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Ref: SU/Acad/ 793  
October/21 /2020

Notification

The Academic Council in its meeting held on 18.06.2020 has approved the following recommendations made by the Board of Faculty of Agriculture in its meeting held on 26.09.2019. The syndicate in its meeting held on 27.07.2020 has also endorsed the decision of Academic Council.

Subject:

1. B.Sc (Hons) Food Science and Technology w.e.f fall 2019 under term system for affiliated colleges (Annex-'A')
2. Revision in curriculum of B.Sc (Hons) Food Science and Technology w.e.f fall 2020-21 under semester / term system for main campus and affiliated colleges (Annex-'B')
3. Revision in curriculum of M.Sc (Hons) Food Science and Technology w.e.f fall 2020-21 under semester system for main campus (Annex-'C')
4. Revision in curriculum of M.Sc (Hons) Food and Nutrition w.e.f fall 2020-21 for main campus (Annex-'D')
5. Revision in curriculum of PhD Food Science and Technology w.e.f 2020-21 for main campus (Annex-'E')
6. Revision in curriculum of PhD Food and Nutrition w.e.f 2020-21 for main campus (Annex-'F')

*[Signature]*  
Muhammad Farooq  
Deputy Registrar (Acad)

*[Signature]*  
21/10/2020

Distribution:

- Director, Institute of Food Science and Nutrition
- Controller of Examinations
- Principals of all affiliated colleges (concerned)
- Web-Developer *(for uploading on university web-site)*

C.C:

- Dean, Faculty of Agriculture
- Deputy Registrar (Affiliation)
- Deputy Registrar (Registration)
- Secretary to the Vice-Chancellor
- P.A to Registrar

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DEC ✓

**REVISED SCHEME OF STUDIES AND**  
**CURRICULUM**

**B.Sc. (Hons.) Food Science and Technology**

**For Semester System (at main campus)**

**For Affiliated Colleges under Term System**

**(With effect from Fall 2020-21)**



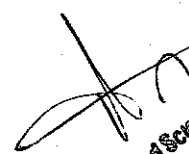
**INSTITUTE OF FOOD SCIENCE AND NUTRITION**

**Faculty of Agriculture**

**UNIVERSITY OF SARGODHA,**

**SARGODHA-PAKISTAN**

**2020**

  
**Director**  
**Institute of Food Science & Nutrition**  
**University of Sargodha, Sargodha**

## B.Sc. (Hons.) Food Science and Technology

Eligibility: At least 45% marks in F.Sc. (Pre-Medical/Pre-Engineering) or A Level

Duration: 04 Years Program (08 Semesters); Degree Requirements: 133 Credit Hours

### Semester-1

Course Code	Course Title	Credit Hours	Course Status
URCE-5102	Language Comprehension & Presentation Skills	3(3+0)	Compulsory
URCI-5109	Introduction to Information & Communication Technologies	3(2+1)	Compulsory
URCP-5106	Pakistan Studies	2(2+0)	Compulsory
ZOOL-6141 / MATH-5128	Introduction to Biology I (for Pre-Engineering students) / Mathematics (for Pre-Medical students)	3(3+0)/ 3(3+0)	Supporting
AGRO-5901	Basic Agriculture	3(2+1)	Supporting
FSAT-5101	Introduction to Food Science and Technology	3(2+1)	Foundation
<b>Total (Credit Hours)</b>		<b>17</b>	

### Semester-2

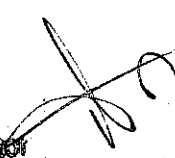
URCE-5103	Academic Writing	3(3+0)	Compulsory
URCI-5105/ ISLS-5108	Islamic Studies / Ethics (for Non-Muslim Students)	2(2+0)/ 2(2+0)	Compulsory
AGEC-5501	Introduction to Agricultural Economics	3(3+0)	Supporting
BIOT-5107	Microbiology	3(2+1)	Supporting
FSAT-5102	Elements of Food and Nutrition	3(3+0)	Foundation
FSAT-5103	Food Processing and Preservation	3(2+1)	Foundation
URCC-5110	Citizenship Education and Community Engagement	3(1+2)	Non-credit
<b>Total (Credit Hours)</b>		<b>17</b>	

### Semester-3

ANSC-5101	Introduction to Animal Husbandry	2(1+1)	Supporting
PLBG-5201	Introductory Genetics	3(2+1)	Supporting
ENTO-5102	Applied Entomology	3(2+1)	Supporting
PLPT-5301	Introduction to Plant Pathogens	3(2+1)	Supporting
FSAT-5104	Unit Operations in Food Processing	3(3+0)	Foundation
FSAT-5105	Community Nutrition	3(3+0)	Major
<b>Total (Credit Hours)</b>		<b>17</b>	

### Semester-4

STAT-5126	Statistics for Agricultural Sciences	3(3+0)	Compulsory
AEXT-5402	Communication Skills in Agricultural Extension	3(2+1)	Supporting
HORT-5602	Horticultural Crop Production	3(2+1)	Supporting
FSAT-5106	Food Safety and Laws	3(3+0)	Major
FSAT-5107	Food Packaging	2(2+0)	Major
FSAT-5108	Plant Design and Layout	3(3+0)	Foundation
<b>Total (Credit Hours)</b>		<b>17</b>	

  
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## Semester-5

FSAT-6109	Food Process Engineering	3(3+0)	Major
FSAT-6110	Fruit and Vegetable Processing	3(2+1)	Major
FSAT-6111	Food Analysis and Sensory Evaluation	3(1+2)	Major
FSAT-6112	Milk Handling and Processing	3(2+1)	Major
FSAT-6113	Introduction to Cereal Technology	3(2+1)	Major
FSAT-6114	Food Biochemistry	3(3+0)	Major
<b>Total (Credit Hours)</b>		<b>18</b>	

## Semester-6

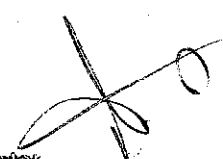
FSAT-6115	Sugar Technology	3(2+1)	Major
FSAT-6116	Poultry, Egg and Sea Food Technology	3(2+1)	Major
FSAT-6117	Baking Science and Technology	3(2+1)	Major
FSAT-6118	Post-Harvest Technology	3(2+1)	Major
FSAT-6119	Dairy Technology	3(2+1)	Major
FSAT-6120	Beverage Technology	3(2+1)	Major
<b>Total (Credit Hours)</b>		<b>18</b>	

## Semester-7

FSAT-6121	Food Product Development and Service Management	3(2+1)	Major
FSAT-6122	Technology of Oils and Fats	3(2+1)	Major
FSAT-6123	Confectionery and Snack Foods	2(2+0)	Major
FSAT-6124	Meat Technology	3(2+1)	Major
FSAT-6125	Food Microbiology	3(2+1)	Major
<b>Total (Credit Hours)</b>		<b>14</b>	

## Semester-8

BUSB-6124	Entrepreneurship and SME Management	3(3+0)	Supporting
FSAT-6126	Food Biotechnology	3(2+1)	Major
FSAT-6127	Food Quality Management	3(3+0)	Major
FSAT-6128	Internship and Report Writing	4(0+4)	Major
FSAT-6129	Introduction to Research and Scientific Writing	2(1+1)	Major
<b>Total (Credit Hours)</b>		<b>15</b>	
<b>Grand Total (Credit Hours)</b>		<b>133</b>	

  
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The course aims at developing linguistic competence by focusing on basic language skills in integration to make the use of language in context. It also aims at developing students' skills in reading and reading comprehension of written texts in various contexts. The course also provides assistance in developing students' vocabulary building skills as well as their critical thinking skills. The contents of the course are designed on the basis of these language skills: listening skills, pronunciation skills, comprehension skills and presentation skills. The course provides practice in accurate pronunciation, stress and intonation patterns and critical listening skills for different contexts. The students require a grasp of English language to comprehend texts as organic whole, to interact with reasonable ease in structured situations, and to comprehend and construct academic discourse. The course objectives are to enhance students' language skill management capacity, to comprehend text(s) in context, to respond to language in context, and to write structured response(s).

#### *Contents*


- 1 Listening skills
- 2 Listening to isolated sentences and speech extracts
- 3 Managing listening and overcoming barriers to listening
- 4 Expressing opinions (debating current events) and oral synthesis of thoughts and ideas
- 5 Pronunciation skills
- 6 Recognizing phonemes, phonemic symbols and syllables, pronouncing words correctly
- 7 Understanding and practicing stress patterns and intonation patterns in simple sentences
- 8 Comprehension skills
- 9 Reading strategies, summarizing, sequencing, inferencing, comparing and contrasting
- 10 Drawing conclusions, self-questioning, problem-solving, relating background knowledge
- 11 Distinguishing between fact and opinion, finding the main idea, and supporting details
- 12 Text organizational patterns, investigating implied ideas, purpose and tone of the text
- 13 Critical reading, SQ3R method
- 14 Presentation skills, features of good presentations, different types of presentations
- 15 Different patterns of introducing a presentation, organizing arguments in a presentation
- 16 Tactics of maintaining interest of the audience, dealing with the questions of audience
- 17 Concluding a presentation, giving suggestions and recommendations

#### *Recommended Texts*

- 1 Mikulecky, B. S., & Jeffries, L. (2007). *Advanced reading power: Extensive reading, vocabulary building, comprehension skills, reading faster*. New York: Pearson.
- 2 Helgesen, M., & Brown, S. (2004). *Active listening: Building skills for understanding*. Cambridge: Cambridge University Press.

#### *Suggested Readings*

- 1 Roach, C. A., & Wyatt, N. (1988). *Successful listening*. New York: Harper & Row.
- 2 Horowitz, R., & Samuels, S. J. (1987). *Comprehending oral and written language*. San Diego: Academic Press.

  
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The course introduces students to information and communication technologies and their current applications in their respective areas. Objectives include basic understanding of computer software, hardware, and associated technologies. They can make use of technology to get maximum benefit related to their study domain. Students can learn how the Information and Communications systems can improve their work ability and productivity. How Internet technologies, E-Commerce applications and Mobile Computing can influence the businesses and workplace. At the end of semester students will get basic understanding of Computer Systems, Storage Devices, Operating systems, E-commerce, Data Networks, Databases, and associated technologies. They will also learn Microsoft Office tools that includes Word, Power Point, Excel. They will also learn Open office being used on other operating systems and platforms. Specific software's related to specialization areas are also part of course.. Course will also cover Computer Ethics and related Social media norms and cyber laws.

#### Contents


1. Introduction, Overview and its types.
2. Hardware: Computer Systems & Components, Storage Devices and Cloud Computing.
3. Software: Operating Systems, Programming and Application Software.
4. Introduction to Programming Language
5. Databases and Information Systems Networks
6. The Hierarchy of Data and Maintaining Data,
7. File Processing Versus Database Management Systems
8. Data Communication and Networks.
9. Physical Transmission Media & Wireless Transmission Media
10. Applications of smart phone and usage
11. The Internet, Browsers and Search Engines.
12. Websites Concepts, Mobile Computing and their applications.
13. Collaborative Computing and Social Networking
14. E-Commerce & Applications.
15. IT Security and other issues
16. Cyber Laws and Ethics of using Social media
17. Use of Microsoft Office tools (Word, Power Point, Excel), mobile apps or other similar tools depending on the operating system.
18. Other IT tools/software specific to field of study of the students if any

#### Recommended Texts

1. Vermaat, M. E. (2018). *Discovering computers: digital technology, data and devices*. Boston: Course Technology Press.

#### Suggested Readings

1. Timothy J. O'Leary & Linda I. (2017). *Computing essentials*, (26<sup>th</sup> ed.). San Francisco: McGraw Hill Higher Education.
2. Schneider, G. M., & Gersting, J. (2018). *Invitation to computer science*. Boston: Cengage Learning.

  
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The course is designed to acquaint the students of BS Programs with the rationale of the creation of Pakistan. The students would be apprised of the emergence, growth and development of Muslim nationalism in South Asia and the struggle for freedom, which eventually led to the establishment of Pakistan. While highlighting the main objectives of national life, the course explains further the socio-economic, political and cultural aspects of Pakistan's endeavours to develop and progress in the contemporary world. For this purpose, the foreign policy objectives and Pakistan's foreign relations with neighbouring and other countries are also included. This curriculum has been developed to help students analyse the socio-political problems of Pakistan while highlighting various phases of its history before and after the partition and to develop a vision in them to become knowledgeable citizens of their homeland.

#### *Contents*

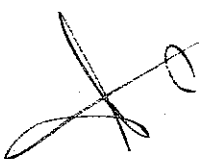
1. Contextualizing Pakistan Studies
2. Geography of Pakistan: Geo-Strategic Importance of Pakistan
3. Freedom Movement (1857-1947)
4. Pakistan Movement (1940-47)
5. Muslim Nationalism in South Asia
6. Two Nations Theory
7. Ideology of Pakistan
8. Initial Problems of Pakistan
9. Political and Constitutional Developments in Pakistan
10. Economy of Pakistan: Problems and Prospects
11. Society and Culture of Pakistan
12. Foreign Policy Objectives of Pakistan and Diplomatic Relations
13. Current and Contemporary Issues of Pakistan
14. Human Rights: Issues of Human Rights in Pakistan

#### *Recommended Texts*

1. Kazimi, M. R. (2007). *Pakistan studies*. Karachi: Oxford University Press.
2. Sheikh, J. A. (2004). *Pakistan's political economic and diplomatic dynamics*. Lahore: Kitabistan Paper Products.

#### *Suggested Readings*

1. Hayat, S. (2016). *Aspects of Pakistan movement*. Islamabad: National Institute of Historical and Cultural Research.
2. Kazimi, M. R (2009). *A concise history of Pakistan*. Karachi: Oxford University Press.
3. Talbot, I. (1998). *Pakistan: A modern history*. London: Hurst and Company.

  
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This subject aims to yield students with a sense of practical relevance of biology to everyday life. This will make students comprehend life by understanding some of the molecular processes that occur in and around cells, to make students cognizant of biologic phenomenon (nature, body, etc.) on an evolutionary, ecological, behavioral, physiologic, tissue, cellular, and molecular level. In this subject students will examine how life is organized into hierarchical levels; how living organisms use and produce energy; how life grows, develops, and reproduces; how life responds to the environment to maintain internal stability; and how life evolves and adapts to the environment. Moreover, it will also enable them to investigate the biological molecules, homeostasis in vertebrates, and the influence of hormones on coordination and control systems of animal body. Upon completion of this subject students will have an enhanced knowledge and appreciation of the basics of growth and development plans of animals and can develop cogent and critical arguments based on the course material.

#### Contents

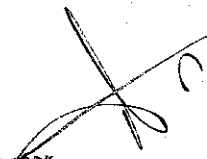
1. Introduction: Nature and scope of biology
2. Branches of biology
3. Relationship between biology and psychology
4. Biological molecules: Carbohydrates, Proteins, Fats, Nucleic acids, Water
5. The cell: Structure and function of cell
6. Cell organelles
7. Different types of cells
8. Homeostasis: Osmoregulation
9. Structure and functions of Nephron
10. Thermoregulation
11. Coordination and control: Structure and physiology of Neuron
12. Introduction to central and peripheral nervous system
13. Hormones
14. Basics of growth and development
15. Embryonic and post embryonic development

#### Recommended Texts

1. Michael, J., & Lenardo. (2013). *Immune Homeoststis: Methods and protocols*. New Jersey: Humama press.
2. Paradise, C. J., & Campbell, A. M. (2016). *Organismal Homeostasis*. New York: Momentum Press.

#### Suggested Readings

1. Lisa A. U., Michael L. C., Steven A. W., Peter V. M., Jane B. R., & Neil A. C. (2016). *Campbell biology*. (11<sup>th</sup> ed.) London: Pearson.
2. Cambell, N. A. Mitchell, I. G., & Reece, J. B. (2009). *Biology: Concepts and connections*. (6<sup>th</sup> ed.) San Francisco: Addison Wesley, Longman
3. Anna A. S., Richard B. P. (2019). *An Introduction to Conservation Biology* (2<sup>nd</sup> ed.) Oxford: Oxford University Press.

  
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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. Mathematics, as a study of patterns, both practical and abstract, involves analytical thought, logical reasoning, problem solving skills, and precise communication. Because of its power and versatility, mathematics has often been called the "Queen of the Sciences." There is no field of scientific inquiry that does not express itself through the language of mathematics. An undergraduate degree in mathematics provides an excellent foundation for students who are interested in pursuing an advanced degree in mathematics or in a related specialized profession. Mathematics can also provide an excellent foundation for students considering professional degrees in such allied fields such as Law, Business Administration, or Medicine. The kinds of analytical and logical thinking skills that one develops while studying mathematics are precisely the skills that recruiters look for in potential employees. Jobs involving significant mathematical background also consistently rank near the top of the list in annual career surveys.

### Contents

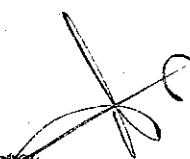
- 1 Real Numbers
- 2 Relations and Functions
- 3 Inequalities
- 4 Quadratic Functions and Complex Numbers
- 1 Linear Equations and Quadratic Equations: Formation of Linear equation
- 2 Solving Linear equation involving one variable
- 3 Solution of Quadratic equation by factorization method
- 4 Solution of quadratic equation by square completion methods
- 5 Solution of quadratic equation by quadratic formula
- 5 Application of quadratic equation
- 6 Sequence and Series
- 7 Types of Sequences; A. P, A. M., G. P., H. P
- 8 Trigonometric Functions
- 9 Trigonometric Applications
- 10 Graph of Functions and Modelling
- 11 Limits and Continuity
- 12 Derivatives
- 13 Integration
- 14 Probability and Binomial Theorem.

### Recommended Texts

1. Gantert, A. X. (2009). *Algebra 2 and trigonometry*. New York: AMCOS School Publication INC.
2. Kaufmann, J. E. (1994). *College algebra and trigonometry* (3<sup>th</sup> ed.) Boston: PWS-Kent Pub. Co.

### Suggested Readings

1. Swokowski, E. W. (1993). *Fundamentals of algebra and trigonometry* (8<sup>th</sup> ed.) Boston: PWS-Kent Pub. Co.
2. Nauman, K. (2019). *Basic mathematics-I: algebra and trigonometry* (2<sup>nd</sup> ed.) Lahore: Al-Hassan Pub.
3. Anton, H. (1999). *Calculus: A new horizon* (6<sup>th</sup> ed.). New York: John Wiley.
4. Stewart, J. (2012). *Calculus* (7<sup>th</sup> ed.). Belmont: Brooks/Cole.

  
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This course is aimed to provide the basic knowledge and background about Pakistan's Agriculture. Agriculture, farming, cultivation, crop growing, gardening; these words describe the word agriculture but not how it is viewed in today's modern times. Why study agriculture? Agriculture is an ancient practice and key to sustaining human development on planet Earth. Today, the way we go about agriculture has changed dramatically with the introduction of technology that has revolutionized production and distribution. If you are looking for a career that touches all disciplines, including science and math, in a fast paced environment that will touch people's lives around the world, a degree in agriculture might just be for you. The importance of agriculture in today's world is critical. Much of the world still relies heavily on what we produce from the land, and as development throughout the world continues, so will demand. The introduction of technology has reshaped much of the industry which is constantly advancing the way we farm around the world.

#### *Contents (Theory)*

- 1 Agriculture, History, Importance, Branches and Allied Sciences
- 2 Salient features of Pakistan's agriculture. Climate, Land and Water resources
- 3 Agro ecological zones of Pakistan
- 4 Farming systems
- 5 Tillage objectives and types
- 6 Seed types and quality
- 7 Crop nutrients, Manures and fertilizers, Sources and methods of application
- 8 Irrigation systems, Types and management
- 9 Crop protection measures
- 10 Crop rotation. Harvesting, Processing, Storage and Marketing of farm produce
- 11 Agro-based industries
- 12 Environmental pollution and Health hazards

#### *Contents (Practical)*


- 1 Land measuring units.
- 2 Demonstration of hand tools and tillage implements.
- 3 Identification of meteorological instruments.
- 4 Identification of crop plants, weeds and seeds.
- 5 Identification of organic and inorganic fertilizers.
- 6 Calculation of nutrient-cum-fertilizer unit value.
- 7 Demonstration of various irrigation methods.
- 8 Field visits.

#### *Recommended Texts*

- 1 Asif, M. (2013). *Crop production*. London: InTech Open Ltd., under CCBY license.
- 2 Cheema, Z. A., & Farooq, M. (2007). *Agriculture in Pakistan*. Lahore: Allied Book Centre, Urdu Bazar.

#### *Suggested Readings*

- 1 Abbas, M. A. (2006). *General agriculture*. Lahore: Emporium Urdu Bazar.
- 2 Balasubramanian, K. (2004). *Principles and practices of agronomy*. Jodhpur: Agro bios.

  
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This is an introductory course which enables the students to understand the basics of food science and technology. Students will explore and gain an understanding into the history of Food Science and the factors that have shaped Food Science in Pakistan, the organizations involved in Food manufacturing, food regulatory processes, Food composition, its classification depending on sources, consumption pattern and basic analysis of food components. The course is the study of the physical, biological, and chemical makeup of food; the causes of food deterioration; and the concepts underlying food processing. Food scientists and technologists apply scientific disciplines including chemistry, engineering, microbiology, and nutrition to the study of food to improve the safety, nutrition, wholesomeness and availability of food. Depending on their area of specialization, food scientists may develop ways to process, preserve, package, and/or store food according to industry and government specifications and regulations. It could involve enhancing the taste, making it last longer, making sure it's safe to eat, or even boosting its nutritional content.

#### *Contents (Theory)*

- 1 Introduction to food science, food technology, relationship with other disciplines
- 2 Career opportunities.
- 3 Significance of food science and technology
- 4 Food industry: history, developments
- 5 Important food industries in Pakistan
- 6 Food sources: plants, animals and marine
- 7 Food constituents and their functions: water, carbohydrates, lipids, proteins, vitamins, minerals.
- 8 Classification of foods on the basis of perishability and pH
- 9 Food spoilage agents: enzymes, microorganisms, pests, physical factors
- 10 Principles of food preservation
- 11 Prevention or delay of autolysis, microorganisms and pests

#### *Contents (Practical)*


- 1 Use of basic food laboratory equipment.
- 2 Estimation of Moisture, Fat, Protein, Carbohydrates, Fiber and Ash content in food samples.
- 3 Determination of soluble solids, total solids, pH, Acidity, total sugars, Specific gravity and Refractive index.

#### *Recommended Texts*

- 1 Awan, J. A. (2018). *Food science and technology*. Faisalabad: Unitech Communications.
- 2 Robert, L. S., Ramirez, A. O., & Clarke, A. D. (2015). *Introducing food science*. (2<sup>nd</sup> ed.) Florida: CRC Press.

#### *Suggested Readings*

- 1 Stewart, G. F., & Amerine, M. A. (2012). *Introduction to food science and technology*. Amsterdam: Elsevier.
- 2 Potter, N. N., & Hotchkiss, J. H. (2012). *Food science*. Berlin: Springer Science & Business Media.

  
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Academic writing is a formal, structured and sophisticated writing to fulfill the requirements for a particular field of study. The course aims at providing understanding of writer's goal of writing (i.e. clear, organized and effective content) and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the academic writing skills. The course would enable the students to develop argumentative writing techniques. The students would be able to the content logically to add specific details on the topics such as facts, examples and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation, plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

#### Contents


- 1 Academic vocabulary
- 2 Quoting, summarizing and paraphrasing texts
- 3 Process of academic writing
- 4 Developing argument
- 5 Rhetoric: persuasion and identification
- 6 Elements of rhetoric: Text, author, audience, purposes, setting
- 7 Sentence structure: Accuracy, variation, appropriateness, and conciseness
- 8 Appropriate use of active and passive voice
- 9 Paragraph and essay writing
- 10 Organization and structure of paragraph and essay
- 11 Logical reasoning
- 12 Transitional devices (word, phrase and expressions)
- 13 Development of ideas in writing
- 14 Styles of documentation (MLA and APA)
- 15 In-text citations
- 16 Plagiarism and strategies for avoiding it

#### Recommended Texts

- 1 Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasks and skills* (3<sup>rd</sup> ed.). Ann Arbor: The University of Michigan Press.
- 2 Bailey, S. (2011). *Academic writing: A handbook for international students* (3<sup>rd</sup> ed.). New York: Routledge.

#### Suggested Readings

- 1 Craswell, G. (2004). *Writing for academic success*. London: SAGE.
- 2 Johnson-Sheehan, R. (2019). *Writing today*. Don Mills: Pearson.
- 3 Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing*. Washington: American Psychological Association.



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Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources of Islam; Qur'an and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational bases of Islam in fields that include Qur'anic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'an and Sunnah.

Islamic Studies is the academic study of Islam and Islamic culture. It majorly comprises of the importance of life and that after death. It is one of the best systems of education, which makes an ethical groomed person with the qualities which he/she should have as a human being. The basic sources of the Islamic Studies are the Holy Qur'an and Sunnah or Hadith of the Holy Prophet Muhammad ﷺ. The learning of the Qur'an and Sunnah guides the Muslims to live peacefully.

#### Contents


1. Study of the Qur'an (Introduction to the Qur'an, Selected verses from *Surah Al-Baqarah, Al-Furqan, Al-Ahzab, Al-Mu'minoon, Al-An'am, Al-Hujurat, Al-Saff*)
2. Study of the Hadith (Introduction to Hadith literature, Selected Ahadith (Text and Translation))
3. Introduction to Qur'anic Studies
4. Basic Concepts of Qur'an
5. History of Quran
6. Basic Concepts of Hadith
7. History of Hadith
8. Kinds of Hadith
9. Uloom –ul-Hadith
10. Sunnah & Hadith
11. Seerat ul-Nabi (PBUH), necessity and importance of Seerat, role of Seerah in the development of personality, Pact of Madinah, Khutbah Hajjat al-Wada' and ethical teachings of Prophet (PBUH).
12. Legal Position of Sunnah
13. Islamic Culture & Civilization
14. Characteristics of Islamic Culture & Civilization
15. Historical Development of Islamic Culture & Civilization
16. Comparative Religions and Contemporary Issues
17. Impact of Islamic civilization

#### Recommended Texts

1. Hassan, A. (1990). *Principles of Islamic jurisprudence*. New Dehli: Adam Publishers.
2. Zia-ul-Haq, M. (2001). *Introduction to al-Sharia al-Islamia*. Lahore: Aziz Publication.

#### Suggested Readings

1. Hameedullah, M. (1957). *Introduction to Islam*. Lahore: Sh M Ashraf Publisher.
2. Hameedullah, M. (1980). *Emergence of Islam*. New Dehli: Adam Publishers.
3. Hameedullah, M. (1942). *Muslim conduct of state*. Lahore: Sh M Ashraf Publisher.

  
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This course is an introduction to the philosophical study of morality, including the theory of right and wrong behavior, the theory of value (goodness and badness), and the theory of virtue and vice. Besides providing familiarity with the primary questions addressed within moral philosophy and the most influential answers given by well-known philosophers, this course is designed to help students develop their abilities to read, explicate, analyze, and evaluate philosophical literature, write and express themselves well about their own ethical positions, and think critically and analytically about ethical issues. This course is intended for the student who has had little or no prior exposure to philosophy. It will provide a broad but reasonably detailed examination of the central issues of moral philosophy and will also consider how these can be applied to several contemporary moral problems. This course has been designed to familiarize students to learn about some of the most important theories and figures of moral philosophy in the hope that you can develop a clear understanding of the questions that recur in ethical debate.

#### Contents


1. Overview of Moral Philosophy
2. Theoretical ethics
3. Moral concepts and justify moral principles and theories
4. Applied ethics: an Islamic point of view
5. Metaphysics and Morality
6. Moral Objectivism and Relativism
7. Features of moral objectivism
8. Qur'an and Sunnah on Ethics
9. Individual relativism:
10. God and Morality
11. Criticism and its manners
12. Reason and Emotion
13. Principles of moral reasoning
14. Ethics in *Seerah* and *Taswwuf*
15. Gender and Morality
16. Significant Muslim masters of ethics
17. Rule-utilitarianism, Moral foundations of authorities
18. The social contract, Libertarianism, Welfare liberalism.

#### Recommended Texts

1. Mackenzie, J. S., & Glasg, L. L. D. (1983). *A manual of ethics*. London: University Tutorial Press.
2. Nadwi, S. S. (1999). *Ethics in Islam*. Karachi: Darul-Ishaat.

#### Suggested Readings

1. Williams, B. (1972). *Morality: An Introduction to Ethics*. Cambridge: Cambridge University Press.
2. Cahn, S.M., & Markie, P. (2019). *History, Theory, and Contemporary Issues*. Oxford: Oxford University Press.

  
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After completing the course, students will develop understanding of the basic concepts of economics and their application in agriculture. Agricultural economics is a branch of applied economics that takes the tools of both micro and macroeconomics and uses them to solve problems in a specific area. With food inflation soaring and agricultural disputes at the heart of the collapse of the latest round of world trade talks, the subject has seldom been so topical. At the micro level, we need to understand the relevant production functions and the relationship between labour and capital. Most courses will also look at the by-products (externalities) of some types of agricultural production, such as the effect of increased nitrogen fertilizer use. Equally, we can use consumer theory to understand how shoppers make choices about the food they buy (including diets and fads). Many courses will also look at the food sector more generally, and ask whether there is excessive market power in the hands of supermarkets.

#### *Contents*


- 1 Definitions and overview of economics and related terms
- 2 Subject matter and scope
- 3 Theory of consumer behavior
- 4 Scale of preferences
- 5 Utility, Indifference curve and related concepts
- 6 Demand and supply analysis
- 7 Elasticity of demand and supply
- 8 Market equilibrium
- 9 Production, Factors of production
- 10 Laws of return and their significance in agriculture
- 11 Concept of macroeconomics
- 12 Approaches to national income estimation
- 13 Growth, Unemployment and inflation
- 14 Important macroeconomic issues in agriculture sector of Pakistan

#### *Recommended Texts*

- 1 Gray, L. C. (2013). *Introduction to agricultural economics*. New York: Read Books Ltd.
- 2 Penson, J. B., Capps, O., Rossen, C. P., & Woodward, R. (2013). *Introduction to agricultural economics*. (5<sup>th</sup> ed.) New Jersey: Prentice Hall.

#### *Suggested Readings*

- 1 Mankiw, N. G. (2011). *Principles of economics*. (5<sup>th</sup> ed.) Boston: Cengage learning Publisher.
- 2 Cramer, G., Jensen C. W., & Southgate, D. D. (2001). *Agricultural economics and agribusiness*. (8<sup>th</sup> ed.) New Jersey: Wiley Publisher.

  
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This course aims to familiarize students with fundamentals of prokaryotic and eukaryotic microbial life including viruses. In this course students will learn about culturing of bacteria, nutritional requirements of microbes and control of microbes. Students will also learn about the importance of microbes in our life. This course will also help to student about knowledge of antibiotics and their mode of action. Students learning this course will be able to complete a substantial research project related to microbiology; seek and employ insights from others in implementing the project; evaluate a significant challenge or question faced in the project in relation to core concepts, methods or assumptions in microbiology; and describe the effects of learning outside the classroom on his or her research or practical skills. Food Microbiologists also develop new and rapid methods to detect pathogenic and spoilage microorganisms in foods. They study the genetic make-up of microorganisms to determine why bacteria have virulence and cause disease.

#### *Contents (Theory)*

- 1 Overview and history of microbiology including microbial diversity (Archaea, bacteria, fungi, algae, protozoa)
- 2 Nutrition and growth of microbes
- 3 Metabolism of microbes
- 4 Cultivation of microbes
- 5 Viruses
- 6 Control of microorganisms:
- 7 Sterilization and disinfection,
- 8 Antimicrobial agents
- 9 Antibiotics, antibiotic resistance and susceptibility
- 10 Antifungal and antiviral agents; cell death
- 11 Symbiosis
- 12 Carbon, nitrogen, sulfur and phosphorus cycles
- 13 Microbiology of soil
- 14 Microbiology of freshwater and seawater

#### *Contents (Practical)*


- 1 Sterilization techniques; culturing of bacteria in liquid and on solid medium
- 2 Gram-staining of bacteria
- 3 colony and cell morphology; bacterial cell count and growth curves; biochemical tests

#### *Recommended Texts*

- 1 Tortora, G. J., Case, C. L., & Funke, B. R. (2016). *Microbiologia*. (12<sup>th</sup> ed.) London: Pearson.
- 2 Talaro, K. P. (2009). *Foundations in microbiology: basic principles*. (7<sup>th</sup> ed.) New York: McGraw Hill Publisher.

#### *Suggested Readings*

- 1 Parija, S. (2016). *Textbook of microbiology and immunology*. (3<sup>rd</sup> ed.) Amsterdam: Elsevier.
- 2 Alcamo, I. E., (2010). *Fundamentals of microbiology*. (9<sup>th</sup> ed.) Massachusetts: Jones & Bartlett Publishers.
- 3 Cappuccino, J. G., & Sherman, N. (2016). *Microbiology: a laboratory manual*. (10<sup>th</sup> ed.) London: Pearson Education.



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This course enables the students to understand the composition, food processes and their interaction with health and diseases. The students learn how to prevent and cure the nutritional disorders. Nutrition has been playing a big role in our lives, affecting daily habits and health behaviours. A career in nutrition is ideal for those seeking to promote a balanced lifestyle and improve people's diets, while helping them to keep a healthy weight, boost their immune system, increase their energy levels, and reduce the risk of developing certain diseases. This course opens up different avenues for future, and depending on the role you choose, could make a real difference to people's lives. A nutritionist can help people to lead healthier lives through education in food and nutrition, or enhance their mental and physical performance through specially designed diets. Nutritionist could become a food analyst or work in public health – and look at the chemical and physical properties of food, or conduct tests for bacteria and disease.

#### Contents

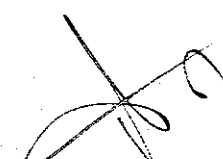
- 1 Introduction: Food, diet, balanced diet, nutrients food groups, food guide pyramid, meal planning, menu planning, diet therapy, principles/factors of diet selection
- 2 Nutritional status assessment
- 3 Eating Food: Smell, taste, satiety
- 4 Water: Functions, sources, regulation in body, dietary requirements, content in food
- 5 Carbohydrates: Types, role in body, dietary fiber, sweeteners, dietary requirements, content in food.
- 6 Fats and Oils: Types, functions, dietary requirements, content in food, fat substitutes
- 7 Proteins: Amino acids, protein synthesis, classification, functions, quality of proteins, dietary requirements, content in foods
- 8 Vitamins: Classification, functions, deficiency and excess, content in food
- 9 Mineral Elements: Classification, functions, deficiency and excess, content in food
- 10 Digestion: Alimentary tract, digestive juices, secretions
- 11 Absorption and Metabolism of Nutrients: Carbohydrates, protein, lipids
- 12 Nutrient and Dietary Deficiency Disorders: Malnutrition, obesity, coronary diseases, diabetes, lactose and gluten intolerance, dental caries-symptoms, causes, prevention
- 13 Acid-Alkaline and Electrolytes status in relation to health and diseases
- 14 Different values of foods in nutrition
- 15 Nutrients and genes

#### Recommended Texts

- 1 Awan, J. A. (2007). *Elements of food and nutrition*. Faisalabad: Unitech Communications.
- 2 Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2013). *Introduction to human nutrition*. (2<sup>nd</sup> ed.) Chichester: John Wiley & Sons.

#### Suggested Readings

- 1 Geissler, C., & Powers, H. (2017). *Human nutrition*. (13<sup>th</sup> ed.) Oxford: Oxford University Press.
- 2 Whitney, E. N., & Rolfes, S. R. (2018). *Understanding nutrition*. (15<sup>th</sup> ed.) Boston: Cengage Learning.

  
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The course provides students the knowledge and training on the process and the impact of the process on food product quality. The student will learn general processing flow for various food products, physical principles of operation for various types of equipment and impact of the processing on the physical, chemical and sensory properties of the food products. In the food processing industry, workers convert food materials from their raw unprocessed states into consumable items. Continue reading this article to learn more about education options and career prospects in the field of food processing. Food processing is the sector of food production whereby raw food materials, such as grains, livestock and fruit, become food items for sale in supermarkets, butcher shops and other food retail locations. Food processing occupations include bakers, butchers and food cooking machine operators. Food scientists are also part of this industry; these workers may develop new ways to process and package foods, research food additives or enforce sanitation laws at food processing sites.

#### *Contents (Theory)*

- 1 Preparation of Foods for food processing:
- 2 Introduction, Properties of raw materials, Storage and Transportation of raw materials.
- 3 Preparatory Operations: Cleaning, Sorting, Grading, Size reduction, Blanching, sulphiting.
- 4 Heat Processing: Methods thermisation, Pasteurization, HTST, Commercial sterilization, UHT.
- 5 Canning: Unit operations. Retort Operation. Equipment. Effect of heat processing on nutrients and microorganisms.
- 6 Low Temperature Preservation. Refrigeration: Methods and equipment.
- 7 Cold storage: requirements, insulation, air circulation, humidity, refrigeration load, controlled atmospheric storage.
- 8 Freezing: Theory, Methods, Equipment and Changes in foods.
- 9 Evaporation and Dehydration: Evaporation concentration and Condensation. Principles, Equipment, Applications.
- 10 Drying: Principles, Equipments, Types of driers. Dehydration: Applications, Dehydrated products vegetables, fruits and milk.
- 11 Use of Chemical Additives: Contaminants, Adulterants, Additives. Food Additives: Classification, Criteria for selection, Effect on food properties, Detection methods.

#### *Contents (Practical)*

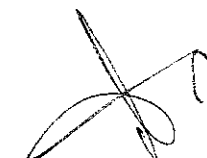
- 1 Bottling/canning of selected fruits, vegetables.
- 2 Cold storage of fruits and vegetables. Freezing of fruits and vegetables.
- 3 Dehydration of fruits and vegetables. Use of chemicals in preservation of food products.
- 4 Production of vinegar, yoghurt and pickles. Evaluation of bottled, frozen and dehydrated products. Visit to food industries.

#### *Recommended Texts*

- 1 Rahman, M. S. (2007). *Handbook of food preservation*: Florida: CRC press.
- 2 Awan, J. A. (2011). *Food processing and preservation*. Faisalabad: Unitech Communications.

#### *Suggested Readings*

- 1 Fellow, P. J. (2005). *Food processing technology: principles and practices*. (2<sup>nd</sup> ed.) Florida: CRC Press, Taylor and Francis Group, Boca Raton.
- 2 Brennan, J. G. (2006). *Food processing handbook*. Weinheim: Wiley-VCH Verlag GmbH and Co. KGaA.

  
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In recent years, community engagement has become a central dimension of governance as well as policy development and service delivery. However, efforts to directly involve citizens in policy processes have been bedeviled by crude understandings of the issues involved, and by poor selection of techniques for engaging citizens. This course will provide a critical interrogation of the central conceptual issues as well as an examination of how to design a program of effective community engagement. This course begins by asking: Why involve citizens in planning and policymaking? This leads to an examination of the politics of planning, conceptualizations of "community" and, to the tension between local and professional knowledge in policy making. This course will also analyze different types of citizen engagement and examine how to design a program of public participation for policy making. Approaches to evaluating community engagement programs will also be a component of the course. Moreover, in order to secure the future of a society, citizens must train younger generations in civic engagement and participation. Citizenship education is education that provides the background knowledge necessary to create an ongoing stream of new citizens participating and engaging with the creation of a civilized society.

#### Contents

- 1 Introduction to Citizenship Education and Community Engagement: Orientation
- 2 Introduction to Active Citizenship: Overview of the ideas, Concepts, Philosophy and Skills
- 3 Identity, Culture and Social Harmony; Concepts and Development of Identity
- 4 Components of Culture and Social Harmony, Cultural & Religious Diversity
- 5 Multi-cultural society and inter-cultural dialogue: bridging the differences, promoting harmony
- 6 Significance of diversity and its impact, Importance and domains of inter-cultural harmony
- 7 Active Citizen: Locally active, Globally connected
- 8 Importance of active citizenship at national and global level
- 9 Understanding community, Identification of resources (human, natural and others)
- 10 Human rights, Constitutionalism and citizens' responsibilities: Introduction to human rights
- 11 Universalism vs relativism, Human rights in constitution of Pakistan
- 12 Public duties and responsibilities
- 13 Social Issues in Pakistan: Introduction to the concept of social problem, Causes and solutions
- 14 Social Issues in Pakistan (Poverty, Equal and Equitable access of resources, unemployment)
- 15 Social Issues in Pakistan (Agricultural problems, terrorism & militancy, governance issues)
- 16 Social action and project: Introduction and planning of social action project
- 17 Identification of problem, Ethical considerations related to project
- 18 Assessment of existing resources

#### Recommended Texts

- 1 Kennedy, J. K., & Brunold, A. (2016). *Regional context and citizenship education in Asia and Europe*. New York: Routledge Falmer.
- 2 Macionis, J. J., & Gerber, M. L. (2010). *Sociology*. New York: Pearson Education

#### Suggested Readings

- 1 British Council. (2017). *Active citizen's social action projects guide*. Scotland: British Council
- 2 Larsen, K. A., Sewpaul, V., & Hole, G. O. (Eds.). (2013). *Participation in community work: International perspectives*. New York: Routledge.

This course will help the students to understand the importance of livestock in national economy. They will get a comprehensive knowledge about nutrition, management, breeding and genetic potential of local breeds of livestock. Students will be trained to handle and manage animals for different procedures at livestock farm. The Animal Husbandry will teach the ins and outs of nutrition, immunology and diagnostics, disease control and animal welfare. Courses in applied research, scientific research methods and project management form an integral part of this programme. In addition, you will acquire scientific knowledge of the main species within the husbandry system: cattle, horses and poultry. This program will qualify for a wide array of jobs throughout the industry - ranging from entrepreneur or manager of your own business to consultant or supplier. As a degree programme with an international focus, the Animal Husbandry Bachelor has been shown to open doors worldwide.

#### *Contents (Theory)*

- 1 Importance of livestock in economy of Pakistan
- 2 Zoological classification of farm animals
- 3 Livestock management
- 4 Introduction to breeding and genetics
- 5 Local breeds of livestock
- 6 Reproductive cycle in farm animals
- 7 Common feeds and their classification
- 8 Basic principles of feeding dry, pregnant and milking animals
- 9 Classes, breeds and varieties of poultry
- 10 Broiler and layer management

#### *Contents (Practical)*


- 1 Demonstration and identification of various breeds of livestock
- 2 Demonstration of male and female reproductive organs
- 3 Body points of animals
- 4 Handling and restraining of animals
- 5 Grooming and cleaning of animals
- 6 Housing plans
- 7 Milk quality analyses; identification of
- 8 Feed samples; formulation of balanced ration for livestock
- 9 Poultry breeds
- 10 Visit to livestock shows/farms

#### *Recommended Texts*

- 1 Banerjee, G. C. (1998). *A Textbook of animal husbandry*. New Delhi: Oxford and IBH Pub. Co.
- 2 Shah, S.I. (1994). *Animal husbandry*. Islamabad: National Book Foundation, Pakistan.

#### *Suggested Readings*

- 1 Haq, A., & Akhtar, M. (2004). *Poultry farming*. Islamabad: Higher Education Commission of Pakistan.
- 2 Khan, B. B., Yaqoob, M., Riaz, M., Younas, M., & Iqbal, A. (2004). *Livestock management manual*. Faisalabad: Department of Livestock Management, University of Agriculture.

  
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This course aims to enable students understand: Basic concepts of genetics, understanding, why the characters of off-springs are similar to their parents, what can be the possible reason for the variation that the off-springs show to their parents. Mechanism of heredity underlying laws of genetics and their practical manifestation in the form of various monohybrid as well as dihybrid crosses. Understanding the linkage and epistasis as potential reasons for deviation from law of independent assortment. Understanding the concepts of allele and gene both at genotypic as well as phenotypic level. Understanding process and purposes of the cell cycle, meiosis, and mitosis, as well as the outcomes of these processes. Enabling the students to solve various genetics problems, making calculated and accurate predictions about inheritance of genetic traits, and map the locations of genes. Chemical and molecular nature of nucleic acids i.e. RNA and DNA. Understanding the concept of gene expression from gene to its product.

#### *Contents (Theory)*

1. Definition of genetics, concepts of heredity and variation.
2. Cell and cell divisions. Mendelian genetics: chromosome theory of heredity, various genotypic and phenotypic ratios and their modifications.
3. Differences between allelic and non-allelic interactions (epistasis), illustration of epistasis with suitable examples.
4. Pleiotropy and multiple allelism. Multiple factor hypothesis. Linkage and crossing over.
5. Sex determination: sex linked and sex influenced traits.
6. Chromosomal aberrations.
7. Nucleic acids: nature, structure and function.
8. Classical vs modern concepts of gene.

#### *Contents (Practical)*

1. Study of cell divisions and gametogenesis.
2. Calculation of monohybrid and dihybrid ratios.
3. Numerical examples relating to gene interaction, multiple alleles and multiple factor inheritance.
4. Calculation of linkage from test cross and  $F_2$  data.

#### *Recommended Texts*

1. Singh, B.D. (2004). *Genetics*. New Delhi: Kalyani Publishers.
2. Klug, W.S. & Cummings, M. R. (2003). *Concepts of genetics*. (7<sup>th</sup> ed.) Singapore: Pearson Education.

#### *Suggested Readings*

1. Singh, P. (2003). *Elements of genetics*. (2<sup>nd</sup> ed.) Delhi: Kalyani Publishers.
2. Stansfield, W.D. ((1988) *Theory and problems of genetics*. (4<sup>th</sup> ed.) New York: McGraw-Hill Book Co.
3. Khan, I. A., Azhar, F. M., Ali, Z., & Khan, A. A. (2008). *Solving numerical genetic problems*. Faisalabad: Department of Plant Breeding and Genetics, University of Agriculture.

The students would be able to acquire the knowledge of different practical aspects of entomology. For instance, they will learn to identify the major insect pest species of agricultural, horticultural and forest crops, vegetables, fruits, stored grains and household pests. Course aims to demonstrate the students about the identification of insect pests, their control methods and pesticide application equipment with basic objective to enhance farmer's productivity through better management and control of insect pests. Moreover, course includes the basic information and introduction related to entomological cottage industries (i.e. honeybee farming, silkworm rearing and lac culture) in order to enhance the productivity of farming community.

#### *Contents (Theory)*

- 1 Introduction
- 2 Causes of success and economic importance of insects
- 3 Principles and methods of insect control i.e. cultural, biological, physical, mechanical, reproductive, legislative, chemical and bio-technological control
- 4 Introduction to IPM
- 5 Insecticides, their classification, formulations and application equipment
- 6 Identification, life histories, mode of damage and control of important insect pests of various crops, fruits, vegetables, stored grains, household, termites and locust
- 7 Entomological industries
- 8 Apiculture
- 9 Sericulture
- 10 Lac-culture

#### *Contents (Practical)*


- 1 Collection, identification and mode of damage of insect pests of various crops, fruits, vegetables, stored grains and household
- 2 Insecticide formulations, their dilutions and safe handling
- 3 Use of application equipment
- 4 Instructions in apiculture, sericulture and lac-culture

#### *Recommended Texts*

- 1 Atwal, A. S. (2005). *Agricultural pests of Southeast Asia and their management*. Ludhiana: Kalyani Publishers.
- 2 Pedigo, L. P., & Rice, M. E. (2014). *Entomology and pest management* (6<sup>th</sup> Ed.). Illinois: Waveland Press Inc.

#### *Suggested Readings*

- 1 Duncton, P. A. (2007). *The Insect: beneficial and harmful aspects*. Ludhiana: Kalyani Publishers.
- 2 Mathews, G. A. (2004). *Pesticide application methods* (3<sup>rd</sup> Ed.) New York: John Wiley & Sons, Inc.

  
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The objective of this course is to acquaint the students with basic concepts and identification of plant pathogens. The course covers all aspects of plant pathogens which include their economic importance, morphology, reproduction and ecology. The course also covers classification of different plant pathogens. In addition to plant pathogens, phanerogamic parasites, viroids and fastidious bacteria will also be covered briefly during this course.

#### *Contents (Theory)*

- 1 Introduction of plant pathology
- 2 Economic importance.
- 3 General characteristics (morphology, reproduction and ecology).
- 4 Identification of plant pathogens
- 5 including fungi, prokaryotes, viruses, viroid, nematodes,
- 6 fungus like organisms
- 7 Phanerogamic parasites
- 8 Taxonomic position of economically important plant pathogens.

#### *Contents (Practical)*

- 1 Orientation of laboratory equipment.
- 2 Sterilization of glassware, preparation of media and isolation of different plant pathogens.
- 3 Study of characteristics of various plant pathogens through slides,
- 4 live specimens and their comparative account/study.

#### *Recommended Texts*

- 1 Verpoorte, R., & Alfermann, A. W. (2013). *Metabolic engineering of plant secondary metabolism*. Berlin: Springer Science & Business Media.
- 2 Agrios, G. N. (2005). *Plant pathology*. (5<sup>th</sup> ed.) Massachusetts: Academic Press.
- 3 Ahmad, I., & Bhutta, A. R. (2005). *Textbook of introductory plant pathology*. Islamabad: National Book Foundation, Pakistan.

#### *Suggested Readings*

- 1 Ravichandra, N. G. (2013). *Fundamentals of plant pathology*. New Delhi: Prentice Hall Pvt. Ltd.
- 2 Trigiano, R. N., Windham, M. T., & Windham, A. S. (2008). *Plant pathology concepts and laboratory exercises*. (2<sup>nd</sup> ed.) London: CRC Press.
- 3 Vidhyasekram, P. (2004). *Concise encyclopedia of plant pathology*. New York: Food product Press and Haworth Press Inc. Binghamton.



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This course is the study of unit operations in preserving foods by thermal and alternative food processing methods. Recitation through problem solving and experimentation. Interdependence of food engineering, chemistry, and microbiology principles in food preservation. Food industry is in need of knowledgeable food scientists with background in engineering, chemistry, microbiology, consumer acceptance among others. Food scientists encounter variety of challenges in day-to-day job which include but not limited to develop novel food processes, operate a food process equipment, evaluate microbial safety, formulate new products, reformulate existing products to meet changing consumer demand, test nutritional content of processed food, develop strategies for improving manufacturing and packaging operation, enforce certain federal and state regulations for making safe product, and study consumer acceptance of formulated products. It is important to understand the process and packaging parameters that make the food safe and preserve food quality. During the semester we will also learn to do simple process calculations that may help answer "what-if" type processing questions. Hopefully, our journey during the semester will help you to better appreciate the importance and benefits of integrating knowledge from engineering, chemistry and microbiology for controlling different food process.

#### Contents

- 1 Introduction: Materials handling. Energy and Mass balance
- 2 Heat transfer fundamentals conduction, convection and radiation
- 3 Preparatory Operations: Receiving, Cleaning, Sorting, Grading, Peeling, Size reduction
- 4 Crystallization. Types of mixers, Centrifugation
- 5 Homogenization, Bleaching, Deodorization, Extraction, Grinding, Mechanical Separation
- 6 Screening, Filtration, Centrifugal filtration
- 7 Filtration based on motion of particles through fluids, Sedimentation
- 8 Transport of Fluids through Pipes: Laminar and turbulent regimes
- 9 Circulation of fluid through porous beds. Darcy'slaw: Permeability, porosity
- 10 Filtration: Fundamentals, Equipment, Maintenance problems, Prospects
- 11 Separation processes by membranes
- 12 Solid-liquid extraction

#### Recommended Texts

- 1 Earle, R. L. (2013). *Unit operations in food processing*. Amsterdam: Elsevier.
- 2 Fellows, P. J. (2009). *Food processing technology: principles and practice*. Amsterdam: Elsevier.
- 3 McCabe, W. L., Smith, J. C., & Harriott, P. (2005). *Unit operations of chemical engineering*. NewYork: McGraw Hill Inc.

#### Suggested Readings

- 1 Jeankopolis, C. J. (2004). *Transport processes and separation process*. New Jersey: Prentice Hall Professional Technical Reference.
- 2 Earle, R. L., & Earle, M. D. (2004). *Unit operations in food processing*. Palmerston North: The New Zealand Institute of Food Science and Technology.
- 3 Gustavo, A., & Barbosa-Canovas, V. (2002). *Unit operations in food Engineering*. Florida: CRC Press, Taylor and Francis Group, Boca Raton.



Students will be able to evaluate community nutrition interventions. Explain the healthcare and nutrition policies. Interpret nutrition information for the public. Community nutrition is the process of helping individuals and groups develop healthy eating habits in order to promote wellness and prevent disease. The goal of community nutrition is to educate individuals and groups so that they adopt healthy eating habits. Dietitians and nutritionists work with many other health care professionals in promoting improved community nutrition. Their efforts emphasize a preventive approach in educating individuals in how a change in dietary habits will reduce the risk of illness. Community nutrition focuses on all age groups. The groups targeted range from babies to pregnant women to older adults. For example, a young pregnant woman may not realize how poor eating habits affect her developing fetus or she may be unaware of the importance of breastfeeding. Older adults may lose interest in eating due to loneliness, inability to prepare meals, or a physical condition such as difficulty chewing. Individuals with diabetes may not understand the need to control their blood glucose levels through diet as well as medication.

#### Contents

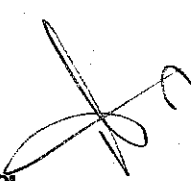
- 1 Introduction
- 2 Health care in America
- 3 The policy-making process
- 4 Food insecurity in united states
- 5 Assessing a community
- 6 Planning and evaluating community nutrition interventions
- 7 Opportunities in community nutrition
- 8 Emerging issues/ determinants of health/ HP2020 health care industry
- 9 Assessing community needs cont./ step 3 national nutrition monitoring/HP 2020
- 10 Understanding behavior change nutrition education
- 11 Domestic hunger programs
- 12 Maternal and child nutrition
- 13 Child and adolescent's nutrition
- 14 Senior nutrition

#### Recommended Texts

- 1 Boyle, M. A. (2017). *Community nutrition in action: an entrepreneurial approach*. (7<sup>th</sup> ed.) Boston: Cengage Learning.
- 2 Temple, N. J., & Steyn, N. (2016). *Community nutrition for developing countries*. Edmonton: Athabasca University Press and UNISA Press.

#### Suggested Readings

- 1 Burgess, A., Bijlsma, M., & Ismael, C. (2009). *Community nutrition: a handbook for health and development workers*. New York: Macmillan Pub., Ltd.
- 2 Nnakwe, N. (2017). *Community nutrition*. Massachusetts: Jones & Bartlett Learning.

  
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This course is designed for under graduate programs of agriculture sciences. The objective of this course is to impart basic and applied knowledge about statistics for collection, presentation, analysis and interpretations of data related to agriculture issues. After completing this course agriculture students will be able to understand the general concepts of basic statistics, to conduct agriculture surveys, to understand design of experiments, and other statistical tools. These statistical concepts are further will be helpful to complete a research related to agriculture sciences. Moreover over students will also learn some statistical softwares such as Minitab, SPSS and Design Expert to improve their computational and analytical skills.

#### Contents

1. Definition and importance of Statistics in Agriculture.
2. Data, Different types of data and variables
3. Classification and Tabulation of data.
4. Frequency distribution, Graphical representation of data.
5. Measure of Central tendency and Measure of Dispersion. Calculation of averages, Range, variance, Standard deviation and coefficient of variation.
6. Regression and Correlation Analysis: Simple and Multiple regression, correlation cases.
7. Sampling and its types: Probability and non-Probability Sampling, Simple random sampling, stratified random sampling, Systematic sampling, Sampling and non-sampling error
8. Sampling distribution of mean and difference between two means.
9. Inference Theory: 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.
10. Test of association of attributes using  $\chi^2$  (chi-square) Testing hypothesis about variance.
11. ANOVA and its assumptions, One-way ANOVA, Two-way ANOVA.

#### Recommended Texts

1. Muhammad, F. (2000). *Statistical methods and data analysis*. Lahore: Ilmi Kitab Khana.
2. Rao, G. N. (2007). *Statistics for agricultural sciences* (2<sup>nd</sup> ed.). Devon: BS Publication.

#### Suggested Readings

1. Lawal, B. (2014). *Applied statistical methods in agriculture, health and life sciences*. Berlin: Springer.
2. Sahu, P. K. (2016). *Applied statistics for agriculture, veterinary, fishery, dairy and allied fields*. Berlin: Springer.
3. Crawshaw, J. & Chambers, J. A. (1994). *Concise course in A. level statistic with world examples*. Berlin: Springer.



Director  
Institute of Food Science & Nutrition  
University of Sargodha Sargodha

At the completion of this course, the students will be able to: define the given concepts of communication. Identify the types of communication. Conduct interviews. Demonstrate improved communication skills. The importance of communication needs to be viewed as a core value in your farming business. Effective communication is something that should be expected, routine and rewarded. Simple steps to improve communication on your farm can be taken by removing communication barriers, maintaining composure in all situations and removing misconceptions that may have been generated for farm. Gaining a strong understand of both verbal and non-verbal communication methods will help employees in a leadership position relate to their employees and improve the production of the farm, along with the job satisfaction level for employees. A better method of communication can also be utilized by implementing the use of different communication instruments such as charts, flag systems and meetings to help strength the understanding of the protocols, goals and expectations of the farm.

#### *Contents (Theory)*

- 1 Concept, Purpose and scope of communication in Agricultural extension.
- 2 Forms of communication in the past, present and future
- 3 Communication and the concept of global community
- 4 Communication as the problem solving approach
- 5 Communication process, elements and their role in effective communication
- 6 Principles of communication. Basic communication models
- 7 Forms of communication
- 8 Interpersonal, intrapersonal and impersonal
- 9 Written, verbal and non-verbal communication
- 10 Barriers to communication and measures to overcome these barriers

#### *Contents (Practical)*

- 1 The students will be involved in developing and critically analyzing different extension messages.
- 2 They will practice different forms of communication in the class

#### *Recommended Texts*

- 1 Leeuwis, C. (2013). *Communication for rural innovation: rethinking agricultural extension*: New Jersey: John Wiley & Sons.
- 2 Anderson, J. R., & Feder, G. (2004). *Agricultural extension: Good intentions and hard realities*. Oxford: The World Bank Research Observer.

#### *Suggested Readings*

- 1 Muhammad, S. (2005). *Communication skills and leadership development*. Faisalabad: Unitech Communications.
- 2 Calvert, P. (2000). *The communicator's handbook; tools, techniques and technology*. (4<sup>th</sup> ed.) Florida: Maupin House Publishing.
- 3 Murphy, H. A., Hildebrandt, H. P., & Thomas, J. P. (2000). *Effective business communication*. Islamabad: International Series, National Book Foundation, Pakistan.

To make students familiar with production technology of important horticultural crops, Horticulture is the science and art of the development, sustainable production, marketing, and use of high-value, intensively cultivated food and ornamental plants. Horticultural crops are diverse; they include annual and perennial species, delicious fruits and vegetables, and decorative indoor and landscape plants. These specialty crops help sustain and enrich our lives by providing nutritious food, enhancing the beauty of our homes and communities and reducing our carbon footprint. Horticulture also contributes to quality of life, and the beauty, sustainability and rehabilitation of our environment and the human condition. Environmental horticulture (i.e., the "green industry"), is composed of careers in greenhouse production, wholesale brokers, commercial nurseries, garden centers, florists and landscape design and construction firms, as well as private and community gardens, municipal parks and state or national reserves.

#### *Contents (Theory)*

- 1 Establishment of orchards, vegetable farms and ornamental gardens;
- 2 Site selection, layout methods, wind breaks and their role.
- 3 Management practices; irrigation, manures and fertilizers, training and pruning, cultivation and weed control.
- 4 Climate, soil, propagation, rootstocks, cultivars.
- 5 Important pests,
- 6 Harvesting, post-harvest handling and marketing of important horticultural crops (fruits, vegetables and ornamentals) of the region.

#### *Contents (Practical)*


- 1 Practice in layout methods,
- 2 Selection of plants from nursery,
- 3 Propagation methods. Planting and after care.
- 4 Production techniques and identification of important cultivars of horticultural crops of the region

#### *Recommended Texts*

- 1 Acquaah, G. (2009). *Horticulture: principles and practices* (4<sup>th</sup> ed.) New Delhi: Prentice-Hall India Learning Pvt. Ltd.
- 2 Adams, C. R., Bamford, K. M., & Early, M. P. (2012). *Principles of horticulture*. (6<sup>th</sup> ed.) New York: Routledge.
- 3 Ingles, J. (2009). *Ornamental horticulture*. New York: Delmar, Maxwell Drive, Cifton Park.
- 4 Dhaliwal, M. S. (2008). *Handbook of vegetable crop*. New Delhi: Kalyani Publishers.

#### *Suggested Readings*

- 1 Chottopadhyay, T. K. (2000). *A textbook on pomology*, Vol II. New Delhi: Kalyani Publishers.
- 2 Laurie, A., & Ries, V. H. (2004). *Floriculture: fundamentals and practices*. New Delhi: Agrobios.
- 3 Pradeepkumar, T., Suma, B., Jyothibhaskar, K. N., & Satheesan, K. V. P. (2008). *Management of horticultural crops (Part I)*. *Horticulture science series* Vol. 11. New Delhi: New India Publishing Agency.
- 4 Yadav, P. K. (2007). *Fruit production technology*. Lucknow: International Book Distributing Co., Publishing Division.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha

The course aims to teach food safety as a scientific discipline describing handling, preparation, and storage of food in ways that prevent food-borne illness. Food can transmit pathogens which can result in the illness or death of the person or other animals. Objective of course is to give concepts of food safety and risk assessments and to provide knowledge about of food safety systems and food laws. The quality and safety of food is an important task, not only for the food industry. The issue of quality and safety of food is highly vital for each person. The way we eat affects our health, working capacity, quality of life, and the health and life of future generations. Food contamination can occur at any stage in the supply chain, and the primary responsibility for ensuring safety lies on food producers. Nevertheless, in many cases, incidents related to foodborne diseases are the result of non-compliance with the rules for handling food at home, catering, and marketing.

#### Contents

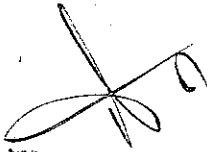
- 1 What is Food Safety?
- 2 Characterization of food hazards, biological, chemical and physical
- 3 Hazards from natural origin
- 4 Hazards produced during food processing, storage and preparation
- 5 Hazards associated with nutrient fortification
- 6 Food Safety systems, GMP, TQM
- 7 HACCP
- 8 Pakistan Standards and Quality Control Authority
- 9 Pure Food Rules
- 10 Punjab Food Authority
- 11 International Organization for Standardization
- 12 National Standard for Drinking Water Quality
- 13 Food labeling
- 14 Concept of Halal, Islamic food laws and regulations
- 15 Consumer laws in Pakistan
- 16 The World Trade Organization (WTO)
- 17 Codex Alimentarius.

#### Recommended Texts

- 1 Rai, V. R., & Bai, J. A. (2017). *Food safety and protection*. London: CRC Press, Taylor & Francis Group.
- 2 Gabriela, S., & Kiran, P. (2016). *International food law and policy*. Switzerland: Springer International Publishing.
- 3 Awan, J. A., & Anjum, F. M. (2010). *Food toxicology*. Faisalabad: Unitech Communications.

#### Suggested Readings

- 1 Schmidt, R. H., & Rodrick, G. E. (2003). *Food safety handbook*. New York: Wiley-Interscience, A John Wiley & Sons Publications.
- 2 PSQCA. (2010). *Standards for different food items*. Karachi: Pakistan Standards and Quality Control Authority.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha

This course will enable the students to learn principles of packaging science including legal and safety aspects, packaging functions and requirements, types of packaging materials, modified atmosphere packaging, active packaging, packaging for emerging processing technologies, shelf life and package testing among other relevant topics. Food packaging lies at the very heart of the modern food industry and very few foods are sold unpackaged. Good packaging prevents waste and ensures that the food retains its desired quality throughout its shelf life. Despite its importance and the key role that packaging plays, it is often regarded as, at best, somewhat superfluous, and, at worst, a serious waste of resources and an environmental menace. Food Packaging plays such an important role in the preservation and marketability of a product, many companies seek a contract packaging service to help them obtain the best quality packaging available. Benefits to a co-manufacturer include cost, speed, quality and innovation.

#### *Contents*

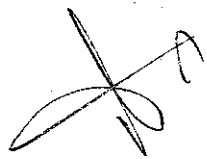
- 1 Food packaging: introduction, needs, functions, systems, development
- 2 Packaging types: primary, secondary, tertiary
- 3 Packaging materials: rigid containers, flexible packaging
- 4 Properties of food packaging: physical, chemical
- 5 Packaging guidelines: retail containers, shipping containers
- 6 Factors influencing design and selection of packaging materials: product, distribution, marketing, packaging operation, cost
- 7 Printing processes: inks, adhesives
- 8 Filling and labeling. Safety and legislation
- 9 Novel food packaging techniques
- 10 Food labeling: importance, types, methods

#### *Recommended Texts*

- 1 Yam, K. L., & Lee, D. S. (2012). *Emerging food packaging technologies: principles and practice*. Berlin: Elsevier.
- 2 Robertson, G. L. (2012). *Food packaging: principles and practice*. (3<sup>rd</sup> ed.) Florida: Taylor & Francis.
- 3 Lee, D. S., Yam, K. M., & Piergiovanni, L. (2008). *Food packaging science and technology*. Florida: CRC Press, Taylor and Francis Group, Boca Raton.

#### *Suggested Readings*

- 1 EIRI. (2007). *Handbook of packaging technology*. New Delhi: Engineers India Research Institute.
- 2 Robertson, G. L. (2006). *Food packaging: principles and practices*. Florida: CRC Press, Taylor & Francis Group, Boca Raton.



Director  
Institute of Food Science & Nutrition  
University of Sarawak, Sarawak

The course has been designed to give introductory understanding about the food plant layout and sanitation. The students will learn about requirements and basics of food plant design and construction, selection of suitable site for construction of food plant, sanitation, and waste disposal and management procedures for development of food plant. The food processing industry is a subset of the manufacturing sector with unique challenges. Among these, ensuring food hygiene and preventing contamination are two issues of prime importance. Hence, designers have to overcome such challenges when designing facilities suitable for food processing. To begin with, food plant design and layout involves the arrangement of the equipment in a processing plant. Such an arrangement should take into consideration the efficiency and convenience/ease of use that will result after laying out all the equipment. Small scale food industries are identical with labor intensive, low efficiency, and bad housekeeping. It needs specific improvement of performance related to their raw material characteristics as agricultural commodities.

#### Contents

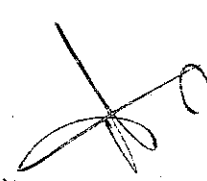
- 1 Food processing industry: introduction, investment.
- 2 Plant location and layout: significance, location analysis, selection criteria.
- 3 Freedom from pollution.
- 4 Availability of potable water.
- 5 Raw Material, labour and energy supply.
- 6 Communication facilities.
- 7 Facilities for waste disposal.
- 8 Building design and construction: floors, drains, walls, doors, windows, ceiling, ventilation, lighting, auxiliary facilities.
- 9 Food plant equipment: requirements, design, construction, choice of material, layout.
- 10 Plant cleaning: soil types, methods, detergents, water conditioners. Sanitizing: chemical, heat, and irradiation.
- 11 Cleaning methods – CIP, dismantling cleaning. Pests: types, inspection, control.
- 12 Waste management: fluid and solid wastes.

#### Recommended Texts

- 1 Awan, J. A., & Rehman, S. U. (2010). *Food plant layout and sanitation*. Faisalabad: Unitech Communications.
- 2 Arvanitoyannis, I. S. (2008). *Waste management for the food industries*. New York: Elsevier Academic Press.

#### Suggested Readings

- 1 Leliveld, H. L. M., Mostert, M. A., & Holah, J. (2005). *Handbook of hygiene control in food industry*. Cambridge: Woodhead Publishing Ltd., Abington Hall, Abington.
- 2 Farber, J.M., & Todd, E. C. D. (2000). *Safe handling of foods*. New York: Marcel and Dekker.



Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha.

This course provides a thorough study of factors affecting the science, such as processing technology, the physical properties and engineering of different foods and thermal processing and preservation of Foods. Food engineering is a rapidly changing discipline. Traditionally, the main focus was on food preservation and stabilization, whereas trends now are on diversity, health, taste, and sustainable production. This discipline discusses the main fields within the discipline such as thermal and non-thermal stabilization processes, separation and isolation processes, chemical and biochemical conversions, mixing and structuring processes. Food engineering is a multidisciplinary field which combines microbiology, applied physical sciences, chemistry and engineering for food and related industries. Food engineering includes, but is not limited to, the application of agricultural engineering, mechanical engineering and chemical engineering principles to food materials. Food engineers provide the technological knowledge transfer essential to the cost-effective production and commercialization of food products and services.

#### *Contents*


- 1 Food Process Engineering: Introduction and applications.
- 2 Units, Dimensions and Conversions. Basic Definitions: Concentration, Surface area, Density, Specific gravity, Specific heat, Thermal conductivity, Moisture, Pressure and Temperature. Heat and Mass Transfer Fundamentals: Conduction, Convection and Radiation, Heat exchangers and microwave heating.
- 3 Thermodynamic Laws and equilibrium. Material and Energy balances.
- 4 Materials handling: equipments. Steam and its uses in industry.
- 5 Fluid flow in Food Processing: Rheology, Viscosity, Types of Fluid flow, Newtonian and Non-Newtonian Fluids, Fluid energy.
- 6 Psychrometry, psychrometric charts and their applications.
- 7 Colligative properties of food material.
- 8 Physical separation processes: Filtration, membrane processes, sieving and gravity separation. Packaging: Types of packaging material and the atmosphere in the package.
- 9 Thermal Processing of Foods: Pasteurization and sterilization. Low temperature. Preservation of Foods: Refrigeration and Freezing. Evaporation and Drying:
- 10 Equipment's used for evaporation and drying.
- 11 Adsorption and ion exchange in food processing.
- 12 Problem solving related to conversions of units, basic definitions,
- 13 Material and Energy balances, Fluid flow in Food Processing and colligative properties of food material.

#### *Recommended Texts*

- 1 Smith, P. G. (2011). *An introduction to food process engineering*. Berlin: Springer.
- 2 Heldman, D. R. (2012). *Food process engineering*. Berlin: Springer Science & Business Media.

#### *Suggested Readings*

- 1 Das, S. K., & Das, M. (2019). *Fundamentals and operations in food process engineering*. Florida: CRC Press.
- 2 Toledo, R. T., Singh, R. K., & Kong, F. (2018). *Fundamentals of food process engineering*. Berlin: Springer International Publishing.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha.



The course discusses the biological, chemical and physical properties of fruits and vegetables and their contribution to human nutrition and diet; and the application of food processing and preservation principles and technologies in the processing, preservation, extension of shelf life and value addition of fruit and vegetable products in terms of safety, nutritional and dietary quality. The aim is to equip the students with functional knowledge and practical skills in the principles, technologies and processes used in the processing, preservation, extension of shelf life and value addition of fruits and vegetables. The student will be equipped with knowledge and understanding of the basic properties of fruits and vegetables and their contribution to nutrition and diet, basic post-harvest biological, chemical, physiological and metabolic processes and changes in fruits and vegetables and how these can be controlled to prevent or reduce deterioration and loss of nutritional quality and value in fruits and vegetables production and processing.

#### *Contents (Theory)*

- 1 Heat processing: principles, blanching, exhausting, pasteurization, HTST, UHT, temperature distribution, heat transfer equipment—retorts. commercial sterilization,
- 2 Canning: unit operations, parameters for canning fruits, vegetables.
- 3 Thermal death time curves: F value, D value, Z value, calculations.
- 4 Effect of heat processing: microorganisms. Spoilage of canned foods.
- 5 Dehydration: principle, methods, dry specific fruit and vegetables.
- 6 Principles of low temperature preservation: refrigeration, cold storage, freezing, refrigeration plants, monitoring and control.
- 7 Cold storage: requirements, insulation, air circulation, humidity, controlled atmospheric storage, racking systems, calculation of refrigeration load.
- 8 Freezing and frozen storage: methods, types, slow and quick freezing, freezing point, freezing curve, rate, changes during freezing, damages during intermittent thawing.
- 9 Freezing different food commodities, packaging requirements. Defects: freeze burn, drip loss.

#### *Contents (Practical)*


- 1 Preparation of fruits and vegetables products: dried, frozen and canned.
- 2 Quality evaluation of the products during storage.
- 3 Manufacturing of 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.

#### *Recommended Texts*

- 1 Siddiq, M., & Uebersax, M. A. (Eds.). (2018). *Handbook of vegetables and vegetable processing*. New Jersey: John Wiley & Sons.
- 2 Jongen, W. (Ed). (2002). *Fruit and vegetable processing – improving quality*. Cambridge: Woodhead Publishing. Ltd., Abington.

#### *Suggested Readings*

- 1 Girdhari, L., Siddappa, G. S., & Tandon, G. L. (1998). *Preservation of fruits and vegetables*. New Delhi: Publications and Information Division, Indian Council of Agricultural Research.
- 2 Sirivastava, R. P., & Sanjeev, K. (2002). *Fruit and vegetable preservation: principles and practices*. Lucknow: International Book Distributing Co.

  
Director  
Institute of Food Science  
University of Agricultural Sciences

The course has been designed to give introductory understanding about the food analysis and sensory evaluation methods. The students will learn how to analyze food by performing proximate and chemical analysis of different food products. Any product that is going to be used by humans needs to be rigorously tested, and because foodstuffs are ingested, the testing is often more crucial to avoid any health issues from occurring. There are many reasons why companies want to analyze foodstuffs, and there are quite a few general areas of food analysis. In terms of the techniques that are used, the go-to choices are a wide range of analytical characterization instruments that are found in almost all quality control laboratories. For food analyses, the range of instruments used includes spectroscopy, chromatography, to name a few common examples. The choice of technique(s) varies depending on what foodstuff is being analyzed, what is being analyzed within the foodstuff, and what the reasons for the analysis is.

#### *Contents (Theory)*

- 1 Food analysis: significance. Sampling: techniques, preparation, preservation.
- 2 Physical properties and analysis of foods and food products
- 3 Proximate analysis, acidity, pH, sugars, minerals, vitamins: significance, methods.
- 4 Chromatography: paper, thin layer. Spectroscopy: atomic emission, atomic absorption.
- 5 Analytical data: evaluation, interpretation, statistical applications.
- 6 Sensory evaluation, attributes, difference and preference tests, consumer acceptance.
- 7 General requirements for sensory testing. Organization and evaluation of sensory testing.
- 8 Measurement: difference, discrimination testing, scaling, threshold methods,
- 9 Descriptive analysis: Texture, Color and flavor evaluation.

#### *Contents (Practical)*

- 1 Lab safety requirements. Preparation and standardization of laboratory solutions.
- 2 Sampling. specific gravity, refractive index, moisture, ash, crude protein, crude fat, crude fiber, NFE, pH and acidity. Estimation of vitamin C.
- 3 Mineral analysis through flame photometer and atomic absorption spectrophotometer. Paper and thin layer chromatography. Sensory evaluation of foods. Taste, odor, trigeminal sensations.

#### *Recommended Texts*

- 1 Zhong, J., & Wang, X. (2019). An introduction to evaluation technologies for food quality. In: *Evaluation technologies for food quality*. Cambridge: Woodhead Publishing.
- 2 O'Mahony, M. (2017). *Sensory evaluation of food: statistical methods and procedures*. Abingdon: Routledge.
- 3 Horowitz, W. (2016). *Official methods of analysis of the Association of Official Analytical Chemists*. (3<sup>rd</sup> ed.) Maryland: Association of Official Analytical Chemists, Gaithersburg.

#### *Suggested Readings*

- 1 Awan, J. A., & Rehman, S. U. (2003). *Food analysis manual*. Faisalabad: Unitech Communications.
- 2 Kemp, S.E., Hollywood, T., & Hort, J. (2009). *Sensory evaluation: a practical handbook*. New York: John Wiley & Sons Inc.
- 3 Chambers, E., & Wolf, M. B. (2005). *Sensory testing methods*. Pennsylvania: American Society for Testing and Materials, West Conshohocken.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha Sargodha

The course provides a biochemical foundation to understand the milk production, milking, milk handling, and composition of milk, including the chemistry, structure and function of its individual components. It will train the students from milking and collection at farm level, to intake at the dairy plant, the processing steps, and the basic liquid milk products. After completing this course, students will better understand the basic components of milk science, including chemical and physical properties, processing, key ingredients, basic processing steps and safety considerations. They will identify how dairy science impacts and supports various aspects of the overall field of food science and what are trends in the dairy sector.

#### *Contents (Theory)*

- 1 Milk: Production, production statistics
- 2 Milk: importance, standards, composition, properties
- 3 Factors influencing raw milk quality
- 4 Milk handling: manual and machine milking, Farm cooling, collection, reception.
- 5 Analyses at different levels and transportation.
- 6 Milk Chemistry: major constituents, their properties and chemistry.
- 7 Milk processing: standardization, Homogenization
- 8 Milk Pasteurization and UHT
- 9 Milk packaging, storage, distribution.
- 10 Effect of storage and heat processing on milk quality.
- 11 Milk adulteration: adulterants, objectives, health effects.
- 12 Milk Microbiology.

#### *Contents (Practical)*


- 1 Milk collection and cooling practices, Milk sampling methods.
- 2 Physical and chemical analyses of raw milk.
- 3 Tests for adulterants.
- 4 Standardization and homogenization, Pasteurization and UHT processes.
- 5 Visit to milk processing plants

#### *Recommended Texts*

- 1 Nero, L. A., & De Carvalho, A. F. (Eds.). (2019). *Raw Milk: balance between hazards and benefits*. Cambridge: Academic Press.
- 2 Bylund, G. (2003). *Dairy processing handbook*. Sweden: Tetra Pak Processing Systems AB.

#### *Suggested Readings*

- 1 Goyal, M. R., & Chavan, R. S. (2018). *Technological interventions in dairy science: innovative approaches in processing, preservation, and analysis of milk products*. Florida: Apple Academic Press.
- 2 Park, Y. W., Haenlein, G. F. W., & Wendorff, W. L. (2017). *Handbook of Milk of Non-Bovine Mammals*. (2<sup>nd</sup> ed.) New York: John Wiley & Sons Ltd.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha Sargodha

The course aims evaluating and predicting wheat flour properties, required new equipment and new techniques and these will be covered in depth. The versatility of wheat flour and its conversion into food is reviewed across a whole spectrum of products. There is a strong emphasis on the use of wheat flour for bread making but with consideration of applications in the manufacture of cakes, cookies, pastries, extruded foods, pasta and noodles. The development process and the benefits to consumers are also addressed. The course will focus on making students understand the basics of cereal science, get familiar with different cereals locally produced, the nutritional value of cereals and the importance of cereals for Pakistani population. The complete flour making procedures are integral part of this course. It hopes that by the end of this course students will have a complete knowledge about cereals and cereal products.

#### *Contents (Theory)*

- 1 Introduction to different Cereal grains and their importance for Production of different gains and utilization of cereals worldwide
- 2 Structure, composition and nutritional value of different cereal grains
- 3 Grain grades and grading criteria's of wheat
- 4 Grain Storage importance and methods of grain storage, Types of grain storage and role of temperature and moisture in grain storage
- 5 Types of milling and Dry milling process of wheat. Cleaning of wheat; methods of wheat cleaning prior to milling
- 6 Tempering and conditioning of wheat prior to milling, grinding process: types of grinding machines, roller flour milling, Sieving process: principles, types of sifters
- 7 Rice: Drying, milling, parboiling. Processing of rice and maize
- 8 Production of breakfast cereals and snack foods
- 9 Feed and industrial uses of cereals

#### *Contents (Practical)*


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

#### *Recommended Texts*

- 1 Kent, N. L., & Evers, A. D. (2017). *Kent's technology of cereals: an introduction for students of food science and agriculture*. Oxford: Pergamon Press.
- 2 Delcour, J. A., & Hosney, R. C. (2010). *Principles of cereal science and technology*. Minnesota: American Association of Cereal Chemists Inc. St. Paul.

#### *Suggested Readings*

- 1 AACC. (2019). *Approved methods of American association of cereal chemists*. Minnesota: American Association of Cereal Chemists Inc, St. Paul.
- 2 Khetarpaul, N., Grewal, R. B., & Jood, S. (2005). *Bakery Science and cereal technology*. New Delhi: Daya Publishing.
- 3 Karel, K., & Joseph, G. P. (2000). *Handbook of cereal science and technology*. New York: Marcel Dekker.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha Sargodha

This is core course which enable the students to understand the basics of physico-chemical phenomenon occurring in food, food systems and products throughout cycle. The students understand to prevent and control all the chemical processes within food system to have desirable or undesirable outcomes. The Food Biochemistry gathering plans to enhance understanding of detailed composition of foods, especially food components that have beneficial effects on human health. The Food Biochemistry include utilization of modern chemical and biochemical analytical methods of food components and their reactions, model systems to study their reactions and efficient statistical tools for data analysis to get the maximum informative value. Biochemistry addresses fundamental questions: How is food converted into energy or body substance? How is genetic inheritance translated into phenotypically expressed properties? How do enzymes – the biological catalysts – differ in power, specificity and controllability from other catalysts? Can we meet human needs by manipulating the DNA of bacteria, plants and animals?

#### Contents

- 1 Water and its relation to food
- 2 Carbohydrates: structure and functions,
- 3 Classification, monosaccharide, disaccharides, polysaccharides,
- 4 Caramelisation
- 5 Proteins: Structure and functions,
- 6 Amino acids, peptides, chemical groups in proteins,
- 7 Covalent structure of protein, three dimensional structure of protein,
- 8 Protein denaturation and folding protein synthesis,
- 9 Maillard reaction,
- 10 Applications of functional properties
- 11 Lipids: Structure and functions,
- 12 Storage lipids, structural lipids,
- 13 Biological and lipid oxidation in foods,
- 14 Hydrogenation, rendering,
- 15 Frying and antioxidants uses
- 16 Enzymes: Function, kinetics,
- 17 Classification and nomenclature of enzymes, enzymatic reactions
- 18 Flavor compounds in foods

#### Recommended Texts

- 1 Nollet, L. M., Toldra, F., Benjakul, S., Paliyath, G., & Hui, Y. H. (2012). *Food biochemistry and food processing*. New Jersey: John Wiley & Sons.
- 2 Belitz, H. D., & Grosch, W. (2009). *Food Chemistry*. (4<sup>th</sup> ed.) Berlin: Springer-Verlag Berlin Heidelberg.

#### Suggested Readings

- 1 Coultate, T. P. (2016). *Food: the chemistry of its components*. (6<sup>th</sup> ed.) Cambridge: Royal Society of Chemistry.
- 2 Damodaran, S., & Parkin, K. L. (2017). *Fennema's food chemistry*. (5<sup>th</sup> ed.) London: CRC press.

  
Director  
Institute of Food Science & Nutrition  
University of Sardar Vallabhbhai Patel  
Surat

This course is designed to familiarize the students with chemical and physical properties of sugar and to give concepts of sugar production technology, its quality and by products. Based on the chemical and physical properties of sucrose and the composition of sugar beet and sugar cane the individual process steps of sugar manufacture are described in this course. Sugar production involves two distinct operations; processing sugar cane or sugar beets into raw sugar, and processing the raw sugar into refined sugar. Cane and beet sugar extracts contain sucrose and undesirable amounts of polysaccharides, lignins, proteins, starches, gums, waxes, and other colloidal impurities that contribute colour and/or taste to the crystalline product and reduce product yield. The raw juice, therefore, is subjected to heating, liming addition and clarification to remove proteins and colloidal matter. Sugar technology focuses on the production, refinement and packaging of sugar from sugar cane and sugar beet.

#### *Contents (Theory)*

- 1 Sugar industry in Pakistan.
- 2 Sugarcane and sugar beet: production, quality.
- 3 Indigenous technology for small scale sugar production: gur, khund, shakar.
- 4 Raw sugar manufacturing
- 5 Unit operations – juice extraction, purification, heating, evaporation, crystallization, crystallization in motion.
- 6 Refining: affination, clarification,
- 7 Decolorisation, crystallization,
- 8 Centrifugation, drying.
- 9 Bagging, storage.
- 10 Factors affecting sugar processing.
- 11 Quality criteria: raw and refined sugar.
- 12 Specialty sugar products: brown or soft sugar, liquid sugar.
- 13 Sugar industry byproducts and their uses.

#### *Contents (Practical)*

- 1 Analysis of sugar cane, sugar beet for 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

#### *Recommended Texts*

- 1 Meyer, J., Rein, P., Turner, P., & Mathias, K. (2013). *Good management practices for the cane sugar industry*. Berlin: Bartens Publisher.
- 2 Asadi, M. (2007). *Beet sugar handbook*. New York: John Wiley & Sons, Inc.

#### *Suggested Readings*

- 1 Panda, H. (2011). *The complete book on sugarcane processing and by products of molasses*. New Delhi: Asia Pacific Business Press Inc.
- 2 Delgado, A.V., & Casanova, C. A. (2001). *Sugar processing and by-products of the sugar industry*. Rome: Food and Agriculture Organization of the United Nations.
- 3 Chen, J. C. P. (2007). *Meade-Chen cane sugar handbook*. New York: John Wiley & Sons, Inc.

This course provide knowledge about nutritional quality of poultry meat, egg and seafood, gives exposure to various forms of poultry meat, egg and seafood available for human consumption and also provides information about various processing and preservation techniques to be used for poultry meat, egg and sea foods. Moreover, quality testing and standards for poultry, egg and seafood products are also informed. Meat, Poultry, Fish, and Egg Extension - The principle interests of the extension program at this time are in the area of total utilization of flesh foods, particularly poultry and fish, animal welfare, and the sustainability of animal agriculture.

#### *Contents (Theory)*

- 1 Status of poultry industry in Pakistan
- 2 Primary poultry processing
- 3 Pre-slaughtering, slaughtering.
- 4 Secondary poultry processing
- 5 Preservation techniques
- 6 Quality assurance
- 7 Eggs: Identification, grading,
- 8 Composition, quality characteristics,
- 9 Handling, storage.
- 10 Egg processing: drying and freezing of whole, white, yolk.
- 11 Functional properties
- 12 Applications in food processing.
- 13 Quality control during processing.
- 14 Fish and shell fish: overview
- 15 Fish processing and preservation.
- 16 Processing of miscellaneous products.
- 17 Quality control and factory sanitation of sea foods

#### *Contents (Practical)*


- 1 Slaughtering and dressing of poultry.
- 2 Tests for freshness of poultry, eggs and seafood.
- 3 Preparation and preservation of poultry, egg and seafood products.
- 4 Quality evaluation for poultry meat, egg and seafood products.
- 5 Visit to processing plant

#### *Recommended Texts*

- 1 Mead, G. C. (2004). *Poultry meat processing and quality*. Cambridge: Woodhead Publishing Ltd., Abington.
- 2 Sahoo, J., & Chatli, M. K. (2015). *Textbook on meat, poultry and fish technology*. New Delhi: Daya Pub. House.

#### *Suggested Readings*

- 1 Isabel, G. L. (2010). *Handbook of poultry science and technology. Vol. 1: primary processing*. New Jersey: John Wiley and Sons Inc.
- 2 Isabel, G. L. (2010). *Handbook of poultry science and technology. Vol. 2: secondary processing*. New Jersey: John Wiley and Sons Inc.
- 3 Simi, J. S., Nakai, S., & Guenter, W. (2000). *Egg nutrition and biotechnology*. New York: CABI Publishing.

  
Director  
Institute of Food Science & Technology  
University of Sargodha, Sargodha.

The course will focus on making students understand the basics of baking science, baking procedures and role of different ingredients in bakery products manufacturing. The complete bread making and other bakery products manufacturing procedures are integral part of this course. It hopes that by the end of this course students will have a complete knowledge about baked products. Students in baking programs learn everything from the ground up. From why certain flours act the way they do to how a twist of the wrist can change a flourish of frosting, students are exposed to everything they need to know to have a chance at succeeding in the world of pastry. Courses in the bakery science program focus on baking techniques, food safety, food microbiology and grain science. Course topics in the programs are: Baking flours, starches, spices, wheat flour, Blending methods, Bakery production, Chemical reactions and food borne illness, Baking equipment and facilities.

#### *Contents (Theory)*

- 1 Baking science and technology: Ingredients; flour, sweeteners, shortening, leavening agents
- 2 water, and yeast, oxidizing agents, salt, mold inhibitors
- 3 Dough improvers. Functional additives: emulsifiers, enzymes, antioxidants, eggs, milk and milk products
- 4 Bakery products: bread – Unit operations
- 5 Mixing, straight dough, sponge dough, rapid processing mechanical dough development,
- 6 Fermentation, dough transfer systems dividing, rounding and molding, panning
- 7 Proofing procedures and reactions during proofing.
- 8 Baking process: stages, baking reactions, thermal reactions
- 9 Bread cooling, packaging and storage. Bread spoilage; staling
- 10 Quality control in baking industry, Processing of other bakery products: biscuits cookies, crackers
- 11 Sourdough bread, nutritional value, types and methods of making sourdough bread

#### *Contents (Practical)*


- 1 Preparation of breads, pastry, biscuits, wafers and cakes
- 2 Effect of different ingredients on bakery products
- 3 Visit to different baking plants

#### *Recommended Texts*

- 1 Joshi, V. K. (2015). *Indigenous fermented foods of South Asia*. Cambridge: CRC press, Taylor and Francis Group.
- 2 Cauvain, S. P. (2012). *Bread making, improving quality*. Cambridge: CRC Press.
- 3 Khetarpaul, N., Grewal, R. B., & Jood, S. (2005). *Bakery science and cereal technology*. New Delhi: Daya Pub. House.

#### *Suggested Readings*

- 1 Edward, W. P. (2007). *The science of bakery products*. Cambridge: The Royal Society of Chemistry.
- 2 Hui, Y. H., Corke, H., Leyn, I. D., & Cross, N. (2006). *Bakery product science and technology*. London: Blackwell Pub. Co.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha



The course has been designed to give introductory understanding about the Post-Harvest Technology of fruits and vegetables. The students will learn about different principles and techniques of fruits and vegetables preservation. Course will train the students on postharvest strategies or technological implementation, such as temperature reduction, modification of the atmosphere, or chemical treatments, are applied. These serve to reduce respiration rates, retard ripening, decrease ethylene production, and consequently retard senescence, prevent dehydration, and extend the shelf-life thus preserving produce quality. These strategies imply that produce are submitted to abiotic stresses and they need to activate different metabolic pathways to cope with these stresses and reach homeostasis to avoid undesirable quality traits that limit produce shelf-life.

#### *Contents (Theory)*

- 1 Pre harvest and Post-harvest Factors Affecting Quality
- 2 Postharvest Handling Operations: Farm house operations, sorting and grading.
- 3 Methods of Precooling: transportation, precooling.
- 4 Post Harvest Treatments: Cleaning and washing, coating and waxing, heat treatment, irradiation, chemicals treatments, disinfection and decay control
- 5 Fruit Ripening: Changes during ripening, Harvesting and handling methods. Maturity assessment of different fruits and vegetables.
- 6 Ripening Process: Respiration, climacteric and non-climacteric patterns, pectic substances, ripening conditions. Postharvest physiology of fruits and vegetables.
- 7 Postharvest Treatments: Coatings, curing, vapor and hot water treatment, de-greening.
- 8 Storage: Refrigerated, CA, hypobaric, MAS. Packaging: Types, design, MAP, recycling.
- 9 Cold Chain: Packing house operations, transportation, safety and quality.

#### *Contents (Practical)*

- 1 Determining basis of grading and sorting of fruits and vegetables.
- 2 Changes in physical and chemical quality parameters of fruits during storage weight loss, acidity, TSS, firmness with penetrometer, color changes.
- 3 Effect of packaging materials on stored fruits and vegetables.

#### *Recommended Texts*

- 1 Kumar, A., Rajpurohit, V. S., & Kautish, S. (2019). *Modern techniques for agricultural disease management and crop yield prediction*. Pennsylvania: IGI Global.
- 2 Ron, W., & John J. G. (2017). *Postharvest: an introduction to the physiology and handling of fruit and vegetables*. (6<sup>th</sup> ed.) London: CABI.

#### *Suggested Readings*

- 1 Sharon, P. S., & Martha C. S. (2010). *Postharvest technology of horticultural crops*. Jaipur: Oxford Book Company, India.
- 2 Elhadi, M. Y. (2011). *Postharvest biology and technology of tropical and subtropical fruits-açai to citrus*. Vol. 2. New Delhi: Woodhead Publishing India Pvt. Ltd.

The course focuses on dairy products technology. It is science and engineering field that deals with the study of milk processing and its products. It is a part of food technology and processing industry that involves processing, packaging, distribution and transportation of various dairy products. Dairy industry is one of the industries which play a dynamic role in Pakistan's agro-based economy. Dairy farming includes breeding and care of milk yielding cattle and buffaloes, procuring milk and processing of milk into a variety of dairy products. Dairy processing involves handling of milk for its safe distribution or its conversion into different dairy products. After the milk has reached the plant, processing work begins and it is converted into a variety of dairy products. Dairy Technologists mainly deal with the technical and quality control aspects of the processing industry and also work to develop improved methods in processing, production preservation and utilization of milk and milk products.

#### *Contents (Theory)*

- 1 Milk Processing: Unit operations in milk processing
- 2 Cream separation, centrifugation.
- 3 Milk standardization and homogenization
- 4 Milk pasteurization
- 5 Milk sterilization and UHT.
- 6 Milk: aseptic packaging and storage
- 7 Chemistry, Production technology, Microbiology and Properties of Milk Products: Liquid milks, Evaporated, condensed and powder milks, butter, yogurt, ice cream and cheese,
- 8 Milk by-Products
- 9 Whey and its utilization.
- 10 Indigenous milk products.

#### *Contents (Practical)*


- 1 Sedimentation test, pH, acidity and, Lactometer reading.
- 2 Physico-chemical analysis of milk and milk products
- 3 Sensory evaluation and microbiological analysis of milk and milk products
- 4 Visit to commercial dairy farms and milk processing plants/industries.

#### *Recommended Texts*

- 1 Spreer, E. (2017). *Milk and dairy product technology*. New York: Routledge.
- 2 Walstra, P., Walstra, P., Wouters, J. T., & Geurts, T. J. (2005). *Dairy science and technology*. London: CRC press.

#### *Suggested Readings*

- 1 Goyal, M. R., & Chavan, R. S. (2018). *Technological interventions in dairy science: innovative approaches in processing, preservation, and analysis of milk products*. Florida: Apple Academic Press.
- 2 Park, Y. W., Haenlein, G. F. W., & Wendorff, W. L. (2017). *Handbook of milk of non-bovine mammals*. (2<sup>nd</sup> ed.) New Jersey: John Wiley & Sons Ltd.
- 3 EIRI. (2015). *Hand book of milk processing dairy products and packaging technology*. New Delhi: Engineers India Research Ins.

  
Director  
Institute of Food Science & Nutrition  
University of Sarawak

The course has been designed to give introductory understanding about the beverage technology. The students will learn about different principles and techniques of beverage manufacturing and preservation. Manufacturing of syrups, squashes and traditional beverages and chemical analysis of beverages will be performed. Course will lead to the study of food and beverage technology, application of food science to the selection, preservation, processing, packaging, distribution, and use of safe food and beverages. Food and beverage technology is a series of process starting with food research, product development, quality assurance and quality control and food regulation. Food and beverage technology is a careful, systematic study, investigation, and compilation of information about foods and their components.

#### *Contents (Theory)*

- 1 Beverages: classification.
- 2 Beverage industry in Pakistan.
- 3 Beverage ingredients
- 4 Water: sources, purification – need, methods. Sweeteners - sugars, artificial sweeteners.
- 5 Additives: colors, flavors, preservatives, acidulants, stabilizers and carbon dioxide.
- 6 Carbonated beverages: syrup room operations, carbonation, filling, capping, bottle washing.
- 7 Fruit based beverages: Fresh juices, ready to serve juice and juice concentrate, nectar, cordial, squash, syrup.
- 8 Traditional beverages. Synthetic and low calorie juices.
- 9 Fruit flavored juices, use and role of tea and coffee.

#### *Contents (Practical)*


- 1 Formulation and preparation of carbonated and non-carbonated beverages.
- 2 Preparation and preservation of fruit pulps and juices and their sensory evaluation
- 3 Storage study of prepared products under different conditions through taking laboratory tests (physical, chemical, sensory and microbiological examination) during whole storage life.
- 4 Use of low caloric sweeteners for the development of diet beverages.
- 5 Manufacture of syrups, squashes, traditional beverages and chemical analysis of beverages.
- 6 Visit to beverage plants.

#### *Recommended Texts*

- 1 Almeida, R. M., Abreu, R., & Perez-Lopez, J. A. (2018). Nascent entrepreneurship and sustainability on the beverage sector. In: *Nascent entrepreneurship and successful new venture creation*. Pennsylvania: IGI Global.
- 2 Hui, Y. H., & Evranuz, E. O. (Eds.). (2012). *Handbook of animal-based fermented food and beverage technology*. Vol. 1. Florida: CRC press.

#### *Suggested Readings*

- 1 Ashurst, P. R. (2005). *Chemistry and technology of soft drinks and fruit juices*. Oxford: Blackwell Pub. Co.
- 2 Steen, D. P. (2006). *Carbonated soft drinks - formulation and manufacture*. Oxford: Blackwell Publishers.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha Sargodha

The aim of this course is to provide the opportunity for students to integrate their training in food science and technology and related disciplines and gain experience with theory and practice of developing food products. Lectures and lab sessions will involve understanding and applying practices to develop food products with traditional and novel food ingredients and processes in the context of existing and projected national and international legal, regulatory, economic, environmental and social constraints. Nutritional and health implications relating to food products will also be considered. The course will also help prepare student for food service management positions in restaurants, hotels and hospitality sector.

#### *Contents (Theory)*

- 1 Food product development: Process, strategy, design, development, commercialization, evaluation
- 2 Key to new product's success and failure
- 3 Consumer behavior, food choices, sensory needs, consumer role. Preference Mapping and Food Product Development. Conducting trials, analyzing, recent developments.
- 4 Case Study of Consumer Oriented Food Product Development: Reduced calorie foods
- 5 Consumer trends and healthy eating, marketing and technological challenges, success factors
- 6 Case Study: Reduced calorie on the go beverages
- 7 The ethics of food production and consumption. Principles of menu development.
- 8 Food Storage: Preservation concepts, sanitary food handling procedures, elementary nutrition
- 9 Kitchen Equipment: Selection layout, purchasing
- 10 The fabrication of chicken, beef, lamb, and fish, Proper cuts and their uses, recognition of the quality of meat. Cake and Pastry: Design and decoration
- 11 Control for dining rooms, banquets (responsibilities of banquet server, roll call, table setting, serving and clearing, safety and sanitation) and catering events
- 12 Human Resource Management: Recruitment and selection, training and development, employee relations, principles of supervision, customer relations
- 13 Fundamentals of marketing in the hotel industry

#### *Contents (Practical)*


- 1 Food Product Development Projects: strategy, design, development, commercialization, launch and evaluation. Practical aspects and sensory evaluation techniques.
- 2 Production and Service of Food in Volume: Chinese dishes, salads, sandwiches, bakery goods, doughnuts, waffles and desserts.
- 3 Visit of restaurants and hotels.

#### *Recommended Texts*

- 1 Sunil, S. (2005). *Food and beverage services*. New Delhi: Akansha Publishing House.
- 2 Earle, M., & Earle, R. (2007). *Case studies in food product development*. Cambridge: Woodhead Publishing Ltd.

#### *Suggested Readings*

- 1 Diyush, B. N. P. (2007). *Food and beverage management*. New Delhi: SBS Publishers and Distributors Pvt. Ltd.
- 2 Bernard, D., Andrew, L., & Sally, S. (2005). *Food and beverage management*. New Delhi: Elsevier Division of Reed Elsevier India Pvt. Ltd.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha

This course will cover the general methods used to examine oils and fats for their physical properties and more basic analytical criteria, procedures to give detailed information on their quality criteria. This course provides the basic chemistry of fats and oils with focus in the understanding of relevance of their physicochemical and biochemical properties in their functions as ingredients in foods. Oil and fats are important parts of the human diet and more than 90% of the world production from vegetable, animal and marine sources is used as food or as ingredient in food products. World demand for dietary oils and fats is steadily increasing. Oils and fats serve as a rich source of dietary energy. They contain certain fatty acid components which are essential nutrients and their functional and textural characteristics contribute to the flavour and palatability of many natural and prepared foods. Modern advances in oils and fats technology and science of nutrition have led to the need for greater awareness of the composition and structure of dietary lipids and many new test methods and analytical procedure have been recently introduced.

#### Contents (Theory)

- 1 Physical and chemical characteristics of Oils and Fats
- 2 Oil Bearing Materials: Pre-treatment, storage.
- 3 Extraction Methods: Rendering, expression, solvent extraction.
- 4 Processing: Degumming, refining,
- 5 Bleaching, deodorization, fractionation,
- 6 Winterization, hydrogenation,
- 7 Interesterification, esterification,
- 8 Emulsification, stabilization.
- 9 Spoilage: Oxidative and hydrolytic rancidity chemistry,
- 10 Prevention use of antioxidants.
- 11 Manufacture of frying oils, margarine, mayonnaise.
- 12 Byproducts of fats and oils industry and their uses.

#### Contents (Practical)


- 1 Basics of lab work (Safety, hygiene, sanitation etc.).
- 2 Handling and storage of glass ware.
- 3 Solution preparation and standardization. Extraction of oils and fats.
- 4 Determination of Color, cold test, melting point, smoke point, specific gravity, solid fat index, refractive index, acid value, peroxide value, iodine value, saponification value.
- 5 Visit to oil and fat industries.

#### Recommended Texts

- 1 Hoffmann, G., & Taylor, S. L. (2013). *The chemistry and technology of edible oils and fats and their high fat products*. Amsterdam: Elsevier Science.
- 2 O'Brien, R. D. (2008). *Fats and oils: formulating and processing for applications*. (3<sup>rd</sup> ed.) Florida: CRC Press.

#### Suggested Readings

- 1 Bockisch, M. (2015). *Fats and oils handbook*. Amsterdam: Elsevier Science.
- 2 Talbot, G. (2015). *Specialty oils and fats in food and nutrition*. Cambridge: Woodhead Publishing.
- 3 Hernandez, E. M., & Kamal-Eldin, A. (2013). *Processing and nutrition of fats and oils*: New Jersey: John Wiley & Sons.



Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha.

The Confectionery and Snack Food segment includes food products such as chocolates, candy bars, sweets, jellies, gums, hard and chew candies, through to snack foods such as potato chips, crisps, ready to eat nuts, trail mix, savory snacks, energy and granola bars. The confectionery industry is not a science-based industry: it is an industry that has been built on the confectioner's craft. Confectionery is normally divided into three classes: flour confectionery, chocolate confectionery, and sugar confectionery. The course is structured towards providing the basic knowledge and skill-set to run a successful confectionery production industry. It also offers basic knowledge in entrepreneurial skill concept that will help students to set up and manage a successful confectionery business. It teaches students the necessary recipe and process on Cakes and Muffins production, Biscuits production, Pies and Rolls production, Snacks production, Bread production, Ice Cream production and Beverage and Custard production.

#### *Contents*

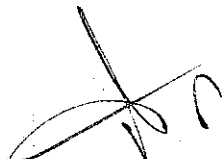
1. Confectionery: Significance
2. Confectionery: Classification
3. Confectionery industries in Pakistan
4. Sugar confectionery: Ingredients and manufacturing of high boiled sweets, caramel, toffee, fudge and gums etc.
5. Sugar free confectionery: Need, ingredients, manufacture
6. Chewing gum technology
7. Chocolate confectionery
8. Snack Foods: History and status.
9. Manufacturing of potato, nuts,
10. Cereal, meat and fish based snack foods
11. Puffed and baked snacks
12. Seasonings: Ingredients, formulations, applications
13. Packaging of confectionery and snack foods
14. Quality control

#### *Recommended Texts*

- 1 Booth, G. R. (2012). *Snack food*. New York: Springer Science and Business Media Van Nostrand Reinhold.
- 2 Panda, H. (2009). *The complete technology on snack foods*. New Delhi: National Institute of Industrial Research.

#### *Suggested Readings*

- 1 Lusas, W., & Rooney, L. W. (2001). *Snack food Processing*. Lancaster: Technomic Pub. Co.
- 2 Edwards, W. P. (2000). *The science of sugar confectionery*. Cambridge: Royal Society of Chemistry Thomas Graham House Science Park.

  
Director  
Institute of Food Science & Nutrition  
University of Sargodha, Sargodha

In this course student will learn about the overview of meat industry in Pakistan, different factors that influence the quality of meat as fresh and during processing. Students will also get knowledge about handling of these food items on scientific lines and will get information about the production of quality products, techniques that can be used to process and preserve the shelf-life of meat products. The supply shortage of livestock products in certain areas in developing countries is a consequence of the traditional marketing systems, where fresh, unprocessed meat is sold at meat markets a few hours after slaughter. Meat technology focuses on value adding to fresh meat and has a fully equipped small scale meat processing plant to manufacture fresh and cooked processed meat products, i.e. emulsions, smoked and cured products. Meat Technology was involved in research leading to the latest legislation on the inclusion of brine in frozen chicken. Our current focus is on the utilization of the fifth quarter (intestines, organs, blood) in processed products and the development of shelf stable meat products at environmental temperatures.

#### *Contents (Theory)*

- 1 Status of meat industry in Pakistan
- 2 Structure, composition and nutritive value of meat muscles
- 3 Slaughtering, Conversion of muscles to meat.
- 4 Meat quality, Meat inspection and grading, Meat spoilage, Meat tenderization, Aging.
- 5 Meat Preservation, Meat co-products
- 6 Non-meat ingredients
- 7 Processed meat products
- 8 Quality assurance and safety in meat industries

#### *Contents (Practical)*


- 1 Identification of meat cuts
- 2 Tests for freshness of meat. Meat grading and quality testing
- 3 Preservation of meat. Preparation of meat products.
- 4 Visit to abattoir and meat processing plants

#### *Recommended Texts*

- 1 Toldra, F. (2010). *Handbook of meat processing*. London: Wiley-Blackwell. A John Wiley & Sons, Inc., Publication.
- 2 Lawrie, A. A., & Ledward, D. A. (2006). *Lawrie's meat science*. Cambridge: Woodhead Publishing Limited.

#### *Suggested Readings*

- 1 Hui, Y. H. (2012). *Handbook of meat and meat processing*. Florida: CRC Press. Taylor & Francis Group.
- 2 Jhari, S., & Manish, K. C. (2015). *Text book on meat, poultry and fish technology*. New Delhi: Daya Publishing House.
- 3 Bekhit, A. A. (2017). *Advances in meat processing technology*. Florida: CRC Press. Taylor & Francis Group.

  
Director  
Institute of Food Science & Nutrition  
University of Saradha, Saradha

This course aims to provide instruction in the general principles of food microbiology. Hands on practical complimented with an industry-based project, give a real-world perspective to microbiological challenges faced by the food industry. The course covers the biology and epidemiology of food- and water-borne microorganisms of public health significance; the microbiology of food preservation and food commodities; principles and methods for the microbiological examination of foods and microbiological quality control. After the completion of the course the student will have knowledge about general concept of microbiology. Awareness and identification of important microorganisms in food and techniques employed for microbial analyses of foods and isolation and identification of microorganisms.

#### *Contents (Theory)*

- 1 Microbiology: introduction, historical background, branches. Significance of microorganisms in food, water and environment.
- 2 Microorganisms: cell structure, prokaryotes, eukaryotes. Characteristics of microorganisms: bacteria, yeasts, molds, viruses. Growth requirements: cultural, physical, chemical, macro- and micro-nutrients.
- 3 Culture media: types, applications. Microbial metabolism. Bacterial multiplication: growth curve, continuous culture. Microbial genetics: conjugation, transduction, transformation.
- 4 Food microbiology: introduction and scope. Morphological, cultural and physiological characteristics: molds, yeasts and yeast like fungi, bacteria.
- 5 Important microbial genera in foods: bacteria, moulds, yeasts, viruses - general, morphological, cultural and physiological characteristics. Factors affecting the growth and survival of microorganisms in food: intrinsic, extrinsic and implicit.
- 6 Contamination and spoilage of perishable, semi perishable and stable foods: sources, transmission, microorganisms.
- 7 Food microbiology and public health: food-borne infections: intoxications.
- 8 Microbiology in food sanitation

#### *Contents (Practical)*

- 1 Safety in microbiological laboratory.
- 2 Basic functions and handling of laboratory equipment. Use of microscope.
- 3 Sterilization and disinfection of glassware. Preparation of culture media. Staining of microorganisms and their structures.
- 4 Bacterial cultivation, growth measurement. Characteristics of bacterial colonies. Bacterial and fungal morphology. Identification and characterization of micro organisms
- 5 Enumeration of microorganisms in food samples

#### *Recommended Texts*

- 1 Frazier, W. C., & Westhoff, D. C. (2008). *Food microbiology*. New York: McGraw Hill Book Co.
- 2 Doyle, M. P., & Buchanan, R. L. (2013). *Food microbiology: fundamentals and frontiers*. New York: ASM Press.

#### *Suggested Readings*

- 1 Bhavbhuti, M. M., Kamal-Eldin, A., Robert, Z., & Iwanski. (2016). *Fermentation: effects on food properties*. London: CRC Press, Taylor and Francis Group.
- 2 Montville, T. J. (2017). *Food microbiology: an introduction*. (4<sup>th</sup> ed.) New York: ASM press.

  
Director  
Institute of Food Science & Nutrition  
University of Agricultural Sciences



This course aims at helping students develop a positive, constructive and practical approach to: Entrepreneurship venture opportunities, innovations, change, fantasies, Environment of small business, sources and resolutions. Risk failure and new venture unit, feasibility of planning and concepts of planning, stages of growth model. The entrepreneur is defined as someone who has the ability and desire to establish, administer, and succeed in a startup venture along with risk entitled to it, to make profits. The best example of entrepreneurship is the starting of a new business venture. The entrepreneurs are often known as a source of new ideas or innovator, and bring new ideas in the market by replacing old with a new invention. This course is designed to help graduate in understanding the importance of new ventures at small scale. Important is to understand the difference between a usual business venture at small scale and entrepreneurship which is need of the modern times.

#### *Contents*

1. Introduction: entrepreneurial perspective,
2. Economics and entrepreneurship,
3. Process, ventures, practices and characteristics.
4. Entrepreneurship and new free enterprise: venture opportunities, innovations, Change, fantasies, environment of small business,
5. Sources and resolutions, corporate entrepreneurship, new venture unit of planning and concepts of planning,
6. Stages of growth model, responsibility of feasibility plan.
7. Product and services concepts and commercial opportunities (macro over view),
8. Products and technology, identification opportunities
9. Product development life cycle, product protection,
10. Trademark and patents, process of patents,
11. Validity of property rights and accessing government information
12. Human resources side of enterprise,
13. Infrastructure of services, types of service venture, success factors.
14. Marketing and new venture development, Marketing research for new ventures,
15. Marketing concepts, startup of marketing research, Market focused on organization, sources of market intelligence,
16. Competitive analysis and implications of market research
17. Marketing strategies and functions, Product concepts, 4 Ps.
18. Entrepreneurial team and business formation

#### *Recommended Texts*

1. Holt, D. H. (1992). *Entrepreneurship: new venture creation*. New Jersey: Prentice Hall.

#### *Suggested Readings*

- 1 Bolton, B. K., & Thompson, J. (2004). *Entrepreneurs: talent, temperament, technique*. (2<sup>nd</sup> ed.) New York: Routledge.

This course is designed for students to understand the development of industrially important fermented food products. After the completion of the course the student will have knowledge about general concept of biotechnology and isolation and preservation of industrially important microorganisms. They also have comprehension about industrial fermentations, legal and social aspects of food biotechnology. While technology generally aims to create tools to empower man, biotechnology aims to change man himself, to better fit him to the world. Biotechnology is the application of advances made in the biological sciences, especially involving the science of genetics and its application.

*Contents (Theory)*

- 1 Biotechnology: introduction, history
- 2 Developments in metabolic and biochemical engineering: metabolites
- 3 Range of fermentation processes
- 4 Components of fermentation processes
- 5 Isolation and preservation of industrially important microorganisms.
- 6 Industrial fermentations: media, design and types of fermenters
- 7 Process variables in fermentation, recovery, purification of fermentation products
- 8 Production of organic acids, Enzymes, amino acids
- 9 Single cell proteins, carotenoids and fermented food products
- 10 GMO in food biotechnology
- 11 Legal and social aspects of food biotechnology

*Contents (Practical)*


1. Isolation of bacterial culture
2. Purification techniques for bacterial culture
3. Maintenance of bacterial cultures
4. Isolation of yeast culture
5. Purification techniques for yeast culture
6. Maintenance of yeast culture
7. Aerobic and anaerobic fermentation
8. Production of various fermented food products

*Recommended Texts*

- 1 El-Mansi, F. M. T., Bryee, C. F. A., Demain, A. L., & Allman, A. R. (2007). *Fermentation microbiology and biotechnology*. Florida: CRC Press, Taylor & Francis Group, Boca Raton.
- 2 Montel, D., & Ramesh, C. R. (2016). *Fermented foods, Part I: biochemistry and biotechnology*. (1<sup>st</sup> ed.) London: CRC Press, Taylor and Francis Group.

*Suggested Readings*

- 1 Otlés, S. (2013). *Probiotics and prebiotics in food, nutrition and health*. London: CRC Press. Taylor and Francis Group.
- 2 Patra, J. K., Das, G., & Shin, H. S. (2018). *Microbial biotechnology: application in food and pharmacology*. Singapore: Springer.

  
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Institute of Food Science & Nutrition  
University of Sarawak, Sarawak

The course is designed to give introductory understanding about the food quality management and sanitation. To introduce basic concepts of quality control and quality assurance, to give an overview of QC/QA in the food industry, to present some statistical quality control tools with applications in the food industry, and to cover up-to-date topics of QC/QA as they relate to food industry and government relations. This course examines food processing systems and food quality management systems. Particular emphasis is on the principles of the various operations including pre-processing, food processing operations and post-processing, as well as on the application of Hazard Analysis Critical Control Point (HACCP) to food production with the aim of producing quality food that meets consumer expectations and food safety standards regulated by the authorities. By completing this course, students will appreciate the principles of food processing and food quality management. Small and medium sized food processing businesses all over the world increasingly have to consider the production of good quality products as essential to their survival. Consumers and buyers are becoming more aware of the importance of safe, high quality products.

#### Contents


- 1 Food quality management: history.
- 2 Food quality management: importance
- 3 Systems of food quality management
- 4 Good manufacturing practices (GMP):
- 5 Personal cleanliness, buildings and facilities,
- 6 Sanitary operations, sanitary facilities and controls, equipment and utensils,
- 7 Production and process control,
- 8 Warehousing and distribution, traceability and recall.
- 9 Hazard analysis and critical control points (HACCP) system: history, prerequisites, preliminary steps, principles.
- 10 Food Safety Management Systems (FSMS) – ISO22000:2005.
- 11 Codex Alimentarius Commission (CAC) guidelines for food quality management.
- 12 Halal audit and certification

#### Recommended Texts

- 1 Luning, P. A., & Marcelis, W. J. (2009). *Food quality management: technological and managerial principles and practices*. Wageningen: Academic Publishers.
- 2 Luning, P. A., Marcelis, W. J., & Jongen, W. M. (2002). *Food quality management: a techno-managerial approach*. Wageningen: Wageningen Pers.

#### Suggested Readings

- 1 Lelieveld, H. L. M., Mostert M. A., & Holah, J. (2005). *Handbook of hygiene control in the food industry*. Cambridge: Woodhead Publishing Ltd.
- 2 CAC. (2007). *Codex alimentarius commission procedural manual*. Rome: Codex Alimentarius Commission, Joint FAO/WHO Food Standards Programme.
- 3 ISO. (2005). *Food safety management systems requirements for an organization in the food chain*. Geneva: International Standards Organization, Switzerland.

  
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The Internship program allows Food Science students to gain practical experience in the workplace before receiving their undergraduate degrees. With employment opportunities increasing in the food processing sector, the industry has increased the demand for skilled professionals. Hence, there is a need of internships for undergraduate students to gain industrial experience and exposure to food processing industry. The students involved in various undergraduate courses of Food Technology are provided with opportunities to get industrial exposure either by their college/university or by their own. Students should get involved in summer trainings provided by various food industries across the country or long term internships (6 months) which provide them an opportunity to learn about the work culture of any industry and do some projects to gain exposure. Students can get involved for internships in R&D, Manufacturing, Quality Control, Sales & Marketing, Teaching and Consulting within the Government etc. The popular sector which can provide internships include Food Manufacturing & Processing (Grains, fruits, vegetables, fish, meat etc.); Bakery & Confectionery Industry; Beverage Industry; Dairy Industry; Poultry Industry; Breweries; FMCG; Pharma-Biotech; Agro-Biotech; Food Supplements and Nutraceuticals; Healthcare; Academia & Research Institutes; Food Packaging Industry; Food Retail.

#### *Contents*


- 1 Every student will undertake practical training in an approved food industry, research organization, food regulatory bodies and hospitals.
- 2 The student will maintain a daily diary duly signed by the industrial/internship supervisor.
- 3 At the end of the internship, the student will submit a written report.
- 4 He/she will be evaluated by a committee on the basis of his/her performance in the industry/research organization, final written report and oral presentation.

#### *Recommended Texts*

- 1 Awan, J. A. (2009). Scientific presentations. Faisalabad: Unitech Communications.

#### *Suggested Readings*

- 1 Murray, N., & Hughes, G. (2008). Writing up your university assignments and research projects: a practical handbook. London: McGraw-Hill Education.
- 2 Anderson, J., Durston, B. H., & Poole, M. (1992). Thesis and assignment writing. New Delhi: Wiley Eastern Ltd.

  
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This course will help to develop and sharpen academic and professional writing and presentation skills and strategies. Writing is a very important part of science; it is used to document and communicate ideas, activities and findings to others. Scientific writing can take many forms from a lab notebook to a project report, or from a paper in an academic journal to an article in a scientific magazine. This guide focuses on scientific writing for academic course work, much of which is devoted to describing and explaining. The aim of science is to generate new and reliable knowledge. If one only applies science, perhaps without doing own research, one should gather and apply state-of-the-art knowledge rather than outdated knowledge. Due to the aim of science, good writing is not a luxury, but an essential skill. It is essential not only for the dissemination of knowledge, but also for creating knowledge: During the writing process one is forced to be precise in all details. It is only during the writing process that gaps in the reasoning or lack of clarity become apparent.

#### *Contents (Theory)*

- 1 Types of scientific presentations
- 2 Collection of literature: printed and electronic sources
- 3 Managing literature.
- 4 How to initiate write up?
- 5 Writing scientific documents.
- 6 Synopsis and Thesis
- 7 Research proposal
- 8 Research and review articles
- 9 How to write references and citations
- 10 Internship report writing
- 11 Oral presentations

#### *Contents (Practical)*


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

#### *Recommended Texts*

- 1 Awan, J. A. (2009). *Scientific presentations*. Faisalabad: Unitech Communications.
- 2 Khalil, S. K., & Shah, P. (2007). *Scientific writing and presentation for crop sciences*. Islamabad: Higher Education Commission of Pakistan.

#### *Suggested Readings*

- 1 Murray, N., & Hughes, G. (2008). *Writing up your university assignments and research projects: a practical handbook*. London: McGraw-Hill Education.
- 2 Anderson, J., Durston, B. H., & Poole, M. (1992). *Thesis and assignment writing*. New Delhi: Wiley Eastern Ltd.

  
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