CURRICULUM

OF

PLANT PROTECTION

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

(Revised 2010)

HIGHER EDUCATION COMMISSION
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 a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

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

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

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

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for BS and MS (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
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  
   Department of Plant and Environmental Protection  
   National University of Agricultural Sciences.  
   NARC, Park Road, Islamabad

2. Prof. Dr. Ahmad-Ur-Rahman Saljoqi  
   Chairman  
   Department Plant Protection  
   NWFP Agricultural University  
   Peshawar

3. Prof. Qamaruddin Abbasi,  
   Chairman  
   Department of Plant Protection  
   Sindh Agriculture University  
   Tandojam

4. Prof. Dr. Masood Khan Khattak,  
   Chairman, Department of Entomology,  
   Faculty of Agriculture,  
   Gomal University, D. I. Khan.

5. Prof. Dr.Ihsan Illahi  
   Dean, Faculty of Sciences,  
   Karakoram International University,  
   Gilgit

6. Prof. Dr. Imtiaz Ali Khan,  
   Chairman, Department of Entomology,  
   NWFP Agriculture University,  
   Peshawar

7. Prof. Dr. Mansoor-ul-Hassan  
   Department of Entomology,  
   University of Agriculture Faisalabad

8. Prof. Dr. Abdul Hakeem Shaikh  
   Department of Botany  
   Federal Urdu University  
   Karachi
<table>
<thead>
<tr>
<th></th>
<th>Name</th>
<th>Position</th>
<th>Institution/Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Dr. Muhammad Ashfaq</td>
<td>Member</td>
<td>Foreign Professor (HEC) National Institute for Biotechnology &amp; Genetic Engineering (NIBGE) Faisalabad</td>
</tr>
<tr>
<td>10</td>
<td>Dr. Abdul Rauf Bhutta</td>
<td>Member</td>
<td>Director, Federal Seed Certification &amp; Registration Department, G-9/4, Islamabad</td>
</tr>
<tr>
<td>11</td>
<td>Dr. M. Inam-ul-Haq</td>
<td>Member</td>
<td>Associate Professor Department of Plant Pathology, Arid Agriculture University, Rawalpindi</td>
</tr>
<tr>
<td>12</td>
<td>Dr. Shaikh Saeed Ahmad</td>
<td>Member</td>
<td>Associate Professor Department of Plant Pathology, Arid Agriculture University, Rawalpindi</td>
</tr>
<tr>
<td>13</td>
<td>Dr. Rashida Parveen</td>
<td>Member</td>
<td>Assistant Professor (Plant Pathology), University College of Agriculture, B. Z. University, Multan</td>
</tr>
<tr>
<td>14</td>
<td>Mr. Tamoor Khan Qambrani</td>
<td>Member</td>
<td>Assistant Professor, Department of Plant Pathology Lesbollah University of Agriculture , Water and Marine Sciences, Uthal Baluchistan</td>
</tr>
<tr>
<td>15</td>
<td>Muhammad Naveed Aslam</td>
<td>Member</td>
<td>Lecturer Plant Pathology, University college of Agriculture and Environmental Sciences The Islamia University, Bahawalpur</td>
</tr>
<tr>
<td>16</td>
<td>Prof. Dr. Imtiaz Ahmad</td>
<td>Member</td>
<td>Department of Agriculture University of Karachi, Karachi-75270.</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics / Biology (2 courses)</td>
<td>6</td>
<td>(3-0) (2-1)</td>
</tr>
<tr>
<td>Statistics 1 &amp; 2</td>
<td>6</td>
<td>(3-0) (3-0)</td>
</tr>
<tr>
<td>Computers / IT</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Pakistan Studies</td>
<td>2</td>
<td>(2-0)</td>
</tr>
<tr>
<td>Islamic Studies</td>
<td>2</td>
<td>(2-0)</td>
</tr>
<tr>
<td>Communications Skills</td>
<td>3</td>
<td>(3-0)</td>
</tr>
<tr>
<td>English</td>
<td>3</td>
<td>(3-0)</td>
</tr>
<tr>
<td>Basic Agriculture</td>
<td>3</td>
<td>(2-1)</td>
</tr>
</tbody>
</table>

**Sub-Total 28**

### 2. Interdisciplinary Foundation Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomy</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Plant Breeding &amp; Genetics</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Entomology</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Plant Pathology</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Food Technology</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Horticulture</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Soil Sciences</td>
<td>3</td>
<td>(2-1)</td>
</tr>
<tr>
<td>Agriculture Economics</td>
<td>3</td>
<td>(2-1)</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course Name</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fundamentals of Plant Projection</td>
<td>3 (2-1)</td>
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</tbody>
</table>

## III Year 5th Semester

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Principles Of Plant Protection</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>3</td>
<td>Pest Ecology</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>4</td>
<td>Pesticides And Their Application Techniques</td>
<td>4 (3-1)</td>
</tr>
<tr>
<td>5</td>
<td>Introductory Acarology</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>6</td>
<td>Elective</td>
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</tr>
</tbody>
</table>

## III Year 6th Semester

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>7</td>
<td>Plant Nematology</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>8</td>
<td>Pests Of Field Crops</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>9</td>
<td>Principles Of Plant Disease Management</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>10</td>
<td>Insect Classification</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>11</td>
<td>Elective</td>
<td></td>
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</tbody>
</table>

## IV Year 7th Semester

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>12</td>
<td>Introduction To Weed Science</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>13</td>
<td>Pests Of Fruits, Vegetables And Ornamentals</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>14</td>
<td>Vertebrate Pest Management</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>15</td>
<td>Post-Harvest Pest Management</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>16</td>
<td>Elective</td>
<td></td>
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</tbody>
</table>

## IV Year 8th Semester

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>16</td>
<td>Range And Forest Pest Management</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>17</td>
<td>Biological Control</td>
<td>3 (2-1)</td>
</tr>
<tr>
<td>18</td>
<td>Scientific Writing And Presentation</td>
<td>2(0-2)</td>
</tr>
<tr>
<td>19</td>
<td>Project/Internship</td>
<td>4(0-4)</td>
</tr>
</tbody>
</table>

**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:

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:
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:

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:
Objective:
To acquaint the students with the basics of pest Ecology.

Theory:

Practical:

Books Recommended:
Objectives:
To acquaint the students with the nature and safe use of pesticides.

Theory:

Practical:

Books Recommended:
INTRODUCTORY ACAROLOGY 3(2-1)

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

Theory:

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:

6TH SEMESTER

PLANT NEMATOLOGY 3(2-1)

Objective:
To educate the students about nematodes and their management.

Theory:
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:

PESTS OF FIELD CROPS

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:
3. Hill. 2005. Pests Of Stored Products And Their Control (Pb)
6. Horowitz 2004. Insect Pest Management: Field And Protected Crops (Hb)

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:

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:
IV Year

INTRODUCTION TO WEED SCIENCE 3(2-1)

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

Theory:

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

Books Recommended:
PESTS OF FRUITS, VEGETABLES AND ORNAMENTALS

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:

VERTEBRATE PESTS AND THEIR MANAGEMENT

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:

Books Recommended:

POST-HARVEST PEST MANAGEMENT 3(2-1)

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

Theory:

Practical:

Books Recommended:
6. Handbook of Post Harvest Technology, Published by Marcel Dekhar Inc. New York, USA. P. 864
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:

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:**
5. Samuel S.G 2002 Biological control of crop diseases (Pak book Corporation)

**SCIENTIFIC WRITING AND PRESENTATION**

**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:**


**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.

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insect Pathology</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>2</td>
<td>Advanced Biological Control</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>3</td>
<td>Biotechnology in Plant Protection</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>4</td>
<td>Host Plant Resistance</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>5</td>
<td>Vectors of Plant Diseases</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>6</td>
<td>Advanced Integrated Pest Management</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>7</td>
<td>Pesticide Toxicology</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>8</td>
<td>Pesticide Residue Analysis</td>
<td>4(2-2)</td>
</tr>
<tr>
<td>9</td>
<td>Research Methods in Plant Protection</td>
<td>4(2-2)</td>
</tr>
<tr>
<td>10</td>
<td>Microbial Control</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>11</td>
<td>Plant Protection and Environment</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>12</td>
<td>Advanced Ecology</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>13</td>
<td>Pesticide Resistance Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>14</td>
<td>Urban Pest Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>15</td>
<td>SPS Measure and Quarantine</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>16</td>
<td>Community Integrated Pest Management</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>17</td>
<td>Pest Management Informatics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>18</td>
<td>International Agreements and Plant Protection</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>19</td>
<td>Advanced biochemical methods</td>
<td>3(2-1)</td>
</tr>
</tbody>
</table>
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 prerequisite 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:
intra cellular microbiota of healthy insects. Management of microbial diseases of useful insects. Role of entomopathogens in IPM.

**Practical:**

**Books Recommended:**

**ADVANCED BIOLOGICAL CONTROL** 4(3-1)

**Objective:**
To educate the students on advances in biological control.

**Theory:**

**Practical:**
Recommended Books

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/organisms (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:**


**HOST PLANT RESISTANCE** 4(3-1)

**Objective:**
To educate students on the mechanism of host plant resistance.

**Theory:**

**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:

VECTORS OF PLANT DISEASES 3(2-1)

Objective:
To educate the students on vectors of plant diseases.

Theory:

Practical:

Books Recommended:


ADVANCED INTEGRATED PEST MANAGEMENT 4(3-1)

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

Theory:

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:
PESTICIDE TOXICOLOGY

Objective:
To educate the students on toxicity and poisoning of pesticide.

Theory:

Practicals:

Books Recommended:
PESTICIDE RESIDUE ANALYSIS

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

RESEARCH METHODS IN PLANT PROTECTION

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:**

**MICROBIAL CONTROL**

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

**Theory:**

**Practical:**
Books Recommended.

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:
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.
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, Jhons & Sons, USA.
Objective:
To educate the students on development and management of resistance in pests.

Theory:

Practicals:

Books Recommended:
Objective:
To educate the students on urban pest management.

Theory:

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

Books Recommended:

SPS MEASURES AND QUARANTINE

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

Theory:

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:
5. Plant Quarantine Act 1976, 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:
Practical:
Farmer Field School and Insectariums visits. Farmers field experiments. Collection, identification and preservation of pests, natural enemies and diseased specimens.

Books Recommended:
9. CABI Bioscience. 2000 Learning to cut the chemicals in cotton. CABI-Bioscience & PAN UK.

PEST MANAGEMENT INFORMATICS

Objective:
To educate the students on pest management informatics.

Theory:
Practical.  
Data Visualization Laboratory. Fluorescent and Confocal Microscopy.

Books Recommended:

INTERNATIONAL AGREEMENTS AND PLANT PROTECTION 3(3-0)

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

Theory:
**Book Recommended:**
3. WTO Publications

**ADVANCED BIOCHEMICAL METHODS**

**Objective:**
To educate the students on the advance biochemical techniques.

**Theory:**

**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:**

**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
b) Writing


c) Reading/Comprehension


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

b) Writing

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

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

Objectives: Enhance language skills and develop critical thinking

Course Contents
- Presentation skills
- Essay writing
  - Descriptive, narrative, discursive, argumentative
- Academic writing
  - How to write a proposal for research paper/term paper
  - How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing
Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended books:
Technical Writing and Presentation Skills
a) Essay Writing and Academic Writing
b) Presentation Skills
c) Reading
The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (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,”
6) Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
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
   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. **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:**


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:

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:**
Kaufmann JE, College Algebra and Trigonometry, 1987, 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.**
Annexure - E

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 digram, 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 digram
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 kensosis

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
4. Basic Statistics an Inferential Approach 2nd Ed. (1986) Fran II. Dietrich-II and Thomas J. Kean's
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

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

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.