology**
   8.1. Legal and social aspects of food biotechnology.

Practical

1. **Isolation, purification and maintenance of yeast and bacterial cultures.**
2. **Fermentation**
   2.1. aerobic and anaerobic fermentation and production of various fermented food products.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. El-Mansi, F.M.T, Bryee, C.F.A, Demain, A.L. & Allman, A.R. (2019). Fermentation Microbiology and Biotechnology. (4th ed.). CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

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2. Shetty, K., Paliyath, G, Pometto, A. & Levin, RE. (2005). Food Biotechnology. Marcel Dekker Inc., New York, USA.

3. Borem, A., Santos, F.R. & Bowen, D.E. (2004). Understanding Biotechnology. Pearson Education Inc., New Jersey, USA.

FST – 206: FOOD CHEMISTRY 3(3-0)

Pre-requisites

Introductry knowledge about composition of food

Course Objectives

This course will provide:

1. Basic knowledge of different food components.
2. Basic concepts of specific quality attributes of food systems as influenced by different food components.
3. Understanding of major chemical and biochemical (enzymatic) reactions during processing of foods at industry.

Learning Outcomes

After completing this course students should be able to:

1. Understand interactions of different food constituents during preparation of foods.
2. Demonstrate fundamental concepts related to chemistry of different food constituents.
3. Have knowledge about colors, flavors and additives in foods.

Theory

1. **Water**
   1.1. types, properties, structure, water activity, effect on shelf life of food.
2. **Carbohydrates**
   2.1. classification, structure, physical and chemical properties, caramelization, Maillard reaction, dietary fiber.
3. **Lipids**
   3.1. classification, structure, fatty acids, properties, rancidity, emulsifiers.
4. **Proteins**
   4.1. classification, structure, amino acids, chemical, physical and functional properties.
5. **Mineral elements**
   5.1. introduction, chemical and functional properties.
6. **Vitamins**
   6.1. classification, properties, structure, stability.

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7. **Colours and pigments**

   7.1. functions, properties, stability.

8. **Flavour**

   8.1. characteristics – taste and other saporous substances, aromatic compounds.

9. **Enzymes**

   9.1. nature, functions, classification.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Jianquan, K. & Kewei, C. (2021). Essentials of Food Chemistry. Springer Singapore.
2. Damodaran, S., Parkin, K.L. & Fennema, O.R. (2008). Fennema‘s Food Chemistry. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
3. DeMan, J.M. (2007). Principles of Food Chemistry. Springer Verlag, Heidelberg, Germany.
4. Belitz, H.D, Groschm, W. & Schieberle, P. (2004). Food chemistry. Springer Verlag, Heidelberg, Germany.

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FST –208: FOOD QUALITY MANAGEMENT **2(2-0)**

Pre-requisite

Introduction to Food science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of food quality management.
2. Basic concepts concerning quality control tools and principles of quality management.
3. Understanding of GMP, HACCP, quality and safety management systems to be applied at food industry.

Learning Outcomes

After completing this course students should be able to:

1. Apply basic principles of food quality and quality related systems.
2. Apply principles of food quality management at industry.
3. Discuss principles of food laws, HACCP and food quality and safety management system at industry.

Course Contents

1. **Food quality management:**
   1.1. history, importance, systems.
2. **Good manufacturing practices (GMP):**
   2.1. personal cleanliness
   2.2. buildings and facilities
   2.3. sanitary operations
   2.4. sanitary facilities and controls
   2.5. equipment and utensils
   2.6. production and process control
   2.7. warehousing and distribution
   2.8. traceability and recall.
3. **Hazard analysis and critical control points (HACCP) system**:
   3.1. history, prerequisites, preliminary steps, principles.

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4. **Food Safety Management Systems (FSMS) –ISO2(2000):(2005).**
5. **Codex Alimentarius Commission (CAC) guidelines for food quality management.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. CAC (Codex Alimentarius Commission). (2019). Codex Alimentarius Commission – Procedural manual. Joint FAO/WHO Food Standards Programme. FAO, Rome, Italy.
2. ISO (International Standards Organization). (2005). Food safety Management Systems – Requirements for an Organization in the Food Chain. Case Postale, Geneva, Switzerland.
3. Lelieveld, H.L.M., Mostert M.A. & Holah, J. (2005). Good Manufacturing Practices in the Food Industry. In: Handbook of Hygiene Control in the Food Industry. Woodhead Publishing Ltd., Abington, Cambridge, UK.
4. Blanchfield, J.R. (1998). Good Manufacturing Practices. Institute of Food Science & Technology, London, UK.

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STAT - 202: APPLIED STATISTICS 3 (3-0)

Pre-requisite

Introductory statistics

Course Objective

To acquaint the students with statistics tools, databases, and applications.

Learning outcomes

After completing this course students will be able to:

1. Design experiments and carry out statistical analysis of data
2. Understand and apply different statistical designs.

Theory

1. Introduction

1.1. Definition, branches of statistics, Scope and importance of statistics

2. Data

2.1. population and sample

2.2. variable, categorical and non-categorical data

2.3. scales of measurements

2.4. errors of measurements

3. Presentation of data

3.1. descriptive statistics

3.2. tabulation of data, parts of table and construction of table

3.3. diagrams and graphs, pictogram, historigram, line chart, histogram

3.4. applications and uses of histogram

3.5. construction of histogram, comparison of data using histogram, Bar chart, multiple bar chart, pie chart, gantt chart, timeline, infograph, pedigree chart;

4. Frequency distribution

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4.1. empirical FD, relative FD, cumulative FD, class frequency, class limits, class boundaries, class mark, class interval, midpoints;

5. Measures of Central Tendency

5.1. types of averages

5.2. arithmetic mean for grouped and ungrouped data

5.3. harmonic mean for grouped and ungrouped data

5.4. geometric mean for grouped and ungrouped data

5.5. median, quartiles, deciles, percentiles and mode

5.6. Advantages and disadvantages of arithmetic mean, harmonic mean, geometric mean, median and mode;

6. Measures of Dispersion

6.1. range, grouped and ungrouped data

6.2. coefficient of range, mean deviation of grouped and ungrouped data.

7. Coefficient of mean deviation

8. Standard deviation and variance of grouped and ungrouped data

9. Variance and standard deviation of population and sample data

10. Probability

10.1. definition, properties, experiment and random experiment

10.2. event, outcome, trial, multiplication rule, sample space and sample point

10.3. mutually exclusive event, combinations and permutations, probability distribution

10.4. binomial experiment

11. Tests of Significance

11.1. hypothesis testing

11.2. steps of hypothesis testing

11.3. Z-test, t-test, types, Chi-square, ANOVA, its uses and LSD

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11.4. correlation

11.5. regression

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Montgomery, D.C. (2012). Design and Analysis of Experiments. (8th ed.). John Wiley & Sons, New Jersy, USA.
2. Muhammad, F. (2000). Statistical Methods and Data Analysis. Kitab Markaz, Bhawana Bazar Faisalabad, Pakistan.
3. Petrie, A. & Watson, P. (2013). Statistics for Veterinary and Animal Science. (3rd ed.). Wiley-Blackwell, UK.
4. Zar, J.H. (2003). Biostatistical Analysis. (4th ed.). Pearson Education (Singapore). Prentice Hall International Limited. London, UK.
5. Jae, K.L. (2010). Statistical Bioinformatics, John Wiley & Sons Inc.

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PS – 202: PAKISTAN STUDIES 2 (2-0)

Pre-requisite

FSc (Pre-Medical)

Course Objectives

To Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.

Learning outcomes

After completing this course students will be able to:

1. Understand the ideological background of Pakistan and historical perception
2. Understand the process of governance and national development

Course Outline

1. Historical Perspective

1.1. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-i-Azam Muhammad Ali Jinnah.

1.2. Factors leading to Muslim separatism

1.3. People and Land

1.3.1. Indus Civilization

1.3.2. Muslim advent

1.3.3. Location and geo-physical features.

2. Government and Politics in Pakistan

2.1. Political and constitutional phases:

2.2. 1947-58

2.3. 1958-71

2.4. 1971-77

2.5. 1977-88

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2.6. 1988-99

2.7. (1999) onward

3. Contemporary Pakistan

3.1. Economic institutions and issues

3.2. Society and social structure

3.3. Ethnicity

3.4. Foreign policy of Pakistan and challenges

3.5. Futuristic outlook of Pakistan

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended books

1. Burki, S.J. (1980). State & Society in Pakistan, The MacMillan Press Ltd.

2. Akbar, S.Z. (2000). Issue in Pakistan's Economy. Karachi: Oxford University Press,.

3. Burke, S.M. & Lawrence, Z. (1993). Pakistan's Foreign policy: An Historical analysis. Karachi: Oxford University Press.

4. Mehmood, S. (1994). Pakistan Political Roots & Development. Lahore.

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5. Wilcox, W. (1972). The Emergence of Bangladesh, Washington: American Enterprise, Institute of Public Policy Research.

6. Mehmood, S. (1975). Pakistan Kayyun Toota, Lahore: Idara-e-Saqafat-e-Islamia, Club Road.

7. Ziring, L. (1980). Enigma of Political Development. Kent England: WmDawson & sons Ltd.

8. Zahid, A. (1980). History & Culture of Sindh. Karachi: Royal Book Company.

9. Afzal, M. R. (1998). Political Parties in Pakistan, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research,.

10. Sayeed, K.B. (1967). The Political System of Pakistan. Boston: Houghton Mifflin.

11. Aziz, K.K. (1976). Party, Politics in Pakistan, Islamabad: National Commission on Historical and Cultural Research.

12. Muhammad, W. (1987). Pakistan Under Martial Law, Lahore: Vanguard.

13. Haq, N. (1993). Making of Pakistan: The Military Perspective. Islamabad: National Commission on Historical and Cultural Research.

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FIFTH SEMESTER

Course No.	Title of Course	Credit Hours
FST – 301	Food Process Engineering	3 (2-1)
FST – 303	Food Analysis	3 (1-2)
FST – 305	Fruits and Vegetables Processing	3 (2-1)
FST – 307	Dairy Technology	3 (2-1)
FST – 309	Cereal Technology	3 (2-1)
FST – 311	Food Plant Layout and Sanitation	2 (2-0)
HQ – 301	Holy Quran Translation-V	0 (0-2)
	Total Credit Hrs.	**17**

FST – 301: FOOD PROCESS ENGINEERING 3 (2-1)

Pre-requisites

Unit Operations in Food Processing

Course Objectives

This course will provide:

1. Basic knowledge of different processes carried out at industry.
2. Basic concepts concerning design of machines for processing of different foods.
3. Knowledge of behavior of foods under different processing and storage conditions.

Learning Outcomes

After completing this course students should be able to:

1. Demonstrate unit operations in food process engineering.
2. Identify and apply various machines/equipment used in food processing.
3. Perform engineering approaches to material handling at industry.

Theory

1. **Agricultural raw materials:**

   1.1. physical, mechanical, biological, thermal and reheological properties.

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2. **Engineering approach in materials handling:**
   2.1. cleaning, sorting, grading, size reduction - equipments and their applications.
3. **Storage structures:**
   3.1. refrigeration, air conditioning and freezing units.
4. **Mobile refrigeration units**.
5. **Equipments used for packing of fruits, vegetables and their products.**
6. **Extraction process for agricultural products:**
   6.1. oil seeds, fruits.
7. **Cost analysis: engineering processes, finished products.**
   7.1. Boilers, steam generators, retorts, fans, blowers: types, selection.
8. **Recycling engineering**
   8.1. fundamentals, applications.
9. **Food engineering:**
   9.1. trends. Properties of foods, physical, colligative, rheological, engineering.
10. **Microstructural and imaging analysis as related to food engineering.**
11. **Heat transfer in food:**
    11.1. heat measurement, transfer and control; steam and its use in industry.
12. **Applications of refrigeration and freezing**:
    12.1. principles, insulation, cold storages - design, equipment, applications.
13. **Sterilization, evaporation, drying, pasteurizing**.
14. **Engineering properties of packaging materials:**
    14.1. diffusion through membrane, gas permeation mechanism.
15. **Materials handling:**
    15.1. equipments.
16. **Energy for food engineering**:
    16.1. steam, fuel utilization, electric power utilization, thermodynamic laws, energy balance for open systems, dynamic response of sensors.

Practical

1. **Materials handling:**
   1.1. cleaning, sorting, grading of raw materials.

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2. **Determination of different types of storage environment conditions for agricultural raw materials.**
3. **Maintenance and operation of equipment used for engineering processes –**
   3.1. refrigerant units
   3.2. heat exchangers
4. **Visit to cold stores and freezing units.**
5. **Determination of depression in freezing point, surface tension and absolute viscosity of given fluids.**
6. **Determination of freezing time for food products using Plank's equation.**
7. **Verification of Stokes law.**
8. **Selection of pumps and fans using characteristic curves.**
9. **Heat Transfer Analysis**
   9.1. Determination of thermal conductivity of food materials
   9.2. Determination of overall heat transfer coefficient of shell and tube heat exchangers
   9.3. Calculation of thermal process time of foods packed in containers

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

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Recommended Books

1. Smith, J.S. & Hui, Y.H. (2014). Food Processing: Principles and Applications 2nd edition. Wiley Blackwell.
2. Keith, W. (2007). Handbook of Waste Management & Co-product Recovery in Food Processing, Vol. I. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
3. Ramaswamy, H.S. & Marcotte, M. (2005). Food Processing: Principles and Applications. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
4. Smith, J.S. & Hui, Y.H. (2004). Food Processing: Principles and Applications. Blackwell Pub. Co., Oxford, England.
5. Zeki Berk. (2018). Food Process Engineering and Technology. Academic Press.
6. Pandey, H., Sharma, H.K., Chauhan, R.C., Sarkar, B.C. & Bera, M.B. (2004). Experiments in Food Process Engineering. CBS Publishers, New Delhi, India.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 303: FOOD ANALYSIS 3(1-2)

Pre-requisite

Food Processing and Preservation

Course Objectives

This course will provide:

1. Basic knowledge of different analysis concerning to food and food products.
2. Fundamental concepts of different techniques to analyze food samples of different nature.
3. Laboratory skills to perform proximate analysis and sensory evaluation of different foods.

Learning Outcomes

After completing this course students should be able to:

1. Understand sampling techniques regarding analysis.
2. Apply modern instrumental methods to analyze chemical and physical properties of foods.
3. Analyze data produced from proximate analysis and sensory evaluation of different foods.

Theory

1. **Food analysis:**
   1.1. significance.
2. **Sampling:**
   2.1. techniques, preparation, preservation.
3. **Physical properties and analysis of foods and food products:**
   3.1. appearance, texture, specific gravity, refractive index, rheology.
4. **Chemical analysis:**
   4.1. significance. Proximate analysis: moisture, ash, proteins, lipids, carbohydrates, fiber, NFE, acidity, pH, sugars, mineral elements, vitamins – significance, methods.
5. **Instrumental techniques:**
   5.1. principles, instrumentation, applications.
6. **Sample preparation.**
   6.1. Supercritical fluid extraction. Chromatography: TLC, ion chromatography, GC, HPLC, LCMS, Spectroscopy: UV-VIS, atomic emission and absorption, Infrared - FTIR, NIR, NMR.
7. **Electrophoresis:**

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7.1. types, principles, applications.

8. **Sensory evaluation of foods**

   8.1. attributes, difference and preference tests, consumer acceptance.

9. **Analytical data:**

   9.1. evaluation, interpretation, statistical applications.

Practical

1. **Lab safety requirements.**

   1.1. Preparation and standardization of laboratory solutions.

2. **Sampling.**
3. **Physicochemical analysis**

   3.1. Determination of specific gravity, refractive index, moisture, ash, crude protein, crude fat, crude fiber, NFE, pH and acidity. Paper and thin layer chromatography. Identification of toxins by TLC.

4. **Estimation of food components**

   4.1. UV-VIS spectrophotometer.

5. **Mineral analysis by flame photometer and atomic absorption spectrophotometer.**
6. **Determination of organic acids by chromatography.**
7. **Determination of volatile compounds by gas chromatography**
8. **Identification of food components by FTIR**
9. **Protein characterization by electrophoresis.**
10. **Sensory evaluation of foods.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

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Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. AOAC. (2019). Official Methods of Analysis of AOAC, 21st Edition. Association of Official Analytical Chemists, Arlington, USA.
2. Otles, S. (2009). Handbook of Food Analysis Instruments. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.Winton, A. & Winton, K.B. (2006). Techniques of Food Analysis. Agrobios Publishing Co., Jodhpur, India.
3. Awan, J.A. & Rehman, S.U. (2003). Food Analysis Manual. Unitech Communications, Faisalabad, Pakistan.
4. Nielson, S.S. (2003). Food analysis, Kluwer Academic/Plenum Pub., New York, USA Pomeranz, Y. & Meloan, C.E. (2000). Food Analysis: Theory and Practice. CBS Publishers, New Delhi.
5. Lawless, H.T. & Haymann, H. (1998). Sensory Evaluation of Food: Principles and Practices. Chapman and Hall, New York, USA.

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FST – 305 FRUIT AND VEGETABLE PROCESSING 3 (2-1)

Pre-requisite

Food Processing and Preservation

Course Objectives

This course will provide:

1. Basic knowledge about deteriorating factors after ripening and harvesting and their control.
2. Understanding of innovative techniques to process fruits and vegetables at industry.

Learning Outcomes

After completing this course students should be able to:

1. Understand handling, storage and packaging of fruits and vegetables to minimize losses.
2. Evaluate the physiological changes occurring to fruit and vegetables during harvesting and storage.
3. Practical skills on how to produce value added products of fruits and vegetables.

Theory

1. **General properties of fruits and vegetables:**
   1.1. chemical composition, nutritional aspects, structural features, choice of processing technologies.
2. **Maintaining post-harvest quality of fruits and vegetables:**
   2.1. quality criteria, quality deterioration – measurement and maintenance.
3. **Spoilage factors and their control**
   3.1. chemical, enzymatic, biological
4. **General procedures for fruits and vegetables preservation:**
   4.1. an overview, new technologies for processing of fruits and vegetables
   4.2. minimal processing technology, modified atmosphere packaging, edible coatings and high pressure processing
   4.3. applications, impact on bacteria and enzymes, product quality.
5. **Future trends in fruits and vegetables processing**

Practical

1. **Preparation of fruits and vegetables products**

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1.1. dried, frozen and canned.

2. **Quality evaluation of the products during storage**
3. **Manufacturing of Products**

   3.1. pickle, juice concentrate, ready to serve juices, squashes, syrups and fruit candies.

4. **Use of edible coating for fruits and vegetables**
5. **Visit to fruit and vegetable processing units**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Urszula, T., Silvia, T., Malgorzata, N. & Artur, W. (2020). Safety, Quality and Processing of Fruits and Vegetables. MDPI.
2. Awan, J.A. & Rehman, S.U. (2009). Food Preservation Manual. Unitech Communications, Faisalabad, Pakistan.
3. Jongen, W. (2002). Fruit and Vegetable Processing – Improving Quality. Woodhead Publishing. Ltd., Abington, Cambridge, UK.
4. Sirivastava, R.P. & Sanjeev, K. (2002). Fruit and Vegetable Preservation: Principles and Practices. International Book Distributing Co., Lucknow, India.
5. Dauthy, M.E. (1995). Fruit and Vegetable Processing. FAO Agricultural Services Bulletin No. 119. Food and Agriculture Organization of the United Nations, Rome, Italy.

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FST – 307: DAIRY TECHNOLOGY 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of biochemistry of milk and its products.
2. Basic concepts concerning milk handling and processing at industry.
3. Laboratory skills for sensorial and adulteration tests as well as physico-chemical and microbiological analysis of milk and milk products.

Learning Outcomes

After completing this course students should be able to:

1. Find the composition, processing and analysis of milk and milk products.
2. Demonstrate industrial production of milk and milk products.
3. Apply principles and techniques for the preservation of milk and milk products.

Theory

1. **Milk**
   1.1. production statistics, importance, standards, major constituents.
2. **Factors influencing raw milk quality**
3. **Milk handling**
   3.1. manual and machine milking, farm cooling, collection, reception, analyses at different levels, transportation.
4. **Unit operations in milk processing**
   4.1. cream separation, bactofugation, filtration, thermization, standardization, homogenization, pasteurization, sterilization, UHT, aseptic packaging, storage, distribution, effect on milk constituents.
5. **Technology, chemistry, microbiology of industrial products**
   5.1. evaporated, condensed and powder milks, butter, yogurt, cheese, ice cream, khoa, gulabjamun, burfi, rabri, paneer, dahi, lassi, kheer, desi ghee.
6. **Milk by-products**
   6.1. dried whey, casein.

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Practical

1. **Milk sampling methods**
2. **Reception tests**
   2.1. Sensory test, sedimentation, pH, acidity; lactometer reading, clot on boiling, alcohol precipitation test, standard plate count, reductase test.
3. **Physico-chemical**
   3.1. Proximate analysis
4. **Microbiolgical analysis of milk and milk products**
5. **Tests for adulterants**
   5.1. Detergents, Formaldehyde, Starch etc
6. **Visit to commercial dairy farms and milk processing plants**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. Chandan, R.C., Kilara, A. & Shah, N. (2015). Dairy Processing and Quality Assurance, John Wiley & Sons Inc., New York, USA.
2. Walstra, P., Wouters J.T.M. & Guerts T.J. (2006). Dairy Science & Technology. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.
3. Winton, A.L. & Winton K.B. (2006). Milk and Milk Products. Agrobios, Agro House, New Delhi, India.

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4. Alfa Laval/Tetra Pak. (2003). Dairy Processing Handbook. Tetra Pak Processing System, Lund, Sweden.

5. Smith, G. (2000). Dairy Processing: Improving Quality. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.

FST – 309: CEREAL TECHNOLOGY 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of cereal grains and cereal industry.
2. Basic concepts concerning milling and processing of different cereal grains into products.
3. Practical knowledge of grain and flour quality assessment.

Learning Outcomes

After completing this course students should be able to:

1. Demonstrate importance, production and grading criteria of cereal based foods.
2. Apply storage principles and allied determinants associated with the storage of dietary cereals.
3. Elaborate the concepts of product development from cereal based ingredients.

Theory

1. **Cereal grains**
   1.1. importance, production, structure, composition, nutrition:
2. **Grain grades and grading. Storage**
   2.1. methods, types, role of temperature and moisture, safe storage methods.
3. **Dry milling process**
   3.1. cleaning, tempering, conditioning.
4. **Grinding process**
   4.1. types of grinding machines.
5. **Sieving process**
   5.1. principles, types of sifters.
6. **Flour treatment and quality assessment**
   6.1. Rheology of doughs and batters.
7. **Maize - wet milling**
   7.1. production of starch, oil, protein.
8. **Rice**
   8.1. Drying, milling, parboiling. Processing of rice and oats.

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9. **Malting and brewing**
10. **Production of breakfast cereals and snack foods**
11. **Feed and industrial uses of cereals**

Practical

1. **Grading of grains**
   1.1. Milling of cereal grain through different mills
2. **Tests for flour quality assessment**
3. **Visit to wheat, maize and rice processing industries**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Kent, N.L. & Evers, A.D. (2018). Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture. (5th ed.). Pergamon Press, Oxford, England.
2. Delcour, J.A. & Hoseney, R.C. (2010). Principles of Cereal Science and Technology. American Association of Cereal Chemists Inc, St. Paul, Minnesota, USA.
3. Karel, K. & Joseph, G.P. (2000). Handbook of Cereal Science and Technology. Marcel Dekker, New York, USA.

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FST – 311: FOOD PLANT LAYOUT AND SANITATION 2(2-0)

Pre-requisite

Food Safety and Toxicology

Course Objectives

This course will provide:

1. Basic knowledge of design and construction of food plant layouts concerning various industries.
2. Basic concepts regarding ideal locations for various food plants.
3. Ideas about cleaning and waste management.

Learning Outcomes

After completing this course students should be able to:

1. Discuss design, construction and sanitation of buildings and equipments in various food processing plants.
2. Elaborate building and layout designs for various food industries and recommend improvements to improve food safety and food quality.
3. Demonstrate maintenance of food plant building for cleaning and waste disposal.

Course Outlines

1. **Food processing industry:**
   1.1. introduction, investment.
2. **Plant location and layout:**
   2.1. significance, location analysis, selection criteria - freedom from pollution, availability of potable water, raw material, labour and energy supply, communication facilities, facilities for waste disposal.
3. **Building design and construction:**
   3.1. floors, drains, walls, doors, windows, ceiling, ventilation, lighting, auxiliary facilities.
4. **Food plant equipment:**
   4.1. requirements, design, construction, choice of material, layout.
5. **Plant cleaning:**
   5.1. soil types, methods, detergents, water conditioners.
6. **Sanitizing:**

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6.1. chemical, heat, irradiation.

7. **Cleaning methods – CIP**

   7.1. dismantling cleaning.

8. **Pests:**

   8.1. types, inspection, control. Waste management: fluid and solid wastes.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Elina, N., Nina, M., Malla, M. & Anna, H. (2020). Food Waste Management. Palgrave Macmillan Cham.
2. Awan, J.A. & Rehman, SU. (2010). Food plant layout and sanitation. Unitech Communications, Faisalabad, Pakistan.
3. Arvanitoyannis, I.S. (2008). Waste management for the Food Industries. Elsevier Academic Press, New York, USA.
4. Leliveld, H.L.M., Mostert, MA. & Holah, J. (2005). Handbook of Hygiene Control in Food Industry. Woodhead Publishing Ltd., Abington Hall, Abington, Cambridge, UK.
5. Farber, J.M. &Todd, E.C.D. (2000). Safe Handling of Foods. Marcel and Dekker, New York, USA.

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SIXTH SEMESTER

Course No.	Title of Course	Credit Hours
FST – 302	Food Microbiology	3 (2-1)
FST – 304	Meat Technology	3 (2-1)
FST – 306	Community Nutrition & Dietetics	3 (2-1)
FST – 308	Beverage Technology	3 (2-1)
FST – 310	Sugar Technology	3 (2-1)
HQ – 302	Holy Quran Translation-VI	1 (0-2)
	Total Credit Hrs.	**16**

FST – 302: FOOD MICROBIOLOGY 3 (2-1)

Pre-requisite

General Microbiology

Course Objectives

The course will provide:

1. Basic knowledge of the microbiology of food preservation and food commodities
2. Basic knowledge of principles and methods for microbial examination of food
3. Understanding of foodborne microorganisms of public health significance

Learning outcomes

After completing this course students will be able to:

1. Identify different types of microorganisms on the basis of morphological and physiological characteristics.
2. Grasp knowledge about microbial contamination of foods and factors affecting microbial growth
3. Understand about food borne infections and food intoxications

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Theory

1. **Food microbiology**:
   1.1. introduction and scope.
2. **Morphological, cultural and physiological characteristics:**
   2.1. molds, yeasts and yeast like fungi, bacteria.
3. **Important microbial genera in foods:**
   3.1. bacteria, moulds, yeasts, viruses -general, morphological, cultural and physiological characteristics.
4. **Factors affecting the growth and survival of microorganisms in food:**
   4.1. intrinsic, extrinsic and implicit.
5. **Contamination and spoilage of perishable, semi perishable and stable foods:**
   5.1. sources, transmission, microorganisms.
6. **Food microbiology and public health:**
   6.1. food-borne infections
   6.2. intoxications.
7. **Microbiological risk assessment.**
8. **Microbiology in food sanitation:**
   8.1. food sanitizers and pathogen reduction
   8.2. a case study.

Practical

1. **Isolation, identification and characterization of microorganisms:**
   1.1. morphology
   1.2. biochemical.
2. **Enumeration of microorganisms in food and water samples**
   2.1. total count, viable count, MPN.
3. **Examination of foods for pathogenic organisms**
   3.1. Escherichia coli
   3.2. Coliform
   3.3. Salmonella
   3.4. Listeria monocytogenes

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Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Michael, P., Doyle, F.D.G. & Colin, H. (2019). Food Microbiology: Fundamentals and Frontiers. (5th ed.). Wiley and Sons, USA.
2. Frazier, W.C. & Westhoff, D.C. (2008). Food Microbiology. McGraw Hill Book Co., New York, USA.
3. Adams, M.R. & Moss, M.O. (2006). Food Microbiology. The Royal Society of Chemistry, Cambridge, UK.
4. Yousef, A.E. & Carlstrom, C. (2003). Food microbiology: A Laboratory Manual. John Wiley & Sons, New Jersey, USA.
5. Brown, M. & Stringer, M. (2002). Microbiological Risk Assessment in Food Processing. Woodhead Publishing Ltd. Cambridge, UK.
6. Spencer, J.F.T. & Ragout, Spencer, A.L. (2001). Food Microbiology Protocols. Humana Press, New Jersey, USA.

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FST – 304 **MEAT TECHNOLOGY** **3 (2-1)**

Pre-requisite

Intrduction to Food Science and Technology

Course Objectives

The course will provide:

1. Basic knowledge of hygiene, nutrition, and quality assurance
2. Understanding modern and conventional slaughtering processes
3. Understanding of various meat processing techniques

Learning outcomes

After completing this course students will be able to:

1. Implement the knowledge of meat safety and meat preservation
2. Do carcass grading and secondary processing
3. Design effective packaging models and storage condition for meat and meat products

Theory

1. **Meat animals:**
   1.1. status in Pakistan, factors influencing growth and development.
2. **Slaughtering process**:
   2.1. pre-slaughtering care and handling of meat animals, stunning methods, bleeding methods – modern, Islamic, Kosher, Jhatka, others.
3. **Meat carcass:**
   3.1. dressing, post-mortem changes, carcass evaluation.
4. **Factors affecting quality of meat**.
5. **Preservation of beef and lamb:**
   5.1. chilling, freezing, canning, dehydration, curing, salting, smoking, irradiation.
6. **Properties of meat:**
   6.1. physical, chemical, and microbiological.
7. **Nutritive value of raw and processed meat.**
8. **Quality assurance and safety in meat industries**.

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Practical

1. **Identification of meat cuts.**
2. **Tests for freshness of meat.**
3. **Meat grading andquality testing.**
4. **Preservation of meat:**
   4.1. freezing, canning, dehydration, smoking, curing. Preparation of meat products.
5. **Visit to abattoir and meat processing plants.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Derrick, B. McCarthy. (2017). Meat and Meat Processing. Nova Science Publishers.
2. Kerry, J., Kerry, J. & Ledward, D. (2007). Meat Processing: Improving Quality. Woodhead Publishing Ltd., Abington, Cambrige, England.
3. NIIR Board of Consultants and Engineers. (2005). Preservation of Meat and Poultry Products. Asia Pacific Business Press Inc., Kalma Nagar, Delhi.
4. Riaz, M.N. & Chaudry, M.M. (2003). Halal Food Production. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
5. Pearson, A.M. & Gillett, T.A. (1997). Processed meats. Chapman & Hall, Inc., New York, USA.

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FST – 306: COMMUNITY NUTRITION AND DIETETICS 3(2-1)

Pre-requisite

Principles of Human Nutrition

Course Objectives

The course will provide:

1. Basic knowledge on concept of humanity, role of nutrition in health promotion and perspectives to solve community nutrition issues.
2. Understanding of nutrition program planning, intervention and evaluation
3. Basic knowledge on goals of community assessment, how community assessment is conducted and different methods to asses nutritional status and health in community.

Learning outcomes

After completing this course students will be able to:

1. Conduct various nutritional assessment in different communities
2. Design effective meal planning according to particular age group and disease

Theory

1. **Community nutrition:**
   1.1. foundation, status of Pakistani masses.
2. **Community nutrition programs:**
   2.1. key features, benefits, planning, implementation, evaluation.
3. **Factors affecting:**
   3.1. social, environmental.
4. **Nutritional status assessment**:
   4.1. anthropometric measurements, dietary, biochemical, clinical.
5. **Nutritional requirements and recommendations:**
   5.1. pre-school children, school children, adolescence, adults, pregnant and lactating women, geriatrics.
6. **Community nutrition and dietetics profession.**
7. **Dietetics:**
   7.1. introduction, food composition tables, nutrit ional databases.

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8. **Balanced diet:**
   8.1. importance in disease prevention, immunonutrition, dietary counseling.
9. **Diet therapy**
   9.1. functional foods, glycemic index.
10. **Therapeutic diets:**
   10.1. routine hospital diets
   10.2. pre- and post-operative diets
   10.3. special feeding methods.
11. **Diet designing:**
   11.1. nutritional requirements, ideal calorie distribution, nutrient density, exchange diets, eating disorders.
12. **Diet for specific ailments:**
   12.1. obesity
   12.2. overweight
   12.3. cardiovascular diseases
   12.4. diabetes, stomach and liver diseases.

Practical

1. **Dietary reference intakes.**
2. **Interpretation of food guide pyramids.**
3. **Nutritional requirements and basal metabolism.**
4. **Food intake assessment.**
5. **Major nutrients estimation in different diets.**
6. **Diet planning**
   6.1. healthy and diseased people
   6.2. planning of exchange diets
   6.3. diet for school children
   6.4. geriatric and healthcare centers

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

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Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. Joan, W.G., Angela, M. & Michelle, H. (2020). Oxford Handbook of Nutrition and Dietetics (3rd ed.). Oxford University Press.
2. Singh J. (2008). Handbook of Nutrition and Dietetics. Lotus Press, Darya Ganj, New Delhi, India.
3. Boyle, M.A. (2008). Community Nutrition in Action: An Entrepreneurial Approach. Thomson Learning Wadsworth, New York, USA.
4. Mann, J. & Truswell, A.T. (2007). Essentials of Human Nutrition. (3rd ed.). Oxford University Press, Oxford, England.
5. Whitney, E. & Rolfes, S.R. (2005). Understanding Nutrition. Thomson Learning Inc., Belmont, U.S.A.

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FST – 308: BEVERAGE TECHNOLOGY 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of beverage industry and classification of beverages.
2. Basic concepts concerning industrial manufacturing of different beverages.
3. Practical skills on testing quality of water and beverages.

Learning Outcomes

After completing this course students should be able to:

1. Classify beverages and basic ingredients used in beverage industry.
2. Elaborate water purification and processing steps involved in the preparation and production of beverages.
3. Discuss the quality control & quality assurance procedures, drinking water standards and Pakistan standards for beverage products.

Theory

1. **Beverage industry in Pakistan.**
2. **Beverages:**
   2.1. classification – still, carbonated, alcoholic.
3. **Beverage ingredients:**
   3.1. water, fruit components, sweeteners, flavorings, colorings, preservatives.
4. **Manufacture of soft drinks and fruit juices:**
   4.1. mixing, pasteurization, homogenization, filling, packing and storage.
5. **Carbonation:**
   5.1. History, CO_2, gas volume.
6. **Soft drinks and fruit juices:**
   6.1. ingredient specifications, manufacturing problems, changes in color, appearance, flavor.
7. **Packaging:**
   7.1. types, interactions.

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8. **Shelf life Issues:**
   8.1. microbiological problems.
9. **Bottled water:**
   9.1. legislation, water treatment, filling, quality issues.
10. **Fermented beverages:**
    10.1. introduction, types, role of microorganisms.
11. **Regulations and standards.**
12. **Statuary requirement:**
    12.1. labeling, nutrition claims.

Practical

1. **Water treatment and analysis.**
2. **Preparation and preservation of fruit pulps and juice concentrates.**
3. **Formulation and preparation of carbonated beverages.**
4. **Analysis of beverages:**
   4.1. chemical
   4.2. microbiological
   4.3. sensory
5. **Manufacturing beverages**
   5.1. fermented beverages and synthetic drinks.
6. **Visit to beverage industries**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

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Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Ashurst, P.R. & Hargitt, R. (2017). Soft Drink and Fruit Juice Problems Solved. (2nd ed.). Woodhead Publishing. Ltd., Abington, Cambridge, UK.
2. Shachman, M. (2000). The Soft Drinks Companions: A Technical Handbook for the Beverage Industry. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.
3. Varnam, H.A. & Sutherland, J.M. (1999). Beverages: Technology, Chemistry and Microbiology. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA

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FST – 310: SUGAR TECHNOLOGY 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of sugar industry and sugar manufacturing at industry.
2. Basic concepts concerning clarification/purification/refining of sugar for premium quality.
3. Laboratory skills for analysis of sugarcane/sugar beet juice and final produced sugar.

Learning Outcomes

After completing this course students should be able to:

1. Elaborate processing and basic concepts related to raw sugar manufacturing.
2. Elaborate sugar processing and refining steps at sugar industry.
3. Discuss quality criteria for raw and refined sugar.

Theory

1. **Sugar industry in Pakistan.**
2. **Sugarcane and sugar beet**:
   2.1. production, quality.
3. **Indigenous technology for small scale sugar production:**
   3.1. gur, khund, shakar.
4. **Raw sugar manufacturing:**
   4.1. unit operations - juice extraction, purification, heating, evaporation, crystallization, crystallization in motion.
5. **Refining:**
   5.1. affination, clarification, decolorisation, crystallization, centrifugation, drying, bagging, storage.
6. **Factors affecting sugar processing.**
7. **Quality criteria:**
   7.1. raw and refined sugar.
8. **Specialty sugar products:**
   8.1. brown or soft sugar, liquid sugar.

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9. **Sugar industry byproducts and their uses.**

Practical

1. **Analysis of sugar cane, sugar beet**
   1.1. TSS, pH, fiber, ash and polarization.
2. **Extraction and clarifications of raw juice.**
3. **Analysis of sugar and its intermediate products.**
4. **Inversion of sugar.**
5. **Visit to sugar industries.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. Asadi, M. (2007). Beet Sugar Handbook. John Wiley & Sons, Inc., New York, USA.
2. Chen, J.C.P. (2007). Meade-Chen Cane Sugar Handbook. John Wiley & Sons, Inc., New York, USA.
3. Chen, C.C. (2000). Handbook of Sugar Refining: A Manual for the Design and Refining Facilities. John Wiley & Sons, Inc., New York, USA.
4. Lionnet, G.R.E. (1999). Sugar Technology for Students. Lang Fred, Durban, South Africa.

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SEVEN SEMESTER

Course No.	Title of Course	Credit Hours
FST-401	Food Laws and Regulations	3 (3-0)
FST-403	Bakery Products Science & Technology	3 (2-1)
FST-405	Technology of Fats and Oils	3 (2-1)
FST-407	Food Product Development	3 (1-2)
FST – 409	Food Packaging	3 (2-1)
FST-411	Confectionery and Snack Foods	3 (2-1)
HQ – 401	Holy Quran Translation-VII	0 (0-2)
	Total Credit Hrs.	**18**

FST – 401: FOOD LAWS AND REGULATIONS **3(3-0)**

Pre-requisites

FSc (Pre-Medical)

Objectives

This course will provide:

1. Basic knowledge of establishment of Punjab food authority and its role.
2. Basic concepts concerning food adulteration and food labeling.
3. Understanding of national and international food laws.

Learning Outcomes

After completing this course students should be able to:

1. Compare principles and food standards in developed and developing countries.
2. Demonstrate the food laws especially Punjab pure food rules and other related standards of food products.
3. Discuss role of Punjab food authority regarding safety and quality of products produced at industry and food premises.

Course Outlines

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1. **Pakistan Standards and Quality Control Authority**
   1.1. functions, authorities, standards.
2. **Pure Food Rules - (2007)**
   2.1. definitions, significant features, enforcement, amendments.
3. **Food inspector and public analyst**
   3.1. qualifications, duties, powers.
4. **Food adulteration**
   4.1. adulterants, health hazards, methods of detection.
5. **Food labelling**
   5.1. perspectives on nutrition labeling.
6. **Islamic food laws and regulations**
   6.1. sources, principles, lawful foods, unlawful foods.
7. Consumer laws in Pakistan.
8. **International food law**
   8.1. introduction.
9. **The World Trade Organization (WTO)**
   9.1. the agreement on the application of sanitary and phytosanitary measures.
10. **GATT**
11. **Codex Alimentarius**
    11.1. general, procedural manual, standards, codes, legal force.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Date of Preparation: 25.05.2022 Date of Revision: _____

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. Government of the Punjab. (2018). The Punjab Pure Food Rules 2018. The Punjab Weekly Gazette. Government Printing Press, Lahore, Pakistan.
2. Meulen, B. & Velde, M. (2014). European Food Law Handbook. Academic Publishers, Wageningen, The Netherlands.
3. PSQCA (Pakistan Standards and Quality Control Authority). (2010). Standards for Different Food Items. PSQCA, Karachi, Pakistan.
4. Riaz, M.N. & Chaudhary, M.M. (2004). Halal Food Production. CRC Press Taylor & Francis Group, Boca Raton, Florida, USA.
5. Khan, M.S. (1999). Consumer laws in Pakistan. Consumer Rights Commission of Pakistan, Islamabad, Pakistan.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 403: BAKERY PRODUCTS SCIENCE & TECHNOLOGY 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Objectives

This course will provide:

1. Basic knowledge of ingredients and additives used for bakery products.
2. Basic concepts concerning recipes of different products.
3. Skills on manufacturing technology of different bakery products.

Learning Outcomes

After completing this course students should be able to:

1. Produce various bakery products under quality control parameters.
2. Demonstrate fundamental concepts related to baking technology.
3. Apply principles of baking at industry and role of major ingredients to be added.

Theory

1. **Science of bakery product:**
   1.1. emulsions, oils & fats, proteins, starch, water.
2. **Raw materials:**
   2.1. grains, milling; grades of flours; types of flours –Chorleywood bread flour, patent, soft, wholemeal, brown and low moisture flours;
3. **Ingredients used in Bakery**
   3.1. leavening agentsfood starch excluding flour, fats, emulsifiers, colors; flavors; antioxidants; sugars; dairy ingredients; gums and gelling agents.
4. **Flour treatments;**
5. **Bread making:**
   5.1. chemistry of dough development, making of bread, types of breads, variants of bread.
6. **Products other than bread:**
   6.1. pastry, biscuits, wafers, cakes and other chemically leavened products.
7. **Dietetics bakery products.**
8. **Quality control in bakery.**

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Practical

1. **Preparation of bakery products**
   1.1. breads, pastry, biscuits, wafers, cakes and chemically leavened products.
2. **Effect of different ingredients on bakery products.**
3. **Visit to different baking plants.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. Weibiao, Z. & Hui, Y.H. (2014). Bakery Products Science and Technology. (2nd ed.). Wiley Blackwell.
2. Edward, W.P. (2007). The Science of Bakery Products. The Royal Society of Chemistry, Cambridge, UK. UK.
3. Hui, Y.H., Corke, H., Leyn, I.D. & Cross, N. (2006). Bakery Product Science and Technology. Blackwell Pub. Co., London, UK.
4. Khetarpaul, N., Grewal, R.B. & Jood, S. (2005). Bakery Science and Cereal Technology. Daya Pub. House, New Delhi, India.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 405: TECHNOLOGY OF FATS AND OILS 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Objectives

This course will provide:

1. Basic knowledge of oils and fats and their extraction at industrial processing.
2. Basic concepts concerning processing and packaging of different products of oils and fats.
3. Practical skills for testing quality of oils and fats based products.

Learning Outcomes

After completing this course students should be able to:

1. Discuss dietary sources and nomenclature of triglycerides.
2. Elaborate various processing steps in oil processing industry.
3. Apply principles and techniques for the production of oil based value added products.

Theory

1. **Oils and fats:**
   1.1. importance, sources, production, uses.
2. **Characteristics of oils and fats:**
   2.1. physical, chemical.
3. **Oil bearing materials:**
   3.1. pre-treatment, storage.
4. **Extraction methods:**
   4.1. rendering, expression, solvent extraction.
5. **Processing:**
   5.1. degumming, refining, bleaching, deodorization, fractionation, winterization, hydrogenation, interesterification, esterification, emulsification, stabilization.
6. **Spoilag**e:
   6.1. oxidative and hydrolytic rancidity-chemistry, prevention - use of antioxidants.
7. **Manufacture of frying oils, margarine, mayonnaise.**
8. **Byproducts**
   8.1. Produced in industry and their uses.

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Practical

1. **Extraction of oils and fats.**
2. **Determination of physical and chemical constants:**
   2.1. color, cold test, melting point, smoke point, specific gravity, solid fat index, refractive index, acid value, peroxide value, iodine value, saponification value.
3. **Visit to oil and fat industries.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Books Recommended

1. AOCS. (2020). Official Methods and Recommended Practices of AOCS. (7th ed.). Am. Oil Chem. Soc., Illinois, USA.
2. Raie, M.Y. (2008). Oils, Fats and Waxes. National Book Foundation, Islamabad, Pakistan.
3. Akoh, C.C. & Min, D.B. (2008). Food Lipids: Chemistry, Nutrition and Biotechnology. (3rd ed.). CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
4. Fereidoon, S. (2005). Edible Oil and Fat Products: Application Technology. John Wiley & Sons, Inc., New York, USA.
5. O'Brien, R.D. (2000). Fats and Oils: Formulating and Processing for Application. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

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FST – 407: FOOD PRODUCT DEVELOPMENT 3(1-2)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of strategies to develop different types of products.
2. Basic concepts concerning different methods of sensory evaluation of food products.
3. Laboratory skills for sensorial evaluation and interpretation of data through statistical software.

Learning Outcomes

After completing this course students should be able to:

1. Demonstrate steps involved in novel food products development and their importance.
2. Apply organoleptic techniques to evaluate novel food products.
3. Have practical skills on sensory evaluation and application of statistical software on sensorial data.

Theory

1. **Food product development:**
   1.1. process, strategy, design, development, commercialization, evaluation.
2. **Key to new product success and failure.**
3. **Consumer in food product development:**
   3.1. consumer behavior, food choices, sensory needs, consumer role.
4. P**reference mapping and food product development:**
   4.1. conducting trials, analyzing, recent developments.
5. **Case study of consumer-oriented food product development:**
   5.1. reducedcalorie foods - Consumer trends and healthy eating, marketing and technological challenges, success factors.
6. **Case study:**
   6.1. reduced-calorie on-the-go beverages.
7. **The ethics of food production and consumption.**

Practical

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1. **Food product development projects**
   1.1. strategy, design, development, commercialization, launch and evaluation.
2. **Practical aspects and sensory evaluation techniques.**
3. **Quality Analysis**
   3.1. Chemical and instrumental quality analysis.

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Francisco, J., Barba, G.C., Farid, C., José, M.L.R., & Paulo, E.S.M. (2020). Design and Optimization of Innovative Food Processing Techniques Assisted by Ultrasound: Developing Healthier and Sustainable Food Products. Academic Press.
2. Earle, M. & Earle, R. (2007). Case Studies in Food Product Development. Woodhead Publishing Ltd., Abington, Cambridge, UK.
3. Frewer, L. & Trijp, H. (2007). Understanding Consumers of Food Products. Woodhead Publishing Ltd., Abington, Cambridge, UK.
4. Earle, M., Earle, R. & Anderson, A. (2001). Food product development. Woodhead Publishing Ltd., Abington, Cambridge, UK.

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FST – 409: FOOD PACKAGING 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of food packaging and types of packaging material.
2. Basic concepts concerning selection of packaging material for different types of products.
3. Idea of novel food packaging techniques.

Learning Outcomes

After completing this course students should be able to:

1. Define the role of packaging material for various food products.
2. Elaborate principles of food packaging for extending the shelf life of various food products under different storage conditions.
3. Have knowledge of testing procedures of different types of packaging material.

Theory

1. **Food packaging:**
   1.1. introduction, needs, functions, systems, development.
2. **Packaging types**:
   2.1. primary, secondary, tertiary.
3. **Packaging materials:**
   3.1. rigid containers
   3.2. flexible packaging.
4. **Properties of food packaging:**
   4.1. physical
   4.2. chemical.
5. **Packaging guidelines**:
   5.1. retail containers, shipping containers.
6. **Factors influencing design and selection of packaging materials:**
   6.1. product, distribution, marketing, packaging operation, cost.
7. **Printing processes:**

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7.1. inks, adhesives.

8. **Filling and labeling.**
9. **Safety and legislation .**
10. **Novel food packaging techniques.**
11. **Food labeling:**
    11.1. importance
    11.2. types
    11.3. methods.

Practical

1. **Identification of packaging materials used for various food products.**
2. **Requirements of foods for specific packaging material.**
3. **Canning in metal containers.**
    3.1. Can testing
4. **Determination of shelf-life in various packaging materials.**
5. **Vapor permeability test.**
6. **Determination of film thickness.**
7. **Visit to packaging industries.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

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Recommended Books

1. Alexandru, M.G. & Alina, M.H. (2018). Food Packaging and Preservation. Academic Press.
2. Lee, D.S., Yam, K.M. & Piergiovanni, L. (2008). Food Packaging Science and Technology. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.
3. EIRI (Engineers India Research Institute). (2007). Handbook of Packaging Technology. Engineers India Research Institute, New Delhi, India.
4. Robertson, G.L. (2006). Food Packaging: Principles and Practices. CRC Press, Taylor & Francis Group, Boca Raton, Florida, USA.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 411: CONFECTIONERY AND SNACK FOODS 3 (2-1)

Pre-requisite

Introduction to Food Science and Technology

Course Objectives

This course will provide:

1. Basic knowledge of confectionery industry and classification of confectionery.
2. Basic concepts concerning manufacturing technology of various confectioneries at industry.
3. Idea of industrial production of sugar based confectioneries and snack foods.

Learning Outcomes

After completing this course students should be able to:

1. Discuss confectionery industry in Pakistan and quality parameters of various confectionery products at industry.
2. Find effect of different ingredients on confectionary/bakery products.
3. Demonstrate industrial manufacturing of different types of confectioneries and snack foods

Theory

1. **Confectionery:**
   1.1. significance, classification, industries in Pakistan.
2. **Sugar confectionery:**
   2.1. ingredients, manufacturing - high boiled sweets, caramel, toffee, fudge, gums.
3. **Sugar free confectionery:**
   3.1. need, ingredients, manufacture.
4. **Chewing gum technology.**
5. **Chocolate confectionery.**
6. **Snack foods:**
   6.1. history, status, manufacture - potato, nuts, cereal, meat and fish based.
7. **Puffed and baked snacks.**
8. **Seasonings:**
   8.1. ingredients, formulations, applications.
9. **Quality control.**
10. **Packaging.**

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Practical

1. **Preparation of candy, toffee, chocolates, and other sugar based confectionery.**
2. **Manufacture of potato chips, fried legumes, nuts, nuggets, extruded snacks.**
3. **Visit to confectionery and snack food industries.**

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Edwards, W.P. (2018). The Science of Sugar Confectionery. (2nd ed.). Royal Society of Chemistry, Thomas Graham House, Science Park, Cambridge, UK.
2. Panda, H. (2013). The Complete Technology Book on Snack Foods. (2nd ed.). National Institute of Industrial Research, New Delhi, India.
3. Lusas, W. & Rooney, L.W. (2001). Snack Food Processing. Technomic Pub. Co., Lancaster, UK.
4. Jackson, E.B. (1995). Sugar Confectionary Manufactures. Blackie Academic & Professional, Glassgow, UK.

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EIGHT SEMESTER

Course No.	Title of Course	Credit Hours
FST – 402	Sensory Evaluation of Foods	3 (2-1)
FST - 404	Research Projects and Scientific Writing	2 (1-1)
FST - 422	Internship / Study Project	5 (0-5)
FST- 424	Seminar	1 (1-0)
HQ – 402	Holy Quran Translation-VIII	1 (0-2)
	Total Credit Hrs.	**12**

FST - 402: SENSORY EVALUATION OF FOODS 3 (2-1)

Pre-requisite

Food Product Development

Course Objectives

The course will provide:

1. Basic knowledge on principles of sensory and consumer science including testing methods
2. Understanding the role of sensory evaluation in marketing of food products and factors effecting it

Learning outcomes

After completing this course students will be able to:

1. Examine sensory properties of food through lab experiments
2. Use terminologies, appropriate to the field of sensory analysis, correctly and contextually
3. Formulate products that meet specified sensory requirements

Theory

1. **Introduction:**
   1.1. overview, physiological and psychological foundations.
2. **General requirements for sensory testing.**
3. **Organization and evaluation of sensory evaluation program.**

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4. **Measurement:**
   4.1. difference, discrimination testing, scaling, threshold methods, descriptive analysis.
5. **Evaluation**
   5.1. Effective texture evaluation, Color and flavor evaluation.
6. **Special problems related to sensory science.**
   6.1. Consumer field tests and questionnaire design.
7. **Statistical procedures**

Practical

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

Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Date of Preparation: 25.05.2022 Date of Revision: _____

Recommended Books

1. Herbert, S., Rebecca, B. & Heather, T. (2020). Sensory Evaluation Practices. (5th ed.). Academic Press.
2. Kemp, S.E., Hollywood, T. & Hort, J. (2009). Sensory Evaluation: A Practical Handbook. John Wiley & Sons Inc., New York, USA.
3. Chambers, E. & Wolf, M.B. (2005). Sensory Testing Methods. American Society for Testing and Materials, West Conshohocken, Pennsylvania, USA.
4. Stone, H. & Sidel, J.L. (2004). Sensory Evaluation Practices. Elsevier Academic Press, California, USA.
5. Carpenter, R.P., Hasdell, T.A. & Lyon, D.H. (2000). Guidelines for Sensory Analysis in Food Product Development and Quality Control. Aspen Publishers, Inc., Gaithersburg, Maryland, USA.
6. Lawless, H.T. & Heymann, H. (1998). Sensory Evaluation of Food: Principles and Practices. Kluwer Academic Publishers, Massachusetts, USA.

Date of Preparation: 25.05.2022 Date of Revision: _____

FST – 404: RESEARCH PROJECTS AND SCIENTIFIC WRITING 2(1-1)

Pre-requisite

Basic and advance courses of food sciences

Course Objectives

This course will provide:

1. Basic knowledge of different types of scientific presentations.
2. Basic concepts concerning writing of research and review papers.
3. Technical skills to write different types of scientific documents.

Learning Outcomes

After completing this course students should be able to:

1. Demonstrate scientific writing process and its key stages.
2. Organize and compose a scientific paper.
3. Analyze and review any scientific document in terms of key message, consistency and justification

Theory

1. **Types of scientific presentations.**
2. **Collection of literature:**
   2.1. printed and electronic sources.
3. **Managing literature.**
4. **Initiating write up.**
5. **Writing scientific documents:**
   5.1. synopsis, research proposal, articles, references, internship report
6. **Oral presentations**.

Practical

1. **Exercises in collecting literature from different sources on assigned topics.**
2. **Organizing and analysis of collected material.**
3. **Writing**
   3.1. synopsis/proposal, short communication
4. **Delivering oral presentation.**

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Teaching-Learning Strategies

Teaching will be a combination of class lectures, class discussions, and group work. Short videos/films will be shown on occasion.

Assignments

The sessional work will be a combination of written assignments, class quizzes, presentation, and class participation/attendance.

Assessments and Examination

Sessional Work: 25 marks

Midterm Exam: 35 marks

Final Exam: 40 marks

Recommended Books

1. Awan, J.A. (2009). Scientific Presentations. Unitech Communications, Faisalabad, Pakistan.
2. Khalil, S.K. & Shah, P. (2007). Scientific Writing and Presentation for Crop Sciences. Higher Education Commission, Islamabad, Pakistan.
3. Anderson, J., Durston, B.H. & Poole, M. (2002). Thesis and Assignment Writing. Wiley Eastern Ltd., New Delhi, India.

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FST-422: INTERNSHIP / STUDY PROJECT 5 (0-5)

Objectives

This course will provide:

1. Practical exposure at food industry or research organization.
2. Basic concepts concerning infrastructures of food industries and research organization.
3. Laboratory skills of proximate composition of foods as well as other analysis.

Learning Outcomes

After completing this course students should be able to:

1. Tackle troubleshooting problems and challenges during work at food industry.
2. Apply the knowledge and/or skills in food processing industry.
3. To explore career options within the food industry or research organization.

Practical training/work at the food industry or at research stations / institutes / organizations / companies; This involves internship report / mini thesis writing by the student and the student will also present his/her report/research in a seminar.

Note: The industry officials will evaluate the practical work by the student. An expert committee to be appointed by the Board of studies/Chairman/Director of the department will also evaluate the student's participation at the industry and at the universities. The committee will also evaluate and grade/mark the report and seminar.

FST-424: SEMINAR 1 (1-0)

The seminar/presentation delivered for internship/research will be mandatory.

HQ-401 to 408: Holy Quran Translation I to VIII 1 (0-1)

As per Center for Quran and Sunnah letter No. 012/CQS, dated 23.11. 2020

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ASSESSMENT EVALUATION AND EXAMINATIONS:

Sr. No.	Elements	Weightage
1.	Mid-term Assessment	**35%**
2.	Sessional Marks on Presentation, Attendance, Assignments and Participation	**25%**
3.	Final-term Assessment	**40%**

A semester comprises of 16-20 weeks. There is midterm examination after 8 weeks of study and final examination after 16 weeks of study. Promotion to the next semester will be based on results of both semesters and decision to be taken at the end of the semester. If a student fails in a course, he/she will be provided two chances to pass a course by registering for the course again in the same semester of the subsequent years. If a student fails to pass the course after availing these two chances, he/she will be dropped from the rolls of the program.

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GRADING SYSTEM:

PERCENT MARKS	LETTER GRADE	GRADE POINTS
85 & Above	A	4.00
80-84	A-	3.70
75-79	B+	3.30
70-74	B	3.00
65-69	B-	2.70
61-64	C+	2.30
58-60	C	2.00
55-57	C-	1.70
50-54	D	1.00
Below 50	F	0.00

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