

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, 2th 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, 6th 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, 3rd ed. Oxford University Press, London.
3. Guyton A.C. and J.E. Hall. 2006. Textbook of Medical Physiology, 11th 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, 2nd ed. MAS Computers, Faisalabad, Pakistan.
5. Tortora, G.J. 2008. Principles of Anatomy and Physiology, 12th 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 (4th 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)

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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, 4th 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, 5th ed. McGraw-Hill Book Co., New York, USA.
5. Montville, T.J., K.R. Mathews and K.E. Kniel. 2012. Food microbiology: an introduction, 3rd ed. ASM Press, Washington DC, USA.
6. Ray, B. and A. Bhunia. 2013. Fundamentals of Food microbiology, 5th 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.