

**CURRICULUM**  
**OF**  
**HUMAN NUTRITION & DIETETICS**

**BS & BSc**

(Revised 2016)



**HIGHER EDUCATION COMMISSION**  
**ISLAMABAD**

# **CURRICULUM DIVISION, HEC**

Prof. Dr. Mukhtar Ahmed	Chairman, HEC
Mr. Fida Hussain	Director General (Acad)
Ms. Ghayyur Fatima	Director (Curri)
Mr. Rizwan Shoukat	Deputy Director (Curri)
Mr. Abid Wahab	Assistant Director (Curri)
Mr. Riaz-ul-Haque	Assistant Director (Curri)

Composed by: Mr. Zulfiqar Ali, HEC, Islamabad

# Table of Contents

1. Introduction	6
2. Agenda Item	10
3. 4-year Degree Programme Introduction	11
4. Vision, Mission, Scope, Public Sector, Private Sector, Foreign Countries	11
5. Scheme of Studies	14
6. Detail of Courses (Semester-wise)	16
7. Recommendations	66

# PREFACE

The curriculum, with varying definitions, is said to be a plan of the teaching-learning process that students of an academic programme are required to undergo. It includes objectives & learning outcomes, course contents, scheme of studies, teaching methodologies and methods of assessment of learning. Since knowledge in all disciplines and fields is expanding at a fast pace and new disciplines are also emerging; it is imperative that curricula be developed and revised accordingly.

University Grants Commission (UGC) was designated as the competent authority to develop, review and revise curricula beyond Class-XII vide Section 3, Sub-Section 2 (ii), Act of Parliament No. X of 1976 titled “Supervision of Curricula and Textbooks and Maintenance of Standard of Education”. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission (HEC) under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

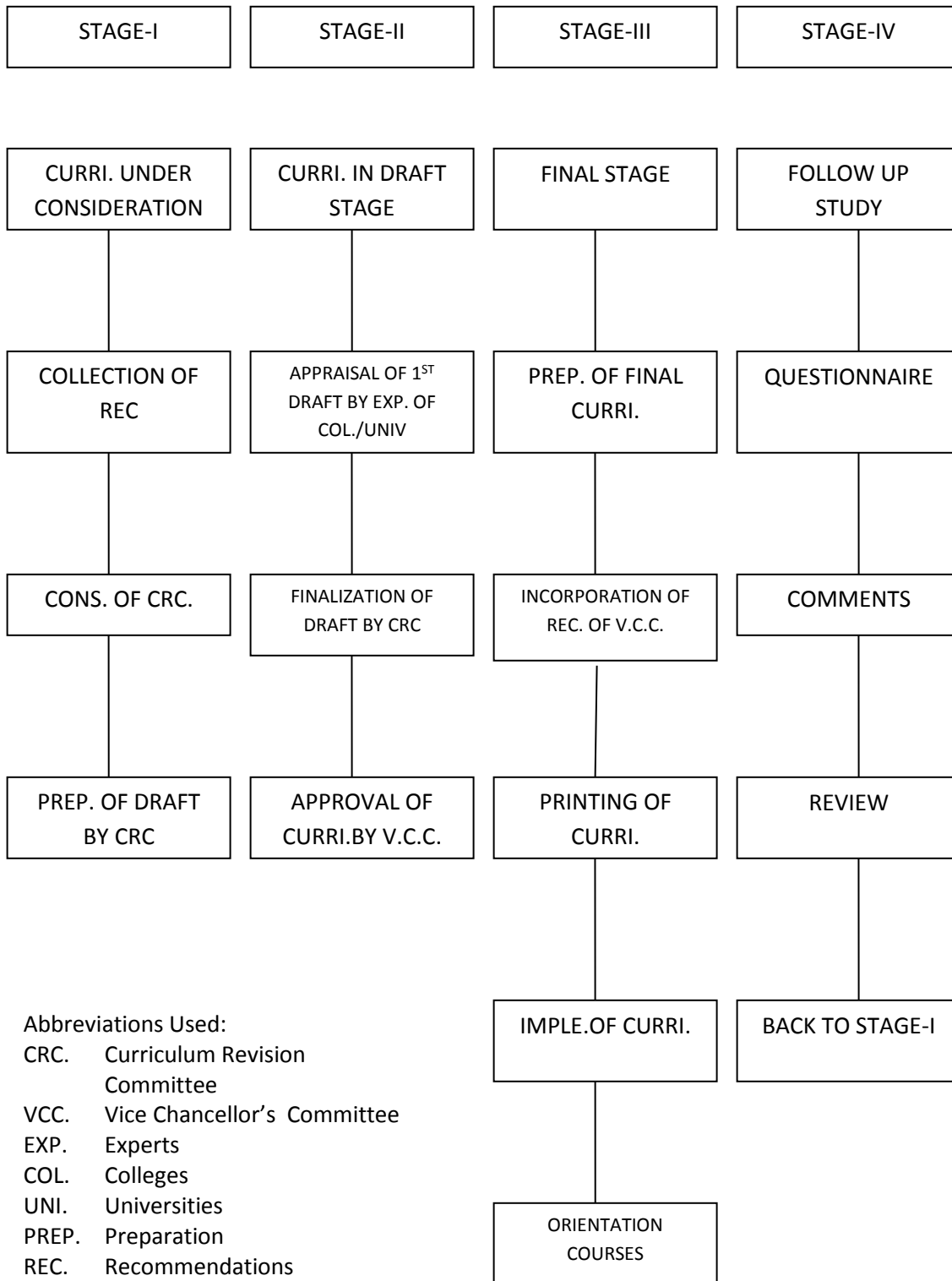
In compliance with the above provisions, the Curriculum Division of HEC undertakes the revision of curricula after every three years through respective National Curriculum Revision Committees (NCRCs) which consist of eminent professors and researchers of relevant fields from public and private sector universities, R&D organizations, councils, industry and civil society by seeking nominations from their organizations.

In order to impart quality education which is at par with international standards, HEC NCRCs have developed unified templates as guidelines for the development and revision of curricula in the disciplines of Basic Sciences, Applied Sciences, Social Sciences, Agriculture and Engineering in 2007 and 2009.

It is hoped that this curriculum document, prepared by the respective NCRC’s, would serve the purpose of meeting our national, social and economic needs, and it would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards. The curriculum is also placed on the website of HEC ([www.hec.gov.pk](http://www.hec.gov.pk)).

**(Fida Hussain)**  
**Director General (Academics)**

# CURRICULUM DEVELOPMENT PROCESS



# INTRODUCTION

The final meeting of NCRC in the discipline of Human Nutrition & Dietetics was held on March 24-26, 2016 at University of Agriculture, Faisalabad. The following experts attended the final NCRC meeting:

1. Prof. Dr. Tariq Masud, Convener  
Professor, Department of Food Technology,  
PMAS Arid Agriculture University,  
Murree Road, Rawalpindi.
2. Dr. Madiha Ilyas, Member  
Assistant Professor,  
Department of Home Economics & Food Science,  
Government College Women University,  
Faisalabad.
3. Ms. Asma Afreen, Member  
Lecturer, Department of Home & Health Science,  
Allama Iqbal Open University,  
Islamabad.
4. Mr. Muhammad Aamir Iqbal, Member  
Lecturer, Department of Food Science and Human Nutrition,  
University of Veterinary and Animal Science,  
Syed Abdul Qadir Jillani Road,  
Lahore.
5. Prof. Dr. Muhammad Laiq Khan, Member  
Medical Nutrition and Dietetics,  
University of Sargodha,  
Sargodha Medical College,  
Sargodha.
6. Dr. Syed Jawwad Hussain, Member  
Head, School of Nutrition & Dietetics,  
The University of Faisalabad, Saleem Campus,  
Sargodha Road,  
Faisalabad.
7. Ms. Sameera Mustafa, Member  
Lecturer/Registered Dietitian,  
Department of Nutrition Sciences,  
University of South Asia, 47 Tufail Road,  
Lahore Cantt.
8. Dr. Muhammad Riaz, Member  
Assistant Professor,  
Institute of Food Science & Nutrition,  
Faculty of Agricultural Sciences & Technology,  
BZU, Multan.

9. Ms. Hafsa Umer, Member  
Lecturer, Department of Food Science & Technology,  
Muhammad Nawaz Shareef University of Agriculture,  
Old Shujabad Road,  
Multan.
10. Prof. Rizwana Muzaffar, Member  
HOD, University Institute of Diet & Nutritional Science,  
The University of Lahore,  
Lahore.
11. Prof. Dr. Masood Sadiq Butt, Member  
Director General,  
National Institute of Food Science & Technology (NIFST),  
University of Agriculture,  
Faisalabad.
12. Prof. Dr. Abdul Hakeem Jokhio, Member  
Department of Community Medicine,  
Peoples University of Medical & Health Sciences for Women,  
Nawabshah, Hospital Road,  
Nawabshah.
13. Dr. Feroz Alam, Member  
Assistant Professor,  
Department of Food Science & Technology,  
University of Karachi,  
Karachi.
14. Prof. Dr. Mahr-un-Nisa, Member  
Chairman,  
Department of Human Nutrition & Dietetics,  
Government College University,  
Faisalabad.
15. Ms. Wajeeha Arshad, Member  
Assistant Professor,  
Department of Home Economics,  
Mirpur University of Science & Technology,  
Mirpur, Azad Kashmir
16. Dr. Sarfraz Ahmad, Member  
Manager, Scientific & Regulatory Authority,  
Engro Foods Limited, the Enterprises Building,  
1 & 2<sup>nd</sup> Floor, Multan Road,  
Lahore.

17. Prof. Dr. Ejaz Mohiuddin, Member  
Principal,  
Hamdard Al-Majeed College of Eastern Medicine,  
Hamdard University, Shahrah-e-Madina-al-Hikmat,  
Karachi
18. Ms. Nasreen Kausar, Member  
Professor,  
Department of Food Science & Nutrition,  
Kinnaird College for Women,  
Lahore.
19. Ms. Shaista Jabeen, Member  
Lecturer,  
University Institute of Diet & Nutritional Sciences,  
University of Lahore,  
Lahore.
20. Dr. M. Khalid Bashir, Member  
Assistant Professor,  
Institute of Agricultural Resources Economics,  
University of Agriculture,  
Faisalabad.
21. Dr. Aamir Shehzad, Member  
Assistant Professor,  
National Institute of Food Science & Technology,  
University of Agriculture,  
Faisalabad
22. Dr. Allah Rakha, Member  
Assistant Professor,  
National Institute of Food Science & Technology,  
University of Agriculture,  
Faisalabad.
23. Dr. Muhammad Sharif, Member  
Assistant Professor,  
Institute of Animal Sciences,  
University of Agriculture,  
Faisalabad.
24. Dr. Muhammad Naeem Faisal, Member  
Assistant Professor,  
Institute of Pharmacy, Physiology and Pharmacology,  
University of Agriculture,  
Faisalabad.



- |     |  |           |
|-----|--|-----------|
| 25. | Miss Hira Iftikhar,<br>Lecturer, Institute of Home Science,<br>University of Agriculture,<br>Faisalabad.   | Member    |
| 26. | Dr. Mian Kamran Sharif,<br>Assistant Professor,<br>National Institute of Food Science & Technology,<br>University of Agriculture,<br>Faisalabad. | Secretary |
| 27. | Ms. Ghayyur Fatima,<br>Director Curriculum,<br>Higher Education Commission, H-9, Islamabad.  |           |

The following experts attended the preliminary NCRC meeting and contributes in the preparation of 1<sup>st</sup> draft of curriculum but could not attend the final meeting due to preoccupation.

1. Mrs. Hajra Ahmed, Assistant Professor, Department of Home & Health Science, Allama Iqbal Open University, Islamabad.
2. Dr. Muhammad Nasir, Assistant Professor/Incharge, Department of Food Science and Human Nutrition, University of Veterinary and Animal Sciences, Lahore.
3. Mrs. Mahnaz Nasir Khan, HoD, Department of Food Science & Human Nutrition, Kinnaird College for Women, Lahore.
4. Dr. Maria Aslam, Senior Lecturer, University Institute of Diet & Nutritional Sciences, University of Lahore, Lahore.
5. Ms. Shaista Jabeen, Lecturer, University Institute of Diet & Nutritional Sciences, University of Lahore, Lahore.
6. Dr. Zia-u-Din, Assistant Professor, Department of Human Nutrition, Faculty of Nutrition Sciences, The University of Agriculture, Peshawar.
7. Dr. Zafar Iqbal, Assistant Professor, Department of Human Nutrition, Faculty of Nutrition Sciences, The University of Agriculture, Peshawar.
8. Dr. Furukh Faiz, Assistant Professor, Department of Food Technology, Karakoram International University, Gilgit.
9. Mr. Shahzad Sikandar, Manager, Corporate Regulatory & Scientific Affairs, Nestle Pakistan Ltd., Upper Mall, Lahore.

## **AGENDA ITEM:**

### **FINAL MEETING OF THE NATIONAL CURRICULUM REVISION COMMITTEE IN HUMAN NUTRITION AND DIETETICS:**

The meeting was started with the recitation of Holy Quran followed by opening remarks by Mrs. Ghayyur Fatima, Director Curriculum, Higher Education Commission, Islamabad. She gave comprehensive presentation about the role of NCRC towards curriculum development of various degree programs in Pakistan. She also presented template of the 4-years degree program encompassing compulsory, general, foundation and major courses, semester-wise distribution and total credit hours of the degree program. Furthermore, she acknowledge the role of University of Agriculture Faisalabad being pioneer institution launching undergraduate degree program in the domain of Human Nutrition & Dietetics as well as holding NCRC meeting at Faisalabad. She also appreciated the active involvement of University allied departments/institutes for their participation in the meeting to help out in the courses and contents related to physiology, anatomy, biochemistry and pathology. Afterwards, Prof. Dr. Masood Sadiq Butt, Director General, National Institute of Food Science & Technology, University of Agriculture, Faisalabad welcomed the participants. On the behalf of University administration he extended thanks to Higher Education Commission Pakistan for choosing University of Agriculture Faisalabad as host of this meeting. He briefed the participants about the start of this degree program during the academic session 2011-12 at University of Agriculture, Faisalabad. He further mentioned that the same degree program has now been replicated in various public and private sector universities of the country with slightly different nomenclature. During preliminary and final meetings the Vice Chancellor University of Agriculture Faisalabad Prof. Dr. Iqrar Ahmad Khan (SI) graced the event through interacting with the participants gathered from all over Pakistan.

Initially, the participants of the meeting introduced themselves and choose Prof. Dr. Tariq Masud as Convener and Dr. Mian Kamran Sharif, Assistant Professor as Secretary for the smooth conduct of the meeting as well as follow up activities. While developing the curricula in Human Nutrition & Dietetics, the existing scheme of studies and detailed contents being offered by different Universities were also discussed and considered. Furthermore, graduate degree programs in the domain were discussed and core courses were identified. There was consensus that after having core competencies, there should be different streams related to clinical nutrition, public health, sports nutrition, food service management etc. to serve the masses in befitting manner. Subsequently, the following recommendations of the meeting were drafted with the consensus of respected participants:

1. There will be 4-years BS/BSc (Hons.) degree program for human nutrition & dietetics under the umbrella of HEC in Pakistan

2. Induction of relevant faculty members including health/medical professionals for medical related courses as per the requirement of the degree
3. Nutrition related institutes need to be strengthened by HEC
4. Nutrition subject should be the part of curriculum at schools/colleges level
5. Induction of nutritionists/dietitians at public and private institutions including hospitals and catering services should be mandatory
6. While enrolling the students, the student-teacher ratio and capacity of the Institute as per HEC rules should be considered
7. Institute offering Human Nutrition & Dietetics should improve counseling, communication, nutritional assessment and diet modification skills among the students to establish the worth of this emerging discipline in Pakistan
8. Establishment of Food and Nutrition Council (FNC) to harmonize and regulate the domain of Human Nutrition & Dietetics in the country

The meeting was concluded with the vote of thanks to the participant by the Director Curriculum, NCRC-HEC and Director General, NIFSAT for their active contribution in the activity. Prof. Dr. Masood Sadiq Butt again extended thanks to Higher Education Commission for holding NCRC meeting at UAF. Mrs. Gayur Fatima, Director Curriculum, Higher Education Commission, Islamabad appreciated the arrangements made by the University of Agriculture Faisalabad related to accommodation and food during the stay of participants.

## 4-Years Degree Program **BS/BSc (Hons.) Human Nutrition & Dietetics**

### **Introduction:**

Pakistani population suffering from a variety of nutritional deficiency disorders ranging from protein-calorie malnutrition to specific micro-nutrients in certain areas of the country. These nutrient deficiencies are propagated by multiple factors like dietary insufficiencies of micronutrients, poor maternal & child health, high burden of morbidity, low levels of micronutrients in the soil, bioavailability issues and have resulted in growth retardation, mental development and various types of physical disabilities. Increasing rate of chronic and acute malnutrition in the country is primarily attributed to poverty, high illiteracy among the mothers, food & nutritional insecurity and lack of cutting edge research to devise local solutions to curb this situation. A large number of infectious diseases such as respiratory and intestinal infections remain responsible for up to 50% of deaths of children under five. Beside micronutrient deficiencies, the incidences of cardiovascular diseases, diabetes, cancer, obesity, hypertension and kidney & liver problems are increasing day by day due to unsafe and poor quality diets. Consequently, malnutrition reduces the GDP by 2-3% that is quite high as compared to the impact of economic crises (2%) and failures in power sector (2%). Likewise, malnourished children are at risk of losing more than 10% of their lifetime earnings potential. Overcoming malnutrition not only improves

productivity but also reduces disease burden and enhances individual & national growth and wellbeing. The present situation demands serious joint efforts with strong political commitment to strengthen the nutritional education, devise proactive interventions for vulnerable population groups such as pregnant and lactating women, young children, elderly and disabled individuals based on indigenous solutions. The long-term and sustainable approach is to prevent and cure diseases with diet management. Realizing the importance of human nutrition in daily life and emergencies like earthquake, drought, famine and man-made disasters, the National Institute of Food Science & Technology at University of Agriculture, Faisalabad started a multidisciplinary and inter-institutional 4-years degree program leading to BSc (Hons.) Human Nutrition and Dietetics in 2011. After the initiation of this degree program, some other Pakistan public and private sector universities also tailored degree programs leading to BS. (Hons.) Nutrition and Dietetics, BS. Food Science and Nutrition, Doctor of Nutrition and Dietetics and B.Sc. (Hons.) Nutrition. The first batch of students enrolled in BSc (Hons.) Human Nutrition & Dietetics passed out in 2015. Most of the students are doing their practice in various clinical settings. Considering the importance of the discipline towards optimum health and management of health disorders, the National Curriculum Revision Committee of Higher Education Commission Pakistan gathered experts across the Pakistan at University of Agriculture Faisalabad in preliminary and final meetings to develop a uniform and up-to-date curricula especially focusing the local as well as global health needs.

**Vision:**

Transformation of human health status through better nutrition and physical activity

**Mission:**

- Discover, disseminate and apply knowledge to promote improved food choices, nutritional status and well-being of the people
- Promote an academically and culturally diverse educational and research environment by providing high-quality nutrition education and skills
- Research for health protection and improvement through judicious intake of food
- Serve the community through participation in nutrition related activities and increasing the awareness at the national and international levels.

**Scope:**

- Nutritionists
- Nutrition Educationists
- Nutrition Consultants
- Dieticians
- Public Health Nutritionists
- Clinical Dieticians
- Food Service Administrators
- Nutrition and Health Expert

- Weight Management Expertise
- Therapeutic Diet Planning

**Public Sector:**

- Public Health Departments
- School Health & Nutrition Programs
- Research and Teaching Institutes
- International Organizations: UNICEF, UNDP, WHO, FAO, World Bank
- Non-Governmental Organizations
- Community Development Program
- Motivational speaker

**Private Sector:**

- Multinational Companies
- Independent Private Practice
- Food Industries
- Pharmaceuticals Industry
- Hospitality industry
- Consultant for Private Companies and Hospitals
- Airlines and Railways Services
- Catering Services
- Health Care Centers

**Foreign Countries:**

- Public health departments in Middle East, Europe etc.
- Independent Private Practice as registered dietitians

## Scheme of Studies

Course No.	Title of Course	Credit Hours
<b>1<sup>st</sup> Semester</b>		
HND	Fundamentals of Human Nutrition	3(3-0) FC
FST	Essentials of Food Science & Technology	3(2-1) FC
Bio/ Math	Mathematics OR Essentials of Biology	3(3-0) GC 3(2-1) GC
Eng	English-I	3(3-0) CC
Biochem	Introductory Biochemistry	3(2-1) GC
SSH	Pakistan Studies	2(2-0) CC
		17 (15-2)
<b>2<sup>nd</sup> Semester</b>		
HND	Macronutrients in Human Nutrition	3(3-0) FC
Eng	English-II	3(3-0) CC
SSH	Islamic Studies/Ethics	2(2-0) CC
Anatomy	Human Anatomy	3(2-1) FC
Physio	Human Physiology-I	3(2-1) FC
Sociology	Fundamentals of Sociology	3(3-0) GC
		17 (14-3)
<b>3<sup>rd</sup> Semester</b>		
HND	Micronutrients in Human Nutrition	3(3-0) FC
Physio	Human Physiology-II	3(2-1) FC
Eng	English-III	3(3-0) CC
PBG/ABG	Introductory Molecular Genetics	3(2-1) GC
FST	Food Microbiology	3(2-1) GC
FST	Food Safety and Quality Management	2(2-0) GC
		17 (14-3)
<b>4<sup>th</sup> Semester</b>		
Stat	Bio-Statistics	3(2-1) CC
CS	Computer Science and Information Technology	3(2-1) CC
HND	Assessment of Nutritional Status	3(2-1) MC
HND	Nutrition Through the Life Cycle	3(3-0) FC
Path	General Pathology	3(2-1) FC
FST	Food Analysis	3(1-2) FC
		18 (12-6)
<b>5<sup>th</sup> Semester</b>		
HND	Dietetics-I	3(2-1) MC
HND	Nutrition and Psychology	3(3-0) MC
HND	Nutritional Education and Awareness	3(2-1) MC
HND	Meal Planning and Management	3(2-1) MC
HND	Public Health Nutrition	3(2-1) MC
FST	Food and Drug Laws	2(2-0) MC
		17 (13-4)
<b>6<sup>th</sup> Semester</b>		
HND	Dietetics-II	3(2-1) MC
HND	Functional Foods and Nutraceuticals	3(3-0) MC
Sociology/HND	Nutrition Through Social Protection	2(2-0) GC

HND	Sports Nutrition	3(2-1) MC
HND	Infant and Young Child Feeding	3(2-1) GC
Biochem	Clinical Biochemistry	3(1-2) GC
		17 (13-4)
<b>7<sup>th</sup> Semester</b>		
HND	Dietetics-III	3(2-1) MC
HND	Global Food Issues	3(3-0) MC
HND	Research Methods in Nutrition	3(3-0) MC
HND	Nutritional Practices in Clinical Care	3(2-1) MC
		12 (10-2)
<b>Elective Courses (2 courses equal to 5 credit hours)</b>		
Elective	Nutritional Immunology	3(3-0) EC
Elective	Drug-Nutrient Interactions	2(2-0) EC
Elective	Food Chemistry	2(2-0) EC
Elective	Preventive Nutrition	3(3-0) EC
Elective	Nutrition in Emergencies	3(3-0) EC
		5(5-0)
<b>8<sup>th</sup> Semester</b>		
HND	Internship/Project	6(0-6) MC
HND	Nutrition Policies and Programs	3(3-0) MC
HND	Food Service Management	3(3-0) MC
		12 (6-6)
<b>Elective Courses (2 courses equal to 5 credit hours)</b>		
Elective	Food Toxins & Allergens	3(3-0) EC
Elective	Nutritional Deficiency Disorders	3(3-0) EC
Elective	Food Supplements	2(2-0) EC
Elective	Metabolism of Nutrients	2(2-0) EC
Elective	Nutrition Epidemiology	2(2-0) EC
		5(5-0)/5(4-1)

**Total Credit Hours = 137**

## DETAIL OF COURSES SEMESTER-WISE

### FIRST SEMESTER

Course No.	Title of Course	Credit Hours
HND	Fundamentals of Human Nutrition	3(3-0) FC
FST	Essentials of Food Science & Technology	3(2-1) FC
Bio/ Math	Mathematics OR Essentials of Biology	3(3-0) GC 3(2-1) GC
Eng	English-I	3(3-0) CC
Biochem	Introductory Biochemistry	3(2-1) GC
SSH	Pakistan Studies	2(2-0) CC
		17 (15-2)

### **HND FUNDAMENTALS OF HUMAN NUTRITION      3(3-0)**

#### **Learning Outcomes:**

- To familiarize with the role of macro- and micro-nutrients in human nutrition
- To understand the absorption, digestion and metabolism of nutrients in the human
- To abreast knowledge about the health disorders due to consumption of non-optimal quantities of the nutrients

#### **Theory:**

Introduction: food, nutrients, nutrition, malnutrition - global and local scenario, diet, balanced diet, food groups, foundations of healthy diet, meal planning; Water: functions, regulation in body, dietary requirements, electrolytes and acid-base balance; Carbohydrates: types, role in body, dietary fiber, bulk and alternative sweeteners, recommended intake and energy value; Fats and oils: types, functions, recommendations concerning fat intake, fat substitutes; Proteins: amino acids, protein synthesis and degradation, classification, functions, quality of proteins, dietary requirements; Vitamins: classification, types, sources, role in body; Mineral elements: types, requirements, sources, role in body; Digestion: alimentary tract, digestive juices, secretions; Absorption and metabolism of nutrients: carbohydrates, protein, lipids; Nutrient and dietary deficiency disorders and special nutrient requirements.

#### **Suggested Readings:**

1. Awan, J.A. 2011. Elements of Food and Nutrition. Unitech Communications, Faisalabad, Pakistan.
2. Bamji, M.S., K. Krishnaswamy and G.N.V. Brahmam. 2009. Textbook of Human Nutrition, 3<sup>rd</sup> ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.



3. Eastwood, M. 2003. Principles of Human Nutrition, 2<sup>nd</sup> ed. John Wiley & Sons, Inc., New York, USA.
4. Geissler, C. and H. Powers. 2011. Human Nutrition, 12<sup>th</sup> ed. Churchill Livingstone, London, UK.

## **FST ESSENTIALS OF FOOD SCIENCE & TECHNOLOGY 3(2-1)**

### **Learning Outcomes:**

- To understand the role of food science & technology towards ensuring food security
- To acquaint knowledge about the food constituents, food classification and spoilage agents
- To comprehend the role of various food processing and preservation methods in shelflife extension and availability of food around the year

### **Theory:**

Introduction: food science and technology, food processing and preservation; Food safety and security; Food sources and global food situation; Food constituents and their functions: water, carbohydrates, lipids, proteins, vitamins and minerals; Food classification based on perishability and pH; Spoilage agents in food: enzymes, microorganisms, insects, rodents, birds and physical factors; Principles of food preservation; Preparatory operations in food processing; Food preservation techniques - high temperature: pasteurization, sterilization, canning; low temperature – refrigeration, freezing; removal of moisture – drying, dehydration; use of chemical additives; fermentation techniques – alcoholic, acetic, lactic; Irradiation technology; food packaging and labelling.

### **Practical:**

Bottling/canning of selected fruits and vegetables; Cold storage of fruits and vegetables; Freezing of fruits and vegetables; Dehydration of fruits and vegetables; Blanching of fruits and vegetables; Use of chemicals in preservation of food products; Preparation of fermented food products – vinegar, preparation; Evaluation of bottled, frozen and dehydrated products.

### **Suggested Readings:**

1. Awan, J.A. and S.U. Rehman. 2011. Food Preservation Manual. Unitech Communications, Faisalabad, Pakistan.
2. Awan, J.A. 2011. Food processing and Preservation. Unitech Communications, Faisalabad, Pakistan.
3. Awan, J.A. 2011. Food Science and Technology. Unitech Communications, Faisalabad, Pakistan.
4. Potter, N.N. and J.H. Hotchkiss. 1995. Food Science, 5<sup>th</sup>ed. The AVI Pub. Co. Inc., Westport, Connecticut, USA.

## BIO ESSENTIALS OF BIOLOGY 3(2-1)

### Learning Outcomes:

- To understand fundamentals of botany and zoology with special reference to their role in food and nutrition
- To study plant morphological characteristics and various animal classes through the dissection of representative plants and animals

### Theory:

**Botany:** Morphology and anatomy of leaf, stem and roots in monocots and dicots; Flowers and inflorescence, their parts and types; Plant systematic, different system of classification and rules of nomenclature; Branches of ecology, their aims and application; Plant communities; Vegetation sampling methods; Ecosystem, its types and components; Food chain and food web; Pollution its types and impact on plants; Metabolic pathways, Light and dark reactions of photosynthesis; Importance of photosynthesis to plant productivity; Respiration, respiratory substrates; Plant water relation, absorption and translocation of water and minerals; Functional role of minerals elements in plants; Growth, role of hormones in plants growth and development; Ethno botany and economic importance of plants.

**Zoology:** Diversity of life; World resources, Classification of animals, Scope of Zoology; Community structure and diversity; Terrestrial and aquatic ecosystem; Ecological problems; Human population growth; Pollution; resource depletion; Approaches to animal behavior; Proximate and ultimate causes; Anthropomorphism; Development of behavior; Learning and control of behavior; Communication; Social behavior; Evolutionary mechanism; Population size, Genetic drift, Gene flow, Mutations, and balanced polymorphism; Species and speciation; Molecular evolution; Mosaic evolution; Protection, Support and Movement in animals; Modes of communication; Endocrine systems and chemical messengers; Circulation, Immunity and gas exchange, Nutrition and Digestion; Temperature and body fluid regulations, Reproduction and development in animals.

### Practical:

Study of the morphology of selected ten monocot and plant species; Identification and technical description of common flowering plants belonging to ten families; Extraction of chlorophyll from the leaves and study of absorption spectra using spectrophotometer; Field observation and report writing on animals and their behavior in terrestrial and aquatic ecosystems; Study of insect cuticle, fish scales, amphibian skin, feathers and mammalian skin; Study of heart, principal arteries and veins in a representative vertebrates (dissection of representative amphibian/fish/mammal).

### Suggested Readings:

1. Campbell, N.A. 2002. Biology, 6<sup>th</sup> ed. Benjamin/Cumming Publishing Company, Inc., USA.

2. Evert, R.F. and S.E. Eichhorn. 2006. *Esau's Plant Anatomy: Meristems, Cells, and Tissues of Plant Body: Their Structure, Function and Development*, 3<sup>rd</sup> Ed. John Wiley & Sons, New Jersey, USA.
3. Hickman, C.P., L.S. Roberts and A. Larson. 2008. *Integrated Principles of Zoology*, 13<sup>th</sup> ed. McGraw-Hill, USA.
4. Kent, G.C. and S. Miller. 2008. *Anatomy of Vertebrates*. McGraw-Hill, USA.
5. Mauseth, J.D. 1998. *An Introduction to Plant Biology: Multimedia Enhanced*. Jones and Bartlett Publishers, UK.
6. Pechenik, J.A. 2006. *Biology of Invertebrates*, 4<sup>th</sup> ed. McGraw-Hill, USA.
7. Taiz, L. and Zeiger, E. 2010. *Plant Physiology*, 5<sup>th</sup> ed. Sinauer Associates Inc., Sunderland, Massachusetts, USA.

## **MATH      MATHEMATICS      3(3-0)**

### **1.      MATHEMATICS I (ALGEBRA)**

**Prerequisite(s):** Mathematics at secondary level

**Credit Hours:**      3 + 0

#### **Specific Objectives of the Course:**

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.

#### **Course Outline:**

*Preliminaries:* Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions. *Matrices:* Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer's rule.

*Quadratic Equations:* Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.

*Sequences and Series:* Arithmetic progression, geometric progression, harmonic progression. *Binomial Theorem:* Introduction to mathematical induction, binomial theorem with rational and irrational indices. *Trigonometry:* Fundamentals of trigonometry, trigonometric identities.

#### **Recommended Books:**

1. Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin, Boston (suggested text)
2. Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
3. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6<sup>th</sup> edition), 1986, PWS-Kent Company, Boston

## 2. MATHEMATICS II (CALCULUS)

**Prerequisite(s):** Mathematics I (Algebra)

**Credit Hours:** 3 + 0

### **Specific Objectives of the Course:**

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

### **Course Outline:**

*Preliminaries:* Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities. *Limits and Continuity:* Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

*Derivatives and their Applications:* Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.

*Integration and Definite Integrals:* Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

### **Recommended Books:**

1. Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8<sup>th</sup> ed.), 2005, John Wiley, New York
2. Stewart J, *Calculus* (3<sup>rd</sup> ed.), 1995, Brooks/Cole (suggested text)
3. Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston
4. Thomas GB, Finney AR, *Calculus* (11<sup>th</sup> ed.), 2005, Addison-Wesley, Reading, Ma, USA

## **English I (Functional English)**

**Credit Hrs. 3(3-0)**

### **Objectives:**

Enhance language skills and develop critical thinking.

### **Course Contents:**

Basics of Grammar  
Parts of speech and use of articles  
Sentence structure, active and passive voice  
Practice in unified sentence  
Analysis of phrase, clause and sentence structure  
Transitive and intransitive verbs  
Punctuation and spelling

### **Comprehension:**

Answers to questions on a given text

**Discussion:**

General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

**Listening:**

To be improved by showing documentaries/films carefully selected by subject teachers

**Translation skills****Urdu to English****Paragraph writing:**

Topics to be chosen at the discretion of the teacher

**Presentation skills:**

Introduction

*Note: Extensive reading is required for vocabulary building*

**Recommended Books:****1. Functional English****a) Grammar**

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

**b) Writing**

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

**c) Reading/Comprehension**

1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

**d) Speaking****BIOCHEM INTRODUCTORY BIOCHEMISTRY 3(2-1)****Learning Outcomes:**

- To acquaint knowledge about the nomenclature, structures and properties of chemical constituents
- To grasp the knowledge about the energy yielding cycle like glycolysis, Kerbs cycle,  $\beta$ -oxidation etc.

**Theory:**

Introduction, scope and importance of biochemistry; Brief introduction of prokaryotic and eukaryotic cells; Bio-macromolecules: composition and

organization; Energy and Principles of bioenergetics; Water: Properties of water, acid/base properties, dissociation of water and pH value, pH buffering capacity, transportation mechanisms across bio-membranes and osmosis, Proteins: Amino acids - structure, nomenclature, classification, Primary structure of proteins - peptide bond, sequencing, synthesis, Secondary structure -  $\alpha$ -helices,  $\beta$ -sheets, Three dimensional structure of proteins, methods for protein structural determination - X-ray, NMR and homology modeling, tertiary and quaternary structures of proteins, protein denaturation, Methods for purifying and studying proteins; Enzymes: functions, mode of action, specificity and inhibition, classification and nomenclature, factors affecting enzymes activity; Introduction to carbohydrates (Glycobiology): biosynthesis, metabolism, glycolysis, Kerbs cycle, Mitochondrial electron transport chain and ATP synthesis; Lipids: introduction, lipogenesis, lipids and lipoproteins in relation to lipid storage diseases, sterol and steroids; Overview of nucleic acids.

### **Practical:**

Model visualization of prokaryotic and eukaryotic cells; Solution preparation; Preparation of different buffers and their pH adjustment; Activity of different enzymes like amylase in saliva; Enzyme purification; DNA extraction; Gel electrophoresis; Determination of amino acid profile using HPLC/Amino acid analyzer; Energy estimation through Bomb Calorimeter.

### **Suggested Readings:**

1. Ahmad, M. 2000. Essentials of Medical Biochemistry, 7<sup>th</sup> ed. Ilmi Book House, Urdu Bazar, Lahore.
2. Nelson, D.L. and M.M. Cox. 2013. Lehninger Principles of Biochemistry, 6<sup>th</sup> ed. W.H. Freeman & Co Ltd., New York, USA.
3. Rodwell, V.W., D.A. Bender, K.M. Botham, P.J. Kennelly and P.A. Weil. 2012. Harper's Illustrated Biochemistry, 30<sup>th</sup> ed. The McGraw-Hill Education, New York, USA.

## **SSH PAKISTAN STUDIES (Compulsory)**

**Credit hours 2 (2-0)**

### **Introduction/Objectives**

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

### **Course Outline:**

#### **1. Historical Perspective**

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
  - i. Indus Civilization

- ii. Muslim advent
  - iii. Location and geo-physical features.
2. **Government and Politics in Pakistan**  
Political and constitutional phases:
    - a. 1947-58
    - b. 1958-71
    - c. 1971-77
    - d. 1977-88
    - e. 1988-99
    - f. 1999 onward
  3. **Contemporary Pakistan**
    - a. Economic institutions and issues
    - b. Society and social structure
    - c. Ethnicity
    - d. Foreign policy of Pakistan and challenges
    - e. Futuristic outlook of Pakistan

### **Recommended Books:**

1. Burki, Shahid Javed. *State & Society in Pakistan*, The MacMillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S.M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Bangladesh*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.
7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: WmDawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Aziz, K.K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

## SECOND SEMESTER

Course No.	Title of Course	Credit Hours
HND	Macronutrients in Human Nutrition	3(3-0) FC
Eng	English-II	3(3-0) CC
SSH	Islamic Studies/Ethics	2(2-0) CC
Anatomy	Human Anatomy	3(2-1) FC
Physio	Human Physiology-I	3(2-1) FC
Sociology	Fundamentals of Sociology	3(3-0) GC
		17 (14-3)

### **HND MACRONUTRIENTS IN HUMAN NUTRITION 3(3-0)**

#### **Learning Outcomes:**

- To abreast knowledge about the normal nutrient metabolism in healthy human
- To understand interactions between the intake, absorption, transport, processing, storage, catabolism and excretion of nutrients and the regulation of metabolic homeostasis in the intact organism

#### **Theory:**

Carbohydrates: nature, structures; Classification and functions of carbohydrates: monosaccharaides, disaccharides, oligosaccharides, polysaccharaides; Digestion and absorption of carbohydrates: glycolitic pathway, glycolysis, glycogenesis, glycogen catabolism, tricarboxylic acid cycle and pentose phosphate pathway; Biosynthesis of carbohydrates: gluconeogenesis; Regulation of carbohydrate metabolism pathways; CHO metabolism in diabetes; Proteins: structural features, characteristics, functions; Amino acids: biosynthesis and degradation, food sources (on the basis of their functions in human body);. Digestion and absorption; Metabolic fates of amino acids: deamination, transamination, Urea cycle, Ketogenic amino acids, Glucogenic amino acids, Protein metabolism in liver and kidney diseases, Protein energy malnutrition; Lipids – nature, classification; Fatty acids: saturated, unsaturated, polysaturated, glycerol, cholesterol, sterol; Lipoprotein systems (blood lipids); Fats biosynthesis: lipids, phospholipids and sphingolipids; Lipid biosynthesis: cholesterol, sterol; Lipid oxidation; Essential fatty acids: sources, health benefits; Adipose tissues; Digestion, absorption, metabolism and transportation of lipids; Oxidation of fatty acids (beta oxidation); Ketone bodies.

#### **Suggested Readings:**

1. Berdanier, C.D. and J. Zempleni. 2009. Advances Nutrition: Macronutrients, micronutrients and Metabolism. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
2. Byrd-Bredbenner, C., G. Moe, D. Beshgetoor and J. Berning. 2015. Wardlaw's Perspectives in Nutrition, 10<sup>th</sup> ed. McGraw-Hill Education, Columbus, OH, USA.



3. David L.N., A.L. Lehninger and M.M. Cox. 2013. Lehninger Principles of Biochemistry, 6<sup>th</sup> ed. W.H. Freeman and Company, New York.
4. Gropper, S.S. and J.L. Smith JL. 2013. Advanced Nutrition and Human Metabolism, 6<sup>th</sup> ed. Cengage Learning, Belmont, CA, USA.

## **English II (Communication Skills)**

**Credit Hrs. 3(3-0)**

### **Objectives:**

Enable the students to meet their real life communication needs.

### **Course Contents:**

#### **Paragraph writing**

Practice in writing a good, unified and coherent paragraph

#### **Essay writing**

Introduction

#### **CV and job application**

Translation skills

Urdu to English

#### **Study skills**

Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

#### **Academic skills**

Letter/memo writing, minutes of meetings, use of library and internet

#### **Presentation skills**

Personality development (emphasis on content, style and pronunciation)

*Note: documentaries to be shown for discussion and review*

### **Recommended Books:**

#### **Communication Skills:**

- a) Grammar
  1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
- b) Writing
  1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
  2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
- c) Reading
  1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

2. Reading and Study Skills by John Langan
3. Study Skills by Riachard Yorky.

**SSH                    ISLAMIC STUDIES/ETHICS                    Credit hours 2 (2-0)**  
**(Compulsory)**

**Objectives:**

This course is aimed at:

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

**Detail of Courses:**

**Introduction to Quranic Studies**

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul -Quran

**Study of Selected Text of Holly Quran**

- 1) Verses of Surah Al-Baqra Related to Faith(Verse No-284-286)
- 2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
- 3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
- 4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
- 5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

**Study of Selected Text of Holly Quran**

- 1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
- 2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
- 3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No-1,14)

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

- 1) Life of Muhammad Bin Abdullah ( Before Prophet Hood)
- 2) Life of Holy Prophet (S.A.W) in Makkah
- 3) Important Lessons Derived from the life of Holy Prophet in Makkah

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

- 1) Life of Holy Prophet (S.A.W) in Madina
- 2) Important Events of Life Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

**Introduction to Sunnah**

- 1) Basic Concepts of Hadith
- 2) History of Hadith

- 3) Kinds of Hadith
- 4) Uloom –ul-Hadith
- 5) Sunnah & Hadith
- 6) Legal Position of Sunnah

### **Selected Study from Text of Hadith**

#### **Introduction to Islamic Law & Jurisprudence**

- 1) Basic Concepts of Islamic Law & Jurisprudence
- 2) History & Importance of Islamic Law & Jurisprudence
- 3) Sources of Islamic Law & Jurisprudence
- 4) Nature of Differences in Islamic Law
- 5) Islam and Sectarianism

#### **Islamic Culture & Civilization**

- 1) Basic Concepts of Islamic Culture & Civilization
- 2) Historical Development of Islamic Culture & Civilization
- 3) Characteristics of Islamic Culture & Civilization
- 4) Islamic Culture & Civilization and Contemporary Issues

#### **Islam & Science**

- 1) Basic Concepts of Islam & Science
- 2) Contributions of Muslims in the Development of Science
- 3) Quran & Science

#### **Islamic Economic System**

- 1) Basic Concepts of Islamic Economic System
- 2) Means of Distribution of wealth in Islamic Economics
- 3) Islamic Concept of Riba
- 4) Islamic Ways of Trade & Commerce

#### **Political System of Islam**

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

#### **Islamic History**

- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

#### **Social System of Islam**

- 1) Basic Concepts of Social System of Islam
- 2) Elements of Family
- 3) Ethical Values of Islam

#### **Reference Books:**

- 1) Hameed ullah Muhammad, "Emergence of Islam" , IRI, Islamabad
- 2) Hameed ullah Muhammad, "Muslim Conduct of State"
- 3) Hameed ullah Muhammad, 'Introduction to Islam
- 4) Mulana Muhammad Yousaf Islahi,"

- 5) Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law” leaf Publication Islamabad, Pakistan.
- 6) Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
- 7) Mir Waliullah, “Muslim Jurisprudence and the Quranic Law of Crimes” Islamic Book Service (1982)
- 8) H.S. Bhatia, “Studies in Islamic Law, Religion and Society” Deep & Deep Publications New Delhi (1989)
- 9) Dr. Muhammad Zia-ul-Haq, “Introduction to Al Sharia Al Islamia” Allama Iqbal Open University, Islamabad (2001)

**Anatomy      HUMAN ANATOMY                      3 (2-1)**

**Learning Outcomes:**

- To acquaint knowledge about structural components of body
- To know about histology and blood composition for the identification of diseases

**Theory:**

Introduction: gross anatomy, histology; Terminology: bones & joints, muscles, cartilage, body structure, tissue, cell, organs; Digestive system: oral cavity, stomach, small & large intestine; Urinary system/ excretory: kidneys, ureter, bladder, urethra; Cardio-vascular system: heart and Pericardium, Arteries system, venous system/ Major arteries & veins; Respiratory system: Upper respiratory- Pharynx, Larynx, Trachea sinuses; Lower respiratory- Bronchus, Lungs, Diaphragm; Reproduction system: Male-Testis, Spermatic cord, Penis, Prostate, Bulbourethral gland/ other glands; Female: Ovaries, Fallopian tubes, Uterus, Vagina, Vulva, Breast; Endocrinology: Pituitary, Thyroid, Parathyroid, Thymus, Adrenal, Renal, super renal; Lymphatic system: Lymph, Lymph vessel, lymph node; Nervous system: Brain, Spinal cord, Cranial nerves, Brachial plexus, Sciatic nerve; Sensory organs: Eyes, Ears, Taste buds, Smell, Touch.

**Practical:**

Four primary tissues of body - Epithelium tissues: Introduction, types, epithelial glands - endocrine & exocrine, connective tissues: loose connective tissue, collagenous, elastic and reticular fiber; Te-cell of loose cartilage (fibroblast, fat cell, plasma cell, macrophages, mast cell); Blood: leukocytes, WBC, RBC & Platelets; Cartilage and its types; Muscle and its types; Histology in: GIT, respiratory, urinary systems, breast, uterus. Microscopy and preparation of histological slides.

**Suggested Readings:**

1. Agur, M.R. and F.D. Arthur. 2009. Grant's Atlas of Anatomy. Lippincott Williams and Wilkins, New York, U.S.A.
2. David, C. 2007. Anatomy of Hatha Yoga: A Manual for Students, Teachers and Practitioners. National Banarisdass Publishers (Pvt.) Ltd., New Delhi, India.

3. Gerard, J. T. and T.N. Mark. 2009. Principles of Human Anatomy. John Wiley and Sons, Inc., New York, USA.
4. Marsh, P. 1920. The Fundamentals of Human Anatomy. C.V. Mosby Publisher, St. Louis MO, USA.

**Physio      HUMAN PHYSIOLOGY–I                      3 (2-1)**

**Learning Outcomes:**

- To familiarize about the functions of different body organs
- To understand risk parameters related to assessment and prognosis of different diseases

**Theory:**

Introduction to human physiology, organization level and cell physiology; Digestive system: oral cavity, salivary glands, teeth, tongue; oesophagus, pharynx, larynx, stomach, small intestine, large intestine, accessory glands associated with GIT (liver, gallbladder and pancreas); Urinary system: introduction, functions of kidney and nephron, Glomerular filtration, tubular reabsorption, tubular secretion, urine excretion and plasma clearance, fluid and acid base balance; Cardiovascular system: functions of heart and blood vessels, electrical activity of heart, mechanical events of heart, cardiac output and its control.

**Practical:**

Blood grouping; Hb estimation; Counting of blood cells; complete blood count (CBC); Electrolyte estimation; Hydration test; Determination of coagulation time, blood pressure, pulse recording; Heart activity – electrocardiography; Test for saliva; Respiratory movement, maximum breathing capacity, pulmonary function test; Intestinal motility; Renal function tests and urine analysis.

**Suggested Readings:**

1. Gillian, P. and C.D. Richards. 2006. Human Physiology: The Basis of Medicine, 3<sup>rd</sup> ed. Oxford University Press, London.
2. Guyton A.C. and J.E. Hall. 2006. Textbook of Medical Physiology, 11<sup>th</sup> ed. J.F. Kennedy Blvd., Philadelphia, USA.
3. Rahman, Z.U., B. Aslam, J.A. Khan and T. Khaliq. 2007. Manual of Physiology-I, 2<sup>nd</sup> ed. MAS Computers, Faisalabad, Pakistan.
4. Rahman, Z.U., B. Aslam, Khan, J.A. and T. Khaliq. 2007. Manual of Physiology-II, 2<sup>nd</sup> ed. MAS Computers, Faisalabad, Pakistan.
5. Tortora, G.J. 2008. Principles of Anatomy and Physiology, 12<sup>th</sup> ed. John Wiley & Sons, Inc., New York, USA.

**Sociology      FUNDAMENTALS OF SOCIOLOGY                      3 (3-0)**

????????????????????

## THIRD SEMESTER

Course No.	Title of Course	Credit Hours
HND	Micronutrients in Human Nutrition	3(3-0) FC
Physio	Human Physiology-II	3(2-1) FC
Eng	English-III	3(3-0) CC
PBG/ABG	Introductory Molecular Genetics	3(2-1) GC
FST	Food Microbiology	3(2-1) GC
FST	Food Safety and Quality Management	2(2-0) GC
		17 (14-3)

### **HND            MICRONUTRIENTS IN HUMAN NUTRITION            3 (3-0)**

#### **Learning Outcomes:**

- To understand the functional roles of vitamins and minerals in human nutrition with special reference to metabolism
- To familiarize with the deficiency symptoms and health disorders associated with improper intake of vitamins and minerals
- To analyze losses of micronutrients during food processing

#### **Theory:**

Vitamins: nomenclature, history, development of the vitamins concept; Fat and water soluble vitamins: sources, chemistry, absorption, transport and storage, metabolism, function, deficiency, bioassay, interaction with other nutrients, recommended daily allowances and toxicities; Diagnosis, treatments and prevention of vitamin deficiencies in human; Stability of vitamins under different storage conditions; Vitamin like compounds; Losses of vitamin during food processing; Minerals: types, history and developments of the minerals concept; Criteria of essentiality of minerals and their classification; Minerals distribution in human body; Macro- and micro-minerals: dietary sources, absorption, metabolism, metabolic function, deficiency symptoms and disorders, recommended daily allowances, diagnosis, treatments and prevention of mineral deficiencies in human; Water and electrolytes.

#### **Suggested Readings:**

1. Allen, L. 2006. Guidelines on Food Fortification with Micronutrients. World Health Organization, Geneva, Switzerland.
2. Bender, D.A. 2009. Nutritional Biochemistry of Vitamins, 2<sup>th</sup> ed. Cambridge University Press, Cambridge, UK.
3. DiSilvestro, R.A. 2004. Handbook of Minerals as Nutritional Supplements. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
4. Gropper, S.S. and Smith, J.K. 2012. Advanced Nutrition and Human Metabolism, 6<sup>th</sup> ed. Wadsworth Cengage Learning, Belmont, CA, USA.

**Learning Outcomes:**

- To understand the functions of respiratory, endocrine, nervous, immune and reproductive systems
- To acquaint knowledge about hormonal and neural interactions on metabolism

**Theory:**

Respiratory system: respiratory mechanics, gas transport and exchange mechanisms, control of respiration, respiratory capacities and volumes, non-respiratory functions of lungs; Immune system and lymphatic system: body defence system and regulation; Endocrinology and reproduction: reproductive physiology, role of hormones in spermatogenesis, menstrual cycles and pregnancy, energy balance and temperature regulation; Nervous system: principles of neuronal and hormonal communication systems, functional organization of nervous system, central, peripheral and autonomic nervous system, action potentials, types of neurotransmitters and their role in pathophysiological integration in body; Musculoskeletal system: principles of neuromuscular physiology.

**Practical:**

Demonstration of the location of endocrine glands in laboratory animal; Adrenalectomy and the effect of adrenaline on metabolism in rats; Effect of adrenaline on metabolism; Nerve muscle preparation, effect of temperature on single muscle twitch, muscle and nerve irritability, neuromuscular fatigue, normal heart activity; Hormonal assay: digestive, growth & reproductive.

**Suggested Readings:**

1. Brar, R.S., H.S. Sandhu and A. Singh. 2002. Veterinary Clinical Diagnosis by Laboratory Methods. Kalyani Publishers Ludhiana, New Delhi, India.
2. Gillian, P. and C.D. Richards. 2006. Human Physiology: The Basis of Medicine, 3<sup>rd</sup> ed. Oxford University Press, London.
3. Guyton A.C. and J.E. Hall. 2006. Textbook of Medical Physiology, 11<sup>th</sup> ed. J.F. Kennedy Blvd., Philadelphia, USA.
4. Rahman, Z.U., B. Aslam, J.A. Khan and T. Khaliq. 2007. Manual of Physiology-I&II, 2<sup>nd</sup> ed. MAS Computers, Faisalabad, Pakistan.
5. Tortora, G.J. 2008. Principles of Anatomy and Physiology, 12<sup>th</sup> ed. John Wiley & Sons, Inc., New York, USA.

# English III (Technical Writing and Presentation Skills)

Credit hours 3(3-0)

## Objectives:

Enhance language skills and develop critical thinking

## Course Contents:

### Presentation skills

### Essay writing

Descriptive, narrative, discursive, argumentative

### Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

### Technical Report writing

### Progress report writing

*Note: Extensive reading is required for vocabulary building*

## Recommended Books:

Technical Writing and Presentation Skills:

- a) Essay Writing and Academic Writing
  1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
  2. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.
  3. Patterns of College Writing (4<sup>th</sup> edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- b) Presentation Skills
- c) Reading

The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharon. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

**PBG/ABG INTRODUCTORY MOLECULAR GENETICS 3 (2-1)**

????????????????



## **FST FOOD MICROBIOLOGY 3 (2-1)**

### **Learning Outcomes:**

- To identify various types of microorganisms on the basis of morphological, cultural and physiological characteristics
- To grasp knowledge about the microbial contamination of foods and factors affecting the growth of microorganisms
- To familiarize students about food borne infections, intoxications and role of probiotics in our daily life

### **Theory:**

Food microbiology: introduction and scope; Important microbial genera in foods: bacteria, mold, yeast and yeast like fungi, viruses general, morphological, cultural and physiological characteristics; Factors affecting the growth and survival of microorganisms in food: intrinsic, extrinsic and implicit; Contamination and spoilage of perishable, semi perishable and stable foods: sources, transmission, microorganisms; Food microbiology and public health: food-borne infections: intoxications; Microbiological risk assessment; Microbiology in food sanitation: food sanitizers and pathogen reduction a case study; Food fermentation; Probiotics in human health.

### **Practical:**

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

### **Suggested Readings:**

1. Adams, M.R. and M.O. Moss. 2006. Food Microbiology. The Royal Society of Chemistry, Cambridge, UK.
2. Adams, M.R., M.O. Moss and P. McClure. 2016. Food Microbiology, 4<sup>th</sup> ed. Royal Society of Chemistry, Cambridge, UK.
3. Brown, M. and M. Stringer. 2002. Microbiological risk assessment in food processing. Woodhead Publishing Ltd. Cambridge, UK.
4. Frazier, W.C., D.C. Westhoff and K.N. Vanitha. 2013. Food Microbiology, 5<sup>th</sup> ed. McGraw-Hill Book Co., New York, USA.
5. Montville, T.J., K.R. Mathews and K.E. Kniel. 2012. Food microbiology: an introduction, 3<sup>rd</sup> ed. ASM Press, Washington DC, USA.
6. Ray, B. and A. Bhunia. 2013. Fundamentals of Food microbiology, 5<sup>th</sup> ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.

## **FST FOOD SAFETY AND QUALITY MANAGEMENT 2 (2-0)**

### **Learning Outcomes:**

- To understand principles lying under safety and quality of foods to ensure their safe production

- To implement the food safety and quality management systems in a food business in a precise and systematic way

### Theory:

Food safety, security and quality: definitions and importance; Different terminologies used in food safety & quality; Categories of hazards: Physical, chemical, biological. Good manufacturing practices; Good storage practices; Plant design layout; Global Food Safety Initiative; Global Food Safety Systems: HACCP, BRC, FSSC 22000, ISO 22000; Quality Management System (ISO 9001:2008); Food safety laws in Pakistan—West Pakistan Pure Foods Ordinance 1960, Cantonments Pure Food Ordinance Act 1966, West Pakistan Pure Food Rules 1965, The Punjab Pure Food Rules 2007 & 2011.

### Suggested Readings:

1. Ali, I. 2003. Food Quality Assurance: Principles and Practices. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
2. David A.S. and F.S. Norah. 1998. Principles and Practices for the Safe Processing of Foods. Woodhead Publishing Limited, Cambridge, England.
3. Early, R. 1995. Guide to Quality Management Systems for the Food Industry. Springer Science + Business Media, LLC., New York, USA.
4. Motarjemi, Y and Lelieveld, H. 2014. Food Safety Management: A Practical Guide for the Food Industry. Academic Press, Elsevier Inc., San Diego, CA, USA.
5. Sun, D. 2012. Handbook of Food Safety Engineering. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
6. Theuvsen, L., A. Spiller, M. Peupert and G. Jahn. 2007. Quality Management in Food Chains. Wageningen Academic Publishers, The Netherlands.

## FOURTH SEMESTER

Course No.	Title of Course	Credit Hours
Stat	Bio-Statistics	3(2-1) CC
CS	Computer Science and Information Technology	3(2-1) CC
HND	Assessment of Nutritional Status	3(2-1) MC
HND	Nutrition Through the Life Cycle	3(3-0) FC
Path	General Pathology	3(2-1) FC
FST	Food Analysis	3(1-2) FC
		18 (12-6)

### Statistics-I

**Credit 3 (2-1)**

Definition and importance of Statistics in Agriculture, Data Different types of data and variables

Classification and Tabulation of data, Frequency distribution, stem-and-Leaf diagram, Graphical representation of data Histogram, frequency polygon, frequency curve.

Measure of Central tendency, Definition and calculation of Arithmetic mean, Geometric mean, Harmonic mean, Median quantiles and Mode in grouped and un-grouped data.

Measure of Dispersion, Definition and Calculation of Range, quartile deviation, Mean deviation, Standard deviation and variance, coefficient of variation.

**Practical:**

- a. Frequency Distribution
- b. Stem-and-Leaf diagram
- c. Various types of Graphs
- d. Mean, Geometric mean Harmonic Mean,
- e. Median, Quartiles Deviation, mean Deviation.
- f. Standard Deviation, Variance, Coefficient of variation,
- g. Skewness and kenosis

**Recommended Books:**

1. Introduction to Statistical Theory Part- I by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Statistical Methods and Data Analysis by Dr. Faquir Muhammad
3. A. Concise Course in A. Level Statistic with world examples by J. Crashaw and J. Chambers (1994)
4. Basic Statistics an Inferential Approach 2<sup>nd</sup> ed. (1986) Fran II. Dietrich-II and Thomas J. Keans

**Statistics-II**

**Credit 3 (2-1)**

Sampling Probability and non-Probability Sampling, Simple random sampling stratified random sampling Systematic sampling error, Sampling distribution of mean and difference between two means. Interference 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, Test of association of attributes using X<sup>2</sup> (chi-square) Testing hypothesis about variance.

**Practical:**

- a. Sampling random sampling
- b. Stratified random sampling.
- c. Sampling distribution of mean
- d. Testing of hypotheses regarding population mean
- e. Testing of hypotheses about the difference between population means
- f. Chi-square test
- g. Testing of Correlation Coefficient
- h. Fitting of simple linear regression
- i. One-way ANOVA
- j. Two-way ANOVA

## **Recommended Books:**

1. Introduction to Statistical Theory Part-II by Sher Muhammad and Dr. Shahid Kamal (Latest Edition)
2. Statistical Methods and Data Analysis by Dr. Faquir Muhammad
3. Principles and Procedures of Statistics A Bio-material approach, 2<sup>nd</sup> ed., 1980 by R. G. D Steal and James H. Tarric
4. Statistical Procedures for Agricultural Research 2<sup>nd</sup> ed.,(1980) by K. A. Gomez and A. A. Gomez

## **Introduction to Information and Communication Technologies**

**Course Structure:** Lectures: 2 Labs: 1 **Credit Hours: 3**  
**Pre-requisite:** None **Semester: 1**

### **Course Description:**

This is an introductory course on Information and Communication Technologies. Topics include ICT terminologies, hardware and software components, the internet and World Wide Web, and ICT based applications.

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

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

### **Course Contents:**

Basic Definitions & Concepts

Hardware: Computer Systems & Components

Storage Devices, Number Systems

Software: Operating Systems, Programming and Application Software

Introduction to Programming, Databases and Information Systems

Networks

Data Communication

The Internet, Browsers and Search Engines

The Internet: Email, Collaborative Computing and Social Networking

The Internet: E-Commerce

IT Security and other issues

Project Week

Review Week

### **Textbooks/Reference Books:**

1. Introduction to Computers by Peter Norton, 6th International Edition, McGraw-Hill
2. Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, 6<sup>th</sup> ed., McGraw-Hill
3. Computers, Communications & information: A user's introduction by Sarah E. Hutchinson, Stacey C. Swayer
4. Fundamentals of Information Technology by Alexis Leon, Mathews Leon, Leon Press.

### **HND ASSESSMENT OF NUTRITIONAL STATUS 3 (2-1)**

#### **Learning Outcomes:**

- To impart hands-on training in nutritional assessment techniques to diagnose health problems
- To understand and apply dietary guidelines for standard nutrient intake
- To select an appropriate method for measuring dietary needs of hospitalized patients.

#### **Theory:**

Nutritional assessment systems: nutrition surveys, nutrition surveillance, nutrition screening. Nutritional assessment methods: anthropometrics, biochemical, clinical, dietary. Measuring food consumption at national level: food balance sheets, total diet consumptions. Food consumption at the household levels: food account, household food records, household 24-hour food record. Measuring food consumption at individual levels: 24-hour recall, repeated 24-hour recall, weighed food records, diet history, food frequency questionnaire. Selecting an appropriate method: determining the mean nutrient intake, calculating the population at risk, ranking individuals by food and nutrient intake.

#### **Practical:**

Practicing methods of nutritional assessment (ABCD of Nutritional assessment); Comparison of the data with references values for drawing conclusions.

#### **Suggested Readings:**

1. Driskell, J.A. and Wolinsky, I. 2011. Nutritional Assessment of Athletes, 2<sup>nd</sup> ed. CRC Press, Taylor & Francis Group, New York, USA.
2. Gibson, R.S 2005. Principles of Nutrition Assessment. Oxford University Press Inc., New York, USA.
3. Lee, R.D. and Nieman, D.C. 2012. Nutritional Assessment, 6<sup>th</sup> ed. The McGraw-Hill Companies Inc., New York, USA.
4. McGuire, M. and Beerman, K.A. 2011. Nutritional Sciences: From Fundamentals to Food. Cengage Learning, Belmont, CA, USA.

**Learning Outcomes:**

- To analyze the nutritional needs during conception, infancy, childhood, adolescence, male and female adults, pregnancy, lactation and during aging
- To suggest dietary recommendations in special clinical conditions

**Theory:**

Preconception nutrition: overview, reproductive physiology, nutrition related disruption in fertility, nutrition and contraceptives, other nutrition concerns, premenstrual and polycystic ovary syndrome, obesity and fertility, diabetes prior to pregnancy, disorders of metabolism. Nutrition during pregnancy: status of pregnancy outcomes, embryonic and fetal growth & development, pregnancy weight gain, nutrition and outcome of the pregnancy, common health problems during pregnancy, nutrient needs and dietary guidelines during pregnancy. Nutrition and lactation: human milk composition, benefits of breast feeding, breast milk supply and demand, maternal diet during lactation, factors influencing breastfeeding initiation and duration, common breast feeding conditions, medical contradictions in breast feeding. Infant nutrition: assessing new born health, energy and nutrient needs, development of infant feeding skills, common nutritional problems and concerns, infants at risk. Toddlers and pre-schooler nutrition: normal growth and development, energy and nutrient needs, common nutritional problems, nutrition related conditions, food allergies and intolerances. Child and pre-adolescent nutrition: normal growth and development, energy and nutrient needs, common nutritional problems, prevention of nutrition related disorders, dietary recommendations. Adolescent nutrition: normal physical growth and development, health and eating related behavior, energy and nutrient requirements, overweight and obesity, eating disorders. Adult nutrition: physiological changes of adulthood, maintaining a healthy body, dietary recommendations, nutrient recommendations, nutrition intervention for risk reduction. Geriatric nutrition: physiological changes, nutritional risk factors, dietary recommendations and food safety, nutrient recommendations, nutrition in special clinical conditions.

**Suggested Readings**

1. Brown, J.E. 2014. Nutrition through the Life Cycle, 5<sup>th</sup> ed. Cengage Learning, Belmont, CA, USA.
2. Rolfes, S.R., K. Pinna and E. Whitney. 2015. Understanding Normal and Clinical Nutrition, 10<sup>th</sup> ed. Thomson and Wadsworth Publishers, USA.
3. Shetty, P. 2002. Nutrition Through the Life Cycle. Leatherhead International Ltd. And Royal Society of Chemistry, Cambridge, U.K.
4. Worthington-Roberts, B.S. and S.R. Williams. 2000. Nutrition Throughout the Life Cycle. The McGraw-Hill Education, Maidenhead, Berkshire, U.K.

**Learning Outcomes:**

- To understand the basic terminologies in different pathological states
- To elaborate the cell injuries, necrosis, their types and practical applications of pathology

**Theory:**

Scope of pathology and concept of diseases; Definition and terminology: Ischemia, Hypoxia, Necrosis, Infarction, Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Plasia, Anaplasia; Response of body to injury and infection, growth disturbance, circulatory disturbances, wound healing and repair, neoplasia, fever, disturbance of mineral deposits and pigmentation, anaemia, diarrhoea, burn injury, infectious diseases, hypertension, acute & chronic inflammation, immunity, allergy, hypersensitivity, ulcer (peptic, duodenal), leukemia or blood cancer, environmental and nutritional diseases; Diagnosis and treatment of Cancer in general, fate, survival and prognosis with tumors.

**Practical:**

Selection, collection, preservation and dispatch of morbid material for laboratory examination; Study of pathological slides of various pathological conditions; Demonstration of blood sampling; Basic concepts of anemia; Demonstration of routine urinalysis, faecal examination and skin scraping; Blood smears, staining and examination; Haematology report interpretation, basic concepts of contents and interpretation of pathology report (serum enzymes and other markers of disease).

**Suggested Readings:**

1. Carton, J. 2012. Oxford Handbook of Clinical Pathology, 1<sup>st</sup> ed. Oxford University Press, New York, U.S.A.
2. Kierszenbaum, A.L. and L. Tres. 2015. Histology and Cell Biology: Introduction to Pathology, 4<sup>th</sup> ed. Elsevier Saunders, Philadelphia, PA, USA.
3. Kumar, V., A.K. Abbas, N. Fausto, and J.C. Aster. 2015. Robbins and Cotran Pathologic Basis of Disease, 9<sup>th</sup> ed. Saunders Elsevier, USA.
4. McPhee, S.J. and W.F. Ganong. 2014. Pathophysiology of Disease: An Introduction to Clinical Medicine, 7<sup>th</sup> ed. McGraw-Hill Education, New York, USA.

**FST FOOD ANALYSIS 3 (1-2)**

**Learning Outcomes:**

- To highlight the significance of food analysis in product development and overall quality
- To comprehend commonly employed types of analysis for product characterization
- To prepare and standardize commonly used lab solutions

**Theory:**

Food analysis: significance; Sampling: techniques, preparation, preservation; Physical properties and analysis of foods and food products: appearance, texture, specific gravity, refractive index, rheology; Chemical analysis: significance; Proximate analysis: moisture, ash, proteins, lipids, carbohydrates, fiber, NFE, acidity, pH, sugars, mineral elements, vitamins – significance, methods; Chromatography: paper, thin layer; Spectroscopy: atomic emission, atomic absorption; Sensory evaluation of foods: attributes, difference and preference tests, consumer acceptance. Overview of the commonly employed statistical methods.

**Practical :**

Lab safety requirements; Preparation and standardization of laboratory solutions; Sampling; Determination of specific gravity, refractive index, moisture, ash, crude protein, crude fat, crude fiber, NFE, pH and acidity; Estimation of vitamin C; Determination of mineral elements through flame photometer and atomic absorption spectrophotometer; Paper and thin layer chromatography; Identification of toxins by TLC; Sensory evaluation of foods.

**Suggested Readings:**

1. AOAC. 2016. Official Methods of Analysis of AOAC International, 20<sup>th</sup> ed. Association of Official Analytical Chemists, Arlington, USA.
2. Awan, J.A. and S.U. Rehman. 2015. Food Analysis Manual. Unitech Communications, Faisalabad, Pakistan.
3. Cruz, R.M.S., I. Khmelinskii and M. Vieira. 2014. Methods in Food Analysis. CRC Press. Taylor & Francis Group, Boca Raton, F.L, USA.
4. Pomeranz, Y. and C.E. Meloan. 2000. Food Analysis: Theory and Practice, 3<sup>rd</sup> ed. Chapman & Hall, New York, USA.
5. Winton, A. and K.B. Winton. 2006. Techniques of Food Analysis. Agrobios Publishing Co., Jodhpur, India.

**FIFTH SEMESTER**

Course No.	Title of Course	Credit Hours
HND	Dietetics-I	3(2-1) MC
HND	Nutrition and Psychology	3(3-0) MC
HND	Nutritional Education and Awareness	3(2-1) MC
HND	Meal Planning and Management	3(2-1) MC
HND	Public Health Nutrition	3(2-1) MC
FST	Food and Drug Laws	2(2-0) MC
		17 (13-4)

**HND                      DIETETICS-I                      3 (2-1)**

**Learning Outcomes:**

- To understand the discipline of dietetics and its role in human wellbeing



- To familiarize with the foundations of healthy diets and their role in disease prevention and management
- To acquaint hands-on training for calorie calculation and menu planning using food composition table and data bases
- To assess BMI and energy expenditures in relation to overweight and obesity

### **Theory:**

Dietetics: definitions, history, importance; Dietitian: role in food service and clinical practice, responsibilities in multidisciplinary team, code of ethics; Foundations of healthy diet: Dietary Reference Intakes, Recommended Dietary Allowance, Food Guide Pyramid and allied approaches, Dietary Guidelines, Exchange system and menu planning; Energy expenditure and basal metabolism; Body mass index; Role of diet in disease conditions; Diet therapy and its principles; Food selection and factors affecting its acceptance; Nutrient density; Alternative patterns of food consumption; Nutritional counselling in clinical practice. Critical diet assessment. Nutrition and diet clinics.

### **Practical:**

Interpretation of food guide pyramid, MyPyramid, Myplate, Eatwell Plate; Energy value of different foods: carbohydrates, fats, proteins; Calculating energy requirements; BMI in relation to obesity and overweight, energy and calorie requirements; Balanced diet and menu planning using exchange lists, food composition tables & data bases; Food intake analysis: Dietary Recall, Food Frequency Questionnaires, Food Surveys.

### **Suggested Readings:**

1. Mahan, L.K., S. Escott-Stump and J.L. Raymond. 2012. Krause's Food, Nutrition & Diet Therapy, 13<sup>th</sup> ed. Elsevier Saunders, St. Louis, Missouri, USA.
2. Mudambi, S.R. and M.V. Rajagopal. 2007. Fundamentals of Foods, Nutrition & Diet Therapy, 5<sup>th</sup> ed. New Age International Pvt. Ltd. Publishers, New Delhi.
3. Punekar, M. and J. D'Souza. 2010. Handbook of Applied Nutrition, Dietotherapy and Diet Management. SBS Publishers & Distributors Pvt. Ltd., New Delhi.
4. Rawat, S. 2015. Applied Nutrition. Random Publication, New Delhi.
5. Schlenker, E. and J.A. Gilbert. 2015. Williams' Essentials of Nutrition and Diet Therapy, 11<sup>th</sup> ed. Elsevier/Mosby Inc., Louis, Missouri.
6. Singh, J. 2008. Handbook of Nutrition and Dietetics. Lotus Press, India.

**HND                      NUTRITION & PSYCHOLOGY                      3 (3-0)**

### **Learning Outcomes:**

- To understand psychology, its types and importance in nutrition
- To abreast the impact of psychological influences on appetite and attitude behavior relationship

**Theory:**

Psychology: introduction, types, classification; Psychology and nutrition adherence; Attitude and eating patterns and the field of cognitive psychology; Perception, visualization and eating patterns, errors in perception process; Eating disorders: diagnosis, assessment and treatment; Face perception; Conceptual model of food choice; Psychological influences on appetite; Process over the life course, integration of biological, social, cultural and psychological influences on food choice; Understanding behaviour: sensation, sense organs/special organs, attention and concentration, memory and its stages, methods for improvement, types and theories of thinking, cognition and levels of cognition, problem solving and decision making strategies, attitude behavior relationship; Measurement issues, indirect effects of attitude on behavior; The theory of reasoned action; Additional variables within the theory of planned behavior; Personality and intelligence; Stress management.

**Suggested Readings:**

1. Blackman, M.C. and C.A. Kvaska. 2011. Nutrition Psychology: Improving Dietary Adherence. Jones and Bartlett Learning Publishers, Ontario, Canada.
2. Booth, D.A. 1994. The Psychology of Nutrition. Taylor & Francis Inc., Bristol, PA, USA.
3. Elmes, D.G., B.H. Kantowitz and H.L. Roediger. Research Methods in Psychology, 9<sup>th</sup> ed. Wadsworth Cengage Learning, Belmont, CA, USA.
4. Jane O. 2010. The Psychology of Eating: From Healthy to Disorders Behavior, 2<sup>nd</sup> ed. Wiley Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.

**HND NUTRITIONAL EDUCATION AND AWARENESS 3 (2-1)****Learning Outcomes:**

- To learn the techniques of creating awareness about health issues in masses
- To acquire information about different modes of communication and their effective use
- To understand the ethical responsibilities for dissemination of knowledge

**Theory:**

Nutrition education: introduction, history, need, competencies and skills, framework, training needs, new development; Nutrition education programs: scope and challenges of educating people about eating well; Biological influences, cultural and social preferences; Education and communication strategies for different groups and settings; Evaluation of nutrition education programs; Family and psychological factors; Expectancy-value theories of motivation, social and cognitive theory; Behavior change as a process, phases of change; Addressing multiple and overlapping influences on behavior; A logical model approach for planning a framework of nutrition education;

Understanding communication model, preparing/organizing oral presentations, delivering oral presentation, delivering nutrition education workshops, types of supporting visual aids, nutrition mass media communication campaigns, social marketing; Ethics in nutrition education, conflicts, participating process in community coalition; Non-government and public health organizations and their current programs.

**Practical:**

Nutritional counselling; Program designing for specific diseases like anemia, neural tube defects, rickets, etc.; Surveys and seminars in different educational institutions; Individual presentations by students on different nutrition topics; Visits of public places for nutrition awareness; Independent student projects.

**Suggested Readings:**

1. Contento, I.R. 2007. Nutrition Education: Linking Research, Theory and Practice. Jones and Bartlett Publishers, Ontario, Canada.
2. FAO. 1997. Nutrition Education for the Public: Discussion Papers of the FAO Expert Consultation. Food and Agriculture Organization of the United Nations, Rome, Italy.
3. Semba, A.D. and M.W. Bloem. 2008. Nutrition and Health in Developing Countries, 2<sup>nd</sup> ed. Humana Press, New York, USA.
4. Walter, W. 2013. Nutritional Epidemiology, 3<sup>rd</sup> ed. Oxford University Press, New York, USA.

**HND MEAL PLANNING AND MANAGEMENT 3 (2-1)**

**Learning Outcomes:**

- To understand the importance of meal planning and its role in everyday life
- To apply the principles of meal planning in the planning of balanced and appropriate meals keeping in mind the nutritional requirements, family budget and food requirements choices of different age groups
- To identify market trends and conditions while purchasing food keeping in mind food costs and quality

**Theory:**

Importance and principles of meal planning for family and occasions; Nutritional value of meal; Family meal budgeting; Rules for good menu planning; Menu planning for families; Selection of various foods in relation to season and market conditions; Composition and storage of food; Selection, use and care of table appointments; Study of different types of table settings, table manners and etiquettes; Kitchen safety and settings; Basics of food hygiene and sanitation; Food labelling; Menus for schools, geriatric and healthcare centers.

**Practical:**

Survey and record keeping of market prices (retail & wholesale); Types of foods available in the market from different food groups. e.g. retail cuts of meat and types of milk; Comparison of weight, volume and effect of cooking on color, taste

and texture of different foods; Planning, preparation and service of meals for different occasions at different income levels; Understanding food labels; Market visits for cost and quality and food marketing regulations. Food service visits (Restaurants, School, Colleges, Hospitals).

### **Suggested Readings**

1. Brown, A. 2015. Understanding Food Principles & Preparation, 5<sup>th</sup> ed. Cengage Learning, Belmont, CA, USA.
2. McWilliams, M. 2012. Fundamentals of Meal Management, 5<sup>th</sup> ed. Dorling Kindersley India Pvt. Ltd., New Delhi, India.
3. Narvaez-Soriano, S. 2004. A Guide to Meal Management and Table Services. Rex Book Store, Manilla, Philippine.
4. Sethi, M. 2008. Institutional Food Management. New Age International Pvt. Ltd. New Delhi, India.

## **HND PUBLIC HEALTH NUTRITION 3 (2-1)**

### **Learning Outcomes:**

- To figure out global and local scenario of public health nutrition
- To understand the core concepts and assessment methods at the population level
- To acquaint hands-on training for development of policies related to nutrition and possible gaps in the matrix of nutrition policies

### **Theory:**

Public health nutrition: overview, concepts, determinants, foundations; Disease burden and its control; Health promotion and disease prevention; Modes of intervention, monitoring and surveillance; Safety and health at work place; Public health nutrition: assessment and programs. Nutritional surveillance and growth monitoring; Public health policies and strategies; Marketing nutrition programs in public; Public health nutrition: a field of practice; Public health nutritionist: competencies, duties, responsibilities, ethics.

### **Practical:**

Food and nutrition surveys for monitoring of public health; Community need assessment; Planning, implementation and monitoring nutrition intervention program based on the need assessment of the community; Marketing nutrition programs in the public; Visit of various public health departments.

### **Suggested Readings:**

1. Edelstein, S. 2011. Nutrition in Public Health: A Handbook for Developing Programs and Services, 3<sup>rd</sup> ed. Jones & Bartlett Learning, Sudbury, M.A, USA.
2. Gibney, M.J., B.M. Margette and J.M. Kearney. 2004. Public Health Nutrition. Blackwell Science Ltd. Oxford, UK.
3. Lawrence, M. and T. Worsley. 2007. Public Health Nutrition: From Principles to Practice. Allen & Unwin Book Publishers, Australia.

4. McKenzie, J.F. and R.R. Pinger. 2015. An Introduction to Community & Public Health. 8<sup>th</sup> ed. Jones & Bartlett Learning, LLC Burlington, MA, USA.
5. Spark, A. 2007. Nutrition in Public Health: Principles, Policies and Practice. CRC Press, Taylor & Francis, Boca Raton, FL, USA.

## **FST FOOD AND DRUG LAWS 2 (2-0)**

### **Learning Outcomes:**

- To get know how about the existing food and drug laws prevailing in the country
- To understand duties and authorities of food safety officers and drug inspectors
- To familiarize with food and drug laws enforcement agencies in Pakistan

### **Theory**

Punjab Pure Food Rules 2011: legal terms and definitions from the food industry; Rules for food additives, categories, permissible limits; Food packaging: rules, criteria for packaging material, labelling requirements; Duties and responsibilities of public analysts and food safety officer; The Drug Regulatory Authority of Pakistan Act, 2012; DRAP Alternative Medicines and Health Products Enlistment Rules 2014; Halal food dietary laws. Consumer protections laws in Pakistan; The Punjab Consumer Protection Rules 2009; The Punjab Consumer Protection Act 2005; The Pakistan Hotels and Restaurants Act, 1976; The Punjab Food Authority Act 2011; The Pakistan Halal Authority Act 2015; Pakistan National Accreditation Council; Punjab Halal Development Agency; Pakistan Standards and Quality Control Authority (PSQCA); Role of electronic and print media in public awareness and empowerment.

### **Suggested Readings:**

1. GOP. 2005. The Punjab Consumer Protection Act 2005. Government of the Punjab, Lahore, Pakistan.
2. GOP. 2011. Punjab Pure Food Rules 2011. Health Department, Government of the Punjab, Lahore, Pakistan.
3. GOP. 2012. Drug Regulatory Authority of Pakistan Act, 2012 *The Drug Regulatory Authority of Pakistan*, Government of the Pakistan, Islamabad.
4. GOP. 2015. *Pakistan Halal Authority Act, 2015*. Minister for Science and Technology, Government of the Pakistan, Islamabad.
5. Independent topics for readings.

## SIXTH SEMESTER

Course No.	Title of Course	Credit Hours
HND	Dietetics-II	3(2-1) MC
HND	Functional Foods and Nutraceuticals	3(3-0) MC
Sociology/HND	Nutrition Through Social Protection	2(2-0) GC
HND	Sports Nutrition	3(2-1) MC
HND	Infant and Young Child Feeding	3(2-1) GC
Biochem	Clinical Biochemistry	3(1-2) GC
		17 (13-4)

**HND                    DIETETICS-II                    3 (2-1)**

### Learning Outcomes:

- To comprehend the principles of diet therapy and therapeutic nutrition
- To understand the role of dietary management in various health disorders related to upper and lower gastrointestinal tract, hepatic, pancreas and coronary heart diseases
- To acquaint hands-on training for the dietary modification of normal diets aligned with various health disorders
- To prepare pre- and post-operative diets

### Theory:

Introduction to diet therapy; Principles of diet therapy and therapeutic nutrition; Therapeutic modifications of normal diets; Dietary management in various health disorders (objective, physiology, food choices, diet plans): Diet in the diseases of the upper gastrointestinal tract – mouth, dental disease, pharynx, esophagitis; hiatal hernia; gastritis; peptic ulcer; Diet in the diseases of the lower gastrointestinal tract - constipation, diarrhoea, mal-absorption syndrome, lactose Intolerance, celiac disease, inflammatory bowel disease, Crohn's disease, ulcerative colitis, irritable bowel syndrome, diverticular disease, gastric surgery, dumping syndrome, small bowel resections, short bowel syndromes, blind loop syndrome, ileostomy or colostomy; Diet in the diseases of liver and accessory organs - hepatitis, hepatic steatosis, non-alcoholic hepatic steatosis, alcoholic liver disease, cirrhosis, hepatic encephalopathy; cholelithiasis, cholecystitis, cholangitis; Pancreatitis; Nutrition education and primary health care camp.

### Practical:

Steps in nutrition care; Types of diets: regular diet, clear liquid diet, full liquid diet, soft diet, bland diet; Dietary modification for texture, energy, nutrients and fluids; Planning of energy modified diets: high calorie diet, restricted calorie diet, high fiber diet, low residue diet, modified carbohydrates diet, moderate carbohydrate diet, modified fat diet, restricted fats diet; Planning and preparation of diets for various pathological conditions; Nutrition in surgical conditions: pre-

operative and post-operative diets; Enteral and parenteral feeding; Hospital visits and nutrition camps.

### **Suggested Readings:**

1. Mahan, L.K., S. Escott-Stump and J.L. Raymond. 2012. Krause's Food, Nutrition & Diet Therapy, 13<sup>th</sup> ed. Elsevier Saunders, St. Louis, Missouri, USA.
2. Mudambi, S.R. and M.V. Rajagopal. 2007. Fundamentals of Foods, Nutrition & Diet Therapy, 5<sup>th</sup> ed. New Age International Pvt. Ltd. Publishers, New Delhi.
3. Punekar, M. and J. D'Souza. 2010. Handbook of Applied Nutrition, Dietotherapy and Diet Management. SBS Publishers & Distributors Pvt. Ltd., New Delhi.
4. Rawat, S. 2015. Applied Nutrition. Random Publication, New Delhi.
5. Schlenker, E. and J.A. Gilbert. 2015. Williams' Essentials of Nutrition and Diet Therapy, 11<sup>th</sup> ed. Elsevier/Mosby Inc., Louis, Missouri.
6. Singh, J. 2008. Handbook of Nutrition and Dietetics. Lotus Press, India.

## **HND FUNCTIONAL FOODS AND NUTRACEUTICALS 3(3-0)**

### **Learning Outcomes:**

- To find out sources of functional foods & nutraceuticals and their impact on nutrition and health
- To familiarize with the standards and regulations used globally regarding regulatory issues and usage of functional foods
- To assess international trade and marketability of functional foods

### **Theory:**

Functional foods and nutraceuticals: past, present, future and health claims; functional foods and their impact on nutrition and health obesity, diabetes, cardiovascular diseases, hypertension and cancer; Functional ingredients and bioactive molecules: Isoflavones, lycopene, polyphenols, dietary fiber, omega-3 & -6 fatty acids, conjugated linoleic acid, antioxidants, prebiotic and probiotic; Functional foods from different food groups: cereals, dairy, meat, fruits and vegetables; Regulatory systems governing the production and distribution of functional food -national and international; Standard and regulations of various agencies: FDA, EC, FAO/WHO, Health Canada; Guidelines for the assessment of functional foods; Marketing and regulatory issues; Conventional and emerging food processing technologies for functional food production; Toxicological and safety aspects of functional foods; Asian functional foods; Functional foods in international market and growth in Pakistan.

### **Suggested Readings:**

1. FAO (Food and Agriculture Organization of the United Nations). 2007. Report on Functional Foods. Food and Agriculture Organization of the United Nations, Rome, Italy.
2. Shi, J., C.T. Ho and F. Shahidi. 2005. Asian Functional Foods. Marcel Dekker/CRC Press, New York, U.S.A.

3. Shi, J., G. Mazza and M.L. Maguer. 2002. Functional Foods: Biochemical and Processing Aspects, Vol. 2. CRC Press, Traylor & Francis Group, Boca Raton, New York, USA.
4. Wildman, R.E.C. 2006. Handbook of Nutraceuticals and Functional Foods, 2<sup>nd</sup> ed. CRC Press, Traylor & Francis Group, Boca Raton, New York, USA.

## **Sociology/HND**

### **NUTRITION THROUGH SOCIAL PROTECTION 2 (2-0)**

#### **Learning Outcomes:**

- To acquaint knowledge about the role of social protection programs in poverty alleviation and overall welfare of the society
- To understand the role of social protection programs in provision of financial support for scaling up nutrition
- To identify the development partners and various social protection and scale up nutrition programs

#### **Theory:**

Food insecurity and vulnerability; Food and social class differences; Food society and environment; Introduction to sociology of nutrition; Food and nutrition in culturally diverse societies; Social change and rural development; Women empowerment and nutrition; Food choices and their determinants; Behaviour change; Social construction and eating disorders; Challenges to combat malnutrition; Nutrition-sensitive and nutrition-specific interventions; Economic opportunities among the poor; Nutrition and gender sensitive policies and strategies of social protection sector; Social assistance, income generation, risk reduction and risk management; Current social protection programs in the public and private sector; Community development projects; Medical social services projects; Role of social welfare/protection sector to scale-up nutrition; Impact of individual financial assistance programs; Backyard poultry farming and backyard kitchen gardening; Social protection strategies in Pakistan and South Asia; Social safety nets for vulnerable group; Role of various development partners, (such as NGOs, INGOs, Asian Development bank, World Bank, USAID, and DFID) in social protection and scaling up nutritional status.

#### **Suggested Readings:**

1. FAO. 2015. Improving Nutrition Through Multisectoral Approaches. Food and Agriculture Organization of the United Nations, Rome Italy.
2. FAO. 2015. Nutrition and Social Protection. Food and Agriculture Organization of the United Nations, Rome Italy.
3. IFPRI. 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. International Food Policy Research Institute, Washington, DC, USA.
4. World Bank, UNICEF, WFP, USAID, ADB and Government of Pakistan Reports



**Learning Outcomes:**

- To emphasize the importance of proper fueling for physical activity, pre- and post-workout
- To provide an overview about dietary supplements, how they are regulated and how to avoid use of contaminated dietary supplements
- To highlight the risks associated with performance enhancing drugs including anabolic androgenic steroids

**Theory:**

The principles of fitness, motivation and conditioning; Nutrition for the athletes, stress management, preventing accidents, stretching, posture and aerobics; Vitamins and minerals supplementation for fitness; High and low intensity exercise, cross training, walking for weight control and case studies; Introduction to muscle contraction, fast and slow fibres, energy storage, fuels used for exercise; Energy balance, fluid balance, fuelling cycle: Pre-exercise, during exercise and during recovery; Athletes eating plan, calorie goals, calorie values, carbohydrate goals, protein goals, fat, vitamins and mineral goals; Competition nutrition; Loosing, gaining and making weight for athletes; Eating disorder and athletes; Sports drink and supplementation; National and international regulations for supplements; Risks associated with performance enhancing drugs; Metabolic Equivalent Task; My pyramid for sportsman.

**Practical:**

Bioelectric impedance analysis; Sweat rate and hydration status calculation; Calculation of BMR and RMR; Diet planning for different sportsmen like body builders, athletes, swimmers, etc. Preparation of sports drinks and food products according to accelerated needs; Use of sports supplements. Visit of sports centers and fitness clubs.

**Suggested Readings:**

1. Antonio, J., D. Kalman, J.R. Stout, M. Greenwood, D.S. Willoughby and G.G. Haff. 2008. Essentials of Sports Nutrition and Supplements. Humana Press, New York, USA.
2. Driskell, J.A. 2007. Sports Nutrition Fats and Proteins. CRC Press, Taylor and Francis Group, Boca Raton, FL, USA.
3. Fink, H.H., A.E. Mikesky and L.A. Burgoon 2011. Practical Applications in Sports Nutrition, 3<sup>rd</sup> ed. Jones & Bartlett Learning Burlington, MA, USA.
4. Lanham-New, S.A., S.J. Stear, S.M. Shirreffs and A.L. Collins. 2011. Sports and Exercise Nutrition. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
5. Maughan, R.J. 2000. Nutrition in Sport: The Encyclopedia of Sports Medicine. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.

**Learning Outcomes**

- To identify problems affecting infant and young child feeding and provide a framework of essential interventions
- To create an environment that will enable mothers, families and other caregivers to implement optimal feeding practices

**Theory:**

Infant young child feeding: introduction, global strategy, importance of breastfeeding, local and international scenario, breastfeeding working; Breastfeeding practices: assessing a breastfeed, taking a feeding history, common breastfeeding difficulties, expressed breast milk; Breastfeeding counselling: listening and learning, building confidence and giving support, counselling for infant feeding decisions, counselling cards tools; Complementary feeding practices: importance, cup-feeding and hygienic preparation of food, replacement feeding in the first 6 months, foods to fill energy and micronutrients gap, quantity and frequency of feeding, feeding techniques, food demonstration; Breastfeeding related topics: growth charts, maternal illnesses and breast feeding, breast conditions, health care practices, International code of marketing of breast milk substitutes, checking understanding and arranging follow-up, feeding during illness and low-birth-weight babies; Feeding guidelines of various global agencies – WHO etc.; Complex challenges to implementing the global strategy for infant and young child feeding.

**Practical:**

Breastfeeding counselling; Preparation of indigenous complementary foods; Therapeutic foods; Infant formulas for various needs; Growth monitoring: APGAR (Appearance, Pulse rate, Grimace, Activity and Respiration) score, Growth charts. Visits of hospitals and day care centers.

**Suggested Readings:**

1. Behan, E. 2008. The baby Food Bible – A Complete Guide to Feeding Your Child from Infancy On, 1<sup>st</sup> ed. Random House Publishing Group, New York, USA.
2. Dykes, F. and V.H. Moran. 2009. Infant and Young Child Feeding: Challenges to Implementing a Global Strategy. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
3. Samour, P.Q. and K. King. 2010. Pediatric Nutrition, 4<sup>th</sup> ed. Jones & Bartlett Learning, Mississauga, Canada.
4. WHO. 2003. Global Strategy for Infant and Young Child Feeding. World Health Organization, Geneva, Switzerland.
5. WHO/UNICEF/GOP (World Health Organization/United Nation's Children Fund/Government of Pakistan). 2008. Infant and young child feeding counselling: an integrated course. Nutrition Wing, Ministry of Health, Government of the Pakistan, Islamabad.

**Learning Outcomes:**

- To understand the role and requirements of clinical laboratory and how chemical and biochemical analysis are applied to the study of disease
- To discuss the function, structure, laboratory investigation and diseases of the different body systems
- To correlate laboratory findings in clinical samples with various pathological processes

**Theory:**

Clinical laboratory: organization and management, safety, good lab practices, quality control and assurance, reference range and normal values, laboratory data processing; Handling and processing of clinical samples; Effect of storage on composition of samples; Commonly used instruments in clinical laboratory: Microscope, Minilab apparatus, X-ray, ECG, MRI, ELISA reader, CT scan etc.; Symptomology and case histories of various diseases. Forensic science, Molecular basis of diagnosis.

**Practical:**

Blood sampling techniques; Complete blood picture (CBP) like Hb, PCV, ESR, TLC, DLC, bleeding time, clotting time, prothrombin time and blood groups; Pregnancy test; Liver function tests; Kidney function test; Cardiac enzymes; Lipid profile, total proteins, albumin and serum minerals; Urine analysis for bile pigments, protein, urea, pH, ketone bodies, sugars, creatinine, pus cells, RBCs and uric acid; Sero-diagnosis of infectious diseases; Visit to clinical laboratory/concerned organization.

**Suggested Readings:**

1. Ahmed, N. 2011. Clinical Biochemistry. Oxford University Press, Oxford, UK.
2. Bain, B.J., I. Bates, M.A. Laffan and S.M. Lewis. 2012. Practical Haematology, 11<sup>th</sup> ed. Churchill Livingstone, Elsevier Ltd., New York, USA.
3. Burtis, C., E. Ashwood and D. Burns. 2006. Tietz Text Book of Clinical Chemistry and Molecular Diagnostics, 4<sup>th</sup> ed. Elsevier Saunders Company, Philadelphia, USA.
4. Chawala, R. 2014. Practical Clinical Biochemistry: Methods and Interpretations, 4<sup>th</sup> ed. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India.
5. Devlin, T. M. 2005. Textbook of biochemistry with clinical correlations, 6<sup>th</sup> ed. Wiley-Liss, Inc., U.S.A.

## SEVENTH SEMESTER

Course No.	Title of Course	Credit Hours
HND	Dietetics-III	3(2-1) MC
HND	Global Food Issues	3(3-0) MC
HND	Research Methods in Nutrition	3(3-0) MC
HND	Nutritional Practices in Clinical Care	3(2-1) MC
		12 (10-2)
Elective Courses (2 courses equal to 5 credit hours)		
Elective	Nutritional Immunology	3(3-0) EC
Elective	Drug-Nutrient Interactions	2(2-0) EC
Elective	Food Chemistry	2(2-0) EC
Elective	Preventive Nutrition	3(3-0) EC
Elective	Nutrition in Emergencies	3(3-0) EC

### **HND-403    DIETETICS–III                    3 (2-1)**

#### **Learning Outcomes:**

- To understand the role of nutrition and dietetics in managing disease and preventing complications
- To get hands-on training for the dietary modification of normal diets aligned with various health disorders
- To comprehend the role of nutrition education and policies towards nutrition security

#### **Theory:**

Diet based regimen to improve the public health; Diet supplementation for diseased patients; Malabsorption and mineral deficiency; Health diets and lifestyles; Preventing diet related diseases; Nutritional implications of various diets; Managing disease and avoiding complications through diet diversification; Dietary management in various health disorders (objective, physiology, food choices, diet plans): obesity, leanness and underweight; coronary heart disease: dyslipidemia, hypertension, ischemic heart disease, heart failure; fevers and infections; diabetes mellitus; diseases of respiratory system: cystic fibrosis, asthma; rheumatic diseases: rheumatoid arthritis, osteoarthritis & gout; inborn errors of metabolism: Phenylketonuria, Maple syrup urine disease, galactosemia, glycogen storage disease; renal diseases; burn; surgical conditions; bacterial overgrowth; infections; AIDS; food allergy; protein energy malnutrition; micronutrient deficiencies; Policy principles for promotion of healthy diets; Incorporating nutrition objectives into development policies; Strategic actions and for promoting healthy diets; Drawing up of nutrition education programs; Role of specialist in dietetics and diseases.

#### **Practical:**

Planning of modified diet: consistent carbohydrate diet, moderate carbohydrate diet; Modified proteins diet: high protein diet, restricted protein diet; Modified fats

diet: restricted fats diet; Modified micronutrients diet; Controlled sodium, potassium and phosphorus diet; Dietary management in various health disorders; Hospital visits and nutrition camps.

### **Suggested Readings:**

1. Mahan, L.K., S. Escott-Stump and J.L. Raymond. 2012. Krause's Food, Nutrition & Diet Therapy, 13<sup>th</sup> ed. Elsevier Saunders, St. Louis, Missouri, USA.
2. Mudambi, S.R. and M.V. Rajagopal. 2007. Fundamentals of Foods, Nutrition & Diet Therapy, 5<sup>th</sup>ed. New Age International Pvt. Ltd. Publishers, New Delhi.
3. Punekar, M. and J. D'Souza. 2010. Handbook of Applied Nutrition, Dietotherapy and Diet Management. SBS Publishers & Distributors Pvt. Ltd., New Delhi.
4. Rawat, S. 2015. Applied Nutrition. Random Publication, New Delhi.
5. Schlenker, E. and J.A. Gilbert. 2015. Williams' Essentials of Nutrition and Diet Therapy, 11<sup>th</sup> ed. Elsevier/Mosby Inc., Louis, Missouri.
6. Singh, J. 2008. Handbook of Nutrition and Dietetics. Lotus Press, India.

## **HND-104 GLOBAL FOOD ISSUES 3 (3-0)**

### **Learning Outcomes:**

- To acquaint knowledge about global food issues having impact on food and nutrition security
- To understand the role of global organizations in food production, consumption and trade
- To study the impact of climate change and other threats on global food availability

### **Theory:**

World food situation; Food and nutrition security; The green revolution: Worldwide post-harvest losses; Global malnutrition: protein energy malnutrition and hidden hunger; Overweight & obesity; Worldwide food price fluctuations; Importance of per capita earning, consumption and purchase power; Irrational food consumption behaviour; Contribution of cereals, legumes, roots, tubers and animal products; World food policy; WTO's trade regulations; Food bioterrorism; International food laws: European and American; Potentials of modern biotechnology to combat food insecurity; Genetically modified foods. Organic, Kosher and Halal Foods; Millennium development goals to sustainable development goals. Global Trends. Climate change.

### **Suggested Readings:**

1. Barbosa-Canovas, G., A. Mortimer, D. Lineback, W. Spices, K. Buckle and P. Colonna. 2009. Global Issues in Food Science and Technology. Academic Press, Elsevier Inc., Burlington, MA, USA.
2. Barrientos, S. and C. Dolan. 2006. Ethical Sourcing in the Global Food System. Earthscan, New York, USA.
3. Hajra, M.A. 2013. Global Food Security: Emerging Issues and Economic Implications. Nova Science Publishers, New York, USA.

4. Oosterveer, P. 2007. Global Governance of Food Production and Consumption: Issues & challenges. Edward Elgar Publishing Inc., Massachusetts, USA.
5. Phoenix, L.E. and L. Walter. 2009. Critical Food Issues: Problems and State of the Art Solutions Worldwide, Vol. 1 & 2. ABC-CLIO, LLC, Santa Barbara, California, USA.

## **HND RESEARCH METHODS IN NUTRITION 3(3-0)**

### **Learning Outcomes:**

- To apply tools and skills required to understand published research
- To identify the types of methods best suited for investigating different types of problems and questions
- To get hands-on training of writing successful research proposals for thesis and projects
- To abreast ethical consideration in research and publications

### **Theory:**

Research methods in nutrition: Introduction, objectives, types of research: basic and applied, quantitative and qualitative, clinical and diagnostic; Types of sampling: probability and non-probability; Collection of literature: printed and electronic sources, managing literature; Methods of data collection; Writing scientific documents: synopsis, research proposal, articles, references, internship report. Research designs: observational studies, cross-sectional, case-control, cohort (prospective, retrospective, time-series); Experimental studies: observational studies, clinical studies. Experimental data analysis: incidence/ prevalence rate; Research ethics.

### **Suggested Readings:**

1. Awan, J.A. 2015. Scientific Presentations. Unitech Communications, Faisalabad, Pakistan.
2. Lovegrove, J.A., L. Hodson, S. Sharma and S.A. Lanham-New. 2015. Nutrition Research Methodologies. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
3. Lowe, M. 2007. Beginning Research: A Guide for Foundation Degree Students, 1<sup>st</sup> ed. Routledge Publications, New York, USA.
4. Starks, T.P. 2006. Trends in Nutrition Research. Nova Science Publishers, Inc., New York, USA.
5. Walliman, N. 2005. Your Research Project, A Step by Step Guide for The First-time Researcher, 2<sup>nd</sup> ed. Sage Publications, Thousand Oaks, CA, USA.

## **HND NUTRITIONAL PRACTICES IN CLINICAL CARE 3 (2-1)**

### **Learning Outcomes:**

- To understand and create a patient-centered nutrition care plan based on sound nutrition principles, scientific evidence and biomedical reasoning

- To assess various physiological conditions and prepare diet plans accordingly
- To acquaint hands-on training in the field of enteral and parenteral nutrition

### **Theory:**

Importance of clinical care nutrition support; Nutritional screening and assessment; The therapeutic process, stress of the therapeutic encounter, focus of care, phases of the care process; Quality patient care and collaborative roles of nutritionists and nurses; Modified diets for various physiological needs; Enteral nutritional: composition, nutritional prescription (dose), strategies to optimize delivery and minimize risks, pediatric enteral feeding; Total parenteral nutrition; composition, intravenous nutritional prescription (dose) for specific conditions; Percutaneous endoscopic gastrostomy and radiologically inserted gastrostomy; Complications in enteral and parenteral nutrition; Nutritional therapy in diseases of infancy and childhood; Drug-nutrient interactions: drug effects on food and nutrients, food effects on drug absorption, food effects on drug; Dietary supplements.

### **Practical:**

Nutritional assessment of patients: selection, nutritional requirements; Tube feeding: types, feeding equipment, preparation and application of enteral/nasogastric diets, monitoring the tube-fed patient; Total parenteral nutrition: basic rules, techniques, prescription, preparation of total parenteral solution; Preparation of pre- and post-operative diets; Case studies and logbooks; Hospital visits.

### **Suggested Readings:**

1. Block, A.S., J. Maillet, W.H. Howell and M.F. Winkler. 2007. Issues and Choices in Clinical Nutrition Practice. Lippincott Williams & Wilkins, Philadelphia, PA, USA.
2. Katsilambros, N., C. Dimosthenopoulos, M.D. Kontogianni, E. Manglana and K.A. Pouliou. 2010. Clinical Nutrition in Practice, 1<sup>st</sup> ed. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
3. Katz, D.L. 2008. Nutrition in Clinical Practice, 2<sup>nd</sup> ed. Lippincott Williams & Wilkins, Philadelphia, PA, USA.
4. Rolandelli, R.H., R. Bankhead, J. I. Boullate and C.W. Compher. 2005. Clinical Nutrition; Enteral and Tube Feeding. 4<sup>th</sup> ed. Elsevier Saunders Publishers, USA.
5. Rolfes, S.R., K. Pinna and E. Whitney. 2015. Understanding Normal and Clinical Nutrition, 10<sup>th</sup> ed. Thomson and Wadsworth Publishers, USA.

**Elective HND                      NUTRITIONAL IMMUNOLOGY                      3 (3-0)**

### **Learning Outcomes:**

- To understand relationship between nutrition and immunity
- To evaluate, summarize and apply current research in the field of nutrition

- To determine and assess factors impacting nutritional and immunological status
- To grasp knowledge about the interactions among the nutrients and immune responses

### **Theory:**

Nutritional immunology: overview, principles; Immune system; Psychoneuroimmunology; Effective detoxification protocols: anti-inflammatory, immune boosting, alkalinizing, detoxification; Mechanisms of immune dysfunction in autoimmune conditions and cancer; Gerson therapy; Harmful effects of vaccinations and antibiotics and nutritional support; Supplementation requirements to treat immune dysfunctions, colds, flus, pandemics. Opportunistic infections. Genetic and immunity; Functional foods and Immunology; Immune boosters; Food Allergies; Cognitive function of nutrients; Immunization and its impacts.

### **Suggested Readings:**

1. Calder, P.C., C.J. Field and H.S. Gill. 2002. Nutrition and Immune Function. CABI Publishing, New York, USA.
2. Gershwin, M.E., J.B. German and C.L. Keen. 2000. Nutrition and Immunology Principles and Practice. Humana Press, New York, USA.
3. Gershwin. ME., P. Nestel and C.L. Keen.2004. Handbook of Nutrition and Immunology. Humana Press, New York, USA.
4. Schat, K.A., B. Kaspers and P. Kaiser. 2014. Avian Immunology, 2<sup>nd</sup> ed. Academic Press, San Diego, CA, USA.

## **Elective      DRUG-NUTRIENT INTERACTIONS                      2 (2-0)**

### **Learning Outcomes:**

- To raise the awareness of potential drug-nutrient interactions and influence on clinical outcomes
- To understand complex underlying mechanisms responsible for drug-nutrient interactions
- To identify factors that can promote drug-nutrient interactions and contribute to nutrition and/or therapeutic failure
- To integrate knowledge of pharmacology, nutrient-nutrient and drug-nutrient interactions into the nutrition care process

### **Theory:**

Basic definitions and concepts: Role of nutrition therapy in pharmacotherapy; Pharmacologic aspects of food and drug interactions; Routes of drug administration; Pharmacodynamics; Pharmacokinetics, absorption, distribution, metabolism, elimination; Effects of food on drug therapy, drug absorption, drug distribution, drug metabolism and drug excretion; Effects of drugs on food and nutrition, nutrient absorption, metabolism and excretion; Effects of drugs on the nutritional status of patients e.g. taste, smell and type of intake; Enteral feeding: drug/nutrient interaction; Gastrointestinal effects, appetite changes; Nutrient



assessment of drug-nutrient interactions; Dietary counselling for the prevention of food drug interactions.

### **Suggested Readings:**

1. Boullata, J.I. and V.T. Armenti. 2010. Handbook of Drug-Nutrient Interactions, 2<sup>nd</sup> ed. Humana Press, New York, USA.
2. Mahan, L.K. and S. Escott-Stump. 2007. Krause's Food & Nutrition Therapy. Elsevier – Health Sciences Division. Philadelphia, USA.
3. McCabe-Sellers, B., E.H. Frankel and J.J. Wolfe. 2003. Handbook of Food-Drug Interactions, CRC Press, Taylor & Francis Group, Boca Raton, FL., USA.
4. Nelms, M.N. and K.P. Sucher. 2016. Nutrition Therapy and Pathophysiology, 3<sup>rd</sup> Ed. Cengage Learning, Belmont, CA, USA.

### **Elective      FOOD CHEMISTRY                      2 (2-0)**

#### **Learning Outcomes:**

- To acquire knowledge and skills for understanding the main physical, chemical and functional properties of food
- To understand and be able to control the major chemical and biochemical reactions that influence food quality with emphasis on food industry applications
- To acquaint information about different food components and interactions among them to modulate the specific quality attributes of food systems

#### **Theory:**

Cellular basis of foods; Water: properties, types, water activity and its effect on shelf life of food; Carbohydrates: roles of in food structure, color, flavor and texture; Lipids: roles in food structure, color, flavor and texture, rancidity, emulsifiers; Proteins: roles in food structure, color, flavor and texture; Enzymes: enzymatic & non-enzymatic browning reactions, influences on color, flavor and texture; Technologies in minerals and vitamins fortification of foods, stability of vitamins; Food colors: natural & artificial colors, pigments; Flavors: characteristics, taste, odor and astringency, off-flavor, aromatic compounds, Chemistry involved in ripening processes of fruits and vegetables; Food additives.

#### **Suggested Readings:**

1. Belitz, H.D, W. Groschm and P. Schieberle. 2009. Food Chemistry. Springer Verlag, Germany.
2. Coultate, T. 2009. Food: The Chemistry of Its Components. The Royal Society of Chemistry, Thomas Graham House, Science Park, UK.
3. Damodaran, S., K. Parkin and O.R. Fennema. 2007. Fennema's Food Chemistry, 4<sup>th</sup> ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
4. DeMan, J.M. 2007. Principles of Food Chemistry. Springer Verlag, Germany.

5. Velisek, J. 2014. The Chemistry of Food. John Wiley & Sons Inc., New York, USA.

**HND                      PREVENTIVE NUTRITION                      3 (3-0)**

**Learning Outcomes:**

- To acquaint knowledge about the preventive nutrition with special reference to historical perspective, public health benefits, ethnic and socioeconomic issues and its role throughout the life cycle
- To understand the role of dietary components in the prevention and management of various health disorders

**Theory:**

Preventive nutrition: a historical perspective, public health benefits, ethnic and socioeconomic issues, nutrition in the age of polypharmacy, preventive nutrition throughout the life cycle; Cancer prevention: upper GIT cancer, prostate cancer, dietary supplements and cancer risks, soy and cancer prevention, micronutrients as intermediate biomarkers in chemotherapy; Cardiovascular disease prevention: omega-3 fatty acids from fish and plants, cardiovascular effects of trans fatty acids, antioxidants and B-vitamins and atherosclerosis, Prevention and nutritional management - TLC dietary patterns, AHA dietary patterns, DASH dietary patterns, weight reduction, increased dietary fiber, Omega-3 fatty acids, soy proteins, fruits and vegetables as antioxidant role, reduce dietary cholesterol; Diabetes and obesity: role of nutrition in pathophysiology, prevention and treatment, Adipokines, nutrition and obesity, obesity and insulin resistance in childhood and adolescence, obesity and chronic disease, meal replacement products and fat substitutes, prevention and treatment (dietary changes, calories restricted diet and other dietary regimens, exercise, behavioural modification); Growth, Immunity and Infection: Role of long chain fatty acids, polyunsaturated fatty acids and autoimmune diseases; Prevention and treatment for hypertension: weight reduction, adaptation of DASH diet, nutrition education for behavioural modification; Bone density: Osteoarthritis - role of nutrition and dietary supplements, calcium requirement during treatment of osteoporosis, Prevention and treatment - adequate calcium intake, adequate vitamin D intake, avoidance of excess phosphorous, lifestyle dietary modifications, exercise; Role of dietary fiber in preventing diseases (colon cancer, diabetes, constipation, diverticular disease, obesity, cardiovascular diseases); Health claims for foods and dietary supplements; Micronutrient and immunity in older people.

**Suggested Readings:**

1. Bendich, A. and R.J. Deckelbaum. 2001. Primary and Secondary Preventive Nutrition. Springer Science+Business Media, New York, USA.
2. Bendich, A. and R.J. Deckelbaum. 2010. Preventive Nutrition: The Comprehensive Guide for Health Professional, 4<sup>th</sup> ed. Humana Press, New York, USA.

3. Coulston, A.M. and C.J. Boushey. 2008. Nutrition in the Prevention and Treatment of Diseases, 2<sup>nd</sup> ed. Academic Press, Elsevier Inc., San Diego, CA, USA.
4. Gerber, J.M. 2007. Handbook of Preventive and Therapeutic Nutrition. Aspen Publications, Silver Spring, MD, USA.
5. Thomson, C. 1996. Preventive and Therapeutic Nutrition Handbook. Chapman & Hall, UK.

**Elective      NUTRITION IN EMERGENCY                      3 (3-0)**

**Learning Outcomes:**

- To understand the context in which emergencies occur and nutritional assessment of the individuals and populations
- To design and implement interventions for prevent and treatment of malnutrition
- To familiarize with the role of national and international agencies in the management of emergencies

**Theory:**

Introduction and concepts: understanding malnutrition, micronutrient malnutrition, causes of malnutrition; Nutrition needs assessment and analysis: individual and population assessment, health assessment and the link with nutrition, food security assessment and the link with nutrition, nutrition information and surveillance systems; Interventions to prevent and treat malnutrition: general food distribution, supplementary feeding, therapeutic care, micronutrient interventions, health and livelihood interventions, infant and young child feeding, HIV and AIDS nutrition; Nutrition information, education and communication; Monitoring and evaluation, standards and accountability; Role of national and international agencies: UNHCR, WFP, NDMA (National disaster management authority), Civil defence; Hygiene and sanitation; Emergency foods.

**Suggested Readings:**

1. ENN (Emergency Nutrition Network). 2011. The harmonized training package (HTP): resource material for training on nutrition in emergencies, version 2. Nutrition Works, Emergency Nutrition Network, Global Nutrition Cluster. Oxford, U.K.
2. FAO. 2005. Protecting and Promoting Good Nutrition in Crisis and Recovery: Resource Guide. Food and Agriculture Organization of the United Nations, Rome, Italy.
3. SC (Save the Children Fund UK). 2004. Emergency nutrition assessment: guidelines for field workers. Save the Children, Westport, U.K.
4. WHO (World Health Organization). 2000. The management of nutrition in major emergencies. World Health Organization, Geneva, Switzerland.

## EIGHTH SEMESTER

Course No.	Title of Course	Credit Hours
HND	Internship/Project	6(0-6) MC
HND	Nutrition Policies and Programs	3(3-0) MC
HND	Food Service Management	3(3-0) MC
		12 (6-6)
Elective Courses (2 courses equal to 5 credit hours)		
Elective	Food Toxins & Allergens	3(3-0) EC
Elective	Nutritional Deficiency Disorders	3(3-0) EC
Elective	Food Supplements	2(2-0) EC
Elective	Metabolism of Nutrients	2(2-0) EC
Elective	Nutrition Epidemiology	2(2-0) EC
		5(5-0)/5(4-1)

**HND INTERNSHIP/PROJECT                      6 (0-6)**

**Elective        NUTRITION POLICIES AND PROGRAMS                      3(3-0)**

**Learning Outcomes:**

- To familiarize with global and local nutrition policies and programs in the domain of public health nutrition
- To prevent and control specific micronutrient deficiencies through diet based approaches among the vulnerable
- To promote appropriate diets and healthy lifestyles and access, analyze and monitor nutrition situations

**Theory:**

History and importance of nutrition intervention planning; World declaration on nutrition; Nutrition development partners; Policy guidelines; Community nutrition programs: national and international, supplementary feeding programs; Food fortification, supplementation and diet diversification; School feeding programs: interventions and impacts; Improving household food security; Protecting consumers through improved food quality and safety; Preventing and managing infectious diseases; Promoting breast feeding; Caring for socio-economically deprived and vulnerable; Preventing and controlling specific micronutrient deficiencies; Promoting appropriate diets and healthy lifestyle; Improving health care; Five years plan for Pakistan (Nutrition); Nutrition intervention: counselling for change; SUN movement; One health concept; National nutrition programs: food & nutrition program, Tawana Pakistan, school health program; Developing effective food and *nutrition policies* and programs.

**Suggested Readings:**

1. Edelstein, S. 2011. Nutrition in Public Health: A Handbook for Developing Programs and Services, 3<sup>rd</sup> ed. Jones & Bartlett Learning, Sudbury, M.A, USA.

2. IFPRI. 2016. Taking Actions: Progress and Challenges in Implementing Nutrition Policies and Programs. International Food Policy Research Institute, Washington, DC, USA.
3. Nnakwe, N.E. 2009. Community Nutrition: Planning Health Promotion and Disease Prevention. Jones and Bartlett Learning International, London, UK.
4. Semba, R.D. and M.W. Bloem. 2008. Nutrition and Health in Developing Countries, 2<sup>nd</sup> ed. Humana Press, New York, USA.
5. Spark, A. 2007. Nutrition in Public Health: Principles, Policies and Practice. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.

**HND            FOOD SERVICE MANAGEMENT            3 (3-0)**

**Learning Outcomes:**

- To describe the key milestones of food service industry
- To relate the current trends in food service operations and evolution through the business life cycle
- To explain the art underlying menu development and method for recipe standardization
- To understand the planning considerations vital for creating a successful food service operation

**Theory:**

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

**Suggested Readings :**

1. Barron, C.W., T. Power and D.R. Reynolds. 2012. Introduction to Management in the Hospitality Industry, 10<sup>th</sup> ed. John Wiley Sons Inc., Hoboken, New Jersey, USA.
2. Reynolds, D.R. 2014. Foodservice Management Fundamentals. John Wiley Sons Inc., Hoboken, New Jersey, USA.
3. Reynolds, D.R. and K.W. McClusky. 2014. Study Guide to Accompany Foodservice Management Fundamentals. John Wiley Sons Inc., Hoboken, New Jersey, USA.

**Elective            FOOD TOXINS & ALLERGENS            3 (3-0)**

**Learning Outcomes:**

- To acquire an in-depth understanding of toxicology related to food and health

- To understand various types of toxins from plant, animal and plant origins as well induced by extraneous chemicals
- To familiarize with food allergens, their health implications and management

### **Theory:**

Toxicology: introduction, dose-response, absorption, translocation, storage, excretion; Natural toxins of plant origin: goitrogens, cyanogenic glycosides, favism, lathyrrogens, lecithins (hemagglutinins), mutagens in natural plant, caffeine, flavonoids and some others; Natural toxins of animal origin: animal liver, marine animals; Toxicity by extraneous chemicals: agricultural chemicals, food processing, packaging, additives, adulterants; Toxicity from water; Microbial toxins: mycotoxins – molds, mushrooms; Bacterial food intoxication; Bacterial food infection; Food allergies: introduction, incidence of food allergy, food allergens of protein families, animal origin and plant origin; Adverse allergic reaction, diagnosis, prevention, legislation and labelling, allergen management, food intolerances, emergency treatment of food-induced allergic reactions.

### **Suggested Readings:**

1. Awan, J.A. and F.M. Anjum. 2010. Food Toxicology. Unitech Communications, Faisalabad, Pakistan.
2. Coutts, J and R. Fielder. 2009. Management of Food Allergens. John Wiley & Sons Ltd., Chichester, West Sussex, UK.
3. Jedrychowski, L. and H.J. Wichers. 2009. Chemical and Biological Properties of Food Allergens. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
4. Metcalfe, D., H.A. Sampson, R.A. Simon and G. Lack. 2014. Food Allergy: Adverse Reaction to Foods and Food Additives, 5<sup>th</sup> ed. Wiley-Blackwell, John Wiley & Sons Ltd., Chichester, West Sussex, UK.
5. Shibamoto, T and L. Bjeldanes. 2009. Introduction to Food Toxicology, 2<sup>nd</sup> .ed. Academic Press, London.

## **Elective      NUTRITIONAL DEFICIENCY DISORDERS      3 (3-0)**

### **Learning Outcomes:**

- To analyze existing global scenario of protein energy malnutrition and hidden hunger
- To understand the causes & consequences of common micronutrient deficiencies and the scale of the problem
- To discuss food based approached for the management of nutritional deficiency disorders

### **Theory:**

Introduction and general concepts; Protein-energy malnutrition and hidden hunger: types, causative factors, clinical symptoms, management; Vitamin related deficiency disorders: Nyctopia (night blindness), xerophthalmia and kerotomalacia; Rickets, osteomalacia, osteoporosis; Scurvy; Beriberi; Pallegra, Biotin Deficiency; Ariboflavinosis; Vitamin K deficiency; Hypocobalaminemia;

Paraesthesia; Minerals related deficiency disorders: nutritional anemia; goiter; zinc, potassium and magnesium deficiency disorders.

### **Suggested Readings:**

1. Boyle, M.A. 2016. Personal Nutrition. Wadsworth Cengage Learning, Belmont, CA, USA.
2. Gropper, S.S., and J.L. Smith. 2013. Advanced Nutrition and Human Metabolism. 6<sup>th</sup> ed. Cengage Learning, Belmont, CA, USA.
3. Rolfes, S.R., K. Pinna and E. Whitney. 2015. Understanding Normal and Clinical Nutrition, 10<sup>th</sup> ed. Thomson and Wadsworth Publishers, USA.
4. WHO. 2004. Vitamin and Mineral Requirements in Human Nutrition. World Health Organization, Geneva, Switzerland.

## **Elective      FOOD SUPPLEMENTS                      2 (2-0)**

### **Learning Outcomes:**

- To identify the current trends in the use of dietary supplement and analysis of their global market
- To demonstrate the impact of dietary supplements on health and disease prevention
- To discuss safety issues and global legislations on food supplements

### **Theory:**

An overview of dietary supplements and their market; Forms of food supplements; Vitamins and mineral supplements; Essential fatty acids; Enzymes as supplements; Natural products and extracts; Probiotics and prebiotics in Health; Fish oil supplements; Non-essential nutrients as dietary supplements; Caffeine in food and dietary supplements; Medicinal plants as food supplements; Codex Alimentarius standards for food supplements; Safety of vitamins and minerals added to foods; Implications of mega doses; Global legislation on food supplements; DRAP Alternative Medicines and Health Products Enlistment Rules 2014.

### **Suggested Readings:**

1. Caballero, B. 2009. Guide to Nutritional Supplements. Elsevier Ltd., Oxford, UK.
2. Ottaway, P.B. 2008. Food Fortification and Supplementation: Technological, Safety and Regulatory Aspects. Woodhead Publishing Limited, Cambridge, England.
3. Pray, L., A.L. Yaktine and D. Pankevich. 2014. Caffeine in Food and Dietary Supplements. The National Academies Press, Washington, DC, USA.
4. Ransley, J.K., J.K. Donnelly and N.W. Read. 2001. Food and Nutritional Supplements: Their Role in Health and Disease. Springer-Verlag Berlin Heidelberg, Germany.
5. Webb, G.P. 2011. Dietary Supplements and Functional Foods, 2<sup>nd</sup> ed. Blackwell Publishing Ltd., Oxford, UK.

**Elective      METABOLISM OF NUTRIENTS      2 (2-0)**

**Learning Outcomes:**

- To understand the metabolic roles of carbohydrates, fats, proteins, vitamins and minerals
- To generalize the way in which nutrients are processed through major metabolic fates in order to perform various energetic and structural functions in the body
- To establish the role of enzymes and hormones in metabolism of nutrients

**Theory:**

Metabolic pathways: objectives, chemical reactions, enzymes, co-enzymes and prosthetic groups, metabolic pathways; Role of ATP in metabolism: objectives, functions, phosphorylation of ADP to ATP; Digestion and absorption: gastrointestinal tract, digestion and absorption of carbohydrates, fats and proteins; Absorption of vitamins and minerals; Metabolism of carbohydrates and fats; Protein nutrition and metabolism; Nitrogen balance and protein requirements; Protein synthesis and metabolism of amino acids; Integration and control of metabolism: pattern of metabolic regulation, intracellular regulation of enzyme activity, responses to fast acting hormone by covalent modification of enzyme proteins, slow acting hormones, changes in enzymes synthesis.

**Suggested Readings:**

1. Bender, D.A. 2014. Introduction to Nutrition and Metabolism, 5<sup>th</sup> ed. CRC Press, Taylor & Francis, Boca Raton, FL, USA.
2. Davidson, S., R. Passmore, R and M.A. Eastwood. 1986. Human Nutrition and Dietetics. Churchill Livingstone, New York, U.S.A.
3. Gropper, S.S. and J.L. Smith. 2013. Advanced Nutrition and Human Metabolism, 6<sup>th</sup> ed. Wadsworth Cengage Learning, Belmont, CA, USA.
4. Kohlmeier, M. 2015. Nutrient Metabolism: Structures, Functions, and Genes, 2<sup>nd</sup> Ed. Academic Press, San Diego, CA, USA.
5. Lanham-New, S.A., I.A. Macdonald and H.M. Roche. 2011. Nutrition and Metabolism, 2<sup>nd</sup> ed. Blackwell Publishing, Jones & Wiley Sons Ltd., Chester, West Sussex, UK.
6. Whitney, E.N. and S.R. Rolfes. 2016. Understanding Nutrition, 14<sup>th</sup> ed. Cengage Learning, Belmont, CA, USA.

**Elective      NUTRITION EPIDEMIOLOGY      2 (2-0)**

**Learning Outcomes:**

- To learn the methodology and applications of nutritional epidemiology
- To apply various epidemiological study designs for research in the domain
- To study collection and handling of data related to socio-demographic profile and dietary intake of the community

**Theory:**

Principles of nutritional epidemiology: objective of nutritional epidemiological research, interpretation, systematic reviews, role of meta-analysis; Nutritional



epidemiological studies: classification, uses in research, selection of right study; Socio-demographic and psycho-social variables; Sampling, study size and power of study: types of sampling, variability, sample size, power of studies; Food consumption, nutrient intake and the use of food composition tables: food consumption tables and nutrient databases, calculation on nutrient intake from data on food intake and composition of foods, food groups and food scores; Household surveys: characteristics of household data, techniques, uses and limitations, using household surveys in epidemiological studies; Individual surveys: methods for assessment of present or recent data, measurement error in dietary assessment, energy adjustment, effects of measurement error on validity, adjustment of intake in the distant past, problems of retrospective assessment in population sub-groups; Validation of dietary assessment: the context of validation, validation techniques, factors affecting the design of validation studies, statistical techniques and interpretation.

### **Suggested Readings:**

1. Frank, G.C. 2008. Community Nutrition: Applying Epidemiology to Contemporary Practice, 2<sup>nd</sup> ed. Jones and Bartlett Publishers Inc., Sudbury, MA, USA.
2. Margetts, B.M. and M. Nelson. Design Concepts in Nutritional Epidemiology, 2<sup>nd</sup> Ed. Oxford University Press, New York, USA.
3. Rothman, K.J., S. Greenland and T.L. Lash. 2008. Modern Epidemiology, 3<sup>rd</sup> ed. Lippincott & Wilkins, Philadelphia, PA, USA.
4. Spark, A. 2007. Nutrition in Public Health: Principles, Policies and Practice. CRC Press, Taylor & Francis, Boca Raton, FL, USA.
5. Walter, W. 2013. Nutritional Epidemiology, 3<sup>rd</sup> ed. Oxford University Press, New York, USA.

## RECOMMENDATIONS

**Missing  
???????**