CURRICULUM

OF

AGRONOMY
BS/BSc (Hons)
MS/MSc (Hons)
Ph.D.

(Revised 2010)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

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PREFACE

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

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

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

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

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

PROF. DR. ALTAF ALI G. SHAIKH
Member Academics

March 2010
CURRICULUM DEVELOPMENT
Rationale of Degree Programs 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 Ph.D 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.
INTRODUCTION

A meeting of the National Curriculum Revision Committee to finalize the draft curriculum of Agronomy was held at HEC, Regional Centre, Lahore, on April 26 – 28, 2010. The following experts attended the meeting:-

Prof. Dr. Zahid Ata Cheema, Chairman Department of Agronomy, University of Agriculture, Faisalabad.

Prof. Dr. Inayatullah Awan
Chairman, Department of Agronomy,
Faculty of Agriculture,
Gomal University,
D.I.Khan.

Prof. Dr. Rana Muhammad Iqbal
Department of Agronomy,
University College of Agriculture &Environmental Sciences,
Islamia University, Bahawalpur.

Prof. Dr. Muhammad Bismillah Khan
Head, Department of Agronomy & Soil Science
B.Z. University Multan.

Prof. Dr. Fayyaz-ul-Hassan Sahi
Department of Agronomy, (Nominee NAEAC)
PMAS Arid Agriculture University, Rawalpindi.

Prof. Dr. Muhammad Hussain
Professor, Department of Agronomy
Faculty of Agriculture, Rawalakot
Azad Jammu & Kashmir.

Prof. Muhammad Akmal
Professor, Department of Agronomy
Agriculture University, Peshawar

Prof. Dr. Hayatullah Khan
Faculty of Agriculture Sciences,
Hazara University,
Haripur Campus Haripur,
Prof. Dr. R.B. Mirbahar  
Dean, Faculty of Crop & Plant Sciences  
Lasbela University (LUAMWS),  
Balochistan

Dr. Zammarud Iqbal Ahmed,  
Associate Professor,  
Department of Agronomy, Arid Agriculture University, Rawalpindi.

Dr. Samsuddin Tunio,  
Professor, Department of Agronomy,  
Sindh Agriculture University,  
Tandojam.

Dr. Fateh Chand Oad,  
Associate Professor/ Chairman,  
Department of Agronomy,  
Sindh Sindh Agriculture University,  
Tandojam.

Dr. Abdul Khaliq  
Associate Professor,  
Department of Agronomy  
University of Agriculture,  
Faisalabad.

Dr. Riaz Ahmed Mann  
PSO, Crop Science Institute,  
National Agriculture Research Centre,  
Park Road, P.O NIH,  
Islamabad.

Dr. Muhammad Naeem Ch.  
Assistant Professor, Department of Agronomy,  
University College of Agriculture & Environmental Sciences, Islamia University,  
Bahawalpur.

Dr. Ejaz Ahmad Khan,  
Associate Professor,  
Department of Agronomy,  
Faculty of Agriculture, Gomal University,  
D.I.Khan
Meeting started with recitation from the Holy Quran by Ch. Bashir Ahmad, Director, HEC, Regional Centre, Lahore. Dr. Muhammad Tahir Ali Shah, Deputy Director, Curriculum Division, HEC, Islamabad welcomed the participants and briefed about the obligations of the Commission for review, revision and development of curricula. He explained the procedure for curriculum revision. The committee critically evaluated the of BS/B.Sc.(Hons) Agri., MS (Hons) Agronomy and Ph.D.
curriculum. Modifications/improvements were made according to the current national requirements. The committee offered *Fatihah* for late Professors Dr. Shahbaz Ahmed Warriach and Dr. Shamshad Hussain Shah (previous NCRC members). The Committee agreed to recommend the Agronomy courses for BS/B.Sc. (Hons), MS (Hons.) and Ph.D. as detailed below:
### Standardized Template for 4-Year BS/B.Sc (Hons) Agriculture

1. **Compulsory Courses**
<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<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><strong>28</strong></td>
</tr>
</tbody>
</table>

2. **Interdisciplinary Foundation Courses**
<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agronomy</td>
<td>3(2-1)</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><strong>24</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>Any other discipline recommended by the</td>
<td></td>
</tr>
<tr>
<td>University/Faculty/College</td>
<td></td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>18-24</strong></td>
</tr>
</tbody>
</table>

   | 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>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR-001</td>
<td>Basic Agriculture</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-002</td>
<td>Field Crop Production-I*</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-003</td>
<td>Field Crop Production-II*</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-004</td>
<td>General Crop Production**</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AGR-005</td>
<td>Arid Zone 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>Crop Growth Modeling and its Application</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>Project Studies</td>
<td>4(0-4)</td>
</tr>
<tr>
<td>AGR-028</td>
<td>Internship***</td>
<td>4(0-4)</td>
</tr>
</tbody>
</table>

**Note:**

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

* Winter /Summer Crops

** Alternate course for Field Crop Production – I & II

*** 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 about Pakistan's Agriculture.

Theory


Practical


Books Recommended

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 pattern. Mono versus multiple cropping. Production technology of cereals-crops (Wheat, Barley, Oats, Rice, Maize, Sorghum and Millets), Fibre Crops (Cotton, Jute, Sunhemp, Deccan-hemp, Sugar crops (Sugarcane and Sugarbeet), 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, their transplanting and inter-cultural practices. Burying of green manure crops. Visit to University/College research areas.

Books Recommended

Objective

- To familiarize the students with production technology of oil seed, grain legume, forage and miscellaneous crops.

Theory

Production technology of oilseed-crops (Toria, Raya, Sarsoon, Canola, Taramira, Castor bean, Sunflower, Safflower, Sesame, Linseed, Groundnut, Soybean), grain legume crops (Chickpea, Lentil, Mungbean, Mashbean, Cowpea, Pigeonpea), forage crops (Berseem, Shaftal, Lucerne, Oats, Maize, Sorghum, Millets, Mottgrass), and 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 and their seeds. 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.

Books Recommended


Objective

- To acquaint the students with field crops production technology.
Theory
Concept of crop production. Classification of field crops. Cropping scheme, Cropping patterns, Cropping systems, Cropping intensity. Production technology of major field crops: cereals (wheat, rice, maize, barley), sugar crops (sugarcane, sugar beet), fiber crops (cotton, jute) oil seed crops (i-Traditional: rapes and mustards, groundnut, linseed, sesame, castorbean; ii-Non-traditional: sunflower, soybean, safflower), grain legumes, (chickpea, lentil, green gram, black gram) fodders (berseem, lucern, oats, sorghums, millets, mott grass, cowpea), special crops (tobacco). Green manure crops (Guara, Dancha. Pigeon pea, Senji etc.).

Practicals

Books Recommended

AGR 005 ARID ZONE AGRICULTURE 3(2-1)

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

Practical

Books Recommended

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

Objective
- To impart awareness regarding principles of farm management.

Theory

Practical
Layout of farm, 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, crop yield estimation. Working out cost of production of major crops grown in irrigated and rainfed areas.

Books Recommended

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

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

Theory
Origin, history, morphology, adaptation, distribution and agro technology of wheat, rice, maize, cotton, sugarcane with special emphasis on regional crops. Management, constraints and 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.

Books Recommended

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

Objective
- To nurture students regarding principles of weed science and control methods.

Theory

Practical

Books Recommended:

AGR-009 FIELD CROP PHYSIOLOGY 3(2-1)

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

Practical

Books Recommended:

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

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

Theory
and functions of growth regulators—Auxins, gibberellins, cytokinins, abscisic acid and ethylene.

**Practical**


**Books Recommended:**


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

**Objective**

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

**Theory**


**Practical**

Books Recommended:

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

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

Theory

Practical

Books Recommended:
AGR-013 SEED PRODUCTION TECHNOLOGY 3(2-1)

Objectives

- To familiarize students about fundamentals of seed technology.

Theory


Practical

Seed testing equipments. Seed identification. 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.

Books Recommended:

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.

Books Recommended:

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

Theory
Concept, importance and objectives of conservation. Agronomic practices for resource conservation. Tillage practices such as contouring, terracing, benching, leveling, grading, watbandi, Zero tillage and minimum tillage, chiseling, deep ploughing and planking, Species and

Practical

Books Recommended:

AGR-016 AGRO ECOLOGY 3(3-0)

Objective
- To inculcate understanding about ecological principles for sustainable cropping systems.

Theory

Books Recommended:
Objective

- To provide knowledge about irrigation principles and management.

Theory

Concept of irrigation agronomy and water management. Sources of irrigation water. Introduction to different irrigation methods, their feasibility in various regions. Water requirement of different crops. Irrigation scheduling and water use efficiency in field crops. Current agro-technology for efficient use of irrigation water in crops. Irrigation water pollution and measures to minimize it.

Practical


Books Recommended:

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

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

Theory

Practical

Books Recommended:

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

Objective
- To educate students about enhancement skills and conservation of fodder
Theory

Practical

Books Recommended:

AGR-020 ORGANIC FARMING 3(3-0)

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

Theory
management. Quality of food and crop productivity under natural ecological systems

**Books Recommended:**


**AGR-021 COASTAL AGRICULTURE 3(2-1)**

**Objective**
- To educate students about potential of agriculture in coastal areas

**Theory**

**Practical**

**Books Recommended:**


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

Objective
• To impart basic information regarding weeds in field crops and their control.

Theory
Weed science: introduction, significance and history, Definition of weeds, Losses caused by weeds, Classification of weeds, Newly introduced foreign weeds, weed problems in Pakistan, Survival mechanism of weeds, Dispersal of weed seeds and fruits and their mode of propagation, Weed/Crop interference: Competition and allelopathy, Principles of weed control, preventive weed control, mechanical weed control, cultural weed control, biological weed control, chemical weed control. Integrated weed control. Application of biotechnology in weed science.

Practical
Weed identification (rabi and kharif weeds), Collection and mounting of weeds, Weed seed identification, Demonstration of weed control methods: manual, mechanical, chemical and organic weed control; Spraying equipment, sprayer calibration; Herbicide dosage calculation, field observation and visits regarding weed surveys and identification; Survey into weed flora of different agro-ecological zones.

Recommended Books:
Intervention to Crop Modeling

Objective

- To familiarize students with the concept and application of crop modeling.

Theory

History and introduction of crop growth modeling, importance and uses, introduction to decision support system for agro-technology transfer, components of a model, input data set for different models, modeling and crop improvement, modeling: 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.

Books Recommended:

AGR-024  CROP MANAGEMENT UNDER STRESSFUL ENVIRONMENTS  3(2-1)

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.

Books Recommended:

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

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

Theory
Importance, origin, adaptation, distribution and production technology of medicinal and special purpose crops – tea, aloe, mint, chamomile, red sorrel, jojoba, castor bean, jatropha, plantains, salicornia, safflower, poppy, tobacco, indigo, oil palm, fennel, ajwain, fenugreek, sweet basil, sesamum, balangu, haloon, kalvanji, guar, senna, etc,
Practicals
Identification of seed and crop plants. Demonstration of improved sowing methods. Studies on phenological development of crops.

Books Recommended:

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, p.p.m, 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.

Books Recommended:

AGR-027     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-028     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 Ph.D Agronomy

AGR-701 Advanced Agronomy 3(2-1)
AGR-702 Applied Crop Ecology 3(3-0)
AGR-703 Advanced Irrigation Agronomy 3(2-1)
AGR-704 Agro-Environment Conservation 3(3-0)
AGR-705 Agro-meteorology 3(3-0)
AGR-706 Allelopathy in Crop Production 3(2-1)
AGR-707 Applied Conservation Agronomy 3(3-0)
AGR-708 Arid Zone Agronomy 3(3-0)
AGR-709 Biological Crop Potential 3(3-0)
AGR-710 Crop Environment 3(3-0)
AGR-711 Crop Management on Problem Soils 4(3-1)
AGR-712 Crop Modeling 3(2-1)
AGR-713 Crop Nutrition Management 3(2-1)
AGR-714 Crop Production and Herbicides 4(3-1)
AGR-715 Farming and Cropping Systems 3(3-0)
AGR-716 Field Crop Experimentation 4(3-1)
AGR-717 Herbicides in Plant and Soil Systems 3(2-1)
AGR-718 Integrated Agriculture 3(3-0)
AGR-719 Modern Concepts of Crop Production 3(2-1)
AGR-720 Recent Advances in Agronomy 3(3-0)
AGR-721 Seed Physiology 3(2-1)
AGR-722 Seed Science and Technology 3(2-1)
AGR-723 Stress Agronomy 4(3-1)
AGR-724 Sustainable Agriculture 3(3-0)
AGR-725 Water Relations in Plant 3(2-1)
AGR-726 Weed Management 3(2-1)
AGR-727 Climate Change and Agriculture 3(3-0)
AGR-728 Special Problem 1(0-1)
AGR-729 Seminar 1(0-1)
AGR-730 Thesis M.Sc. (Hons.) Agronomy 6(0-6)
AGR-731 Thesis Ph.D. Agronomy 12(0-12)

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

Courses selected/qualified for M.Sc. (Hons) Agronomy will not be permitted to take again in Ph.D.
DETAILS OF COURSES FOR MS/MSC. (HONS) AND PH.D IN AGRONOMY

GR-701 ADVANCED AGRONOMY 3(2-1)

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

Theory

Practical

Books Recommended:

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

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

Theory

Books Recommended:
Objective

- To educate about estimation/measurement of environmental variables used in irrigation scheduling.

Theory


Practical

Measurements of plant and soil moisture contents. Demonstration of Irrigation scheduling for different crops. Water flow measurements with different techniques. Visits to controlled irrigation systems.

Books Recommended:

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

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

Theory
Agro-chemicals: use, abuse, uptake, persistence, degradation and residual effects. 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.

Books Recommended:

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

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

Theory

Books Recommended:

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

Objective
- To educate students about allelopathic phenomena and its utilization in agro-ecosystem.

Theory

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.

Books Recommended:

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

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

**Theory**
Objectives and types of conservation. Current problems of conservation agronomy. Farming systems and cultural practices with focus on integrated natural resource conservation; conservation structures, water harvesting in rainfed regions. Developments in soil conservation and crop productivity.

**Books Recommended:**

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

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

**Theory**
Classification of dry areas. Aridity: causes and implications. Climatic factors affecting crop production. Vegetation of the arid zones. Water resources, their conservation and development in irrigated and...

Books Recommended:

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

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

Theory

Books Recommended:

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

Objective
- To broaden the understanding of relationships between crop and environment.

Theory

Books Recommended:

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

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

Books Recommended:

AGR -712 CROP MODELING 3(2-1)

Objective
• To strengthen and broaden the knowledge of crop modeling and its application for field crops.

Theory

Practical
Preparation of file X, file A, file T. Preparation of weather and soil files. Working with different models. Setting of appropriate coefficient for cultivars, calibration, evaluation and validation. Working with sequence, seasonal, economic analysis, easy grapher etc.

Books Recommended:
AGR-713  CROP NUTRITION  3(2-1)

Objective
- To equip students with latest developments in crop nutrition.

Theory

Practical
Demonstration of nutrient deficiency symptoms. Calculation of fertilizer levels. Preparation of different nutrient solutions. Nutrient analysis (macro & micro) of soil and plants

Books Recommended:
Objective
- To enhance students capability about herbicides and their use for crop maximization.

Theory

Practical

Books Recommended:

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

Theory
Factors governing choice and size of enterprises and resource allocation in farming system. Organic farming. Resource management under constraint situations. Low Input Sustainable Agriculture (LISA) concepts and principles. Low cost technology and non monetary inputs.

Books Recommended:

AGR-716 FIELD CROP EXPERIMENTATION 4(3-1)

Objective
- Capacity building for designing, handling of experiment, data collection and interpretation.

Theory
- Methods of scientific inquiry. General types of experiments. Principles of experimental designs. Planning, layout and conducting field experiments. Recording data, trimmed and Winsorized means, separation of means, probability, Chi-square, F-test, and t distribution. Measures of dispersion; Types of field experiments, Experimental designs used in field and lab trials. Regression and correlation analyses. Transformation of data.

Practical
Books Recommended:

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

Practical

Books Recommended:
AGR -718 INTEGRATED AGRICULTURE 3(3-0)

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

Theory

Books Recommended:
Objective

To build capacity of students to understand various developments related to crop productivity.

Theory


Practical

Measurement of growth and yield determinants. Planning multiple cropping systems. Calculation of Land Equivalent Ratio (LER), Area Time Equivalent Ratio (ATER), Crowding Coefficient, Competition Index, etc. Field visits.

Books Recommended:


Objective

To inculcate knowledge with respect to current developments in agronomic research.
Theory

Selected topics in recent advances in agronomy. Evaluation of the most recent research of the entire field. Lectures and discussions by the specialists in the areas of their research.

Periodicals Recommended:
1. Agronomy for Sustainable Development. All volumes of last three years. EDP Science’s INRA-CMSE-PME, Dijon, France.
2. Agronomy, J. All volumes of last three years. ASA, Wisconsin, Madison, USA.
5. Sustainable Agriculture; Reviews. All volumes of last three years. Springer, Netherlands.

AGR-721 SEED PHYSIOLOGY 3(2-1)

Objective

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

Theory


Practical


Books Recommended:

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

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

Theory

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.

Books Recommended:
Objective
• To broaden the knowledge regarding various stresses influencing crop production and their management

Theory
Concept of stress agronomy. Plant stress factors and their impact on productivity of cropping systems. Types of stresses (Water, nutrient, salt, temperature, CO$_2$, 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.

Books Recommended:
fertilizers. Cropping systems to sustain productivity. Multiple cropping, rotations, N-fixation and mycorhizae and alternate land uses, compromise between higher yields and resource conservation. Site specific technological options for sustainable crop production.

**Books Recommended:**

**AGR-725 WATER RELATIONS IN PLANTS 3(2-1)**

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

**Theory**

**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.

**Books Recommended:**
AGR-726       WEED MANAGEMENT 3(2-1)

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

Theory

Practical
Collection, identification and classification of weeds. Demonstration of competition, duration and timing on crop growth. Demonstration of integrated weed management.

Books Recommended:
AGR-727   CLIMATE CHANGE AND AGRICULTURE    3(3-0)

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 temperate, humid, sub-humid, semi-arid and arid regions; Impact of climate change on vegetation ($C_3$ & $C_4$), crops, pests, livestock and natural resources; Strategies for managing climate change vulnerability.

Books Recommended:

AGR-728   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.
**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.S (Hond.) students will deliver one seminar while Ph. D 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 M.S (HONS) AGRONOMY**  
6(0-6)

**AGR-731**  
**THESIS PH.D.**  
12(0-12)

**Recommendations:**

After thorough discussion, the participants of the National Curriculum Revision Committee of Agronomy 2010 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 polices 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 BS/B.Sc. (Hons.) degree.
3. The courses of Statistics 1 & 2 should be merged into one course in the proposed scheme of studies.
4. The template approved by the Deans Committee should be revised to accommodate the main disciplines of agriculture giving at least minimum one more slot to agronomy in third and/or fourth semesters.
5. The below suggestion should be on regular basis
6. Higher Education Commission is requested to arrange a training of the in-service young faculty through using the capabilities and expertise of the senior/retired faculty for the areas where universities feel deficiency.
7. HEC is requested to ensure availability of minimum 5-10 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.

8. 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.

9. To improve the standard of the higher education at national level, the committee recommends that the appointment of local examiners should be discouraged at M.Sc (Hons)/M.Phil degree programs.

10. The below suggestion is not in practice

11. It is recommended that periodic inter-university/inter-provinces visits of the Faculty Members 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.

12. 10 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.
List of Books Recommended for Agronomy

3. Agronomy for Sustainable Development. All volumes of last three years. EDP Science’s INRA-CMSE-PME, Dijon, France.
4. Agronomy, J. All volumes of last three years. ASA, Wisconsin, Madison, USA.
61. Govindan, K. and V.Thirumurugan. 2003. Principles and
83. IAEA. 2006. Management practices for improving sustainable crop production in tropical environments. IAEA, Vienna, Austria.
Principles of Plant Nutrition. 5th Ed. International Potash Institute, Bern, Switzerland.


191. Sustainable Agriculture; Reviews. All volumes of last three years. Springer, Netherlands.


204. Wani, S. P., J. Rockstrom and T. Oweis. 2009. Rainfed Agriculture: Unlocking the potential. IARC, New Delhi, India.


Annexure – A

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

**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).
Annexure - B

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)
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:

Annexure - D

COMPULSORY MATHEMATICS COURSES FOR B.Sc (Hons) AGRICULTURE

1. MATHEMATICS I (ALGEBRA)
   Prerequisite(s): Mathematics at secondary level
   Credit Hours: 3 + 0

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

   Course Outline:
   Preliminaries: Real-number system, complex numbers, introduction to sets, set operations, functions, types of functions.

   Matrices: Introduction to matrices, types, matrix inverse, determinants, system of linear equations, Cramer’s rule.

   Quadratic Equations: Solution of quadratic equations, qualitative analysis of roots of a quadratic equations, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations.

   Sequences and Series: Arithmetic progression, geometric progression, harmonic progression.

   Binomial Theorem: Introduction to mathematical induction, binomial theorem with rational and irrational indices.

   Trigonometry: Fundamentals of trigonometry, trigonometric identities.

   Recommended Books:
   Dolciani MP, Wooton W, Beckenback EF, Sharron S, Algebra 2 and Trigonometry, 1978, Houghton & Mifflin,
   Kaufmann JE, College Algebra and Trigonometry, 1987, PWS-Kent Company, Boston
2. **MATHEMATICS II (CALCULUS)**

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

**Credit Hours:** 3 + 0

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

**Course Outline:**
- **Preliminaries:** Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities.
- **Limits and Continuity:** Limit of a function, left-hand and right-hand limits, continuity, continuous functions.
- **Derivatives and their Applications:** Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.
- **Integration and Definite Integrals:** Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

**Recommended Books:**
- 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:**


**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.*
Definition and importance of Statistics in Agriculture, Data Different types of data and variables

Classification and Tabulation of data, Frequency distribution, stem-and-Leaf diagram, Graphical representation of data Histogram, frequency polygon, frequency curve.

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

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

Practicals
  a. Frequency Distribution
  b. Stem-and-Leaf 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 kenois

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

Statistics-II

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 II
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.*
Annexure – F

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.