

CURRICULUM
OF
PLANT PROTECTION

BS/B.Sc (Hons)
MS/M.Sc (Hons)
Ph.D

(Revised 2010)



HIGHER EDUCATION COMMISSION
ISLAMABAD

CURRICULUM DIVISION, HEC

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Composed by: Ms. Pakeeza Yousuf, HEC, Islamabad

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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-semester 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-semester, 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 (Plant Protection). 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

INTRODUCTION

The meeting of the National Curriculum Revision Committee to review/revise the curriculum of B.Sc. (Hons.), M.Sc.(Hons.) and Ph. D. in Plant Protection was held from May 10-12, 2010 at HEC, Regional Centre, Karachi. Following experts attended:

1. Prof. Dr. Ghulam Jilani Member/**Convener**
Department of Plant and Environmental Protection
National University of Agricultural Sciences.
NARC, Park Road, Islamabad
2. Prof. Dr. Ahmad-Ur-Rahman Saljoqi Member/Secretary
Chairman
Department Plant Protection
NWFP Agricultural University
Peshawar
3. Prof. Qamaruddin Abbasi, Member
Chairman
Department of Plant Protection
Sindh Agriculture University
Tandojam
4. Prof. Dr. Masood Khan Khattak, Member
Chairman, Department of Entomology,
Faculty of Agriculture,
Gomal University, D. I. Khan.
5. Prof. Dr. Ihsan Illahi Member
Dean, Faculty of Sciences,
Karakoram International University,
Gilgit
6. Prof. Dr. Imtiaz Ali Khan, Member
Chairman, Department of Entomology,
NWFP Agriculture University,
Peshawar
7. Prof. Dr. Mansoor-ul-Hassan Member
Department of Entomology,
University of Agriculture Faisalabad
8. Prof. Dr. Abdul Hakeem Shaikh Member
Department of Botany
Federal Urdu University
Karachi

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| 9. | Dr. Muhammad Ashfaq
Foreign Professor (HEC)
National Institute for Biotechnology &
Genetic Engineering (NIBGE)
Faisalabad | Member |
| 10. | Dr. Abdul Rauf Bhutta
Director,
Federal Seed Certification & Registration Department,
G-9/4, Islamabad | Member |
| 11. | Dr. M. Inam-ul-Haq,
Associate Professor
Department of Plant Pathology, Arid Agriculture University,
Rawalpindi | Member |
| 12. | Dr. Shaikh Saeed Ahmad
Associate Professor,
Department Environmental Sciences,
Fatima Jinnah University,
Rawalpindi | Member |
| 13. | Dr. Rashida Parveen
Assistant Professor (Plant Pathology),
University College of Agriculture,
B. Z. University, Multan | Member |
| 14. | Mr. Tamoor Khan Qambrani
Assistant Professor,
Department of Plant Pathology
Lesbellah University of Agriculture ,
Water and Marine Sciences, Uthal
Baluchistan | Member |
| 15. | Muhammad Naveed Aslam
Lecturer Plant Pathology,
University college of Agriculture and Environmental Sciences
The Islamia University, Bahawalpur | Member |
| 16. | Prof. Dr. Imtiaz Ahmad
Department of Agriculture
University of Karachi,
Karachi-75270. | Member |

17. Prof. Dr Farman Ullah.
Department of Plant Protection .
NWFP Agricultural University
Peshawar

Member

Meeting started with recitation from the Holy Quran by Prof. Dr. Ahmad-Ur-Rahman Saljoqi. Prof. Dr. Altaf Ali G. Shaikh, Member (Acad), HEC welcomed the participants and briefed about the obligations of the Commission for review/revision of curriculum. He briefed the participants about on-going activities of HEC for uplift of Higher Education in the Country.

The committee considered the existing curriculum and expatriate Pakistani expert's comments.

The committee agreed to recommend BS/B.Sc (Hons) Plant Protection courses comprising core and supporting courses as compulsory for all students majoring in Plant Protection and relevant elective courses for their proper training in the subject . More emphasis has been given to the major courses in Plant Protection and Research at post graduate level. Sufficient flexibility has also been incorporated in the curriculum for giving more emphasis to the courses to cater the needs of the area where university/college is located.

The Committee agreed to recommend the Plant Protection courses for B.Sc.(Hons) and M.Sc. (Hons.)/Ph. D. The committee agreed to incorporate Plant Protection subject in the interdisciplinary Foundation Courses like all other major courses.

Meeting ended with vote of thanks by Dr. Muhammad Tahir Ali Shah, Deputy Director (Curri), HEC, Islamabad.

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 FOR BS/B.Sc (HONS) PLANT PROTECTION

I or II year 1st Semester – 4th Semester

S.No.	Course Name	Credit Hours
1	Fundamentals of Plant Projection	3(2-1)
III Year 5th Semester		
2.	Principles Of Plant Protection	3 (2-1)
3.	Pest Ecology	3 (2-1)
4.	Pesticides And Their Application Techniques	4 (3-1)
5.	Introductory Acarology	3 (2-1)
6.	Elective	

III Year 6th Semester

7.	Plant Nematology	3 (2-1)
8.	Pests Of Field Crops	3 (2-1)
9.	Principles Of Plant Disease Management	3 (2-1)
10.	Insect Classification	3(2-1)
11.	Elective	

IV Year 7th Semester

12.	Introduction To Weed Science	3 (2-1)
13.	Pests Of Fruits, Vegetables And Ornamentals	3 (2-1)
14.	Vertebrate Pest Management	3 (2-1)
15.	Post-Harvest Pest Management	3 (2-1)
16.	Elective	

IV Year 8th Semester

16.	Range And Forest Pest Management	3 (2-1)
17	Biological Control	3 (2-1)
18	Scientific Writing And Presentation	2(0-2)
19	Project/Internship	4(0-4)

Grand Total 130 – 140

DETAIL OF COURSES FOR BS/B.Sc IN PLANT PROTECTION

A- BASIC COURSES

FUNDAMENTALS OF PLANT PROTECTION 3(2-1)

Objectives:

To acquaint the students with the basics of plant protection.

Theory:

Introduction, importance and scope. The concepts of pest, predator, parasites, parasitoids and pathogens. Introduction to plant pests: insects, vertebrates, diseases, weeds, parasitic plants, nematodes and mites. Losses and damages caused by pests. Methods of pest control (Cultural, Mechanical, physical, biological, legal, genetical, bio Pesticides and chemical). Plant protection equipments. Introduction to integrated crop management and integrated pest management (ICM and IPM). Bio-technology in plant protection.

Practical:

Collection, preservation and identification of pests and diseases specimen of field crops, fruits, vegetables and their natural enemies. Field/labs demonstration of damages and losses caused by major pests and pathogens . Use of plant protection equipments.

Books Recommended:

1. Bhutta,A.R. 2010.Text book of introductory seed pathology.HEC., Islamabad.
2. Atwal, A. S and G. S, Dhaliwal.2005. Agricultural Pests of South Asia and their Management, 5th ed. Kalyani Publishers, Ludhiana
3. Agrios, G. N. 2005. Plant Pathology, 5th ed. Elsevier Academic Press Inc., New York.
4. Shah, H. A. and Saleem, M. A. 2005. Applied Entomology. 3rd ed. B. Z. University Press, Multan.
5. Ahmad, I. and Bhutta, A. R. 2004. Text book of Introductory Plant Pathology. Pub. National Book Foundation, Islamabad, Pakistan.
6. Oudejans,J.H.1991.Agro-Pesticides: Properties and functions in integrated crop protection.United Nation Pub. Bangkok.Thiland

B. SPECIALIZATION IN PLANT PROTECTION

The committee has proposed the following “TITLES” with credit hours for specialization in Plant Protection during III year (5th and 6th semesters) and 4th year (7th and 8th semester). These are the “CORE” courses, comprising 56-60 credit hours including elective courses, internship, writing and presentation. To fulfill minimum requirements for the completion of the degree, each university may incorporate more courses according to their needs into their schemes of studies (Curricula).

PRINCIPLES OF PLANT PROTECTION 3(2-1)

Objective:

To acquaint the students with the principles of plant protection.

Theory:

Introduction: Importance and scope. Methods of plant protection (Cultural, Mechanical, Physical, Biological, Ecological, Reproductive, Legislative & Chemical Control). Pesticide equipments. Agro-ecosystem. Integrated pest management (IPM). Concept of community agriculture, principles and components of participatory IPM: Training of Facilitators (TOF) & Farmer Field Schools (FFS). Concept of field biodiversity conservation. Crop appraisal (Damage vs loss).

Practical:

Study of nature and extent of major pest damage. Demonstration of various methods of pest control and use of equipment. Conflict resolution. Demonstration of communication/facilitation skills. Visits to FFS & TOF.

Books Recommended:

1. Atwal, A.S and G.S, Dhaliwal.2005. Agricultural Pests of South Asia and their Management.5th ed. Kalyani Publishers, Ludhiana
2. Gadewarr, A.V. 2006. Plant protection in new millennium. Vol. 1. Hardcover Publishers.
3. Shah, H. A. and Saleem, M. A. 2005. Applied Entomology. 3rd ed. B. Z. University Press, Multan.
4. Upadhyay, R. K. 1999. Integrated Pest & Disease Management CAB International, Kew, UK.
5. Pedigo, Larry. P. (2006). “Entomology and Pest Management”, Pearson Education.
6. Hashmi, A.A. 1994. Pest Management (Vol. I,II,III). PARC, Islamabad
7. Pontius, J, Dilts R and Bartlett A. 2002. From farmer field School to comm.: Ten years of IPM training in Asia. FAO Community IPM Program-FAO Regional Office for Asia and the Pacific , Bangkok Thailand.

PEST ECOLOGY 3(2-1)

Objective:

To acquaint the students with the basics of pest Ecology.

Theory:

Ecology in relation to pests. Pest Classification (Insects, Pathogens, Nematodes, vertebrates, Weeds etc.). Biotic and abiotic factors and their effect on pests. Habitat, niche, diapause, degree days, food chain, food web and food mesh concepts. Introduction to life-table parameters. Concepts of environmental impact assessment (EIA's). Natural and agro-ecosystems. Host plant-pest interactions. Ecological succession. Population, its characteristics and estimation.

Practical:

Maintenance and measurement of abiotic factors with different instruments. Population estimation and construction of life-tables. Calculations of degree days. Agro-ecosystem analysis.

Books Recommended:

1. Baret, G. 2004. Fundamentals of Ecology. Thomsons Learning.
2. Saleem, M. A and M. Ashfaq. 2004. Environmental Pollution and Agriculture. B. Z. University Press, Multan.
3. Henderson, P. 2003. Practical Methods in Ecology. Blackwell Science.
4. Smith, R. and Smith, T. 2002. Ecology and Field Biology: Hands-On Field package (With CD and Additional Printer Guide). 6th ed. Pearson Education.
5. Smith, R. and T. Smith. 2002. Elements of Ecology. 5th ed. Pearson Education.
6. Newman, E. I. 2001, Applied Ecology. Blackwell Science.
7. Schowalter, Y.D.. 2000. Insect Ecology - An Ecosystem Approach. Academic Press.
8. Southwood, T.R.E. and P.A. Henderson. 2000. Ecological Methods. 3rd ed, Blackwell publishers UK.
9. Ricklefs, R.R.E. and G.L. Miller.1999. Ecology. W. H. Freeman & Co.
10. Chapman, J.L. and M. J. Reiss. 1998. Ecology-Principles and Applications. 2nd ed. Cambridge University Press
11. Ireland, W. 2005. Frost and crops : Frost Prediction and plant protection, eastbourne publishers, New Zealand.

PESTICIDES AND THEIR APPLICATION TECHNIQUES 4(3-1)

Objectives:

To acquaint the students with the nature and safe use of pesticides.

Theory:

Introduction, history, classification and formulation of pesticides. Pesticide regulation, registration and distribution in Pakistan. FAO code of conduct for pesticide use and handling (Codex Alimentarius) Pesticide hazards, safety (protective devices, first aid). Pesticide storage, indoor, ground, aerial, soil applications and fogging. Pesticide compatibility and selectivity. Pre-harvest safety intervals. Pesticide application equipments. Calibration methods, measurement of droplet size and aerosols.

Practical:

Demonstration of pesticide application techniques. Pesticide application equipments and calibrations. Types of sprayers, nozzles and their use. Measurement of droplet size. Visit to formulation plant/ quality testing lab. Pesticide safe handling, precautions and first aid.

Books Recommended:

1. Pretty, J. 2005. The Pesticide Detox: Towards A More Sustainable Agriculture. Earthscan. London, UK.
2. Jorgen, S. 2004. Chemical pesticides: Mode of action and toxicology. CRC Press, London.
3. Saleem, M. A. 2002. Principles of Insect Toxicology, Volume 1, Izhar sons Printers, 9 Rattigan Road, Lahore.
4. Mallis, A., Hedges, S.A. and Moreland, D. 2004. Pest control technology. 9th ed. The Mallis. Handbook of Pest Control technology.
5. Mathews, G. A. 2004. Pesticide application methods. 4th ed. World Science. Publishing Co.
6. Dodia, D.A. I.S.Patel and G.M.Patel. 2008. Botanical pesticides for pest management. Scientific publishers.
7. Raj, B.S. Parmar and S.S. Tomar. 2004. Pesticide formulation: theory and practice. CBS publishers.
8. Ware, G. W. and Whitacre, D. M. 2004. The pesticide book. 6th ed. MeisterPRO Information Resources
9. Rami, H.A. and Isaac, I. 2004. Insect pest management- field and protected crops. Springer.
10. Oudejans, J.H. 1991. Agro-Pesticides: Properties and functions in integrated crop protection. United Nation Pub. Bangkok. Thailand

INTRODUCTORY ACAROLOGY 3(2-1)

Objective:

To acquaint the students regarding mites, their mode of damage and control.

Theory:

Introduction; methods of collection, rearing preservation and morphology. Classification of mites as pests of crops, vegetables, fruit trees, ornamentals and stored grain products. Parasitic and predatory mites, losses caused by mites and their management. Estimation of mites population and their dispersal. Mites in relation to plant diseases.

Practical:

Collection, sampling, preservation, identification, and rearing techniques of phytophagous, predatory, parasitic and stored grain mites. Preparation of temporary and permanent slides. Population estimation, losses in crop plants and stored grain products.

Books Recommended:

1. Gulati, R. and Bhatnagar. P. 2007. Agricultural Acarology / Edited by B S Chhillar, Daya Publisher, India.
2. Khuhro, R.D. 1998. Introduction to Acarology. Kashif Publishers, Hyderabad (Sindh), Pakistan.
3. Evans, G.O. 1992. Principles of Acarology. CAB International. University Press, Cambridge.
4. Helle, W. and Sabelis, M.W. (edit.) 1985. Spider Mites, Their biology, Natural enemies and control, Vols IA. and IB. Elsevier Oxford, U.K.

6TH SEMESTER

PLANT NEMATOTOLOGY 3(2-1)

Objective:

To educate the students about nematodes and their management.

Theory:

Introduction; history and importance of nematodes in agriculture. Morphology, taxonomy and biology of nematodes of agricultural importance. Types of plant parasitic nematodes (parasitism). Symptoms caused by plant parasitic nematodes. Entomophagous nematodes. Nematodes as vectors and their interaction with other plant pathogens. Dispersal, survival and diseases of crops caused by plant parasitic nematodes. Nematode management.

Practical:

Sampling and extraction techniques of nematodes from soil and plant materials. Staining and preparation for microscopic studies. Identification and culture of nematodes. Preparation of temporary and permanent slides of nematodes. Demonstration of nematode management.

Books Recommended:

1. Ahmad, I. and Bhutta, A. R. 2005. Text book of Introductory Plant Pathology. Pub. National Book Foundation, Islamabad, Pakistan.
2. Agrios, G. N. 2005. Plant Pathology. 5th ed. Elsevier Academic Press Inc., New York.
3. Luc, M., R.A. Sikora and J. Bridge. 2005. Plant Parasitic Nematodes in Sub-tropical and tropical Agriculture. 2nd Ed. C.A.B. Intl. Inst. of Parasitology, London.
4. Siddiqi, M. R. 2002. Tylenchida: Parasities of plant and insects?
5. Sterr, J.L., R.Cook and J. Bidge. 2002. Plant Resistance to Parasitic Nematodes.
6. Maqbool, M.A. and F. Shahina. 2001. Systematic and distribution: Biodiversity of nematode Fauna in Pakistan
7. Shurtleff, M.C. and Averre III, C.W. 2000. Diagnosing Plant Diseases Caused by Nematodes. APS
8. Alam, M.M and Sharma, N. 2002. Nematode control in crops. International book distributor, India.
9. Perry, R.N and Wright, D.T. 1998. The physiology and biotechnology of free living and plant parasitic nematodes. Willing ford, cab, incorporated inc. UK.
10. Grewal, P.S., Ehler, R and Shapiro-Ilen. 2008. Nematodes as biological control agents.

PESTS OF FIELD CROPS

3(2-1)

Objective:

To educate the students about pest of field crops.

Theory:

Introduction, identification, distribution of pests of economic importance and their symptoms. Mode of damage, life history and management techniques of pests of major field crops (Cereals, leguminus, fiber, oil seed, tobacco and sugarcane crop).

Practical:

Field visits, collection and identification of pests of major crops. Symptoms, mode of damage, loss assessment and management.

Books Recommended:

1. Bhargava M.C. and K.C. Kumawat. 2010. Pests of Stored Grains and Their Management New India Publisher.
2. Atwal, A.S and G.S,Dhaliwal.2005. Agricultural Pests of Southeast Asia and their Management. Kalyani Publishers, Ludhiana
3. Hill. 2005. Pests Of Stored Products And Their Control (Pb)
4. Shah, H. A. and Saleem, M. A. 2005. Applied Entomology. 3rd ed. B. Z. University Press, Multan.
5. Amerika Singh, (2005). "Integrated Pest Management", CBS Pub.
6. Horowitz 2004. Insect Pest Management: Field And Protected Crops (Hb)
7. Norris, R F. (2002). "Concepts in Integrated Pest Management", Prentice Hall of India.
8. Hashmi, A.A. 1994. Insect Pest Management (Vol-I &III). PARC, Islamabad.
9. Hill, D.S. 1993. Agricultural Insect Pests of the Tropics and their Control. Cambridge University Press.

PRINCIPLES OF PLANT DISEASE MANAGEMENT 3(2-1)

Objective:

To acquaint the students with plant diseases and their management.

Theory:

Introduction to integrated management of plant diseases. Symptoms and disease-index of important diseases of field crops, fruits and vegetables. Principles and methods of plant disease management. Role of environmental factors and nutrition in relation to plant disease development. Host plant resistance in disease management. Epidemiological basis of disease management strategies, such as plant disease forecasting, regulatory procedures, pathogen exclusion and eradication. Seed health certification and good agriculture practices (GAP).

Practical:

Collection, identification and diagnosis of different plant disease specimens. Sampling techniques and assessment of disease index. Demonstration of different disease control methods including seed treatment. Acquaintance with equipment and machinery and their calibration. Safety measures for use of chemicals.

Books Recommended:

1. Bhutta, A.R.2010. Text book of introductory Seed Pathology.HEC Press.
2. Burns, R. 2007. Plant Pathology. Humana press.USA.

3. Ciancio, A. 2007. Concepts In Integrated Pest And Disease Management. Springer publisher.
4. Agrios, G. N. 2005. Plant Pathology. 5th ed. Elsevier Academic Press Inc., New York.
5. Ahmad, I. and Bhutta, A. R. 2005. Text Book of Introductory Plant Pathology. Pub. National Book Foundation, Islamabad, Pakistan.
6. Strange, R. N. 2003. Introduction to Plant Pathology. New York, John Willey.
7. Mehrotra, R. S. 2003. Plant Pathology. TATA McGraw Hill. Pub. Company Ltd. New Dehli, India.
8. Trigiano, R.N., Windham, M.T. and A.S Windham. 2003. Plant Pathology: Concepts and Laboratory Exercises. CRC Press,USA.
9. Kranz, J. 2002. Comparative Epidemiology of Plant Diseases. Springer Publisher.

INSECT CLASSIFICATION 3(2-1)

Objective:

To educate the students regarding principles of insect classification.

Theory:

Introduction: Ontogeny and phylogeny, types of classification. Classification of insect orders up to family level with particular reference to insects of Pakistan.

Practical:

Study of representative types regarding phylogenetic arrangement of insect orders. Collection and identification of insects up to family level with the help of taxonomic keys.

Books Recommended:

1. Daly, H.V. Doyen J.T. Purcell A.H. and Daly, B.B. 1998. Introduction to Insect Biology and Diversity. Oxford University Press.
2. Hashmi, A.A. 1994. Pest Management. (Vol. III). PARC, Islamabad.
3. Borror, D.J., DeLong, D.M and. Triplehorn, C.A. 1985. An Introduction to the Study of Insects, 6th ed. Holt, Rinehar and Winston, N.Y.
4. Richards, O.W. and Davies, R.G. 1984. IMM's General Text Book of Entomology. Vol. II, 10th ed. (Revised), Chapman and Co. Ltd., London.
5. Ross, H.H., Ross, C.A and. Ross, J.R.P. 1982, A Text Book of Entomology. 4th ed. John Wiley and Sons Inc., N.Y.

7TH SEMESTER

IV Year

INTRODUCTION TO WEED SCIENCE 3(2-1)

Objective:

To enable the students to know the basics of weeds and their management.

Theory:

Introduction to weeds and their economic importance. Weed sampling, identification, classification, biology, ecology and dissemination. Weed-crop competition and losses. Weed-insect and pathogen interactions. Principles and methods of weed management. Selectivity and safe use of herbicides. Invasive weeds.

Practical:

Collection, preservation and identification of weeds. Sampling techniques, methods and determination of population density of weeds. Herbicide application, equipments and calibration.

Books Recommended:

1. Gupta, O.P. 2007. Fundamentals of weed science: A text book of weeds. agrobios
2. Monaco, T J; Weller, S.C. and Ashton, F.M. 2002. Weed Science –
3. Principles and Practices, 4th ed. John Wiley & Sons.
4. Gressel, J.B. 2002. Molecular Biology of Weed Control. CRC Press.
5. Liebman, M., Mohler, C.L. and Staver, C.P.. 2001. Ecological Management of Agricultural Weeds. Cambridge University Press.
6. Rao, V.S., 2000. Principles of Weed Science. 5th ed. Oxford & IBH Publ. Co. Ltd., New Delhi.
7. Gupta O.P. 1998. Weed Management: Principles and Practices / Edited by: Agro Botanical Sciences/anica Publisher, India.
8. Zimdahl, R.L. 1999. Fundamentals of Weed Science, Second Edition. Academic Press, San Diego, CA.
9. Aldrich R.J. and R.J. Kremer. 1997. Principles in Weed Management, Second Edition. Iowa State University Press, Ames, IA.
10. Anderson, W.P. 1996. Weed Science: Principles and Applications, Third Edition. West Publishing Company, St. Paul MN.
11. Raenthal, S.S., D.M. Meddex and K. Brunetti. 1986. Biological Methods of Weed Control. Thomsan Pub. Francisco, California. USA.

PESTS OF FRUITS, VEGETABLES AND ORNAMENTALS

3(2-1)

Objective:

To acquaint the students with the pests of fruits, vegetables and ornamentals.

Theory:

Identification, distribution, host plants, economic importance of insect pests. Extent and nature of damage, life history and integrated management of fruits, vegetables and ornamental pests. Evaluation of insect pest management options for having best IPM protocols.

Practical:

Field visit, collection, identification and nature of damage by insect pests of various fruits, vegetables and ornamentals. Collection and identification of parasitoids and predators of fruits, vegetables and ornamental pests.

Books Recommended:

1. Srivastava, K. P and D. K. Buttan. 2009. Pest management in vegetables. Vol-1 and II. 2nd ed. India.
2. Atwal, A.S and G.S, Dhaliwal. 2005. Agricultural Pests of South Asia and their Management. 5th ed. Kalyani Publishers, Ludhiana
3. Gupta, H.C.L. 2005. "Management of Insect Pests of Horticultural Crops", Agrotech.
4. Buczacki, Stefan, Collins. 2005. Pests, Diseases & disorders Of Garden Plants
5. Arya, Arun, (2004). "Tropical Fruits: Disease and Pest", Kalyani Publishers.
6. John, C. 2001. Handbook of Vegetable Pests. Academic Press.
7. Hashmi, A.A. 1994. Insect Pest Management. Pests of Fruits. (Vol-II). PARC, Islamabad.

VERTEBRATE PESTS AND THEIR MANAGEMENT

3(2-1)

Objective:

To educate students on vertebrate pests and their management.

Theory:

Introduction to vertebrate pests and their impact on agricultural economy. Important vertebrate pests, their biology, behavior, ecology and distribution. Methods of population and damage assessment. Causes and prevention of damage by vertebrate pest species to: food and fiber plants and structures. Methods of vertebrate pest management (physical, mechanical, cultural, biological and chemical). Bait formulations and their application.

Practical:

Identification of important vertebrate pests. Population and damage assessment methods. Baits formulations, their application and field evaluation in control programmes. Use of fumigants.

Books Recommended:

1. Bhargava, M.C and K.C.Kumawat.2010.Pest of stored grain and their management. New India publishers.
2. Gerozisis,J,Hadlington, Phillip and J.staunton.2008.Urbon pest management in Australia.5th ed.University of new south wales press.
3. Sridhava,S. 2006. Vertebrate pests in agriculture. The Indian scenario scientific Pub,India.
4. Gosh,S.K and S.L.Durbey. 2003 Integrated management of stored grain pest. IBDCO
5. Brooks J. E. 1990. Training Manual. Vertebrate Pest Management. PARC/US AID/ DWRC Publication

POST-HARVEST PEST MANAGEMENT 3(2-1)**Objective:**

To acquaint students with the management of pests and post harvest losses.

Theory:

Types of post-harvest losses. Economic importance of post-harvest losses in vegetables, seeds, fruits, grains and their products. Factors affecting post-harvest losses (physical, physiological, biochemical and pathological considerations). Compositional and physical changes occurring during maturation and senescence. Biology and Ecology of storage pests and management. Methods of loss assessment; sampling techniques and quality analysis procedures. Storage structure and methods of storage at farm and public levels. Inspection and suitability of building and commodity. Grain storage management and fumigation technology.

Practical:

Post-harvest loss assessment. Godowns visits. Collection and identification of stored product pests and their natural enemies, assessment of rodent infestation in godowns. Demonstration of spray, fumigation, baits and traps techniques.

Books Recommended:

1. Bhutta, A.R.2010. Text book of introductory Seed Pathology.HEC Press.
2. Jongen, W. 2005. Fruit and vegetable processing, improving quality 388 pages. Wood head publishing Ltd.

3. Bhutta, A. R., Hussain, A and Rehman, M. R, 2004. Handbook on Seed Processing and Storage, Publ. by Federal Seed Certification & Registration Department, GOP, Islamabad\
4. Avid Rees. 2004. Insects of Stored Products. Manson Publishing
5. Chakraverty, A. Muyumdar, A. S. Raghavan, GSV and Ramaswamy, H. S. 2003.
6. Handbook of Post Harvest Technology, Published by Marcel Dekhar Inc. New York, USA. P. 864
7. Dennis S. Hill. 2002. Pests of Stored Foodstuffs and their Control. Kluwer Academic Publishers
8. J A Bartz and J K Brecht . 2002. Postharvest Physiology and Pathology of Vegetables. Marcel Dekker, USA.
9. Bhutta, A. R. and Ahmad, I. 2000, Seed Pathological Techniques and their Application. Publ. National Book Foundation, Islamabad, Pakistan.

8TH SEMESTER

RANGE AND FOREST PEST MANAGEMENT 3(2-1)

Objective:

To educate the students regarding range and forest pest management.

Theory:

Introduction. Pests of range and forest plantation. Identification, distribution, economic importance, life history of range and forest pests. Extent and nature of damage. Pest management in range, forest trees and nurseries.

Practical:

Collection and identification of forest pests; insects, mammals, diseased specimens and parasitic plants in range and forest. Demonstration of management techniques of range and forest pests.

Books Recommended:

1. Sathe, T.V. 2009. A text book of Forest Entomology. Daya Pub. New Dehli, India.
2. Jha, L. K and P. K. Sen- Sarma. 2008. Forest Entomology. APH Pub. Co. New Dehli, India.
3. Thakur, M. L. 2000. Forest Entomology: Ecology and Management. Sari Pub. Dehra Dun, New Dehli, India.
4. Tooke J E 2009 Textbook Of Forest Entomology.
5. Niar. S. 2007. Tropical Forest Insect Pest. Ecology, Impact and Management.
6. Winenouse. D. 2005. Ecological Methods in Forest Pest Management.
7. Barbosa. P, Wagner. M.R. Introduction to Forest and Shade Tree Insects.
8. Forest and Insect. Allan D. Watt, N.E. Sterk, Mark D. Hunter. (1997).
9. Ecology and Management of Forest Insects. Martin R. Speight, David Wain house. (1991).
10. Principles of Forest Pathology Tainter, F. H. (Frank H.) John Wiley 1996

BIOLOGICAL CONTROL

3(2-1)

Objective:

To educate the students on principles and practices of biological control insect pests and weeds.

Theory:

Introduction, concept, history and scope of biological control . Ecological basis of biological control. Natural enemies: predators, parasites, parasitoids,

nematodes and pathogens. Characteristics of bio-control agents. Procedure of biological control (introduction, colonization, conservation, screening, mass culture, augmentation, release and monitoring). Biological control of weeds. Role of biological control in IPM.

Practical:

Collection, preservation and identification of predators, parasitoids, nematodes and pathogens. Laboratory culture of important natural enemies. Extent of parasitism and predation of different bio-control agents. Visit to public/ private bio-control labs.

Books Recommended:

1. Irshad, M. 2008. Biological Control of Insects and Weeds in Pakistan. Higher Education Commission, Islamabad, Pakistan.
2. Copping, L.G. 2004. The Manual of Biocontrol Agents. BCPC
3. Hajek, A. 2003. Natural Enemies - An Introduction to Biological Control. Cambridge University Press
4. Helyer, 2003. A Color Handbook Of Biological Control In Plant Protection Neil Timber Press
5. Samuel S.G 2002 Biological control of crop diseases (Pak book Corporation)
6. Rechcigl, J. E. and Rechcigl, N. A., 1999. Biological and Biotechnological Control of Insect Pests. CRC Press September
7. Hawkins, B. A. and Cornell, H. V., 1999. Theoretical Approaches to Biological Control. Cambridge University Press
8. Bellows, T. S., Fisher, T. W., Caltagirone, L. E., Dahlsten, D. L., Huffaker, C. and Gardh G., 1999. Handbook of Biological Control - Principles and Applications of Biological Control. Academic Press, USA.
9. Barbosa, P. 1998. Conservation Biological Control. Academic Press
10. Van Driesche, R. G. and Bellows, T. S. 1996. Biological Control. An international publishing company, New York.
11. Heikki M.T., Hokkeanen, James M. Lynch. 1996. Biological Control – Benefits and Risks Cambridge University Press.

SCIENTIFIC WRITING AND PRESENTATION

2(2-0)

Objective:

To familiarize the students with research methods, handling of experimental data and writing research papers & reports.

Theory:

Literature search and citation. Use of internet sources and databases for plant protection information. Layout of experiments. Collection, tabulation, analysis and interpretation of research data. Writing synopsis,

research paper, research project and monograph. Preparation of multimedia presentations.

Books Recommended:

1. Jan. M. T., Shah, P., Hollington, P and Jamal, M. 2009. Agricultural Research; Design and Analysis. Department of Agronomy, Agricultural University Peshawar Pak.
2. artha.D.2005. Scientific papers and presentations. Academic press.
3. Quinn, G.P. and J.K. Michael. 2002. Experimental Design and Data Analysis for Biology. Cambridge University Press.
4. Ghani, M.A. and M. Ashfaq (Edit). 1987, A resume of Post-Graduate Research, 1929-1985. Department of Entomology, University of Agriculture, Faisalabad
5. Gilbert, I. and C.J. Himalton, 1983, Entomology: A Guide of information sources, Mausell Publishing Co. Ltd
6. Baily, P. T. 2007. Pests of field crops and pastures: identification and control. CSIRO Publishing Australia. 520p.

INTERNSHIP

4(0-4)

Assessment by the Host organization (public / private)

SCHEME OF STUDIES FOR MS/M.Sc (HONS) IN PLANT PROTECTION

A. M.Sc.(Hons.)

Minimum requirement for the completion of M.Sc.(Hons.) in Plant Protection will be 35 credit hours course work. Out of which 6 credit hours shall be allocated to compulsory courses (3 credit hours for Biochemistry and 3 credit hrs for Statistics). Out of remaining 29 credit hours 2/3 shall be allocated to major courses, whereas 1/3 credit hours shall be from supporting courses. Thesis will bear 10 credit hours.

The committee drafted the following postgraduate courses for the scheme of studies of Plant Protection.

1.	Insect Pathology	4(3-1)
2.	Advanced Biological Control	4(3-1)
3.	Biotechnology in Plant Protection	4(3-1)
4.	Host Plant Resistance	4(3-1)
5.	Vectors of Plant Diseases	3(2-1)
6.	Advanced Integrated Pest Management	4(3-1)
7.	Pesticide Toxicology	4(3-1)
8.	Pesticide Residue Analysis	4(2-2)
9.	Research Methods in Plant Protection	4(2-2)
10.	Microbial Control	4(3-1)
11.	Plant Protection and Environment	4(3-1)
12.	Advanced Ecology	4(3-1)
13.	Pesticide Resistance Management	3(2-1)
14.	Urban Pest Management	3(2-1)
15.	SPS Measure and Quarantine	3(2-1)
16.	Community Integrated Pest Management	4(3-1)
17.	Pest Management Informatics	3(2-1)
18.	International Agreements and Plant Protection	3(2-1)
19.	Advanced biochemical methods	3(2-1)

DETAIL OF COURSES FOR MS/M.Sc (HONS)/Ph.D

CORE COURSES

The following shall be the core courses in Plant protection at M.Sc. (Hons.) level.

- | | | |
|----|--------------------------------------|---------|
| 1. | Research Methods in Plant Protection | 4 (2-2) |
| 2. | Community IPM | 4 (3-1) |
| 3. | Advanced Biological Control | 4 (3-1) |
| 4. | Host Plant Resistance | 4 (3-1) |

Ph.D.

The committee recommended that course work should be compulsory pre-requisite for the Ph.D degree. It was further decided that for a Ph.D degree, a student shall have to complete 25 credit hours, out of which 2/3 credit hours shall be from major courses and 1/3 from supporting courses and a comprehensive examination (written and oral) shall follow.

The following courses were recommended as “CORE COURSES” for Ph.D degree in Plant Protection.

CORE COURSES

- | | | |
|----|-------------------------------------|---------|
| 1. | Advanced Integrated Pest Management | 4 (3-1) |
| 2. | Microbial Control | 4 (3-1) |
| 3. | Plant Protection and Environment | 4 (3-1) |

INSECT PATHOLOGY 4(3-1)

Objective:

To educate the students on the injuries and methods of infection by pathogens in insects.

Theory:

Introduction, history and scope. Types of insect pathogens (bacteria, fungi, viruses, nematodes etc). Resistance and immunity in insects. Transmission of insect pathogens. Host range, persistence and virulence of insect pathogens. Types of injuries and methods of infection by pathogens in insects. Pathogenic diseases and their diagnosis in insects, extra cellular and

intra cellular microbiota of healthy insects. Management of microbial diseases of useful insects. Role of entomopathogens in IPM.

Practical:

Isolation, purification, culture and identification of insect pathogens from the diseased insects. Diagnosis of different pathogenic diseases in insects. Control of microbial diseases of useful insects. Determination of extent of parasitism by pathogens in insects.

Books Recommended:

1. Van Emden, H. F. and Service, M. 2004. Pest and Vector Control. Cambridge University Press, UK.
2. Gaugler, R. 2001. Entomopathogenic Nematology. CABI Publishing UK.
3. Navon, A. 2000. Bioassays of Entomopathogenic Microbes and Nematodes. CABI Publishing UK.
4. Boucias, D.G. 1998. Principles of Insect Pathology. Chapman Hall, London.
5. Van Dreische, R. G. 1996. Biological Control. An International Thomson Publishing Company
6. Tanada, Y. and H. Kaya, 1992. Insect Pathology. Academic Press, New York.

ADVANCED BIOLOGICAL CONTROL

4(3-1)

Objective:

To educate the students on advances in biological control.

Theory:

Recent developments in biological control. Parasitoids and Predators of Arthropods and Molluscus. Entomopathogenic organisms (Fungi, Bacteria, Virus and Nematodes) as bio-control agents. Herbivores and Pathogens used for Weed Control. Biological Control of Plant Pathogens and Nematodes. Behavior of Insect Parasites, Parasitoids and Predators. Biology of Arthropod Parasitoids and Predators. Natural enemy Monitoring and Evaluation Techniques. Integration of Biological Control into Pest Management System. Latest research articles on biological control.

Practical:

Demonstration and Estimation of Predation and Parasitism. Collection, Identification and Preservation of natural enemies. Mass rearing of important natural enemies and their field application techniques. Sampling methods of bio-control agents for pest management. Screening of pesticides against natural enemies.

Recommended Books

1. Irshad, M. 2008. Biological Control of Insects and Weeds in Pakistan. Higher Education Commission, Islamabad, Pakistan.
2. Muniappan. 2007. Biological control of tropical weeds using arthropods R. Cambridge University Press.
3. Jervis., Mark, A. 2007 Insects as Natural Enemies, Springer UK.
4. Chincholkar, S. B. 2006 Biological control of plant diseases. Haworth food & agricultural products press.
5. Hajek, A. 2004. Natural Enemies – An Introduction to Biological Control, Cambridge University Press.
6. Bellows, T.S., Fisher, T. W., Catagirane, L.E., Dahlsten, D.L., Huffaker, C. and Gardh, G. 1999. Hand Book of Biological Control, Principles and Application of Biological Control. Academic Press, USA.
7. Jerrvis, M. and Kidd, N. 1997. Insect Natural Enemies- Practical Approaches to their Study and Evaluation. Chapman and Hall, New York.
8. Van Driesche, R.G. and Bellows, T.S. 1996. Biological Control. Chapman and Hall, New York.
9. Backaye, N.E., Thompson, S.N. and Federici, B.A. 1993. Parasites and Pathogens of Insects. Academic Press, New York.
10. www.ipmworld.umn.edu. (RadCliffe's IPM world Text Book.)

BIOTECHNOLOGY IN PLANT PROTECTION

4(3-1)

Objectives:

To educate the students on the role of biotechnology in plant protection.

Theory:

Importance and scope of biotechnology in plant improvement and use of insects as model in biotechnology. Tools of biotechnology for plant improvement. Micro propagation, embryo rescue, haploid development, virus free plant material and somoclonal variation. Recombinant DNA technology and genetic engineering, genetic diversity in plant/insect. Markers for gene/insects (biotypes) identification, PCR, gene cloning, GMOs, incorporation of novel genes for tolerance against biotic and abiotic stresses, gene for insect and disease resistance. BT crops, herbicide resistant crops, ethical issues and public concerns regarding GMOs.

Practical:

Plant tissue culture, DNA isolation from plant/insects, agrobacterium mediated transformation of plant cells, PCR using RAPD primers for examining genetic diversity of insect spp. DNA quantification, gel electrophoresis. Visits to biotechnology labs.

Recommended Books:

1. Fowler, M.W., Warren, G.S. and Young, M. M. 2008. Plant Biotechnology, Oxford Press.
2. Sharma, H.C. 2008. Biotechnological approaches for pest management and ecological sustainability. CRC Press.
3. Slater. A., Scott, N. W and Fowler, M. R. 2008. Plant Biotechnology. The Genetic Manipulation of Plants. Oxford University Press, London.UK.
4. Nag, A. 2008. Textbook of Agricultural Biotechnology. Prentice-hall of India.
5. Naidu, C.K. 2006 Applied Biotechnology. Aavishkar, India.
6. Srivastava. S, A. Narula, S. S. Bhojwani, 2004. "Plant Biotechnology and Molecular Markers" Inc Net Library, publishers Springer UK.
7. Handler, A.M.and James, A.A. 2004. Insect Transgenesis methods and applications, comprehensive review of insect gene transfer, its methodologies, applications and risk assessment and regulatory issues, CRC Pres, USA.
8. Hoy, M.A.2003.Insect Molecular Genetics: An introduction to principles and applications. 2nd ed. Academic press, London, UK.
9. Thomas 2002 Biotechnology And Safety Assessment 3/E (Hb)
10. Ilahi, I. 2010. Plant Tissue Culture. HEC Pak.

HOST PLANT RESISTANCE

4(3-1)

Objective:

To educate students on the mechanism of host plant resistance.

Theory:

Introduction, types and mechanisms of resistance against insects, nematodes and pathogens. Ecological and physiological factors in induced and genetic resistance. Role of allelochemicals and phytochemicals in insect resistance. Antixenosis, antibiosis, tolerance, disease escape & immunity. Genetic basis of resistance. Effect of environment on resistance and biotypes development. Measurement of resistance. Development of resistant varieties. Screening of germplasm for resistance. Comprehensive review of the concepts and achievements in resistance. Study of various infection types on host differentials. Resistance through genetic engineering.

Practical:

Testing and measurement of relative plant resistance to pests. Determination of factors and mechanisms of resistance. Preparation of mass inocula of various plant pathogens and methods of application to host plants. Screening of crop germplasm for the detection of sources of resistance.

Books Recommended:

1. Smith, C.M. 2005. Plant resistance to arthropods: molecular and conventional approaches. Springer, UK.
2. Sadasivan, S. and Thayumanavan, B. 2003. Molecular Host Plant Resistance to Pests. Marcel Dekker, USA.
3. Sterr, J.L., Cook, R and Bridge J 2002. Plant Resistance to parasitic nematodes. CABI Publishing,UK.
4. Mills, D., Kunoh, H. Keen, N. and Mayama, S. 1996. Molecular Aspects of pathogenicity and Resistance Requirements for Signal Transduction. American Phytopathology Society Press, St., Paul. Minnesota, USA.
5. Pedigo, L.P. 1996. Entomology & Pest Management. Prentis & Hall. Inc. London.
6. Smith, C.M., Khan, Z. R. and Pathak, M.D. 1994. Techniques for Evaluating Insect Resistance in Crop Plants. CRC Press, U.S.A.
7. Smith, C.M., 1989. Plant Resistance to Insects. A Fundamental Approach. John Wiley & Sons., New York.
8. Agrawal, A. A., Tuzun S. and Bent, E. 1999. Induced Plant defence against pathogens and herbivores. APS. Press, St. Paul Minnesota, USA.

VECTORS OF PLANT DISEASES 3(2-1)

Objective:

To educate the students on vectors of plant diseases.

Theory:

Introduction, identification & bionomics of different vectors. Inter-relationship of plants and vectors. Mode and mechanism of transmission of plant pathogens by insects, nematodes and mites. Seed as a carrier of plant diseases. Factors affecting the mechanism of transmission of plant diseases. Study of causal organisms, etiology, symptoms and management of important fungal, bacterial, viral and nematode disease vectors.

Practical:

Collection and identification of insects, mites, nematodes and pathogens vectors. Culture of pathogens on artificial media for inoculation. Rearing and handling of vectors for plants pathological studies. Bioassay and mode of transmission of pathogens in plants by vectors. Demonstration of vector management techniques.

Books Recommended:

1. Bhutta, A.R.2010. Text book of introductory Seed Pathology.HEC Press.
2. Van Emden, H. F. and Service, M. 2004. Pest and Vector Control. Cambridge University Press, UK.

3. Taylor, C. E. and Brown, D. J. F. 1997. Nematode vectors of plant viruses. Wallingford CAB International, UK
4. Basu, A.N. and Gerry, B.K. 1993. The essentials of viruses: Vectors and Plant Diseases. Wiley, Eastern Ltd. New Delhi, India.
5. Julian, G.L. 1997. Insect transmission of plant diseases. Biotech Books Publishers Dehli, India.
6. Pierre, J. 1988. Inter relationship between insects and plants. CRC Press, London.

ADVANCED INTEGRATED PEST MANAGEMENT

4(3-1)

Objectives:

To educate the students on advanced techniques of integrated pest management.

Theory:

Introduction, history and concepts of IPM. IPM in present scenario. Agro-ecosystem analysis. Components of IPM. Quantitative basis of IPM and sampling methods. Analyses of key pests and their natural enemies. Economic levels in IPM. Principles of IPM technology transfer. Resurgences and outbreaks of pests. Role of parasites, parasitoids, predators, nematodes, pathogens, pheromones, feeding deterrents and anti-metabolites in IPM. Plant resistance in IPM. Role of genetic control and transgenic technology in IPM. Pesticides, bio-pesticides and IGR's in IPM. Comprehensive review of IPM in Pakistan.

Practical:

Methods of pest scouting, monitoring and forecasting. Estimation of losses by different sampling techniques. losses caused by insects, mites, pathogens, and weeds. Determination of economic levels. Visit to Training of facilitators (TOF), farmer field school (FFS) and woman open school (WOS).

Books Recommended:

1. Bethke, C. M. 2005. Integrated Pest Management: Principles And Applications (2 Vols Set)
2. Rami, H.A. and Isaac, I. 2004. Insect Pest Management – Field and Protected Crops. Springer, UK.
3. Dhaliwal, G. S. and Ramesh, A. 2004. Integrated pest management. Kalyani Publishers, India.
4. Ahmad, I. and Bhutta, A. R. 2004. Text book of Introductory Plant Pathology. Pub. National Book Foundation, Islamabad, Pakistan.
5. Thacker, J. R. M. 2002. An Introduction to Arthropod Pest Control. Cambridge University Press, UK.

6. Norris, R., Caswell-Chen, E. and Kogan, M. 2002. Concepts in Integrated Pest. Pearson Education, USA.
7. Pimentel, D. 2002. Encyclopedia of Pest Management. Marcel Dekker, USA.
8. Mallis. A., Hedges, S.A. and Moreland, D. (eds.). 2004. The Mallis Handbook of Pest Control.9th ed. Pest Control Technology (PCT)
9. George, G. K. and Turnia, S. B. 2000. Emerging Technologies for Integrated Pest Management, Concept Research and Implementation, UIC.
10. www.ipmworld.umn.edu. (Radcliffe's IPM world Text Book.)

PESTICIDE TOXICOLOGY

4(3-1)

Objective:

To educate the students on toxicity and poisoning of pesticide.

Theory:

Introduction, chemistry and mode of action of pesticides. Anti-cholinesterases, acetylcholine receptor agents, axonic poisons, mixed function oxidase (MFO) inhibitors, chitin synthesis inhibitors, inhibitors of mitochondrial electron transport, uncouplers of oxidative phosphorylation, inhibitors of cell division etc. Pesticide metabolism: Phase-I and Phase-II reactions. Toxicokinetics: pesticide absorption, distribution and excretion in insects and humans. Antidotes against pesticides poisoning. Phytotoxicity in crop plants.

Practicals:

Instructions regarding laboratory equipments used in the toxicological experiments. Gross symptoms produced by representative pesticides in insects and rodents. Determination of C x T product in comparing relative toxicity of fumigants. Bio-assay of pesticides and probit analysis.

Books Recommended:

1. Tomlin, C. 2003. The Pesticide Manual. 13th ed. CPC, USA
2. Saleem, M. A. 2002. Insect Toxicology. Izhar sons printer, Pakistan .
3. Roberts, T. 2000. Metabolism of Agrochemicals in Plants. John Wiley & Sons, UK.
4. Gupta, H.C.L. 1999. Insecticides: Toxicology and Uses. Agrotech Publishing Academy, India.
5. Isaac, I. and Degheele, D. 1998. Insecticides with novel modes of action. Springer-Verlag, USA.
6. Ware, G. W. and Whitacre, D. M. 2004. The pesticide book.6th ed. Meister PRO Information Resources, USA.

PESTICIDE RESIDUE ANALYSIS

4(2-2)

Objective:

To educate the students on residual effects of pesticides and their analysis.

Theory:

Theoretical and practical aspects of modern analytical techniques used in the qualitative and quantitative analysis of pesticides and their residues. Separation and quantification techniques: gas chromatography, high performance liquid chromatography (HPLC), affinity chromatography, electrophoresis, and immuno-chemistry. Identification of pesticides and their metabolites through mass spectroscopy techniques, infrared, nuclear magnetic resonance, and ultraviolet spectroscopy.

Practical:

Use of laboratory equipments for the above mentioned techniques. Interpretation of spectra of pesticide chemicals. Use of TLC, GLC, HPLC and other chromatographic & spectrometric equipments in pesticides residue analysis.

Books Recommended

1. Horwitz, W. 2004. Official Methods of Analysis of AOAC International. 18th Eds. AOAC International, USA.
2. Lee, P.W. 2004. Hand book of residue analytical methods for agrochemicals. 2 volume set. Wiley & Sons, USA.
3. Tomlin, C. 2003. The Pesticide Manual. 13th ed. BCP, USA.
4. Ohannesian, L. and Streeter, A. J. 2001. Handbook of Pharmaceutical Analysis. Marcel Dekker, USA.
5. U. S. Food and Drug Administration. 1999. Pesticide Analytical Manual Volume I (PAM). <http://www.cfsan.fda.gov/~download/pami-all.exe>

RESEARCH METHODS IN PLANT PROTECTION

4(2-2)

Objective:

To acquaint students with the research techniques used in plant protection.

Theory:

Introduction: Art of scientific investigation, identification of problems, aims and objectives of work plan. Scientific background of research plan, techniques including experimental designs and apparatus employed in plant protection research. Scientific photography and digital image processing. Online information collection and digital library search. Computer software in

plant protection. Data collection, analysis, interpretation and presentation. Project planning, execution and report writing.

Practical:

Lab exercises based on the matters described above.

Books Recommended:

1. Jan. M. T., Shah, P., Hollington, P and Jamal, M. 2009. Agricultural Research; Design and Analysis. Department of Agronomy, Agricultural University Peshawar Pak.
2. Hicks, C.R. and Turner, K.V. 1999. Fundamental Concepts in the Design & Analysis of experiments. 5th ed. Oxford University Press, USA
3. Hicks, C.R. and Turner, K.V. 1999. Solutions Manual for Fundamental Concepts in the Design & Analysis of experiments. 5th ed. Oxford University Press, USA
4. Zar, J. H. 1999. Biostatistical Analysis. 4th ed. Prentice-Hall, Inc., Upper Saddle River, USA.
5. Sokal, R. R. and Rohlf, F. J. 1995. Biometry: the principles and practice of statistics in biological research. 3rd ed. W. H. Freeman and Co., USA.
6. Tonapai, G.T. 1994. Experimental Entomology – An aid to Laboratory and Field Studies. CBS Publishers and Distributors, India.

MICROBIAL CONTROL

4(3-1)

Objective:

To educate the students on microbes as source of insect management.

Theory:

Introduction, history & scope. Ecological basis of microbial control. Characteristics of pathogens of pest species. Management of insects, mites, weeds, nematodes and plant pathogens by pathogenic bacteria, fungi, viruses, nematodes and protozoan's. Mass production of antagonistic microbes. Mode of action, storage, infectivity, virulence, biosafety and bioassay of plant pathogens. Microbial control as a component of IPM. Microbial pesticides: production, standardization, formulation and application. Compatibility of microbial pesticides with synthetic pesticides and bio-control agents. Transgenic micro organisms as bio-control agents.

Practical:

Collection, preservation, screening and identification of pathogenic fungi, bacteria, nematodes, protozoa and viruses. Diagnosis of insect diseases. Isolation, purification, culture, formulation and application of pathogens. Awareness, safety and quality control of microbial pesticides. Mass production of bio-control agents. Compatibility test of microbial-pesticides with bio-control agents.

Books Recommended.

1. Hajek, A. E., Glare, T. and O' Callaghan, M. 2009. Use of microbes for control and eradication of invasive arthropods. Vol. 6. Springer, UK.
2. Koul, O. and Dhaliwal, G. S. 2001. Microbial Biopesticides. CRC Press, USA.
3. Gaugler, R. 2001. Entomopathogenic Nematology. CABI Publishing UK.
4. Khetan, S. K. 2000. Microbial Pest Control. Marcel Dekkar, USA.
5. Trividei, P. C. 1998. Plant Nematode Management: A biocontrol Approach.
6. Van Driesche, R. G. and Bellows, T. S. 1996. Biological Control. International Publishing company, USA.

PLANT PROTECTION AND ENVIRONMENT

4(3-1)

Objective:

To educate students on plant protection with reference to environment.

Theory:

Introduction, concept with environmental perspective. Diversity of pests in different environments. Interactions of various groups of pests with biological, chemical and physical parameters of their environments. Impact of air, water, soil pollutants and agrochemicals on pests and non-target organisms. Biological responses to pollutants and biogeochemical cycles. Pesticide pollution. Insects, microbes, fish and birds as bio-indicators of environmental pollution. Bio-remediation potential of microbes and plants.

Practical:

Underground water testing, Human blood sampling, hospital visits to know the patients status, Air and soil pollutions. Pollutants effects on useful fauna.

Books Recommended:

1. Pretty, J. 2005. The Pesticide Detox: Towards a more sustainable agriculture. Earthscan. London, UK.
2. Saleem, M. A. and Ashfaq, M. 2004. Environmental Pollution and Agriculture. B. Z. University Press, Pakistan.
3. Hill, M. K 2004. Understanding Environmental Pollution, A Primer, 2nd ed. Cambridge University Press, UK.
4. Hokka, N. Heikki, M. T. 2003. Environmental Impacts of Microbial Insecticides Kluwer Academic, USA.
5. Timbrell, J. A. 2002. Introduction to Toxicology, 3rd ed. Taylor and Francis, USA.
6. Terry, R. 2000. Metabolism of agrochemicals in plants. John Willey and Sons, USA.

7. Horwitz, W. 2004. Official methods of analysis of AOAC International. 18th ed. AOAC International, USA.

ADVANCED ECOLOGY

4(3-1)

Objective:

To educate the students on the principles and advances in ecology.

Theory:

Population growth theories, life-tables, key factor analysis, regression, co-existence, co-habitation, competition & mutual displacement, variation, speciation and diversity. A mathematical approach to the dynamics of single and multi-species populations and communities with analytical and simulation model techniques: mathematical and statistical techniques applied to population dynamics and community ecologies. Critical survey of models of population growth, niche matrices, competition, predation, ecological genetics, species diversity & distribution and ecological succession.

Practical:

Use of computer simulations in population of agricultural pests. Computer modeling used by ecologists to clarify and interpret large field data by clustering, transforming, matrices and multivariate analysis. Life table in selective environments.

Books Recommended:

1. Rockwood, L. L. 2006. Introduction to population ecology. Willey, Johns & Sons, USA.
2. Bernstein, R. 2003. Population Ecology: An Introduction to Computer Simulations . Willey & Sons, USA.
3. Mario, G. 2003. Multi Scale integrated analysis of agro systems. CRC Press, USA.
4. Vandermeer, J. H. and Goldberg, D.E.2003. Population ecology: First Principles. Princeton university Press, USA.
5. Linda, A. 2003. An Introduction to Stochastic Processes with Biology Applications. Pearson Education, USA.
6. Mario Giampietro . 2003. Multi-Scale Integrated Analysis of Agroecosystems. CRC Press .
7. Williams, B. K., Nichols, J. D. and Conroy, M. J. 2002. Analysis and Management of Animal Populations. Academic Press, USA.
8. McGlade, J. 1999. Advanced Ecological Theory. Blackwell Publisher, UK.

Objective:

To educate the students on development and management of resistance in pests.

Theory:

Introduction. Development and types of resistance. Mechanisms of resistance: biochemical, behavioral and genetical resistance. Comparative metabolism of pesticides: activation and detoxification mechanism in pests. Monitoring and management of resistance against various pests. IPM as a tool for resistance management. Resistance management in transgenic crops. Ways, means and strategies in resistance management. Comprehensive review of resistance development in Agricultural pests of Pakistan.

Practicals:

Collection of potentially resistant strains/biotypes of insect pests from the pesticide treated fields. Detection of levels of resistance in resistant strains. Biochemical basis of resistance. Demonstration of resistance breaking techniques.

Books Recommended:

1. Sharma, H.C. 2008. Biotechnological approaches for pest management and ecological sustainability. CRC , USA.
2. Whalon, M.E. 2008. Global Pesticides Resistance in arthropods. CABI, UK.
3. Pedigo, L.P. 2007. Entomology and Pest Management. 5th ed. McMillan Publishing Co.,USA.
4. Saleem, M. A. 2005. Insecticide Resistance and Management. B. Z. University Press, Multan, Pakistan.
5. Brooks, G.T. 2005. Pesticide chemistry and bioscience the food-environment challenge. Woodhead Publishing Limited,UK.
6. FAO. 2001. Policy and strategy for rational use of pesticides in Pakistan.FAO-UN, Pakistan.
7. www.irac-online.org.

URBAN PEST MANAGEMENT

3(2-1)

Objective:

To educate the students on urban pest management.

Theory:

Identification, life history, habits and habitats of pests: microorganisms, obnoxious insects, mites, birds, rats, nematodes and other pests of human habitations attacking house hold commodities (food, wood, fabrics etc.) and public health. Physical control methods: sanitation, traps, sound, radiation, baits, attractants and repellents. Principles of fumigation: evaporation, diffusion and penetration. Dosimetry and toxicity of fumigants to pests. Fumigation of mills, ships, barges, cargo, bagged goods etc. Fumigant application techniques.

Practical:

Survey, collection, identification and preservation of important pests. Demonstration of fumigation techniques, dosimetry and control methodologies.

Books Recommended:

1. Atwal, A.S and Dhaliwal, G.S. 2005. Agricultural Pests of Asia and their Management. 5th ed. Kalyani Publishers, India.
2. Ogg, B., Ferraro, D. and C. Ogg. 2005. Cockroach manual. <http://pested.unl.edu.ckcom.htm>
3. Termite Handbook. 2005. <http://pested.unl.edu/termite>
4. Ebeling, W, 2002. Urban Entomology. www.entomology.ucr.edu
5. Gerozisis, J. and Hadlington, P. 2001. Urban Pest Management in Australia 4th ed. UNSW Press, Australia.
6. Chartered Institute of Environmental Health. 2008. Urban pests and their public health significance – A CIEH summary. available online at: www.urbanpestsbook.com/downloads/WHO-Summary.pdf
7. Chartered Institute of Environmental Health. 2008. Urban pests and their public health significance – A CIEH summary. available online at: www.urbanpestsbook.com/downloads/WHO-Summary.pdf

SPS MEASURES AND QUARANTINE

3(2-1)

Objective:

To educate the students on Sanitary and Phytosanitary (SPS) Measures and quarantine regulations.

Theory:

Introduction to Sanitary and Phytosanitary (SPS) Measures under WTO regime. Plant and pest related issues. Quarantine concept and principles.

Domestic and international quarantine measures. Quarantine Act, standards and rules in Pakistan. Quarantine regulated and non-regulated pests. Outbreaks of pests introduced in Pakistan and elsewhere through import of plant and planting materials. Pest risk analysis and management. Seed Act, 1976 and its implementations in seed import/ export. Impact of SPS and quarantine measures on economy of Pakistan. Identification of pests and inspection procedure of import/export consignment. International Standards of Phytosanitary Measures (ISPM). Procedures and measures adopted under National Animal and Plant Health Inspection Service (NAPHIS).

Practical.

Analysis of various plants and planting material from exportable & importable consignments. Visit of port of entry, dry port and quarantine facilities. Demonstration of quarantine procedures and inspection. Seed sampling, testing procedure and Registration by Federal Seed Certification and Plant Protection departments.

Books Recommended:

1. Bhutta, A.R. 2010. Text book of introductory Seed Pathology. HEC Press.
2. Ranjann, S. 2007. Sanitary and Phytosanitary Measures-An introduction, Lefai University Press, India.
3. Bhutta, A.R. and Ahmad, I. 2000. Seed pathological techniques and their application. National Book Foundation, Pakistan.
4. FAO. 2000. Multi lateral Trade Negotiation on Agriculture. A Resource Manual-III-SPS & TBT Agreement. Publ. FAO-UN, Rome, Italy.
5. Plant Quarantine Act 1976, Govt. of Pakistan.
6. Seed Act (amended) 2008, Govt. of Pakistan.
7. WTO Publications.

COMMUNITY INTEGRATED PEST MANAGEMENT 4(3-1)

Objective:

To educate the students on integrated pest management approach at community level.

Theory:

Community IPM basics; Community IPM at farmer's fields, homes, schools, industrial work places, office buildings, parks and recreational areas and public property etc. Agro-ecosystem analysis. Field base diagnostics. Biodiversity conservation. Educational foundations of the farmer field schools. Farmer field experimentation & research. Participatory approach in Community IPM. Non-formal education, group dynamics and community IPM in Asia. Government policies and their impacts on community IPM. Curriculum development of training of facilitators (TOF). Women Open School (WOS) and Children Ecological Clubs (CEC).

Practical:

Farmer Field School and Insectariums visits. Farmers field experiments. Collection, identification and preservation of pests, natural enemies and diseased specimens.

Books Recommended:

1. Community IPM. 2005. <http://www.communityipm.org/doc>
2. IPM-Based Landscape Design. 2005. <http://www.efn.org/~ipmpa/D-Mhome.html>
3. Fundamentals of a Low Maintenance, Integrated Pest Management Approach to Landscape Design. 2005. <http://www.efn.org/~ipmpa/descnsd.html>
4. FAO 2004. Environmental education for poor farmers. FAO-EU IPM Program for cotton in Asia. FAO Regional office for Asia and the Pacific, Bangkok, Thailand.
5. Van den Berg .2004. Farmer Field Research: An analysis of experiences in Indonesia. FAO Regional office for Asia and the Pacific, Bangkok, Thailand.
6. Ahmad, I. and Bhutta, A. R. 2004. Text book of Introductory Plant Pathology. Pub. National Book Foundation, Islamabad, Pakistan.
7. Kazmi, M. R. and R. Zada 2003 . Facilitation Skills: A Resource Book. National IPM Program, NARC, Islamabad.
8. Reijntius, J. and Dilts, R. and Bartlett, A. (eds.), 2002. From Farmer field school to community IPM, Ten years of IPM training in Asia. Published by FAO community IPM Programmes, FAO-UN, Regional Office for Asia and the Pacific, Bangkok, Thailand.
9. CABI Bioscience. 2000 Learning to cut the chemicals in cotton. CABI-Bioscience & PAN UK.

PEST MANAGEMENT INFORMATICS

3(2-1)

Objective:

To educate the students on pest management informatics.

Theory:

Information Technology in Plant Protection. The Internet facilities. Internet-based IPM Informatics and decision support. IPM resources on the world wide web. Site specific IPM. Invasive species, databases, and decision making: Current Issues. Good laboratory practices. Biological compliance. Data analysis and visualization. Getting started with HTML. Advanced HTML. Library searching the scientific literature. World wide web technology. Basics of photographic and video capture microphotography. Basics of scientific illustration, adobe Photoshop and image modification/ enhancement. Geospatial technology. Production and scanning ideography microphotography world wide web disease informatics. Bioportal.

Practical.

Data Visualization Laboratory. Fluorescent and Confocal Microscopy.

Books Recommended:

1. Dass, S. K. and Y.K. Singh. 2007. Internet and information technology. Shree publisher. India
2. Narendrasinh, C., Jhala and J, Sarvaiya. 2005. Information Technology for Agricultural Production, Education and Management. Satish Serial Publishers, India.
3. Doja, M. N., deep and Deep. 2005. Fundamentals of Computers and Information Technology. India.
4. Date, C.J. 2004. Database systems. 8th ed. Addison Wesley Pub.co.
5. Connolly,R and P, Begg. 2009. Database Systems: A practical approach to design, Implementation and Management. 5th ed. Addison-Wesley Pub.Co.
6. Coral Pak xp-4 CD. 2009. For photo editing. Web Designing and Image Tracing Software.
7. U lead Vidio Studio 11.5. Plus. 2009 Advances Vidio Editing Software.
8. Burger, Peter and Gillies, D.F 2003. Interactive computer graphics: Functional procedural and device level methods. Addison-Wesley Pub. Co.,USA

INTERNATIONAL AGREEMENTS AND PLANT PROTECTION

3(3-0)

Objective:

To educate the students on international obligations and agreements with reference to plant protection.

Theory:

International treaties, agreements and their relevance to plant protection. An over view of Cartagena Protocol on Biosafety, Codex Alimentarius Commission (CAC), International Seed Testing Association (ISTA), Union of Plant Variety Protection (UPOV), World Intellectual Property Organization (WIPO), Intellectual Property Rights (IPR), International Plant Protection Convention (IPPC), regional organizations and their working strategies. Sanitary and Phytosanitary measures its working relation with FAO. Stockholm Convention on POPs. Main disputes, issues and problems in export & import of plant and plant products. Impact of major international agreements on economy of Pakistan. Writing of assignment / report on international agreements of Pakistan with other countries. Requirement of Material Transfer Agreement (MTA) and application of Plant Breeder's Rights (PBR).

Book Recommended:

1. Osmanczyk, E and Mango, A. 2003. Encyclopedia of the United Nations and International Agreements, 3rd ed. 3500 pp (4 Vol. Set).
2. FAO, 2000. Multilateral Trade Negotiation on Agriculture. A Resource Manual-III.SPS&TBT Agreement. Pub. by FAO-UN Rome. Italy
3. WTO Publications

ADVANCED BIOCHEMICAL METHODS

3(2-1)

Objective:

To educate the students on the advance biochemical techniques.

Theory:

Sample preparation. Spectroscopic methods for matrix characterization. Quantification of enzymes and their substrates. Quantitative immunoassays with labels. Immunological methods, Biosensors. Principles, types & applications of electrophoresis. Isoelectric focusing. Centrifugation methods. Chromatography of biomolecules. Applications of NMR and mass spectrometry in analysis of biomolecules. Concepts and techniques in metabolites.

Practicals:

Preparation of samples, extraction and analyses. Isolation, purification and characterization of major enzymes with the help of chromatographic technique. Research techniques based on the topics discussed in theory sessions.

Books Recommended:

1. Susan R. Mikkelsen, Eduardo Cortón. 2004. Bioanalytical Chemistry. Wiley.
2. Segel, I.R. 1976. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition. Wiley.
3. Alfred Pingoud, Claus Urbanke, Jim Hoggett, Albert Jeltsch. 2002. Biochemical Methods: A Concise Guide for Students and Researchers. Wiley.
4. Gordon G. Hammes. 2005. Spectroscopy for the Biological Sciences. Wiley.

Reference Books:

Methods of Biochemical Analysis (Multi-voluminous treatise, issued each year)
Advances in Enzymology and Related Areas of Molecular Biology, (Multi-voluminous treatise, issued each year)

**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. Brian 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 Francoise 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 Yorkey.

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 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).

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-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) 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 Banglades.*, 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 Statistic 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.

GENERAL RECOMMENDATIONS

1. All the universities should implement the revised curriculum (2010) of Plant Protection in its true spirit.
2. University should ensure that all recommended books in the HEC curriculum are made available in the university libraries.
3. It is strongly recommended by the committee members that refresher courses/workshops/training/seminars be arranged and funded by the HEC in the field of Plant Protection, biotechnology, bio-informatics, toxicology, acarology, quarantine and plant disease management.
4. HEC should provide opportunities/resources to the teachers to visit International /National universities/institutions to update their knowledge in their respective fields.
5. The universities should arrange to provide sufficient number of faculty to teach courses at graduate/post-graduate levels, keeping in view student: teacher ratio per university rules as recommended by HEC.
6. It is highly recommended that HEC should provide funds to equip laboratories with apparatus and chemicals especially to the universities where these are not available.
7. Adequately qualified and trained technicians/engineers be employed by university for the processing of samples and maintenance of sophisticated laboratory equipment. The in-service technicians/engineers should also be provided training facilities to update their knowledge.
8. It is recommended that the universities should follow uniform thesis examination policy at post graduate level.
9. The committee members realized that three days allocated to discuss curriculum was not sufficient. It is recommended that at least five working days should be allocated for the same.