

CURRICULUM
OF
AGRICULTURAL CHEMISTRY
BS/B.Sc (Hons.)

2010



HIGHER EDUCATION COMMISSION
H-9, ISLAMABAD

CURRICULUM DIVISION, HEC

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PREFACE

The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

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

In compliance with the above provisions, the HEC undertakes revamping and refurbishing of curricula after regular intervals in a democratic manner involving universities/DAIs, research and development institutions and local Chamber of Commerce and Industry. The intellectual inputs by expatriate Pakistanis working in universities and R&D institutions of technically advanced countries are also invited to contribute and their views are incorporated where considered appropriate by the National Curriculum Revision Committee (NCRC).

To bring international compatibility to qualifications held from Pakistani universities/DAIs for promotion of students mobility and job seekers around the globe, a Committee comprising of Conveners of the National Curriculum Revision Committee of HEC met in 2009 and developed a unified template for standardized 4-years/8-semesters BS degree programmes. This unified template was aimed to inculcate broader base of knowledge in the subjects like English, Sociology, Philosophy, Economics etc in addition to major discipline of study. The Bachelor (BS) degree course requires to be completed in 4-years/8-semesters, and shall require qualifying of 130-140 credit hours of which 77% of the curriculum will constitute discipline specific and remaining 23% will comprise compulsory and general courses.

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for BS and MS (Agricultural Chemistry). The same is being recommended for adoption by the universities/DAIs channelizing through relevant statutory bodies of the universities.

PROF. DR. ALTAF ALI G. SHAIKH
Member Academics

March 2010

CURRICULUM DEVELOPMENT

Abbreviations Used:

NCRC. National Curriculum Revision Committee

VCC. Vice-Chancellor's Committee

EXP. Experts

COL. Colleges

UNI. Universities

PREP. Preparation

REC. Recommendations

LI Learning Innovation

R&D Research & Development Organization

HEC Higher Education Commission

INTRODUCTION

The final meeting of National Curriculum Revision Committee (NCRC) in Agricultural Chemistry was held on March 29-31, 2010 to finalize the draft curriculum developed in the first meeting of the committee (November 02-04, 2009) at Higher Education Commission, Regional Centre Lahore. The meetings were attended by the following experts:

1. Prof. Dr. Hamid Ullah Shah
Dean, Faculty of Nutrition Sciences
NWFP Agricultural University
Peshawar
Convener
2. Prof. Dr. Fahim uddin
Ex-Convener NCRC and Advisor to
Vice Chancellor (Acad)
Department of Chemistry
University of Karachi
Karachi
Member
3. Prof. Dr. Muhammad Saeed Khattak
Department of Agricultural Chemistry
Faculty of Agriculture
Gomal University, Dera Ismail Khan,
NWFP
Member
4. Dr. Saghir Ahmed Sheikh
Professor and Director, Institute of
Food Sciences and Technology
Sindh Agriculture University, Tandojam
Member
5. Dr. Tahira Shafiq
Chief Scientific Officer, and Head
Department of Environment
PCSIR Labs Complex
Ferozepur Road, Lahore
Member
6. Prof. Dr. M. Jamil Ahmed
Chairman, Department of Horticulture
Faculty of Agriculture, Rawalakot
University of AJandK , Muzaffarabad
Member
7. Dr. Fahim Ashraf Qureshi
Assistant Professor,
Department of Chemistry
G.C. University, Lahore
Member

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|-----|---|--------------------|
| 8. | Dr. M. Zafar-ul-Hye Gondal
Assistant Professor of Soil Science
Department of Agronomy and Soil
Science
B.Z. University, Multan | Member |
| 9. | Dr. Maazullah Khan
Principal Engineer,
Food Science Division
Nuclear Institute for Food and
Agriculture (NIFA) Tarnab, Peshawar | Member |
| 10. | Dr. Barkat Ali Khan
Senior Research Officer
Agricultural Research Institute
Tarnab, Peshawar | Member |
| 11. | M. Fakhar-U-Zaman Akhtar
Lecturer, Department of Soil Science
University College of Agriculture and
Environmental Sciences
The Islamia University of Bahawalpur | Member |
| 12. | Dr. Muhammad Akmal
Assistant Professor,
Department of Soil Science and Soil
Water Conservation,
PMAS- Arid Agriculture University,
Rawalpindi | Member |
| 13. | Dr. Ismat Naeem
Professor,
Department of Chemistry
Lahore College for Women University,
Jail Road Lahore | Member / Secretary |

The proceedings started with recitation of The Holy Quran. Mr. Mohammad Bashir, Director Regional Centre, HEC Lahore welcomed the participants for attending the meeting in Lahore. Mr. Shafiullah, Deputy Director (Curriculum) , HEC, Islamabad welcomed the participants and briefed them the objectives of the meeting and the obligations of the Higher Education Commission for review, revision and development of curricula.

He further informed the members that Higher Education Commission is striving hard to enhance the quality of education in public sector Universities/Institutions by developing curricula and making it more compatible with international standards, job oriented and in line with the needs of the society. He distributed the template of the 4 years B.Sc

(Hons) in Agriculture disciplines among the members as a guideline for developing Agricultural Chemistry curriculum. He suggested that Internship of full semester be reduced to a four credit hour course and contact hours of practical be increased from 2 to 3 hours. The four year degree program should be of 130 to 140 credit hours.

The convener Prof. Dr. Hamid Ullah Shah welcomed all the members and thanked the participants for attending the meeting. He informed the members that the curriculum of Agricultural Chemistry is being taught in only two universities of Pakistan. After thorough discussions and deliberations, the proposed draft of curricula of B.Sc. (Hons) Agricultural Chemistry was developed.

Prof. Dr. Hamid Ullah Shah thanked all the members for attending the meeting and their contributions. The meeting ended with a vote of thanks.

At the end, all the members thanked Mr. Muhammad Bashir, Director, Regional Center, Lahore for their comfortable stay at the Regional Center, HEC, Lahore.

AIMS AND OBJECTIVES

- Upgrade and update the knowledge regarding the progress in Agricultural Chemistry and related disciplines
- Bring uniformity in curricula taught in different universities offering Agricultural Chemistry as major
- Provide recent trends and skills to help in an agricultural system which can meet the need of our country and contribute to global requirement as well
- Encourage students to broaden their knowledge and develop their own capabilities and self confidence
- Advance communication and interpersonal skills, both verbal and written particularly in the context of the Agricultural Chemistry.
- Achieve the highest possible standards in teaching and research in Agricultural Chemistry and related disciplines.

Template for 4-Year BS/B.Sc. (Hons) in Agricultural Disciplines

1. Compulsory Courses

	Credits Hours
Mathematics / Biology (2 courses)	6 (3-0) (2-1)
Statistics 1 & 2	6 (3-0) (3-0)
Computers / IT	3 (2-1)
Pakistan Studies	2 (2-0)
Islamic Studies	2 (2-0)
Communications Skills	3 (3-0)
English	3 (3-0)
Basic Agriculture	3 (2-1)
Sub-Total	28

2. Interdisciplinary Foundation Courses

Agronomy	3 (2-1)
Plant Breeding & Genetics	3 (2-1)
Entomology	3 (2-1)
Plant Pathology	3 (2-1)
Food Technology	3 (2-1)
Horticulture	3 (2-1)
Soil Sciences	3 (2-1)
Agriculture Economics	3 (2-1)
Sub-Total	24

3. Supporting Courses {6-8 courses (3 Cr. hr) amongst below}

Agriculture Extension	
Forestry & Range Management	
Animal Science	
Marketing & Agri Business	
Rural Development	
Human Nutrition	
Agriculture Chemistry	
Agriculture Engineering	
Water Management	
Any other discipline recommended by the university	
Sub-Total	18-24

Sub-Total during the first four semesters	70-76
Semester 5, 6, 7 & 8	56-60
Project / Internship	04
Grand Total	130-140

- 1 credit of theory = one contact hour per week for 16-18 weeks and 1 practical/Lab hour = 3 contact hours per week for 16-18 weeks.

- In case of non availability of department of supporting courses, courses from foundation courses can be opted.

SCHEME OF STUDIES

BS/B.Sc. (HONS) AGRICULTURE (MAJOR IN AGRICULTURAL CHEMISTRY)

S. No.	Courses Title	Credit Hours
1.	Introduction to Agricultural Chemistry (supporting course)	3(2-1)
2.	Principles of Biochemistry	4(3-1)
3.	Vitamins and Minerals	3(2-1)
4.	Chemistry of Lipids	3(2-1)
5.	Bio-organic Chemistry	4(3-1)
6.	Bio-Physical Chemistry	3(2-1)
7.	Protein Chemistry	3(2-1)
8.	Principles of Food Security	3(2-1)
9.	Environmental Chemistry	3(2-1)
10.	Plant Biochemistry	3(2-1)
11.	Clinical Biochemistry	3(2-1)
12.	Agricultural Microbiology	3(2-1)
13.	Applied Biochemistry	3(2-1)
14.	Introduction to Organic Chemistry	3(2-1)
15.	Pesticide Chemistry	3(2-1)
16.	Fundamentals of Phytochemistry	3(2-1)
17.	Analytical Chemistry	3(2-1)
18.	Molecular Biology	3(2-1)
19.	Soil Chemistry	3(2-1)
20.	Food Chemistry	3(2-1)
21.	Preparation of Research Project and Scientific Writing	2(2-0)
22.	Seminar	1(1-0)
23.	Internship	4(0-4)

DETAIL OF COURSES FOR BS/BSc (HONS) IN AGRICULTURE CHEMISTRY

COURSE TITLE: INTRODUCTION TO AGRICULTURAL CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Discipline of Agricultural Chemistry and its applications
- Concepts of acids and bases
- Importance of carbohydrates, proteins, lipids and enzymes

COURSE OUTLINE

Agricultural chemistry: Introduction, history, contribution and scope. **Acids and bases:** General concepts, relative strength of acids and bases, significance of pH, buffer solution and standard solutions. **Water:** Importance, sources, quality concern and management. **Importance of carbohydrates, proteins and lipids:** Classifications, reactions and qualitative analysis. **Enzymes:** Terminology, nature, classification, specificity and factors affecting enzyme activity.

PRACTICALS

Laboratory equipment and apparatus, name and use, general lab instructions

Preparation and standardization of solutions

Determination of moisture and ash contents

Qualitative tests of carbohydrates and protein

Determination of reducing and non-reducing sugars

Determination of protein by Kjeldahl method

BOOKS RECOMMENDED:

1. David, H. 2000. Modern Analytical Chemistry. International ed. McGraw Hill Co. Inc. New York.
2. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.
3. Khalil, I. A. and H. Shah. 2003. Basic Biochemistry. National Book Foundation Islamabad, Pakistan.
4. Lehninger, A.L. 2000. Principles of Biochemistry. 3rd ed. Worth Publisher, New York. USA.
5. Rupm, H. and H. Krist, 1992. Laboratory Manual for the Examination of Water, Wastewater and Soil. 2nd ed. Weinheim, Fed. Rep. Germany.
6. Stryer, L. 1994. Biochemistry. 5th ed. W. H. Freeman and Co. London UK.

7. Vogel, A. I. 1995. A Text Book of Macro and Micro Quantitative Inorganic Analysis. 1st ed. Longman Green and Co. Inc, New York.
8. Zubay, G. 1999. Biochemistry. 4th ed. MacMillan Publishing Co. London UK.
9. Shah Hamid Ullah, 2010. Laboratory Safety Manual. HEC-BC JHELP-II, NWFP Agriculture University Peshawar.
10. James, Finlay, Weir and Johnston., 2008, Elements of Agricultural Chemistry and Geology. Biblio Bazaar, USA.
11. Fraps. G.S. 2009, Principles of Agricultural Chemistry. Cornell University, USA.

COURSE TITLE: PRINCIPLES OF BIOCHEMISTRY

Credit Hours: 4(3-1)

OBJECTIVES

The students will learn about:

- Metabolism of carbohydrates, lipids and proteins
- Metabolism and bio energetics of macro molecules
- Enzyme kinetics

COURSE OUTLINE

General introduction. An overview of biological molecules, carbohydrates, lipids, proteins, amino acids and vitamins. **Enzymes:** General characteristics of enzyme, nomenclature and classification, substrate specificity, enzyme kinetics and Michaelis-Menten equation. **Vitamins:** Role of vitamin as co-factor. **Bioenergetics:** Biological oxidation-reduction including respiratory carriers, cell bio energetics, oxidative phosphorylation, free energy change and redox system. **Metabolism of carbohydrates:** Digestion, absorption and transport of sugars into cell, glycolysis, citric acid cycle, gluconeogenesis, glycogenesis, glycogenolysis. **Metabolism of Lipids:** Digestion of lipids, absorption and transport of lipids and fatty acids, oxidation of saturated, un-saturated, odd chain and branched chain fatty acids, biosynthesis and utilization of ketone bodies. **Metabolism of Proteins:** Digestion of proteins, absorption and transport of amino acids to the cell, biochemical reaction of amino acids, decarboxylation, deamination, transamination and transmethylatation, urea cycle and inter-relationship between carbohydrate, lipid and protein metabolism.

PRACTICALS

Quantitative analysis of carbohydrates
 Quantitative analysis of proteins
 Quantitative analysis of lipids
 Purification of enzymes

BOOKS RECOMMENDED:

1. Hein. 2009. Introduction to General Organic and Biochemistry 9th Ed. John Wiley, USA .
2. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.
3. Khalil, I. A. and Shah Hamid Ullah, 2003. Basic Biochemistry. National Book Foundation Islamabad, Pakistan.
4. Lehninger, A.L. 2000. Principles of Biochemistry. 3rd ed. Worth Publisher, New York, USA.
5. Sinnott, M.L., Greig I.R., Buchanan, G.J. and Williams I.H. 2007. Carbohydrate Chemistry and Biochemistry. Taylor and Francis, U.K.
6. Stryer, L. 1994. Biochemistry. 5th ed. W. H. Freeman and Co. London, UK.
7. Zubay, G. 1999. Biochemistry. 4th ed. McMillan Publishing Co. London, UK.

COURSE TITLE: VITAMINS AND MINERALS

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Physiological functions and deficiency symptoms of vitamins
- Macro and micro nutrients
- Diseases associated with deficiency

COURSE OUTLINE

Vitamins: Historical review, classification, structure, physiological functions, deficiency symptoms, sources and recommended dietary allowances (RDA), hypo and hypervitaminosis **Minerals:** Macro and micro nutrients, their role, interaction, sources and deficiency symptoms **Methods of determination:** Vitamins (A and C) and minerals.

PRACTICALS

Determination of vitamin A by spectrophotometer/HPLC.
Determination of vitamin C by dye reduction method.
Determination of phosphorus by spectrophotometer.
Determination of micronutrients by atomic absorption spectrophotometer
Determination of Na and K by flame photometer.

BOOKS RECOMMENDED:

1. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.

2. Machlin L. J. 1984. Handbook of Vitamin. Marcel Dekker, New York, USA.
3. Mendham, J., R.C. Denny, J.D. Barnes and M. Thomas. 2000. Vogel's Text Book of Quantitative Chemical Analysis, 6th ed. Prentice Hall, USA.
4. Metzler, M.S. 1979. Biochemistry, Academic Press, New York, USA.
5. Morton, R.A. 1970. Fat Soluble Vitamin. 1st ed. Pergamon Press, New York, USA.
6. Skoog D.A., D.M. West and F.J. Holler, 1992. Fundamentals of Analytical Chemistry, 6th ed. Saunders College Publishing Co. New York, USA.

COURSE TITLE: CHEMISTRY OF LIPIDS

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- The nature of fatty acids, oils and lipids
- Physical properties and metabolism of fats and oils
- Role of dietary fat in health

COURSE OUTLINE

Introduction: Composition and classification of dietary fats and oils.
Fatty acids: Nomenclature, saturated and unsaturated fatty acids, essential fatty acids.
Properties of fats and oils: Melting point, refractive index, hydrogenation, hydrolysis, halogenation, saponification and rancidity of fats and oils.
Metabolism of fats and oils: Digestion, absorption and transport of fats, oxidation of fatty acids, formation of ketone bodies, biosynthesis of fats, phospholipids and cholesterol.
Dietary fat and health: Plasma lipoproteins, low-density lipoprotein (LDL) and high-density lipoprotein (HDL), their association with coronary heart diseases (CHD), effect of dietary fat on health such as obesity, hypertension, diabetes, cancer etc. and immune response system, recommended level of different types of dietary fat.

PRACTICALS

Determination of iodine value
 Determination of R.M. and Polenske value
 Determination of melting point of fat
 Fatty acid determination by GLC
 Cholesterol determination by spectrophotometer

BOOKS RECOMMENDED:

1. Campbell, M.K. 1991. Biochemistry. Saunders College Pub. Co. Philadelphia, USA.

2. FAO/WHO. 1994. Fats and Oils in human nutrition. Report of joint expert consultation, Food and Nutrition paper 57. Rome, Italy.
3. Feher, M.D. and W. Richmond. 1990. Lipids and lipids disorders. J.B. Lippincott Company Philadelphia, USA.
4. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.
5. Khalil, I. A. and H. Shah. 2003. Basic Biochemistry. National Book Foundation, Islamabad, Pakistan.
6. Vergroesen, A.J. 1975. The Role of Fats in Human Nutrition. Academic Press, New York, USA.
7. Vance, D.E. and J.E. Vance, 2008. Biochemistry of Lipids and Membranes 5th ed. Elsevier, The Netherlands.

COURSE TITLE: BIO-ORGANIC CHEMISTRY

Credit Hours: 4(3-1)

OBJECTIVES

The students will learn about:

- Organic chemistry of chemical compounds commonly found in plants
- Stereo chemistry of complex natural products
- Chemistry of bio-macromolecules and their applications

COURSE OUTLINE

Introduction: Chemistry of natural products (alkaloids, flavonoids and terpenes), organic matter (cellulose, hemicellulose, humic, fulvic acids and lignin) and biosynthesis. **Stereochemistry:** Classification, absolute configuration and conformational analysis. **Chemistry of bio-macromolecules:** Carbohydrates, nucleic acid and protein. **Chemistry and application:** Protective groups, phosphorus containing compounds, amino acid and lipids.

PRACTICALS

Preparation of iodoform

Preparation of aspirin

Measurement of optical activity by polarimeter

Qualitative and quantitative determination of alkaloids (nicotine, caffeine etc)

Qualitative tests of naphthalene, quinone etc

BOOKS RECOMMENDED:

1. Bansel, R.K. 1998. Synthetic Approaches in Organic Chemistry. 2nd ed. Jones and Bartlett Publishers Inc., New York, USA.

- Bansel, R.K. 2001. Heterocyclic Chemistry. Weig Eastern Ltd. New Delhi, India.
- Clayden, J., N. Greeves, S. Warren, P. Wothers, 2001. Organic Chemistry. Oxford, Uk.
- Finar, I.L. 2000. Organic chemistry. 6th ed. John Wiley and Sons Inc., New York, USA.
- Morrison, R.T., and Boyd, R.N., 2001. Organic Chemistry. 6th Ed. Prentice Hall. NY.
- Blei, I. and G. Odian, 2006, Organic Biochemistry 2nd Ed. Freeman, USA.

COURSE TITLE: BIO-PHYSICAL CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- The physical aspects of bio-macromolecules
- Purification and separation techniques of bio-macromolecules
- Molecular weight determination

COURSE OUTLINE

Acids, bases: Introduction and scope, modern concepts of acids and bases, pH measurement, buffers and their role in biological system. **Thermodynamics:** Laws of thermodynamic, entropy, free energy and enthalpy. **Diffusion and osmosis:** Introduction, differentiation, osmotic pressure in isotonic, hypotonic, and hypertonic solutions, role of osmotic pressure in fluid exchange of biological system. **Colloids and polymers:** Introduction, types, nature and characteristics, purification and application, methods for the determination of molecular weights. **Biophysical phenomena:** Adsorption isotherms (Langmuir and Freundlich), viscosity (Newtonian and non Newtonian fluids), surface tension.

PRACTICALS

Determination of molecular weight by osmometry
 Determination of viscosity
 Determination of surface tension
 Determination of pH
 Adsorption of acetic acid on charcoal
 Preparation of colloidal solution and purification

BOOKS RECOMMENDED:

- Adamson, A.W. and P.G. Alice. 1997. Physical Chemistry of Surfaces. 6th ed. John Wiley and Sons Inc., New York, USA.

2. Alberty, R.A. and R.J. Silbey. 1992, Physical Chemistry. 5th ed. John Wiley and sons Inc., New York, USA.
3. Atkins, P. and J. de Paula, 2005, Physical Chemistry for the Life Sciences. Freeman, USA.
4. Dykstra, C.E. 1997. Physical Chemistry, A modern Introduction. International ed. Prentice Hall International Inc., USA.
5. Hammes, G.G. 2007, Physical Chemistry for the Biological Sciences, John Wiley, USA.
6. Sheehan, D., 2009, Physical Biochemistry: Principles and Applications. 2nd Ed. John Wiley, USA.
7. Van Holde, K. E., Johnson, C. and P.S. Ho, 2005. Principles of Biochemistry. 2nd Ed. Printice Hall, USA.

COURSE TITLE: PROTEIN CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Types of proteins and amino acids
- Functions in living organisms
- Protein quality evaluation

COURSE OUTLINE

Introduction: Structural and functional proteins, importance of proteins.
Amino Acids: Structure, classification and properties, essential and non essential, occurrence in animals and plants. **Protein:** Characteristics, properties and reactions, solubility, optical activity, dialysis, ultra centrifugation, electrophoresis, precipitation and hydrolysis. **Protein quality evaluation:** Amino acid score with reference to FAO/WHO, deficient amino acids score in food, protein efficiency ratio (PER), net protein utilization (NPU), biological value (BV) and nitrogen balance (NB).

PRACTICALS

Protein determination by different methods
Preparation of protein hydrolysate for amino acid analysis
Amino acid determination by paper and ion exchange chromatography
Qualitative tests of protein and amino acid

BOOKS RECOMMENDED:

1. Campbell, M.K. 1991. Biochemistry. Saunders College Pub. Philadelphia USA.
2. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.

3. Khalil, I.A. and H. Shah. 2003. Basic Biochemistry. National Book Foundation, Islamabad, Pakistan.
4. Lehninger, A.L. 2000. Principles of Biochemistry. 3rd ed. Worth Publisher, New York, USA.
5. Stryer, L. 2002. Biochemistry. 5th ed. W.H. Freeman and Co., London, UK.
6. Howard, G.C. W.E. Brown, 2001. Practical Methods in Advance Protein Chemistry. CRC Press, USA.
7. Whitford, D. 2005. Proteines Structure and Function. John Wiley, USA.

COURSE TITLE: PRINCIPLES OF FOOD SECURITY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Food security in relation to food production in Pakistan
- Policies and plans to ensure food security
- Post harvest management

COURSE OUTLINE

Introduction: Food security, international commitment to end hunger and malnutrition. **Food security and human rights:** Conceptual understanding of food security, nutrition security, household food security. **Factors affecting food security:** Determinants/dimensions, nutrition linkages and millennium development goals, postharvest technology and food security. **Food safety and food quality.** Food laws in Pakistan, quality control and quality assurance system in Pakistan. food trade, WTO and Codex Alimentarius. **Food insecurity and its measurement:** Chronic, transitory and seasonal food insecurity, FIVIMS, meeting the challenges of food security in Pakistan, the role of agriculture.

PRACTICALS

Use of food composition tables
 Determination of dietary intake through questionnaire
 Use of questionnaire to measure household food security
 Designing home gardens for food security
 Determination of food insecurity in terms of malnutrition

BOOKS RECOMMENDED:

1. FAO (2003) Focus on food insecurity and vulnerability-A review of the UN system common country assessment and World Bank poverty reduction strategy papers. FIVIMS secretariat and Wageningen University and research centre.
www.fao.org/DOCREP/006/Y5095EOO.htm.

2. FAO 1997, Food, Agriculture and Nutrition, Food and Nutrition FAO, Rome, Italy.
3. FAO website: <http://www.foodsec.org/pubs.htm> and other literature.
4. FAO/WHO, 1992. International Conference on Nutrition (ICN). Final report of the conference, Rome, Italy.
5. Jones, J.M. 1992. Food Safety. AAcc. Paul, Minn, USA.
6. Khalil, J.K. 2007. Food security with special reference to Pakistan. Higher Education Commission, Pakistan, Islamabad. (Text book).
7. Schmidt, R.H. and G.E. Rodrick. 2003. Food Safety Hand Book. John Wiley, USA .
8. Ryan, J., J. Glarum, 2008. Biosecurity and Bioterrosim containing and Preventing Biological Threats. Elsevier, The Netherlands.

COURSE TITLE: ENVIRONMENTAL CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Various sources and types of environmental pollution
- Health hazards caused by environmental pollution
- Global warming and climate changes

COURSE OUTLINE

Introduction: Anthropogenic activities. **Atmospheric and Air pollution:** Vehicular exhausts and industrial emissions, atmospheric photochemical reactions and ozone depletion, emission of toxic gases and heavy metals. **Contaminants of soil and water:** Organic and inorganic sources, health hazards, water quality parameters and limits of water quality according to WHO standards, purification of water/ wastewater, primary, secondary and tertiary treatment at source. **Global warming and climate change:** Green house effect, role and atmospheric concentrations of emission gases i.e., CO₂, CH₄, N₂O, CFC's, and O₃. **Agrochemical pollution:** Impact of fertilizer and pesticide industry, residual effect of pesticide, plant response to metals in soil and water, biosorption of metals, bioremediation. **Fossil Fuel and Energy Sources:** Origin and development of coal, origin of petroleum and natural gas, composition and classification of petroleum, environmental problems associated with petroleum, nuclear fusion and reactors.

PRACTICALS

Qualitative and quantitative analysis of irrigation water
 Qualitative and quantitative analysis of drinking water
 Determination of BOD and COD in waste water
 Estimation of heavy metals in soil / plants and wastewater

BOOKS RECOMMENDED:

1. Chiras, D.D. 1985. Environmental Science. Benjamin/Cumming Pub. Co., USA.
2. Dara, S.S. 2004. A Text Book of Environmental Chemistry and Pollution Control 7th Ed. S. Chand and company Ltd, Ram Nagar, New Delhi.
3. McBride, M.B. 1994. Environmental Chemistry of Soil. Oxford University Press Inc., New York, USA.
4. Moore, J.W. and E.M. Moore. 2000. Environmental Chemistry. Academic Press, New York, USA.
5. Spiro, T.G. and W.M. Stingliani. 1996. Chemistry of the Environment. 1st ed. Printice Hall, New York, USA.
6. Baird, C. and M. Cann, 2008. Environmental Chemistry. Freeman, USA.
7. Van Loon, G. W. and F.J. Duffy, 2005. Environmental Chemistry: A Global Prospective. 2nd Ed. Oxford University press, USA.
8. Wright, J. 2003. Environmental Chemistry. Taylor and Francis, UK.

COURSE TITLE: PLANT BIOCHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- The structure and composition of cell
- Secondary metabolites and their nature
- Functions of plant hormones along with photosynthetic pathways

COURSE OUTLINE

Cell: Structure, functions, origin and nature of bio-molecules, chemical composition of cell membrane, cell wall and transport processes. **Plant Enzyme and co-enzymes:** Nature and functions, kinetics and inhibition. **Nucleic acids:** purines, pyrimidines, nucleosides, nucleotides, structure and functions of DNA and RNA. **Secondary Metabolites:** Alkaloids, terpenes, polyphenols. **Growth Hormones:** Types, sources, functions, bio synthesis, mode of action and applications, pheromones. **Photosynthesis:** Cyclic and non cyclic photophosphorylation, light and dark reactions with reference to C₃, C₄ and Crussulacean acid metabolism (CAM) plants.

PRACTICALS

Microscopic examination of cell
Determination of phytic acid in cereal and legume
Determination of gluten
Ripening of fruits by application of different hormones

Detection of Alkaloids in *Alloe vera*

BOOKS RECOMMENDED:

1. Lehninger, A.L. 2000. Principles of Biochemistry. 3rd ed. Worth Publisher, New York.
2. Stryer, L. 1994. Biochemistry. 5th ed. W. H. Freeman and Co., London.
3. Verma, S.K. 2005. A Text Book of Plant Physiology and Biochemistry. 4th Ed. S. Chand and Co. Ltd New Delhi.
4. Voet, F. D., J.G. Voet and C.W. Pratt. 1999. Fundamentals of Biochemistry. John Wiley and Sons, New York.
5. Zubay, G. 1999. Biochemistry. 4th ed. McMillan Publishing Co., London.
6. Bowsher, C., M., Sleer, and A. Tobin, 2008. Plant Biochemistry. Taylor and Francis, UK.
7. Heldt, H.W. 2004. Plant Biochemistry 3rd ed. Elsevier, The Netherlands.

COURSE TITLE: CLINICAL BIOCHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Chemistry and functions of blood
- Bio chemical processes causing different diseases
- Different techniques of clinical diagnosis and treatments

COURSE OUTLINE

Introduction: Role of clinical Biochemistry in health and diseases, factors causing diseases. **Biochemistry of blood:** Chemistry and function of blood, blood plasma, serum protein, red blood cell, white blood cell, platelet, structure and function of hemoglobin, coagulation and its mechanism. **Chemistry of gastrointestinal tract:** Enzymatic and hormonal mechanism, liver function test, CSF, clinical significant, **Immunology:** Definition, myeloma hybridoma and immunoglobulin, immune system and its abnormalities, allergy and inflammation and compliment system, immune diagnostics. **Biochemical aspects of cancer:** Etiology, clinical diagnosis and treatment, oncogenesis. **Infection and infestation:** Chemical and physical agents, genetic and constitutional factors, diseases of organs. **Diagnostic Tools:** Radio isotopes, PCR based diagnostic test.

PRACTICALS

Determination of blood urea
Determination of total cholesterol in blood
Determination of lipid profile
Determination of billirubin in blood serum

Determination of calcium, phosphorus, uric acid
Analysis of normal and pathogenic urine

BOOKS RECOMMENDED:

1. Murry, D.K., P.A. Grammer and V.W. Rodwell, 2000. Harper's Biochemistry, 25th ed, Appleton and Lange, USA.
2. Rose, N.R., H. Friedman and J.L. Fahey. 1986. Manual of Clinical Laboratory, Immunology. 3rd ed. American Society for Microbiology, USA.
3. Sawhney, S.K. and R. Singh, 2000. Introductory Practical Biochemistry. Narosa Pub. House, New Dehli, USA.
4. Zilva J.F., P.R. Pannall, and P.D. Mayne, 1988. Clinical Chemistry in Dignosis and Treatment, Appleton and Lange, USA.
5. Devlin, T. M. 2010. Text Book of Biochemistry with clinical correlations. 7th Ed. John Wiley, USA.
6. O'Reilly, D.J., Murphy, M.J., Steward, M.J., Cowan, R.A. and Gaw, A. 2008. Clonical Biochemistry and Illustrated Color Text. 4th Ed. Elsevier, The Netherlland.

COURSE TITLE: AGRICULTURAL MICROBIOLOGY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Isolation and identification of microbes
- Biological nitrogen fixation and PGPR
- Microbial transformations

COURSE OUTLINE

Introduction: Definition and history. **Microbiological techniques:** Pure and sterilize culture media, selective media, and light microscopy, antimicrobial activity. **Viruses:** Morphology, types and classification, life cycle, **Bacteria:** Morphology, cell structure, growth, reproduction, classification, actinomycetes, **Rhizobacteria** plant growth promoting rhizobacteria (PGPR), biological nitrogen fixation (BNF). **Fungi:** Morphology, reproduction, classification, useful and harmful fungi. **Toxicity:** Microbial contamination and bioremediation. **Microbial transformations:** Transformations of nitrogen, sulphur, iron and manganese.

PRACTICALS

Preparation of culture media for microbes, routine and selective media. Isolation, morphological and bio-chemical identification of microbes.

Staining Techniques: Simple, negative, ground, acid fast, spore, capsule staining and motility.

Microbial tests for drinking water quality.

BOOKS RECOMMENDED:

1. Bey R. F. 2001. Microbiology Laboratory Manual.
2. Dubey, R.C. and D.K. Maheshwari. 2005. Text Book of Microbiology. 2nd Ed. S. Chand and company Ltd, New Delhi.
3. Kathleen, P.T. and T. Arthur. 2001. Foundations in Microbiology: Basic Principles. McGraw Hill Co. Inc., New York, USA.
4. MacKane, L. and J. Kandal. 1986. Microbiology: Essential and Application. McGraw Hill Co. Inc., New York, USA.
5. Mitchell, R. 1992. Environmental Microbiology, John Wiley and Sons, Inc. USA.
6. Stainier, R.Y., J.L. Ingraham, M.L. Wheelis and P.R. Painter. 1992. General Microbiology, 5th ed. McMillan Education Ltd. UK.
7. Wolk, W.A. 1992. Basic Microbiology. 7th ed. Harper Collins Publishers, USA.

COURSE TITLE: APPLIED BIOCHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Basic biochemical processes
- Structures of common chemicals of biological importance
- Processes involved in different industries

COURSE OUTLINE

Fermentation: Aerobic and anaerobic fermentation, production of bio-fuels. **Pulp and Paper Industry:** Sulfite, sulfate pulp, types of paper and production processes. **Oils and Ghee Industry:** Importance, sources, extraction, refining, hydrogenation and Ni, Pt and Ag catalysis. **Soap Industry:** Types, uses and production processes. **Sugar and Starch industry:** Production from Sugarcane and sugar beet, by-products of sugar industry and its utilization. **Starch:** Sources, production and uses. **Fertilizer Industry:** Types and composition, manufacturing processes, application and bio-fertilizer.

PRACTICALS

Determination of saponification value and acid value

Fermentation of milk

Identification of sugars

Extraction of crude oil from oil seeds

Ethanol production from corn

BOOKS RECOMMENDED:

1. Austin, G. T. 1984. Chemical Process Industries. 5th ed. McGraw Hill, Inc. New York.
2. Bradbury, S and B. Bracegirdle, 1998. Introduction to Light Microscopy, 1st ed. BIOS Scientific Publisher Ltd. UK.
3. Jain, J.L., S. Jain and N. Jain. 2006. Fundamentals of Biochemistry. S.Chand company Ltd. Ram Nagar, New Delhi.
4. Kent, J. A. 1997. Riegel's Handbook of Industrial Chemistry. CBS Publishers and Distributors, New Delhi, India.
5. Lehninger A.L. D.L. Nelson and M.M. Cox. 2000. Principles of Biochemistry. 3rd ed. Worth Publisher, New York USA.
6. Smith, R. 1995. Chemical Process Design. 2nd ed. McGraw Hill, Inc. New York USA.
7. Boyer, R.F. 2005, Concepts in Biochemistry with the Interactive concepts in Biochemistry. 3rd ed. John wiley, USA.

COURSE TITLE: INTRODUCTION TO ORGANIC CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Basic concepts in chemical bonding
- Characteristics of organic molecules
- Reactions of organic compounds and chemistry of functional groups

COURSE OUTLINE

Introduction: History, contribution and scope. **Basic concepts in chemical bonding:** Localised and delocalised bonding, concept of hybridization leading to bond angles, bonding in organic molecules, bond energies and geometry of simple organic molecules, dipole moment, resonance. **Nomenclature of Organic Compounds:** Common and trivial names; systematic naming of organic compounds by IUPAC rules. **Hydrocarbons:** Open Chain: preparation, properties, and reactions of alkanes, alkenes and alkynes; Closed chain: properties and reactions of small and medium sized cycloalkanes; Aromatic compounds: structure of benzene, aromaticity and reactions. **Isomerism:** Classification, geometric isomerism, cis, trans isomerism in compounds containing two double bonds, optical isomerism, optical activity and chirality, racemisation and resolution of racemic mixture. **Chemistry of functional groups:** Halides, hydroxyl, phenolic, ethers, carbonyl, carboxylic, ester, amino and amide groups.

PRACTICALS

Qualitative determination of organic compounds containing groups (COOH, OH, NH₂ and C=O)

Purification techniques (solvent extraction, distillation and recrystallization)
Chemical reactions of benzene.
Qualitative and quantitative determination of starch.
Preparation of methyl salicylate (ester)

BOOKS RECOMMENDED:

1. Clayden, J., Greeves, N., Warren, S., Wothers, P. 2001. *Organic Chemistry*. Oxford, UK.
2. McMurry, J.E. 2007. *Organic Chemistry*, 7th Ed. Cengage Learning, USA.
3. Solomon, T. W. G. and C.B. Fryhle, 2007. *Organic Chemistry*. John Wiley, USA.
4. Smith, M.B. and J. March, 2007. *March's Advanced Organic Chemistry. Reactions Mechanism and Structure*. 6th Ed. John Wiley, USA.
5. Hornback, J.M. 2005. *Organic Chemistry* 2nd Ed. Cengage Learning, USA.

COURSE TITLE: PESTICIDE CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Different classes of pesticides and their mode of action
- Types of pesticide formulations
- Hazards of pesticides in environment

COURSE OUTLINE

Introduction: History, importance, current application status, international concern about pesticide usage, role of pesticides in agriculture.

Formulation of Pesticides: Common pesticide formulations (liquid, dry, specialized pesticides), solvent selection, surfactants and adjuvants.

Groups of Pesticides: Organochlorine, organophosphate, carbamate, pyrethroids and bio-pesticides, classification, mode of action (MRL, lethal dose). **Herbicides:** Types, application and mode of action. **Fungicides:** Types, application and mode of action, chemical protection measures.

Pheromones: Introduction, chemistry, method of application, mode of action and protection measures. **Environmental Hazards of Pesticides:** Pesticide poisoning, occupational hazards, water contamination, toxicity and safety measures.

PRACTICALS

Sampling procedures for pesticide analysis

Determination of emulsification characteristics of emulsifiable concentrate pesticides

Wet sieve analysis of wettable powder formulations
Dry sieve analysis of granular formulations

BOOKS RECOMMENDED:

1. Corbett, J.R., K. Wright and A.C. Bailli. 1984. The Biochemical Mode of Action of Pesticides. 2nd edn. Academic Press London, UK.
2. Hutson D.H. and T.R Roberts. 1988. Progress in pesticide Biochemistry and Toxicology. Vol.3, John Wiley and Sons, New York.
3. Khan, S.A., B.A Khan and S.A. Khalil, 2007. Pesticide Bio-chemistry. National book foundation, Islamabad, Pakistan.
4. White, R. 1971. Pesticides in the Environment. Vol. I, 2nd ed. Marcel Dekker Inc., New York, USA.
5. Whitford, F. 2002. The Complete Book of Pesticide Management, Science, Regulations, Stewardship and communication. John Wiley, USA.

COURSE TITLE: FUNDAMENTALS OF PHYTOCHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Taxonomy of medicinal plants
- Essential chemical components of medicinal herbs, including appropriate extraction and quantitation methods, and strategies for structure elucidation
- Biosyntheses and synthetic methodologies, involved in deriving the active components of medicinal herbs.

COURSE OUTLINE

Introduction: History, scope and development of phytochemistry. **Plant taxonomy:** Study of following families with special reference to important medicinal plants of apocynaceae, solanaceae, rutaceae, umbelliferae, leguminosae and liliaceae. **Record keeping (Herbarium):** Collection, identification, processing and storage of medicinal plants. **The classification and nomenclature of important medicinal herbs:** Senna, ephedra, hyoscyamus, atropa, datura, catharanthus. aconite, rheum, belladonna, rauwolfia. podophyllum, sanguinaria. mentha, digitalis, eucalyptus. clove, fennel, castor and coriander. **Factors influencing cultivation of medicinal plants:** Types of soils and fertilizers of common use, pest management and natural pest control agents. **Study of important chemical classes found in medicinal herbs (including their role and ecological function):** Alkaloids, terpenoids and phenylpropane derivatives, glycosides, lignin.

PRACTICALS

Preliminary Screening of Natural Products: Preliminary chemical tests for the detection of carbohydrates, tannins, alkaloids, glycosides, steroids, saponins, terpenes and flavonoids

Alkaloids: Mayer's reagent test, Wagner's reagent test, Dragendorff's reagent test

Glycosides: Kedde reagent test, Keller killiani test

Saponins: haemolysis test, froth test, Leibermann-Burchard test

Sterols: Salkoawaski test

Flavonoids: colour test, cyanidin test. UV detection

Tannins: ferric chlorides test, lead acetate test

Macroscopic Examination of Natural Products:

Over ground parts: Seed: Melia, Cucumis, Psoralea, Ricinus, Lallementia, Ipomea,

Microscopic Examination of Natural Products:

Powdered drug examination: Cinnamon bark, nux vomica seeds, clove flower bud, senna leaf, coriander, cardamon

BOOKS RECOMMENDED:

1. Bruneton, J.1999, Pharmacognosy, Phytochemistry, Medicinal Plants, Technique and Documentation, Intercept. 2nd Ed. Lavoisier, France.
2. Graeth, T., 2000, Medicinal Chemistry. John Wiley, USA.
3. Hostettman, K. 1995, Phytochemistry of Plants Used in Traditional Medicines. Clarendon, Oxford.
4. Jonathan,C., N. Greeves, W. Stuart, and W. Peter, 2001, Organic Chemistry. Oxford University Press, USA.
5. Liang, X.T. and W.S. Fang, 2006. Medicinal Chemistry of Bioactive Natural Products John Wiley, USA.

COURSE TITLE: ANALYTICAL CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Laboratory management, safety and quality control
- Chromatography and electrophoresis
- Spectroscopy and microscopy

COURSE OUTLINE

COSHH: Control of substances hazardous to health (COSHH) and regulations. **Laboratory Management:** Sampling, collection techniques, use of balances, preservation of various chemicals, safety measurements. **Quality Control:** Calibration and standardization of instruments.

Chromatography: Various types, paper, thin layer, ion exchange, liquid (HPLC) and gas (GC). **Electrophoresis:** Principle, theory and uses. **Spectroscopy:** Uses of FTIR spectrophotometer, UV/VIS spectrophotometer, flame photometer, atomic absorption spectrophotometer, nuclear magnetic resonance (NMR) spectrophotometer, mass-spectrophotometer, ICP, polarimeter and refractometer. **Microscopy:** Types, principle and operation. **Centrifugation:** Cell fractionation.

PRACTICALS

Study of sampling techniques

Calibration and standardization of instruments

Determination of concentration of samples by spectrophotometer

Determination of concentration of samples by refractometer

Determination of cell fractionation by centrifugation

Determination of various proteins by electrophoresis with respect to their molecular weight

Determination of various sugars and amino acids by paper and thin layer chromatography

BOOKS RECOMMENDED:

1. Braun, R. D. 1987. Introduction to Chemical Analysis. McGraw Hill Publisher, U.K.
2. Enke, C.G. 2001. The Art and Science of Chemical Analysis. John Wiley and Sons, New York, USA.
3. Ewing, G.W. 1985. Instrumental Methods of Chemical Analysis. 5th ed. McGraw Hill Publisher, UK.
4. Shah, Hamid Ullah,. 2010. Laboratory Safety Manual. HEC-BC JHELP-II, NWFP Agriculture University Peshawar.
5. Thomas, S. and M. Williams. 1976. Modern Methods of Chemical Analysis. Pecsok. 2nd ed. John Wiley and Sons, New York, USA.
6. Harris, D.C. 2006. Quantitative Chemical Analysis. 7th Ed. Freeman, USA.
7. Hage, D.S., and J.R. Carr, 2010. Analytical Chemistry and Quantitative Analysis. Prentice Hall, USA.

COURSE TITLE: MOLECULAR BIOLOGY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- The genes and genome of living organisms
- The biochemistry of DNA and RNA.
- Regulation of gene expression in living organisms

COURSE OUTLINE

Introduction: History, contribution and scope. **Cell:** Structure, chromosomes, genes and genome, mitosis, meiosis; **DNA:** Structure, replication, mutability, repair and recombination. **RNA:** Structure, synthesis and splicing. **Proteins:** Structures, synthesis, proteomics, targeting and turnover. **Genes regulation:** Genes expression in prokaryotes and eukaryotes, post transcriptional modification in eukaryotes.

PRACTICALS

Estimation of proteins in serum by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE)
Determination of UV absorption spectra of proteins
Polymerase Chain Reaction (PCR)
Separation of nucleotide by HPLC
Extraction of DNA and RNA
Measurement of DNA, RNA and protein concentration

BOOKS RECOMMENDED:

1. Albert, B., D. Bary, J. Lewis, M. Raff, K. Roberts and J. D. Watson, 1994. Molecular Biology of Cell. 3rd Ed. Garlands Publishing Inc., NY, USA.
2. Lodish, H., D. Baltimore, A. Erk, S. L. Zipursky, P. Matsudaira, and J. Danell, 1995. Molecular Cell Biology. 3rd Ed. Scientific American Books, N.Y. USA.
3. Warner, R., 1992. Essential Biochemistry and Molecular Biology. 2nd Ed. Elsevier N. Y.
4. Weaver, R.F. 2007. Molecular Biology. 4th Ed. McGraw Hill, USA.
5. Alberts, B. 2007, Molecular Biology 5th Ed. Taylor and Francis, Uk.
6. Tropp, B.E. 2007. Molecular Biology, Genes and Proteins 3rd Ed. Jones and Bartlett, USA.

COURSE TITLE: SOIL CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Chemical and physical properties of elements, soil, colloids and minerals
- Ion exchange equations
- Absorption and desorption of ions in soil

COURSE OUTLINE

Soil: Definition, type and composition. **Nature of soil elements:** Occurrence, electronic configuration, and chemical and physical properties

of nitrogen, phosphorus, potassium, hydrogen, oxygen, carbon, calcium, magnesium, sulphur, boron, chlorine, copper, iron, manganese, molybdenum and zinc. **Properties of soil:** Structure, texture, color, temperature, consistency, inorganic soil colloids and minerals, layer silicate clays, cation and anion exchanges and their significance, ion exchange equations, soil pH and buffering capacity, soil redox potential, base saturation percentage of soil, adsorption and desorption of ions in soil.

PRACTICALS

Collection and preparation of soil sample
Determination of electrical conductivity (EC) of saturated soil extract
Determination of soluble cations and anions in saturated soil extract
Determination of extractable cations in saturated soil extract
Determination of soil cation exchange capacity (CEC)
Determination of soil pH
Determination of soil micro nutrients (Fe, B, Cu and Zn)

BOOKS RECOMMENDED:

1. Bohn, H.L., B.L. McNeal and G.A. O'Connor. 1998. Soil chemistry. (2nd Ed.). A Wiley Inter Science Publ., NY, USA
2. Essington, M.E. 2004. Soil and Water chemistry. CRC Press LLC. 2000. N.W. Corporate Blvd. Boca Raton, FL 33431, USA.
3. McBride, M.B. 1994. Environmental chemistry of soils. Oxford University Press, New York, USA.
4. Tan, K.H. 1993. Principles of soil chemistry. (2nd Ed.). Marcel Dekker, Inc., NY, USA.
5. Carter, M.R. and E. G. Gregorich, 2007. Soil Sampling and Methods of Analysis. 2nd Ed. CRC Press, USA.

COURSE TITLE: FOOD CHEMISTRY

Credit Hours: 3(2-1)

OBJECTIVES

The students will learn about:

- Composition and properties of food
- Methods of improving the quality of food
- Natural toxins in food and their detoxification

COURSE OUTLINE

Introduction: Color, flavor and taste of foods, sensory evaluation of foods. **Composition of Foods:** Chemical nature and role of fats, risk factors, carbohydrates and dietary fiber, their role in food system, proteins and amino acids, and their influence on the quality of foods. **Methods of improving protein quality of food:** Protein quality, essential amino acids,

scoring pattern-supplementation and complementation. **Enzymes and vitamins:** Enzymes and co-enzymes and their role in digestion, vitamins in food, water-soluble and fat-soluble vitamins, their occurrence, physiological functions and daily requirements. **Mineral elements:** Essential mineral elements in food, heavy metal contamination. **Food additives and value addition:** Introduction and significance. **Toxicity of food:** Natural toxins in food, methods of detoxification. **Water activity:** Definition, role of water activity in food storage.

PRACTICALS

Qualitative tests for carbohydrates and proteins
Organoleptic assessment of food
Proximate analysis of food
Determination of water activity
Estimation of total dietary fiber
Separation of natural food colors

BOOKS RECOMMENDED:

1. Belitz, H.D. and W. Grosch. 1999. Food Chemistry 2nd Ed. Springer Verlag, Berlin, Heidelberg, Germany.
2. Deman, J.M. 1996. Principles of Food Chemistry, Avi. Pub. Co. Inc. West Post. Conn. USA.
3. Fennema, O.R. 1996. Food Chemistry 5th Ed. Marcel Dekker, Incl, New York.
4. Lawless, H. T. and H. Heymann. 1998. Sensory Evaluation of Food, Principles and Practices. Chapman and Hall, New York.
5. Pomeranz, Y. 1994. Food Analysis – Theory and Practice, Champman and Hell, USA.
6. Damodran, S., O.R. Fennema and K. Parking, 2007. Fennema's Food Chemistry 4th Ed. Taylor and Francis, UK.
7. Weaver, C.M. and R. J. Daniel, 2003. The Food Chemistry Laboratory, 2nd Ed. Taylor and Francis, Uk.

COURSE TITLE: PREPERATION OF RESEARCH PROJECT AND SCIENTIFIC WRITTING

Credit Hours: 2(2-0)

OBJECTIVES

The students will learn about:

- Literature survey
- Synopsis and scientific paper writing
- Delivering oral presentation.

COURSE OUTLINE

Scientific presentation: Types, review of literature from printed and electronic sources, organizing literature, initiating write up and writing review of literature, synopsis, thesis, writing scientific paper, quoting references in text and in bibliography, delivering oral presentation and writing internship report.

BOOK

1. Awan, J.A. 2003. Scientific presentations. Unitech communications, Faisalabad.

DETAILS OF COMPULSORY COURSES

COMPULSORY COURSES IN ENGLISH FOR Undergraduate Level

English I (Functional English)

Credit Hrs. 3

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. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking

English II (Communication Skills)

Credit Hrs. 3

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.

English III (Technical Writing and Presentation Skills) Crh. 3

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. Mc=Graw-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 norther 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).

ISLAMIC STUDIES
(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-Ihzb 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) Quranic & 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 Jrisprudence 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)

Pakistan Studies (Compulsory)

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-i-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

Books Recommended

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.

**COMPULSORY MATHEMATICS
COURSES FOR B.Sc (Hons) AGRICULTURE**

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:

Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin,

Boston (suggested text)

Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston

Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th 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:

Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York

Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)

Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston

Thomas GB, Finney AR, *Calculus* (11th edition), 2005, Addison-Wesley, Reading, Ma, USA

3. MATHEMATICS III (GEOMETRY)

Prerequisite(s): Mathematics II (Calculus)

Credit Hours: 3 + 0

Specific Objectives of the Course: To prepare the students, not majoring in mathematics, with the essential tools of geometry to apply the concepts and the techniques in their respective disciplines.

Course Outline:

Geometry in Two Dimensions: Cartesian-coördinate mesh, slope of a line, equation of a line, parallel and perpendicular lines, various forms of equation of a line, intersection of two lines, angle between two lines, distance between two points, distance between a point and a line.

Circle: Equation of a circle, circles determined by various conditions, intersection of lines and circles, locus of a point in various conditions.

Conic Sections: Parabola, ellipse, hyperbola, the general-second-degree equation

Recommended Books:

Abraham S, Analytic Geometry, Scott, Freshman and Company, 1969

Kaufmann JE, College *Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston

Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

Note:

1. *Two courses will be selected from the following three courses of Mathematics.*
2. *Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.*

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 ungrouped data.

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

Practicals

- 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 kurtosis

Book Recommended

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 Statistics with world examples by J. Crawshaw and J. Chambers (1994)
4. Basic Statistics an Inferential Approach 2nd 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 X² (chi-square) Testing hypothesis about variance.

Practicals

- 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

Book Recommended

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-metrial approach, 2nd Edition, 1980 by R.G.D Steal and James H. Tarric
4. Statistical Procedures for Agricultural Research 2nd Edition (1980) by K.A. Gomez and A.A. Gomez

Note: *Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.*

Course Name: **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

Text Books/Reference Books:

Introduction to Computers by Peter Norton, 6th International Edition (McGraw HILL)

Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, 6th Edition (McGraw HILL)

Computers, Communications & information: A user's introduction by Sarah E. Hutchinson, Stacey C. Swayer

Fundamentals of Information Technology by Alexis Leon, Mathewsleon Leon Press.

Functional Biology-I

Credit Hours 3+0

Biological Methods

Principles of Cellular Life
Chemical Basis
Structure and Function
Principles of Metabolism
Energy Acquisition

Principles of Inheritance

Mitosis and Meiosis
Chromosomes
Observable Inheritance Patterns
DNA Structure and Function
RNA and Proteins
Genes
Genetic Engineering and Biotechnology

Biodiversity

Fundamental Concept of Biodiversity
One or two examples of each of the following from commonly found organism
Prions
Viruses
Bacteria
Protistans
Algae
Fungi
Plants
Crops
Animals
Invertebrates
Vertebrates

Reading

1. Roberts, M.M., Reiss and G.Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Functional Biology-II

Credit Hours 3+0

Myths and Realities of Evolution

Microevolution

Speciation

Macroevolution

Level of Organization

Plants

Tissues

Nutrition and Transport

Reproduction

Growth and Development

Animals

Tissue, Organ System and Homeostasis

Information Flow and Neuron

Nervous System

Circulation and Immunity

Nutrition and Respiration

Reproduction and Development

Ecology and Behavior

Ecosystems

Biosphere

Social Interactions

Community Interactions

Human Impact on Biosphere

Environment Conservation

Reading

1. Roberts, M.M., Reiss and G.Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Note: Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.

RECOMMENDATIONS

The existing curriculum of the degree in Agricultural Chemistry was revised / updated and a new comprehensive agriculture oriented curriculum at graduate levels was developed.

Keeping in view the significance of Agriculture in Pakistan, following recommendations were unanimously made:-

- Such degree programme of B.Sc (Hons.) in Agricultural Chemistry, may also be initiated in other Universities of Pakistan, on the pattern of NWFP Agricultural University, Peshawar and Gomal University, Dera Ismail Khan
- Graduates of Agricultural Chemistry should be placed in agriculture sector and other related disciplines/ industries and fields by HEC or any other relevant Government Authority
- Refresher courses/workshops pertaining to in-service teacher's training in relevant fields may also be arranged on priority basis to improve the teaching standards of the Faculty.
- Curriculum revision exercise of the HEC was very much appreciated and such exercise should continue in future
- Job opportunities to agricultural chemists must be provided in relevant provincial and federal departments, export promotion bureau, PASSCO, Pakistan Standard Quality Control Authority and Agro-based Industry on priority basis
- The Departments of Agricultural Chemistry should be strengthened and modernized by funding, hiring of experienced faculty members, purchase of laboratory equipment and up-gradation of library facilities to meet the RandD requirements of the present time.