CURRICULUM

OF

AGRONOMY
BS/BSc/MS/MSc (Hons)/PhD

(Revised 2014)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

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

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

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

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

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

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

(Fida Hussain)
Director General (Academics)
CURRICULUM DEVELOPMENT PROCESS

STAGE-I  STAGE-II  STAGE-III  STAGE-IV

CURRI. UNDER CONSIDERATION

COLLECTION OF EXP NOMINATION UNI, R&D, INDUSTRY & COUNCILS

CONS. OF NCRC.

PREP. OF DRAFT BY NCRC

FINALIZATION OF DRAFT BY NCRC

PRINTING OF CURRI.

IMPLE. OF CURRI.

ORIENTATION COURSES BY LI, HEC

REVIEW

BACK TO STAGE-I

APPRAISAL OF 1ST DRAFT BY EXP

PREP. OF FINAL CURRI.

QUESTIONNAIRE

COMMENTS

FOLLOW UP

COLLECTION OF EXP NOMINATION UNI, R&D, INDUSTRY & COUNCILS

STAGE-I

STAGE-II

STAGE-III

STAGE-IV

Abbreviations Used:
NCRC. National Curriculum Revision Committee
VCC. Vice-Chancellor’s Committee
EXP. Experts
COL. Colleges
UNI. Universities
PREP. Preparation
REC. Recommendations
LI Learning Innovation
R&D Research & Development Organization
HEC Higher Education Commission
RATIONALE OF DEGREE PROGRAMME
IN AGRONOMY

Achieving sustainability in food grain production and food security, in its totality, continues to be a challenge in the developing world including Pakistan. The produce of green revolution, we are harvesting now, seems to be saturated in terms of genetic potential. Over the past two decades, global food production has trebled, largely because of advances in agronomy.

The major challenges to sustainable food grain production in Pakistan include availability of quality seed, declining soil health, fragile cropping systems, looming water crisis, environmental degradation owing to indiscriminate use of farm chemicals, post harvest losses, minimal value addition and product differentiation, inadequate food storage and preservation, and poor marketing system. The imperative need, therefore, is to address these issues more forcefully in order to tap the considerable productivity potential of the agriculture sector through resource conservation.

The objective of the education and training in Agronomy is to generate, integrate, and apply knowledge about crop plants that are grown for food, feed, fiber and the general benefit of people. Education and training programs in agronomy (at under graduate, post graduate and PhD level) aim at developing trained human resource base who conduct basic and applied research in various aspects of crop production and soil management under varying agro-ecological and socio-economic conditions of the farming community. The graduates majoring in agronomy help find and disseminate answers to problems, and discover opportunities concerning efficiency and sustainability of production systems by developing safe and environmentally-sound practices. Manpower so trained serves in different capacity providing advisory services to farmers, NGOs and the relevant agro-based industry, impart short term training to farmers and in-service agri-personnel pertaining to latest developments in this field for better resource management and sustaining crop yields under changing environmental scenario.
MINUTES OF THE FINAL MEETING OF HEC NATIONAL CURRICULUM REVISION COMMITTEE FOR AGRONOMY HELD AT HEC RC LAHORE FROM FEBRUARY 17-19, 2014

The final meeting of National Curriculum Revision Committee (NCRC) in the discipline of Agronomy was held from February 17-19, 2014 to finalize the preliminary draft of Agronomy for BSc (Hons) & Postgraduate programmes, prepared in its meeting held from November 27-29, 2013 at Karachi. The following members attended the meeting:-

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Name &amp; Address</th>
<th>Contact No. Tel / Cell</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. Ehsan Ullah, Professor and Chairman, Department of Agronomy, University of Agriculture, Faisalabad. <a href="mailto:ehsanchahal@gmail.com">ehsanchahal@gmail.com</a></td>
<td>03336536062</td>
<td>Convener</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Bashir Ahmad, Professor &amp; Chairman, Department of Agronomy, University of Agriculture, Peshawar. <a href="mailto:bashir1259@yahoo.com">bashir1259@yahoo.com</a></td>
<td>03149006134</td>
<td>Secretary</td>
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<tr>
<td>3.</td>
<td>Dr. Muhammad Naeem Chaudhary, Head Agronomy, University College of Agriculture &amp; Environmental Science, Islamia University of Bahawalpur, Bahawalpur. <a href="mailto:dr.naemch@gmail.com">dr.naemch@gmail.com</a></td>
<td>062-9255531, 03217662772</td>
<td>Member</td>
</tr>
<tr>
<td>4.</td>
<td>Prof. Dr. Fayyaz ul Hassan Sahi, Professor &amp; Chairman, Department of Agronomy, PMAS Arid Agriculture University, Rawalpindi.</td>
<td>03009514597</td>
<td>Member</td>
</tr>
<tr>
<td>Sr.</td>
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<tr>
<td>5.</td>
<td>Dr. Amjed Ali, Assistant Professor, Department of Agronomy, University College of Agriculture, University of Sargodha, Sargodha. <a href="mailto:amjedali@uos.edu.pk">amjedali@uos.edu.pk</a></td>
<td>03336800878</td>
<td>Member</td>
</tr>
<tr>
<td>6.</td>
<td>Dr. Hakoomat Ali, Professor and Chairman, Department of Agronomy, Bahauddin Zakariya University, Multan.</td>
<td>03006323637</td>
<td>Member</td>
</tr>
<tr>
<td>7.</td>
<td>Mr. Riaz Ahmad Ghumman, Sr. Manager Marketing (Agri Services) Fauji Fertilizer Company Ltd, 11-Shahrrar-e-Awan-e-Tijarat, Lahore. <a href="mailto:riazahmad@ffc.com.pk">riazahmad@ffc.com.pk</a></td>
<td>03218484485</td>
<td>Member</td>
</tr>
<tr>
<td>8.</td>
<td>Dr. Shamsuddin Tunio, Professor &amp; Dean, Faculty of Crop Production, Sindh Agriculture University, Tandojam. <a href="mailto:sd_tunio@hotmail.com">sd_tunio@hotmail.com</a></td>
<td>03443421375</td>
<td>Member</td>
</tr>
<tr>
<td>9.</td>
<td>Dr. Qamaruddin Chachar, Professor &amp; Chairman, Department of Crop Physiology, Sind Agriculture University, Tandojam.</td>
<td>03003125641</td>
<td>Member</td>
</tr>
<tr>
<td>10.</td>
<td>Dr. Muhammad Akmal, Professor, Department of Agronomy, The University of Agriculture Peshawar, Peshawar.</td>
<td>03005883292</td>
<td>Member</td>
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<th>Name &amp; Address</th>
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<tbody>
<tr>
<td>11.</td>
<td>Dr. Farooq Shah, Assistant Professor, Department of Agronomy, Abdul Wali Khan University, Mardan. <a href="mailto:farooqshah@awkum.edu.pk">farooqshah@awkum.edu.pk</a></td>
<td>03360934308</td>
<td>Member</td>
</tr>
<tr>
<td>12.</td>
<td>Dr. Muzzamil Hussain Siddiqui, Professor &amp; Chairman, Department of Agronomy, Faculty of Agriculture, The University of Poonch, Rawalakot. <a href="mailto:smuzzammil@ymail.com">smuzzammil@ymail.com</a></td>
<td>03007777109</td>
<td>Member</td>
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<tr>
<td>13.</td>
<td>Dr. Ejaz Ahmed Khan, Professor &amp; Chairman, Department of Agronomy, Gomal University, D I Khan. <a href="mailto:Takreem95@hotmail.com">Takreem95@hotmail.com</a></td>
<td>0345-9821177 0333-9985822</td>
<td>Member</td>
</tr>
<tr>
<td>14.</td>
<td>Dr. Mushtaq Hussain Kazmi, Controller of Examination, Virtual University of Pakistan, Lahore. <a href="mailto:kazmimushtaq@yahoo.com">kazmimushtaq@yahoo.com</a></td>
<td>0321-5557255</td>
<td>Member (Hec Invited)</td>
</tr>
<tr>
<td>15.</td>
<td>Dr. Abdul Khaliq, Associate Professor, Department of Agronomy, University of Agriculture, Faisalabad. <a href="mailto:khaliquaf@gmail.com">khaliquaf@gmail.com</a></td>
<td>0321-6615848</td>
<td>Member</td>
</tr>
<tr>
<td>16.</td>
<td>Dr. Muhammad Bilal Chattha, Professor, Institute of Agricultural Sciences, Quaid-e-Azam Campus, University of the Punjab, Lahore. <a href="mailto:bilal.iags@pu.edu.pk">bilal.iags@pu.edu.pk</a></td>
<td>04299231846 03007665728</td>
<td>Member</td>
</tr>
</tbody>
</table>
2. The Following member of the NCRC could not attend the meeting due to their official/personal engagement:

1. Prof. Dr. Muhammad Bismillah Khan  
   Department of Agronomy  
   Bahauddin Zakariya University, Multan.

2. Mr. Muneer Ahmed,  
   Head, Department of Agronomy,  
   Lasbella University of Agriculture, Water & Marine Sciences,  
   Uthal, Balochistan.

3. The meeting started with the recitation of Holy Quran by Mr. Riaz-ul-Haque, Assistant Director, HEC & meeting coordinator. He, on behalf of the Chairperson and the Executive Director, HEC welcomed the participants and thanked all the members of the Committee for sparing precious time for this national cause. He briefed the participants on the procedure of finalization & circulation of final curriculum for implementation through HEC.

4. Prof. Dr. Ehsan Ullah, Convener of the preliminary meeting took charge to conduct proceedings of technical sessions of the meeting for three days while Prof. Dr. Bashir Ahmed, as Secretary reviewed the previous meeting proceedings for update. Dr. Ehsan Ullah thanked the participants for their participation and started proceedings of the meeting in accordance with the agenda.

5. The Committee reviewed and discussed the draft curriculum of BSc (Hons), prepared in preliminary meeting and considered the inputs given by the members of NCRC & after detailed discussion, the Committee incorporated their suggestions in the draft curriculum. The Committee also discussed the agenda item regarding development of Scheme of Postgraduate degree programme and it was concluded that as per HEC policy and international standards credit hours for MSc (Hons) would be 30 credit, 24 credit hours for courses and 6 credit hours for research work.

6. After three days through deliberations the committee unanimously approved the final draft curriculum of the BSc (Hons) and Postgraduate Agronomy degree programmes which was prepared in the preliminary meeting of NCRC. The Committee during its deliberation achieved the following objectives:
1. Reviewed and finalized the draft curriculum for BSc (Hons) and Postgraduate in the discipline of Agronomy so as to bring it at par with international standards.

2. Incorporated latest reading & writing material for each course.

3. Brought uniformity and developed minimum baseline courses in each and every course of study.

4. Made recommendations for promotion/development of the discipline which will be published in the Curriculum for circulation by HEC.

7. The Convener of the NCRC, Prof. Dr. Ehsan Ullah thanked all the members, especially the Secretary of the committee Prof Dr. Bashir Ahmed, for their valuable inputs in finalizing the revised curriculum keeping in view the requirement of the country and to make it more practical competitive and effective. He appreciated their dedication and hard work in this task of national importance. The Committee highly appreciated the efforts made by the HEC Coordinator and all of other officials of HEC Regional Centre, Lahore for providing local hospitality.

8. Mr. Riaz-ul-Haque, Assistant Directors, HEC thanked the Convener and all the members of the Committee on behalf of Prof. Dr. Naeem Khalid, Adviser (Academics) & Mr. Fida Hussain, Director General (Academics), HEC for sparing precious time and for their quality contribution towards preparation of the preliminary draft curriculum in the discipline of Statistics.

9. The meeting ended with vote of thanks to and from the chair.
# STANDARDIZED TEMPLATE FOR 4-YEAR BS/BSc (HONS) AGRICULTURE

1. **Compulsory Courses**
<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Mathematics / Biology (2 courses)</td>
<td>6 (3-0) (2-1)</td>
</tr>
<tr>
<td>Statistics 1 &amp; 2</td>
<td>6 (3-0) (3-0)</td>
</tr>
<tr>
<td>Computers /IT</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Pak Studies</td>
<td>2(2-0)</td>
</tr>
<tr>
<td>Islamic Studies</td>
<td>2(2-0)</td>
</tr>
<tr>
<td>Communication Skills</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>English</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>Basic Agriculture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td>28</td>
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</table>

2. **Interdisciplinary Foundation Courses**
<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Agronomy</td>
<td>9(----)</td>
</tr>
<tr>
<td>Plant Breeding &amp; Genetics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Entomology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Plant Pathology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Food Technology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Horticulture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Soil Sciences</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Agriculture Economics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td>24</td>
</tr>
<tr>
<td>Agriculture Extension</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Forestry &amp; Range Management</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Animal Science</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Marketing &amp; Agri Business</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Rural Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Human Nutrition</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Agriculture Chemistry</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Agriculture Engineering</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>Water Management</td>
<td>3(2-1)</td>
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<tr>
<td>Any other discipline recommended by the University/Faculty/College</td>
<td></td>
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<tr>
<td><strong>Sub-Total</strong></td>
<td>24</td>
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**Sub-Total during the first four semesters** 70-76
**Semester 5, 6, 7 & 8** 56-60
**Project / Internship** 04
**Grand Total** 130-140
### SCHEME OF STUDIES FOR BS/BSc (HONS) IN AGRONOMY

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AGR-001</td>
<td>Basic Agriculture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-002</td>
<td>Principles of Agronomy</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-003</td>
<td>Field Crop Production-I</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-004</td>
<td>General Crop Production-II</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR 005</td>
<td>Arid and Rainfed Agriculture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-006</td>
<td>Farm Record Maintenance</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-007</td>
<td>Agro-technology of Major Crops</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-008</td>
<td>Principles of Weed Science</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-009</td>
<td>Field Crop Physiology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-010</td>
<td>Plant Nutrients and Growth Regulators</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-011</td>
<td>Water Management in Rainfed Area</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-012</td>
<td>Biological Nitrogen Fixation</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-013</td>
<td>Seed Production Technology</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-014</td>
<td>Research and Scientific Writing</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-015</td>
<td>Conservation Agronomy</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-016</td>
<td>Agro Ecology</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AGR-017</td>
<td>Irrigation Agronomy</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-018</td>
<td>Environment and Crop Production</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-019</td>
<td>Forage and Fodder Production</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-020</td>
<td>Organic Farming</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AGR-021</td>
<td>Coastal Agriculture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-022</td>
<td>Introduction to Weed Science</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-023</td>
<td>Introduction to Crop Modeling</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-024</td>
<td>Crop Management under Stressful Environments</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-025</td>
<td>Medicinal and Special Crops</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-026</td>
<td>Plant and Soil Analysis</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-027</td>
<td>Production Technology of Condiments and spices'</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-028</td>
<td>Project Studies</td>
<td>4(0-4)</td>
</tr>
<tr>
<td>AGR-029</td>
<td>Internship*</td>
<td>4(0-4)</td>
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</tbody>
</table>

**Note:**

Universities/Faculties/Colleges may adopt their own system for course numbers and credit hours for different courses.

* Internship can be performed 5th semester onward.
DETAIL OF COURSES FOR BS/BSC (HONS.)
IN AGRONOMY

AGR-001  BASIC AGRICULTURE  3(2-1)

Objective
To provide the basic knowledge and background about Pakistan's Agriculture.

Theory
Agriculture, concept, history and importance; Branches and allied sciences in agriculture; Salient features and problems of Pakistan's agriculture; Climate, weather and seasons of Pakistan, their major characteristics and impact on crop production; Land resources and their utilization; Crop nutrition; Water resources, surface and ground water, canal system; Agro ecological zones of Pakistan; Farming systems; Agro-based industries.

Practical
Land measuring units; Demonstration of hand tools and tillage implements; Identification of meteorological instruments; Identification of crop plants, weeds and seeds; Identification of organic and inorganic fertilizers; Calculation of nutrient-cum-fertilizer unit value; Demonstration of various irrigation methods; Field visits.

Recommended Books
Theory
Agronomy-definition and scope; Principles of Agronomy, Tillage: objectives and types; Use of improved seed, seed multiplication and distribution systems; Nutrient management; manures and fertilizers, their classification, composition, methods of application; Irrigation management; methods and scheduling. Water use efficiency; Crop protection; Harvesting, postharvest management and marketing; Crop rotations and types; Mono vs multiple cropping; Modern concepts in agronomy.

Practical
Demonstration and use of tillage implements; Preparatory tillage, seedbed preparation and intercultural operations; Seed purity analysis; Identification of organic and inorganic fertilizers and manures; Calculation of nutrient cum fertilizer unit value; Demonstration and layout of various irrigation methods; Identification of crop pests; Visits to University farms.

Recommended Books
Objective
To understand the production technology of cereals, fibre, sugar and green manure crops.

Theory
Concept and classification of field crops; Cropping intensity, cropping schemes and cropping patterns; Cropping patterns in different ecological zones, factors affecting cropping patterns. Mono versus multiple cropping; Production technology of cereals (wheat, barley, oats, triticale, rice, maize, sorghum and millets), Fibre crops (cotton, jute, sun hemp, deccan-hemp), Sugar crops (sugarcane and sugar beet), Green manure crops (guara, dhancha, pigeon pea, senji, etc.).

Practical
Identification and plant characteristic of crops, cultivars, and seeds; Demonstration of improved sowing methods; Raising of crop nurseries and their transplanting; Intercultural practices; Delinting of cotton seed; Burying of green manure crops; Visits to University/College research area.

Recommended Books

Objective
To familiarize the students with production technology of oil seeds, grain legumes, forages and miscellaneous crops.
Theory
Production technology of oilseed crops (toria, raya, sarson, canola, taramira, castor bean, sunflower, safflower, sesame, linseed, groundnut, soybean); Grain legumes (chickpea, lentil, mungbean, mashbean, cowpea, pigeon pea), Forage crops (berseem, shaftal, lucerne, oats, maize, sorghum, millets, mottgrass); Miscellaneous crops (potato, sweet potato, tobacco, tea, medicinal crops); Techniques and practices for enhancing crop productivity.

Practical
Identification and plant characteristic of crops, cultivars, and seeds of the crops; Demonstration of improved sowing methods; Inoculation of legume seeds; Interculture practices; Weed control practices; Demonstration of harvesting and threshing operations; Visits to University/College research areas.

Recommended Books

AGR-005 ARID AND RAINFED AGRICULTURE 3(2-1)

Objective
To educate the students for enhancing crop production under limited moisture regimes.

Theory
Introduction, concept and causes of aridity; Climatic zones of Pakistan and their features; Climatic factors such as light, temperature, rainfall, relative humidity, wind, etc. and their effects on crop yield; Crop growth and yield responses to moisture supply in different soils; Evapotranspiration (ET), relation between crop yield and ET; Dry farming, water conservation practices, tillage, fertilizer use, sowing date and plant density; Crop rotations and cropping patterns in rainfed...
regions; Water harvesting and water conservation practices.

**Practical**
Demonstration of rainwater harvesting and conservation techniques; Determination of soil moisture; Mulching and tillage practices for moisture conservation; Field visits.

**Recommended Books**

**AGR-006 FARM RECORD AND MAINTENANCE 3(2-1)**

**Objective**
To impart awareness regarding principles of farm management and maintenance of farm records.

**Theory**
Concept of farm management and maintenance of farm records; Definition and fundamental principles of farming system and types of farming; Objective and advantages of keeping farm records; Different systems of book keeping; Principles of double entry system and their application; Objective of journal and ledger; Classification of accounts; Drawing ledger, opening, posting and closing of ledger accounts, cash book, drawing up a trial balance; Profit and loss account/income statement; Bank accounts, bank cheques, discount, interest, bad debts; Appreciation and depreciation of live and dead stock, land and buildings, plant and machinery; Preparation of trading, profit and loss account and balance sheet.

**Practical**
Training in maintenance of crop, livestock and dead stock registers; Preparation of a balance sheet and different types of accounts; Calculation of appreciation and depreciation of different farm articles; Working out cost of production of major crops grown in irrigated and non
irrigated areas; Layout of farms and demonstration plots.

**Recommended Books**


**AGR-007 AGRO-TECHNOLOGY OF MAJOR CROPS 3(2-1)**

**Objective**

To comprehend crop husbandry of major field crops with special emphasis on critical production factors.

**Theory**

Food security (food availability, access, nutritional security), from different angles (history, policy, agronomy, food aid, agri. food chains, GMOs, organic, etc.) and different scales (global, national, household, individual); Origin, history, morphology, adaptation, distribution, economic importance and agro-technology of major field crops such as wheat, rice, maize, cotton, sugarcane and potato with special focus on regional crop.; Management of irrigation, the timing of planting and harvesting, pest management, fertilization, postharvest handling and marketing, etc.; Management, constraints and technological measures to optimize crop productivity; Modern techniques for crop improvement.

**Practical**

Demonstration of improved sowing methods; Raising and transplanting of rice nursery; Delinting of cotton seed by conventional and modern techniques, its impact on seed germination and seedling establishment; Techniques of maintaining optimum plant population under field conditions; Plant characteristics and phenological development of major crops; Introduction to sugar industry; Demonstration of methods used for estimating crop yields for major crops.

**Recommended Books**

AGR-008 PRINCIPLES OF WEED SCIENCE 3(2-1)

Objective
To strengthen students' understanding regarding principles of weed science and control methods.

Theory
Definition and importance of weed control; Harmful effects of weeds; Classification and biology of weeds; Weed-crop interference (competition and allelopathy); Merits and limitations of different weed control approaches; Formulation and mode of actions of herbicides; Weed control in major field crops. Integrated weed management.

Practical
Weed collection and identification; Demonstration of various hand tools & implements for weed control; Trials for testing the germination of different weeds and treatment for breaking their dormancy; Calibration and demonstration of sprayers for herbicide application; Survey into weed flora of different agro-ecological zones.

Recommended Books
AGR-009 FIED CROP PHYSIOLOGY 3(2-1)

Objective
To study mechanisms, processes and functions involved in plants under field conditions.

Theory
Concept and importance of crop physiology; Carbon metabolism; Factors affecting photosynthesis and respiration; Photosynthetic efficiency of different crop plants; Physiology of germination, dormancy, seedling establishment, tillering, root, stem, leaf, flower and seed development; Maturity, senescence and abscission; Source-sink relationships in crop plants; Stress physiology; Biological nitrogen fixation; Plant growth regulators, their synthesis, translocation, and mode of action; Physiological determinants of crop yield.

Practical
Equipment used in crop physiology; Preparation of solutions of various strengths; Demonstration of various types of seed germination; Respiratory losses of food reserves during seed germination; Imbibition of water by seed; Determination of water content of plant and seed; and water transpired by plants; Influence of growth regulators on plant growth; Identification of crop growth stages.

Recommended Books

AGR-010 PLANT NUTRIENTS AND GROWTH REGULATORS 3(2-1)

Objective
To provide know-how about mineral nutrition and growth regulators.

Theory
Mineral nutrients, classification, functions and deficiency symptoms; Criteria for essentiality of mineral nutrients; Factors affecting nutrient availability; Mechanisms of nutrient uptake and translocation in the plants; Composition and types of fertilizers; Biosynthesis, translocation
and functions of growth regulators-auxins, gibberellins, cytokinins, abscisic acid and ethylene.

Practical
Raising plants in different growth media with various nutrients; Identification of deficiency symptoms; Demonstration of nutrient uptake; Demonstration of plant responses to growth regulators.

Recommended Books

AGR-011 WATER MANAGEMENT IN RAINFED AREAS 3(2-1)

Objective
To educate students about moisture resource management in rainfed areas.

Theory
Concept of water management; Rainfed areas of Pakistan; Sources of water, soil as a water reservoir; Available water, water holding capacity, intake rates and movement; Effective rainfall; atmospheric variables affecting soil moisture; Rainfall, pattern and frequency; Appropriate cropping patterns and water budgeting; Water requirement and water use efficiency of crops; Water harvesting and run-off farming; Irrigation systems; Rodhkohi system.

Practical
Determination of bulk density and water holding capacity of soil; Measurement of moisture content; Calculation of water-use efficiency; Measurement of rainfall and evapo-transpiration.

Recommended Books
AGR-012 BIOLOGICAL NITROGEN FIXATION 3(2-1)

Objective
To educate students about mechanism of biological nitrogen fixation and its utilization in agriculture systems.

Theory
Importance of nitrogen; Nitrogen cycle; Assimilation of nitrate and ammonium ions; Nitrogen fixation; Biological nitrogen fixation, its potentialities, perspectives and limitations; BNF in a symbiotic and nonsymbiotic association in legumes and non legumes, stages in nodulation; Nitrogenase: structure and function; Mechanism and biochemistry of BNF; Gaseous exchange in nodules; Role of leghemoglobin; Effect of environment on nitrogen fixation; Stem nodules; Prospects for making new symbiosis; Physiological limitations and genetic improvements of biological nitrogen fixation; Possibilities of engineering non-legume plants for nitrogen fixation.

Practical
Demonstration of inoculation methods; Study of nodule formation under different environmental conditions; Career material for effective inoculants; Identification of effective and non-effective nodule; Methods used to measure biologically fixed nitrogen.

Recommended Books

AGR-013 SEED PRODUCTION TECHNOLOGY 3(2-1)

Objective
To familiarize students about fundamentals of seed technology.

Theory
Introduction, orientation, concept and perspective of seed technology; Seed production terms, their definition and types of seeds; Origin of seed industry; National and international seed centers; Origin of new varieties, variety development and plant variety production; Seed problems: Germination, stand failures, mixtures, weeds, genetics. Seed certification classes: Nucleus breeder seed, pre-basic, basic, certified and approved class. Seed analysis, sampling, processing, conditioning drying, cleaning, grading, treatment, vigor and viability: Their similarity and differences; Seed longevity and storage; Seed certification: Regulations schemes and field inspection; Seed distribution and marketing; Seed act and laws; Promotion of seed industry; biotechnology and seed development; Economic liberalization and seed trade.

Practical
Seed identification; Seed testing equipment; Study of seed structures; Sampling techniques for seed testing; Moisture testing. Purity analysis of seed; Seed viability, vigor and germination tests; Study visits to seed production farms/ processing industry.

Recommended Books

AGR-014  RESEARCH AND SCIENTIFIC WRITING  3(2-1)

Objective
To provide guidelines for research methodology, develop and improve skills in scientific writing.

Theory
Concept of research, scientific method and experiment; Planning and execution of trials; Experimental designs and layout; Research trial observations; collection, processing and analysis of data; Measures of experimental variability; Interpretation and summarization of results; Types of scientific writing and developing a research proposal.

Practical
Writing of research proposal; Layout of field experiments; Collection, tabulation and analysis of data; presentation of data in tables, curves, histograms, etc. Writing of scientific paper/report.

Recommended Books
AGR-015  CONSERVATION AGRONOMY  3(2-1)

Objective
To develop the concept of soil and water conservation for sustaining productivity.

Theory
Concept and objectives of soil and water conservation; Agronomic practices for conservation-tillage (contouring, terracing, benching, levelling, grading, deep ploughing, etc.), species selection, crop rotations, cover cropping, strip cropping, etc. Farmyard and green manuring for conservation; Stubble and crop-residue management for resource conservation; Field drainage. Watershed management under rainfed conditions.

Practical
Demonstration of soil water conservation structures; Effect of different mulches; Demonstration of tillage practices for soil and water conservation; Measurement of runoff and soil erosion; Visit to different soil and water conservation centers/institutes.

Recommended Books

AGR-016  AGRO ECOLOGY  3(3-0)

Objective
To inculcate understanding about ecological principles for sustainable cropping systems.
Theory
Ecosystem; definition and components. Ecological pyramids; process within the ecosystem; Primary production processes; measuring primary production; Estimation of primary production in ecosystems; Biogeochemical cycling process; cycling of CO₂, nitrogen, water, phosphorus and sulphur; Factors within the ecosystem; Agroecosystem; biotic structure, primary producers, consumers, decomposers; Primary productivity; Energy flow; Competition, crop yields and variability in relation to the ecological optima; responses of crop plants to biotic and abiotic factors.

Recommended Books

AGR-017 IRRIGATION AGRONOMY 3(2-1)

Objective
To provide knowledge about irrigation principles and management.

Theory
Concept of irrigation agronomy and water management; Sources of irrigation water and their efficient use in crop production; Irrigation scheduling and water use efficiency in field crops; Irrigation water losses and their control through on-farm water management practices; Current agro-technology for efficient use of irrigation water in crops; Irrigation water pollution and measures to minimize it.

Practical
Estimation of potential evapotranspiration by different methods; Calculation of water use efficiency in field crops; Potential soil moisture deficit and its calculation.

Recommended Books

AGR-018 ENVIRONMENT AND CROP PRODUCTION 3(2-1)

Objective
To familiarize students about components of environment and their relationship with crop productivity.

Theory
Environment, climate change and food security. Types and classification of environment; Dynamics of aerial and soil environment in a crop canopy at macro and micro level; Influence of different environmental factors-radiation, temperature, relative humidity, wind and CO$_2$ on crop growth and development; Greenhouse effect; El Nino and La Nino phenomenon; Crop adaptation to changing climate.

Practical
Measurement and estimation of different environmental variables; Calculations of potential evapotranspiration and different drought indices; Estimation of radiation interception and its use efficiency in field crops.

Recommended Books

**AGR-019 FORAGE AND FODDER PRODUCTION 3(2-1)**

**Objective**
To enhance skill of students for fodder production and its preservation.

**Theory**
Importance of forages and fodders; Terminology and taxonomy of forage and fodder crops; Forage production in Pakistan-current status and future scenario; Agro techniques for production of legume/nonlegumes forages and fodders for sustainable forage production; Rangeland status, increasing productivity of pastures and range lands; Seed production of forages, nutrient management in fodders/forages; Forage quality-its status and improvement, fodder/forage production constraints and remedies; Fodder preservation (hay and silage); Fodder research studies in Pakistan.

**Practical**
Identification of fodder/forage crops and seed; estimation of sprout density and plant population; silage and hay making practices; preparation of fodder calendar; determination of forage quality parameters; visits of university farms.

**Recommended Books**
AGR-020  ORGANIC FARMING  3(3-0)

Objective
To familiarize students with the concept of organic farming and its field application

Theory
Concept and brief history of organic farming; Quality of food and crop productivity under natural ecological systems; Principles of organic agriculture; Merits and demerits-organic vs inorganic farming; Components of organic farming (weed, insect, pest and fertilizer management); Maintenance of buffer zone; Preparation of organic manures-humus, sewage sludge, organic compost; Farm waste recycling, organic mulches, bio-fertilizers, etc.; Natural products for control of crop pests (weeds, insects and diseases).

Recommended Books

AGR-021  COASTAL AGRICULTURE  3(2-1)

Objective
To educate students about potential of agriculture in coastal areas

Theory
Coastal agriculture and its scope; Farming trends in coastal areas of Pakistan; Saline agriculture, halophytes and their classification; Coastal land management; Agronomic techniques for use of sea water;
Production and processing of coastal and biofuel crops; Post harvest techniques.

Practical
Identification of halophytes; Measurement of soil and water salinity; Plant screening for tolerance to sea water; Determination of soil texture in coastal areas; Visits to coastal areas.

Recommended Books

AGR-022 INTRODUCTION TO WEED SCIENCE 3(2-1)

Theory
Introduction, significance and history of weed science; Weeds-definition and classification; Losses caused by weed; Noxious and invasive weeds; Weed survival mechanisms; Propagation of weeds; Dispersal of weed seed and fruits; Critical weed crop competition period; Economic threshold level; Principles and methods of weed control.

Practical
Identification of common weeds, collection mounting and display of weed specimens; Demonstration of weed control methods under field condition; Calibration of sprayer; Field visits.

Recommended Books

**AGR-023 INTRODUCTION TO CROP MODELING**

**Objective**
To familiarize students with the concept and application of crop modeling

**Theory**
History and introduction of crop growth modeling; Fundamental concepts of crop modeling, their importance and uses; Introduction to decision support system for agro-technology transfer; Components of a model, input data set for different model; Modelling and crop improvement; Modelling a tool for future predictions.

**Practical**
Demonstration and practice of crop growth models: CERES-wheat, DSSAT V. 4, APSIM, Measurement of different environmental variables from observatories.

**Recommended Books**

**AGR-024 CROP MANAGEMENT UNDER STRESSFUL ENVIRONMENTS**

**Objective**
To elaborate the concept of stress in field crops and approaches to sustain yields under such conditions.

**Theory**
Components of crop productivity; Crop environment and its components; Environmental optima for crop growth and development; Concept of stress and stressful environments under field conditions; Modifications in
growth and developmental patterns of crop plants under biotic and abiotic stresses; Approaches for ameliorating the stress effects for crop production.

Practical
Acquaintance with the symptoms of stresses on crop; visits to affected areas and noting the patterns of vegetative and reproductive growth of crop plants.

Recommended Books

AGR-025 MEDICINAL AND SPECIAL CROPS 3(2-1)

Objective
To introduce a production technology for medicinal and special purpose crops

Theory
Economic importance, origin, history, adaptation, distribution and production technology of medicinal and special purpose crops-tea, aloe, mint, aloe vera, chamomile, kava, red sorrel, jojoba, castor bean, jatropha, plantains, salicornia, safflower, poppy, tobacco, indigo, oil palm, fennel, ajwain, fenugreek, sweet basil, sesame, balangu, haloon, kalvanji, guar, senna, quinoa, bitter gourd, etc.; Integrated pest management and precision farming for special purpose crops; Processing, postharvest technology, products, utilization and marketing of medicinal crops.

Practical
Identification of seed and crop plants; Demonstration of improved sowing methods. Studies on phenological development of crops. Optimization of soil types for medicinal plants; Methods for extraction of useful ingredients of medicinal plants.

Recommended Books

AGR-026 PLANT AND SOIL ANALYSIS 3(2-1)

Objective
To train the students about different methods of soil and plant analysis.

Theory
Types and use of different balances; Preparation of solutions of known concentrations-normal, molar, molal, ppm, etc.; Preparation of stock solutions for drawing standard curves; Soil and plant sampling techniques; Preparation of plant and soil samples for analytical work; Estimation of EC, pH, N, P, K, Na, organic matter, etc.

Practical
Demonstration of analytical methods in the laboratory, recording data, computation work and recommendations.

Recommended Books
AGR-027  PRODUCTION TECHNOLOGIES OF CONDIMENTS AND SPICES  3(2-1)

Objective
To educate and familiarize students with production technology of condiments, spices and vegetables.

Theory
Concept and scope of condiments and spices; their classification and value addition; Production technology for: condiments (chillies, onion, garlic, ginger and turmeric) and spices (cumin seed, ajwain, fenu greek, fennel, kaloongi, coriandar, mint and black cumin).

Practical
Identification of seeds and propagation materials of condiments and vegetables; Demonstration of sowing methods; Raising and transplanting of nursery; Demonstration and practice of harvesting, digging, picking and processing of different crops; Visits of local farms.

Recommended Books

AGR-028  PROJECT STUDIES  4(0-4)

The students will be assigned projects in different areas of agronomy; They will deliver a seminar which will be evaluated by a committee constituted by the department; In addition, they will write a comprehensive report at the completion of the project which will be evaluated by external and internal examiners.

AGR-029  INTERNSHIP  4(0-4)

Practical training/work at the farms of progressive farmers and at research stations/institutes/organizations/companies; This involves
report writing by the student and the student will also present report in a seminar.

**Note:** The farmers/farm managers/Director will evaluate the practical work by the student. An expert committee to be appointed by the board of studies/Chairman of the department will also evaluate the student's participation at the farms and at the universities. The committee will also evaluate and grade/mark the report and seminar. The seminar/presentation delivered for internship will be mandatory but not be considered extra credit.
### SCHEME OF STUDIES FOR MS/MSC (HONS) AND PHD AGRONOMY

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>AGR-701</td>
<td>Advanced Agronomy</td>
<td>3(2-1)</td>
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<tr>
<td>AGR-702</td>
<td>Applied Crop Ecology</td>
<td>3(3-0)</td>
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<tr>
<td>AGR-703</td>
<td>Advanced Irrigation Agronomy</td>
<td>3(2-1)</td>
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<td>AGR-704</td>
<td>Agro-Environment Conservation</td>
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<td>AGR-705</td>
<td>Agro-meteorology</td>
<td>3(3-0)</td>
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<tr>
<td>AGR-706</td>
<td>Allelopathy in Crop Production</td>
<td>3(2-1)</td>
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<tr>
<td>AGR-707</td>
<td>Applied Conservation Agronomy</td>
<td>3(3-0)</td>
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<tr>
<td>AGR-708</td>
<td>Arid Zone Agronomy</td>
<td>3(3-0)</td>
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<td>AGR-709</td>
<td>Biological Crop Potential</td>
<td>3(3-0)</td>
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<td>AGR-710</td>
<td>Crop and Environment</td>
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<td>AGR-711</td>
<td>Crop Management on Problem Soils</td>
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<td>AGR-712</td>
<td>Crop Modeling</td>
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<td>AGR-713</td>
<td>Crop Nutrition Management</td>
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<td>AGR-714</td>
<td>Crop Production and Herbicides</td>
<td>4(3-1)</td>
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<td>AGR-715</td>
<td>Farming and Cropping Systems</td>
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<td>AGR-716</td>
<td>Field Crop Experimentation</td>
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<td>AGR-717</td>
<td>Herbicides in Plant and Soil Systems</td>
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<td>AGR-718</td>
<td>Integrated Agriculture</td>
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<td>AGR-719</td>
<td>Modern Concepts of Crop Production</td>
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<tr>
<td>AGR-720</td>
<td>Recent Advances in Agronomy</td>
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<td>AGR-721</td>
<td>Seed Physiology</td>
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<td>AGR-722</td>
<td>Seed Science and Technology</td>
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<td>AGR-723</td>
<td>Stress Agronomy</td>
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<td>AGR-724</td>
<td>Sustainable Agriculture</td>
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<td>AGR-725</td>
<td>Water Relations of Plant</td>
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<td>AGR-726</td>
<td>Weed Management</td>
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<td>AGR-727</td>
<td>Climate Change and Agriculture</td>
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<td>AGR-728</td>
<td>Postharvest Technology of Crops</td>
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<td>Seminar</td>
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<tr>
<td>AGR-732</td>
<td>Thesis PhD Agronomy</td>
<td>12(0-12)</td>
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**Note:** Universities/Faculties/Colleges may adopt their own system for course numbers and credit hours for different courses selected/qualified for MSc (Hons) Agronomy will not be permitted to take again in PhD.
DETAIL OF COURSES FOR MS/MSC (HONS.)
AND PHD IN AGRONOMY

AGR-701 ADVANCED AGRONOMY 3(2-1)

Objective
To deepen understanding about advanced concepts of crop growth and development

Theory
Phenological development of crop plants; Determinants of crop growth; Factors affecting development of crop canopy, Photosynthesis and respiration; Photosynthetic efficiency and respiration in relation to crop productivity; Crop management for improving photosynthetic efficiency and harvest index; potential for increasing dry matter accumulation in crop plants, dry matter partitioning; Crop growth analysis, its objectives and agronomic uses; Growth analysis of individual plants and crops, classical and functional growth analysis, biological relevance of different growth functions and curve fitting in crop growth studies.

Practical

Recommended Books
AGR-702    APPLIED CROP ECOLOGY    3(3-0)

Objective
To impart better understanding of ecological optima and its relevance to crop production.

Theory
Ecosystem concepts; Dynamics of Agro-ecosystems; Ecology of crop plant domestication; Ecological risk assessment, Ecological evaluation of different farming systems; Ecological characteristics of intensive agriculture with special reference to environmental pollution; Air pollution; noise pollution; Insecticide pollution, Nuclear pollution, Soil pollution; Pollution due to socio economic factors; Crop productivity and ecological optima; Biodiversity and its ecological role in agro-ecosystems; Ecology of economic crops, oil seed crops, pulses & misc. crops, sugar crops, etc.

Recommended Books

AGR-703    ADVANCED IRRIGATION AGRONOMY    3(2-1)

Objective
To educate about estimation/measurement of environment variables used in irrigation scheduling.

Theory
Relationship between irrigation and crop yields; Methods of irrigation scheduling; Moisture sensitive periods; Indices of drought: Stress degree days, canopy temperature variability; Crop water stress index; maximum allowable depletion, etc.; Response of yield to irrigation; Penman's
irrigation-yield response analysis; Concept of potential soil moisture deficit and limiting deficit; Crop response to total water received and drought; Criteria for drought resistance; Concept of lost time for growth and crop yield; Water use efficiency and factors affecting it.

**Practical**
Measurement of plant and soil moisture contents; Demonstration of irrigation scheduling for different crops; Water flow measurements with different techniques; Visits to controlled irrigation systems.

**Recommended Books**

**AGR-704 AGRO-ENVIRONMENT CONSERVATION 3(3-0)**

**Objective**
To enhance the understanding of agro-environment for sustainable productivity.

**Theory**
Agro-chemicals: use, abuse, uptake, persistence, degradation and residual effects on ecosystem; Management and recycling of agro-industrial wastes: solid waste, farm waste, sewage sludge etc.; Role of agriculture in environmental conservation; Integrated approaches to reduce the use of agro-chemicals in agriculture.

**Recommended Books**

AGR-705  AGRO-METEOROLOGY  3(3-0)

Objective
To important knowledge about meteorological optima and its relevance to crop production.

Theory
Scope of agricultural meteorology; Agricultural zones of Pakistan; Crop adaptation and distribution in relation to climate; Crop weather-relationships regarding crop growth and yield formation; Diurnal and seasonal variation in photoperiod and light integral; Atmospheric pollution and plant productivity; Climate change and its potential effects on crop production; Weather and pests of crops; Crop monitoring and forecasting; Drought monitoring and planning for mitigation; Remote sensing; Geographical Information System (GIS); Global Positioning System (GPS) and their application in agricultural meteorology; Use of climate information to improve agricultural productivity.

Recommended Books

AGR-706  ALLELOPATHY IN CROP PRODUCTION  3(2-1)

Objective
To educate students about allelopathic phenomena and its utilization in agro-ecosystem for sustaining productivity of crops.

Theory
Concept and history of allelopathy; Allelopathic plants; Types of
allelochemicals; Mechanism of allelochemicals’ action; Factors influencing production and effectiveness of allelochemicals; Production, release, absorption and translocation of allelochemicals; Role of allelopathy in agro-eco systems; Interactions among cropping systems; Utilization of allelopathy for pest management; Enhancing crop productivity by utilizing allelopathy; Recent research trends in allelopathy.

**Practical**
Preparation of allelopathic plant water extracts; Comparison of crop cultivars for their allelopathic effects; Demonstration of allelopathic effects of crop extracts/residues on seed germination and seedling growth of crops/weeds; Identification of allelopathic chemicals.

**Recommended Books**

**AGR-707 APPLIED CONSERVATION AGRONOMY 3(3-0)**

**Objective**
To develop understanding about resource conservation with special emphasis on soil and water.

**Theory**
Principles, objective and types; Water resources, their conservation and economic use in irrigated and non-irrigated regions; Modern conservation practices in irrigated and non-irrigated areas; Integrated resource conservation in different farming systems; Conservation agronomy and climate change; Use of farm machinery in conservation techniques; Conservation structures; Biological conservation; Recent developments in the field of conservation agronomy.
Recommened Books

AGR-708 ARID ZONE AGRONOMY 3(3-0)

Objective
To broaden the understanding of problems, limitations and potentials of arid areas.

Theory
Constrains and techniques of arid agriculture; Characteristics of dry land agriculture; Problems, prospects and strategies of dry land agriculture; Moisture availability index; Aridity index; Moisture deficit index; Agronomic approaches for dry land agriculture (tillage requirement, selection of most adaptive crops, sowing of crops, cropping pattern, pasture management, cropping plans to meet the weather conditions, weed control, plant protection measure); Managing dry spells during crop periods, Lay farming for non-arable lands; Recommendations for dry farming areas; Plant adaptation to water stress; Soil and rainfall characteristics in dry land farming; Soil and moisture conservation techniques; Water shed management; Water harvesting; Sustainable dry land crop production.

Recommended Books

AGR-709 BIOLOGICAL CROP POTENTIAL 3(3-0)

Objective
To elaborate the concept of biological potential and exploitation in crops.

Theory
Concept of biological crop potential; Agro-physiological factors limiting yield potential of crops; Ecological optima in relation to crop productivity; Blackman's principle of limiting factor; Determinants of crop growth; Components of plant leaf area expansion, crop canopy development, canopy architecture and interception of solar radiation; Potential for increasing photosynthetic efficiency; Dry-matter partitioning; Modern agro-physiological techniques for harvesting maximum potential of field crops; Crop plants in relation to environment.

Practical
Collection of data pertaining to actual and potential yields of various crops/varieties; Determination of leaf area and dry weight of field crops to calculate relative growth rate, net assimilation rate, etc. Determination of leaf area index, leaf area duration and harvest index of various field crops. Comparative study of crop canopy development in cereals, oilseeds and grain legumes.

Recommended Books

AGR-710 CROP AND ENVIRONMENT 3(3-0)

Objective
To broaden the understanding of relationships between crop and environment.
Theory
Crop environment, components, determinants and their role in crop productivity; Microclimate in relation to crop management; Global warming and green house effects; Environmental pollution and plant growth; Energy exchange by plants in ecosystem; Evapotranspiration and its reduction approaches; Antitranspirants, reflectants; Plant physiological aspects and plant architecture.

Recommended Books

AGR-711 CROP MANAGEMENT ON PROBLEM SOILS  3(3-0)

Objective
To strengthen the knowledge for raising crops successfully on problem soils.

Theory
Concept and perspective of crop productivity in eroded, salt affected, water deficit and water-logged soils; their improvement and reclamation; Site specific cultural practices; Fertilizer and irrigation adjustments; Specific cropping patterns and crop management practices for economic crop production in problem soils; Demonstration of degraded soils.

Recommended Books
AGR-712 CROP MODELING 3(2-1)

Objective
To enhance the knowledge of crop modeling and its application in agriculture.

Theory
Philosophy and terminology of system science, scope of system analysis; Crop modeling, concept and types of models, specification and uses; Statistical parameters in modeling; Parameterization and evaluation of crop models; Model application in crops, soil, water and agrometeorology; Modeling for crop improvement and risk assessment; Crop models application in research, education and extension; Integration of crop models with GIS and remote sensing.

Practical
Working with different models like DSSAT, APSIM, AQUACROP; Setting of appropriate coefficients for cultivars, calibration, evaluation and validation; Preparation of different input files; crop management, and experimental data files; Preparation of weather and soil files; Working with sequence, seasonal, economic analysis, easy grapher, etc.

Recommended Books

AGR-713 CROP NUTRIENT MANAGEMENT 3(2-1)

Objective
To equip students with latest developments in crop nutrition.

Theory
Crop nutrition in modern agriculture; Rationale for use of fertilizers; Biofortification; Physiological classification of minerals; Dynamics of plant
nutrients in normal, flooded and salt affected soils; Nutrient uptake and assimilation; Nutrient losses and causes of low efficiency; Improving nutrient use efficiency; Balanced nutrition and integrated plant nutrient management systems; Concept of remote sensing in crop nutrition; Nutrient indexing.

Practical
Demonstration of nutrient deficiency symptoms. Preparation of different nutrient solutions for field, pots and hydroponic cultures; Nutrient analysis (macro and micro) of soil and plants.

Recommended Books

AGR-714 CROP PRODUCTION AND HERBICIDES 3(2-1)

Objective
To enhance students capability about herbicides and their use for crop maximization.

Theory
Herbicides: importance, nomenclature, registration; classification systems; Chemical classification; Bio-herbicides; Herbicide formulations; surfactants and adjuvants; Application and incorporation techniques and equipment; Spray drift management; Herbicide selectivity; Herbicide mixtures and compatibility; Effect of herbicide residues on succeeding crops; Herbicide hazards, toxicity, environmental pollution; Storage, transportation and disposal of herbicides.

Practical
Calculation of herbicide dosage; Determination of active ingredients in various herbicide formulations; Types of sprayers, their parts and spray calibration; Boom height adjustment and study of overlapping. Study of residual effects on soil and succeeding crops. Tank mixing of herbicides.
Recommended Books


AGR-715 FARMING AND CROPPING SYSTEMS 3(3-0)

Objective
To identify the issues of farming/cropping systems and demonstrate research methods for sustainable production.

Theory
Concept, scope, classification and components; Agricultural resources, their utilization and management; Major farming and cropping systems of Pakistan; Role of tillage, root dynamics, cover crops, crop residues in cropping system; Assessing input use efficiencies in various farming/cropping systems; Role of precision agriculture in farming system; Study of allied enterprises (livestock, poultry, aquaculture, mushroom culture, tunnel farming); Emerging trends in farming/cropping system research; Researchable issues and research methods in farming and cropping systems.

Recommended Books


AGR-716 FIELD CROP EXPERIMENTATION 3(2-1)

Objective
To plan the experiments according to different design and layout therein the field and to collect the data, analysis it and interpretation.
Theory
Methods of scientific inquiry; general types of experiments; Principles of experimental design; Planning, layout and conducting field experiments; Recording research observations; Transformation of data; Planned F test; Data processing, analyses and its statistical interpretation; Means separation; Probability; F and t distributions; Regression and correlation; Research results reporting.

Practical
Statistical calculations based on sample data; Exercise in the layout of experiments; Transformation of Experimental data; Preparation of analysis of variance table; Use of different tests of significance; Factorial experiments and their uses in scientific research; Reporting results of experiment; calculation of linear regression and correlations; Use of statistical packages for data.

Suggested Readings

AGR-717 HERBICIDES IN PLANT AND SOIL SYSTEMS 3(2-1)

Objective
To elucidate role of herbicides in plants and their dynamics in soil and environment.

Theory
Absorption and translocation of herbicides; Effects of herbicides on photosynthesis; respiration, protein, nucleic acid metabolism and enzymes; Metabolism of herbicides in plants; Sub lethal effects of herbicides; Herbicides and soil interaction; Fate of herbicides in soils; Herbicide residues in soil. Bioassay techniques in herbicide residue analysis; Instrumentation techniques for herbicide analysis; Herbicides resistance; Methods to combat herbicide resistance.
Practical
Demonstration of herbicide resistance through dose response test, Demonstration of residual effect on germination and seedling growth of succeeding crops, Demonstration of herbicide movement in soils.

Recommended Books

AGR-718 INTEGRATED AGRICULTURE 3(3-0)

Objective
To equip students with the challenges and potential of Pakistan Agriculture.

Theory
Concept of integrated agriculture; Challenges in Pakistan’s Agriculture; Present scenario and future prospects; Analytical overview: issues and strategies for improvement of crop management, livestock management, fisheries; Cottage industry, national resource management and rural development; Institutions and policies: issues and options.

Recommended Books
AGR -719 MODERN CONCEPTS OF CROP PRODUCTION  3(2-1)

Objectives
To give the students an insight understanding of Agro-physiological factors affecting crop potential. To harvest the maximum out of possessed genetic potential of a variety by integrating all the yield determinants.

Theory
Concept and indices of agricultural productivity; Key issues limiting agricultural productivity in Pakistan; Significance of crop management in determining crop productivity; Dynamics of stand establishment; Multiple cropping; Manipulation of different tillage systems; Manipulation of crop development by the use of growth regulators; Concept and components of good agricultural practices (GAP), Organic farming; Precision agriculture and its tools; Remote sensing and its application in Agriculture; Biotechnology in improving crop production; Global warming in relation to crop productivity.

Practical
Study of different factors influencing stand establishment under field conditions; Evaluation of some case histories for economic feasibility of different cropping systems; Field observation of different tillage systems; Filed visits and observation on GAP; Demonstrations on the simulation of effects of global warming on agricultural productivity; Visits to various agricultural research facilities to acquaint the students about contemporary practices in farming.

Recommended Books

AGR-720 RECENT ADVANCES IN AGRONOMY  3(3-0)

Objective
To inculcate knowledge with respect to current developments in agronomic research.
Theory
Selected topics on recent advances in agronomy; Evaluation of the recent research of the entire field; Lectures and discussions by the specialists in the areas of their research.

Recommended Books
2. Agronomy for Sustainable Development. All volumes of last three years. INRA-CMSE-PME, Dijon, France and Springer, the Netherlands.
5. Sustainable Agriculture Reviews. All volumes of last three years. Springer, the Netherlands.

AGR-721 SEED PHYSIOLOGY 3(2-1)

Objective
To enhance students’ understanding of physiological processes in seeds.

Theory
Seeds and human beings; Review of embryogenesis; Physiological development of "seed"; Implications of seed maturation; Chemical composition of seed, its phylogenetic implications, importance in storage, energy relationships; Dormancy, its survival value, occurrence and persistence of dormancy in cultivated, weedy and wild species, methods of overcoming dormancy; Role of growth regulators in seed development and dormancy; Seed sink strength and intensity; Seed food reserves, location and composition; Physiological and biochemical manifestation of seed aging; Seed deterioration-factors influencing rate of deterioration, theories of seed dying; Concept of seed vigor; Seed enhancement-production and yield; Requirements for germination-re-hydration and water relations, temperature and oxygen relations.

Practical
Recommended Books

AGR-722 SEED SCIENCE AND TECHNOLOGY 3(2-1)

Objective
Augmenting students capacity regarding principles of seed production and innovations in seed technology.

Theory
Functional concept of seed production; Recent trends in seed technology and management; Hybrid and synthetic seed production; Seed vigor and quality; Ecological aspects of seed production; Seed certification standards; Seed storage, structures and related problems; Seed industry. Import/export of seed; Seed legislation and quarantine laws; Genetically modified seeds (GMOs); Transgenetics for crop improvement; Seed quality, control and management; Seed fortification and invigoration; Seed health. Organic seed production.

Practical
Analysis for quality tests: physical purity, seed viability, germination and vigor tests. Seed cleaning, grading, treatment. Seed priming. Sampling techniques involved in seed testing. Visit to seed farms, storage houses and processing plants.

Recommended Books
1. Advances in seed sciences and technology 2006 Agro Bios, India.

AGR-723 STRESS AGRONOMY 3(2-1)

Objective
To broaden the knowledge regarding various stresses influencing crop production and stress management

Theory and Stress Agronomy
Concepts of stress Agronomy; Plant stress factors and their impact on productivity of cropping systems; Types of stresses (water, nutrient, salt, temperature, CO2, light, inter and intra plant competition, etc.), Crop responses and adaptation to different stresses and their individual and interactive impact on plant growth and development; Agro-management practices for successful crop husbandry under stress environments.

Practical
Experiments will be designed to invoke understanding among the students about plant behavior to various types of stresses. Field visits to demonstrate types of stresses and their impact on crop productivity.

Recommended Books

AGR-724 SUSTAINABLE AGRICULTURE 3(3-0)

Objective
To extend students’ knowledge about management of agricultural resources on sustainable basis.

Theory
Definition, concept and significance; Evolution of sustainable agriculture; Management practices for sustainable agriculture; Sustainable utilization
of land water, resources and agro-biodiversity; Integrated nutrient management; Sustainable Weed management; Integrated farming systems to sustain farm productivity; Alternate and uses; Agriculture; Climate change and carbon sequestration; Latest research methodologies related to the above topics.

Recommended Books

AGR-725 WATER RELATIONS OF PLANTS 3(2-1)

Objective
To enhance the understanding of relationship between plants and water.

Theory
Importance of water in plants; Physical and chemical properties of water; The ascent of sap; The cohesion mechanism, anatomy of pathway; water potential gradient, capillary rise in xylem; Free energy and chemical potential; Water potential and its components; analysis of chemical potential; Standard state, hydrostatic pressure, water activity and osmotic potential; Van’t Hoff equation, matric potential; Ohm’s law to study the movement of water in the soil-pant atmosphere system.

Practical
Techniques and experimental approaches for measurement of plant water status: Measurement of water content, water potential, pressure chamber technique and psychrometric techniques. Methods of inducing water stress in plants.
Recommended Books

AGR-726 WEED MANAGEMENT 3(2-1)

Objective
To acquaint students with comprehensive knowledge of weed management in field crops.

Theory
Concept of weed management and its significance in modern agriculture; Weed management using principles of competition, Integrated weed management; weed management for field crops, Weed Management for Horticultural crops, Weed management in lawn, turf grass, pastures, forestry and range lands, Management of problematic, parasitic and non-cropped area, Invasive weeds and their management, Herbicide tolerant crops, herbicide resistant weeds and their management, Natural products as lead for new herbicides.

Practical:
Identification and collection of weeds; Demonstration of competitive effect of weeds on crop growth, Determination of critical period of weed interference in crops; use of tillage implements for effective and economical weed control. Testing of herbicide resistance in weeds.

Recommended Books
Objective
To develop ink-link about crop production under changing climate.

Theory:
Climate and agriculture; Climate variability and change-past, present and future scenario; Impact of climate change in different regions; Influence of climate change on productivity of major and minor crops; Implications of changing climatic scenario for pests, livestock and natural resources; Strategies for managing climate change and vulnerability; Capacity building and action plan for policy makers and planners.

Recommended Books

AGR-728 POSTHARVEST TECHNOLOGY OF CROPS 3(2-1)

Objective
To introduce and educate students with post-harvest technology of different field crops.
**Theory**


**Practical**

Demonstration of harvesters, reapers and pickers, threshers, air screen cleaners (Wheat and paddy) and ginners (Cotton). Field demonstration for sugarcane cutting and sugar beet digging by manual methods. Seed processing, cleaning, grading and packing practices in cereals, legumes, oilseeds, condiments, spices and vegetables etc. Visits of local farms.

**Recommended Books**

**AGR-729 SPECIAL PROBLEM 1(0-1)**

**Objective**

To broaden student capacity for handling a project independently.

Preparation of research proposals for plant science. Field/Laboratory Experiment. Collection, Compilation and presentation. Interpretation of results and report writing by the student.

**Note:** The post-graduate students will be assigned the topics on recent developments in agronomy by the concerned teacher.
AGR-729 SEMINAR 1(0-1)

Objective
- To improve students’ communication and presentation skills. Selection of topic, preparation of material for presentation, and presentation by the student in the class on a particular topic.

Note: M.Sc (Hons.) students will deliver one seminar while PhD students will deliver two seminars. The Seminar delivered on synopsis/research proposal and/or thesis will not be considered extra credit hour for academic purposes.

AGR-730 THESIS MSc (HONS) AGRONOMY 6(0-6)
AGR-731 THESIS PhD 12(0-12)
Annexure

LIST OF RECOMMENDED BOOKS
FOR AGRONOMY

4. Agronomy for Sustainable Development. All volumes of last three years. INRA-CMSE-PME, Dijon, Francis and Springer, The Netherlands.
161. Qureshi, M.A. M.A. Zia and M.S. Qureshi. 2006. Pakistan
203. Sustainable Agriculture Reviews. All volumes of last three years. Springer, the Netherlands.
Soil Sci. Am. Inc., Madison, WI, USA.


DETAIL OF COMPULSORY COURSES
IN ENGLISH FOR
UNDERGRADUATE LEVEL

English I (Functional English) Credit Hrs. 3

Objective: 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

Annexure – A

b) Writing

c) Reading/Comprehension

d) Speaking

English II (Communication Skills) Credit Hrs. 3

Objective
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

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

Objective
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
discursive, descriptive, argumentative and report writing).


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 Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).
Objective:
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 Holy Quran
1) Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18)
3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
4) Verses of Surah al-Furqan Related to Social Ethics (Verse No.63-77)
5) Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154)

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

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

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

**Introduction To Sunnah**
1) Basic Concepts of Hadith
2) History of Hadith
3) Kinds of Hadith
4) Uloom –ul-Hadith
5) Sunnah & Hadith
6) Legal Position of Sunnah

**Selected Study from Text of Hadith**

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

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

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

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

**Political System of Islam**
1) Basic Concepts of Islamic Political System
2) Islamic Concept of Sovereignty
3) Basic Institutions of Govt. in Islam
Islamic History
1) Period of Khlaft-E-Rashida
2) Period of Ummayyads
3) Period of Abbasids

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

Reference Books:
1) Hameed ulah Muhammad, "Emergence of Islam", IRI, Islamabad
2) Hameed ulah Muhammad, "Muslim Conduct of State"
3) Hameed ulah 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)
9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)
Annexure - C

PAKISTAN STUDIES
(COMPULSORY)

Introduction/Objective
- 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

Recommended Books
1. MATHEMATICS I (ALGEBRA)

Prerequisite(s): Mathematics at secondary level
Credit Hours: 3 + 0

Specific Objective 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.
- Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.
- Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.

Recommended Books:

2. **MATHEMATICS II (CALCULUS)**

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

**Credit Hours:** 3 + 0

**Specific Objective 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 Objective 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 diagram, Graphical representation of data Histogram, frequency polygon, frequency curve.

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

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

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

Recommended Book
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

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.

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

Recommended Book
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:


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
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.*
Recommendations

After thorough discussion, the participants of the National Curriculum Revision Committee in Agronomy 2014 formulated the following recommendations for uniform and effective implementation of the HEC policies at national level.

1. The committee appreciates HEC’s role in improvement of Higher Education in the country and recommends uniform implementation of its policies including work load and financial matters in all public sector universities.

2. The committee strongly recommends that mathematics/biology should be considered as deficiency courses and shall not be counted towards the total credit hours of the B.Sc. (Hons.) degree.

3. As proposed earlier in the meeting of 2010 of NCRC in agronomy, the courses of Statistics 1 & 2 should be merged into one course in the proposed scheme of studies. It has been adopted by some of the universities and others need to implement the same for its uniformity across the country.

4. The existing template should be revised by the HEC before arranging the final meetings of all NCRCs in agricultural disciplines.

5. To strengthen the background of agriculture students in different specializations, it is proposed to allocate at least three foundation courses from agronomy during the first four semesters.

6. The course of crop physiology may be included in interdisciplinary foundation courses template.

7. It is recommended that periodic inter-university/inter-provinces visits of the faculty along with PhD scholars should be made compulsory to enhance the exchange of views and observe the site specific technology developed in different provinces/universities.

8. HEC is requested to review the policy for funding Lab establishment with priority for the proposal relevant to practical facilities of the newly developed courses being offered at different institutions.

9. It is proposed to arrange refresher courses for the young faculty at national/international level for effective delivery of new topics/courses amended by NCRC.

10. NCRC recommends to regularly hold meetings of all HODs (at least once in six months).
Suggestions

1. Higher Education Commission is requested to arrange a training of the in-service young faculty through using the capabilities and expertise of the experts from public/private sector for the areas where universities feel deficiency.

2. HEC is requested to ensure availability of at least 10 copies of all recommended books (Annexure enclosed) to the departmental libraries of all the Agricultural Universities/Faculties/Colleges of the country and to improve the library/documentation of the institutions.

3. Professors and Associate Professors should also be considered for different administrative courses run by national policy institutes/public administration staff colleges to enhance administrative and financial management skills.

4. To improve the standard of the higher education at national level, the committee recommends that the appointment of local examiners should be discouraged at MSc (Hons.)/MPhil degree programs.

5. A final copy of the curriculum (2014) must be provided to at least every faculty member of agronomy all over the country.

6. A viable mechanism for follow up of implementation of recommendations/suggestions should be developed.

7. NCRC nominated Prof. Dr. Fayyaz ul Hassan, Chairman Department of Agronomy, PMAS-Arid Agriculture, Rawalpindi to act as Focal Person for such follow up.