CURRICULUM

OF

AGRICULTURAL EXTENSION

EDUCATION

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

(Revised 2015)

HIGHER EDUCATION COMMISSION
ISLAMABAD
CURRICULUM DIVISION, HEC

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Composed by: Mr. Tanveer Ali, HEC
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PREFACE

The curriculum, with varying definitions, is a plan of the teaching-learning process that students of an academic programme are required to undergo. It includes objectives and learning outcomes, course contents, scheme of studies, teaching methodologies and methods of assessment of learning. Knowledge in all academic disciplines is expanding and even new disciplines are also emerging, it is imperative that curriculum are developed and revised regularly.

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 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 nominated by their organizations.

In order to impart education at par with quality 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  CURRI. IN DRAFT STAGE  FINAL STAGE  FOLLOW UP STUDY

COLLECTION OF REC  APPRAISAL OF 1ST DRAFT BY EXP. OF COL./UNIV  PREP. OF FINAL CURRI.  QUESTIONNAIRE

CONS. OF CRC.  FINALIZATION OF DRAFT BY CRC  INCORPORATION OF REC. OF V.C.C.  COMMENTS

PREP. OF DRAFT BY CRC  APPROVAL OF CURRI. BY V.C.C.  PRINTING OF CURRI.  REVIEW

IMPLE. OF CURRI.  BACK TO STAGE-I

Abbreviations Used:
CRC. Curriculum Revision Committee
VCC. Vice Chancellor’s Committee
EXP. Experts
COL. Colleges
UNI. Universities
PREP. Preparation
REC. Recommendations
CURRICULUM DEVELOPMENT

The final meeting of National Curriculum Revision Committee (NCRC) was held at University of Agriculture, Faisalabad from April 28-30, 2015 to finalize the 2nd draft of Agricultural Extension Education curriculum. The following experts attended the meeting:

Prof. Dr. Sher Muhammad
Institute of Agricultural Extension and Rural Development,
University of Agriculture, Faisalabad

Prof. Dr. Munir Ahmad
Institute of Agricultural Extension and Rural Development, University of Agriculture, Faisalabad

Prof. Mr. Amjad Ali
Chairman,
Department of Agricultural Extension,
Baluchistan Agriculture College, Chaman Road, Baleli, Quetta

Prof. Dr. Ejaz Ahmad Khan
Chairman,
Department of Agronomy/Botany,
Gomal University, Dera Ismail Khan

Prof. Dr. Khalid Nawab
Chairman,
Department of Agricultural Extension, Education & Communication,
The University of Agriculture, Peshawar

Prof. Dr. Muzammil Hussain Siddiqui
Chairman,
Department of Agronomy, Faculty of Agriculture,
University of Poonch, Rawalakot, AJK

Dr. Muhammad Riaz Chattha
Director/Coordinator,
Department of Agri. Extension,
Agriculture Poly-technique Institute,
National Agricultural Research Center (NARC),
Park Road, Chak Shehzad, Islamabad

Convener
Member
Member
Member
Member
Member
Dr. Zaheer Uddin Mirani  
Associate Professor,  
Agricultural Extension Education  
Sind Agriculture University, Tando Jam  

Dr. Farhat Ullah Khan  
Assistant Professor,  
Department of Agricultural Sciences,  
Allama Iqbal Open University, Islamabad  

Dr. Muhammad Luqman  
Assistant Professor,  
University College of Agriculture,  
University of Sargodha, Sargodha  

Dr. Muhammad Waseem  
Assistant Professor,  
Faculty of Agriculture,  
Lasbela University of Agriculture, Water & Marine Sciences, Uthal, Lasbela, Balochistan  

Dr. Sajid Ali  
Assistant Professor,  
Institute of Agricultural Sciences,  
Quaid-e-Azam Campus,  
University of the Punjab, Lahore  

Mr. Muhammad Hamid Nawaz Khan  
Lecturer,  
Department of Agricultural Extension Education,  
University College of Agriculture & Environmental Sciences,  
Islamia University of Bahawalpur, Bahawalpur  

Dr. Badar Naseem Siddiqui  
Associate Professor & Chairman,  
Department of Agricultural Extension  
Faculty of Crop and Food Sciences,  
PMAS-Arid Agriculture University Rawalpindi
Template for 4-Year BSc (Hons) in Agricultural Disciplines

1. **Compulsory Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit hours</th>
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<tbody>
<tr>
<td>Mathematics/Biology (2 courses)</td>
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<tr>
<td>Statistics 1 &amp; 2</td>
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<tr>
<td>Computer/IT</td>
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<tr>
<td>Pakistan Studies</td>
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<td>Islamic Studies</td>
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<tr>
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<tr>
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<tr>
<td><strong>Sub-Total</strong></td>
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</table>

2. **Interdisciplinary Foundation Courses** (3 Cr. hr)

- Agronomy
- Plant Breeding & Genetics
- Entomology
- Plant Pathology
- Food Technology
- Horticulture
- Soil Science
- Agriculture Economics

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td><strong>Sub-Total</strong></td>
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3. **Supporting Courses** (6-8 courses (3 Cr. hr) amongst below)

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

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<tbody>
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<td><strong>Sub-Total</strong></td>
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</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
1 credit of Theory = one contact hour per week for 16-18 weeks and 1 Practical/Lab hour = 3 contact hours per week for 16-18 weeks.
In case of non-availability of department of supporting courses, courses from foundation courses can be opted.
## SCHEME OF STUDIES FOR UNDERGRADUATE COURSES IN AGRICULTURAL EXTENSION EDUCATION

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<thead>
<tr>
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<td>Introduction to Agricultural Extension</td>
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<tr>
<td>AEE 402</td>
<td>Introduction to Communication in Agricultural Extension</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 501</td>
<td>Communication and Leadership Skills in Agricultural Extension</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 502</td>
<td>Agricultural Journalism</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 503</td>
<td>Introduction to Extension Education Methods</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 504</td>
<td>Adult Learning</td>
<td>3(3-0)</td>
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<tr>
<td>AEE 505</td>
<td>History and Philosophy of Agricultural Extension</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AEE 506</td>
<td>Extension Programme Development</td>
<td>3(2-1)</td>
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<tr>
<td>AEE 507</td>
<td>Rural Development Programmes in Pakistan</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AEE 508</td>
<td>Rural Youth in Agricultural Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 509</td>
<td>Agricultural Technology Transfer</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 510</td>
<td>Poverty Alleviation and Sustainable Development</td>
<td>3(3-0)</td>
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<tr>
<td>AEE 601</td>
<td>Introduction to Cyber Extension</td>
<td>3(2-1)</td>
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<tr>
<td>AEE 602</td>
<td>Introduction to Programme Evaluation</td>
<td>3(2-1)</td>
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<tr>
<td>AEE 603</td>
<td>Human Resource Development</td>
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</tr>
<tr>
<td>AEE 604</td>
<td>Research Methods in Social Sciences</td>
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<tr>
<td>AEE 605</td>
<td>Agricultural Advertising</td>
<td>3(2-1)</td>
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<tr>
<td>AEE 606</td>
<td>Biodiversity and Agricultural Extension</td>
<td>3(3-0)</td>
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<td>AEE 607</td>
<td>Agricultural Extension and Gender Studies</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AEE 608</td>
<td>Distance Education</td>
<td>2(1-1)</td>
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<tr>
<td>AEE 609</td>
<td>Food Security and Agricultural Extension</td>
<td>3(3-0)</td>
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<tr>
<td>AEE 610</td>
<td>Internship</td>
<td>4(0-4)</td>
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</table>
DETAIL OF COURSES FOR
UNDERGRADUATE STUDIES IN
AGRICULTURAL EXTENSION EDUCATION

AEE 301 INTRODUCTION TO AGRICULTURAL EXTENSION 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:

- Comprehend the concept and principles of effective extension
- Identify the organizational set-up of agricultural extension
- Understand the concept of adoption/diffusion of innovations, motivation, planning and evaluation


Practical
Identification of farming problems, their prioritization and possible solutions thereof. Preparation of audio-visual material.

Recommended Books
AEE 402  INTRODUCTION TO COMMUNICATION IN AGRICULTURAL EXTENSION  3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend the concept, process and scope of communication
- Analyse different forms and models of communication
- Identify different barriers to communication

Theory
Concept, purpose and scope of communication in agricultural extension. Communication process, elements and their role in effective communication. Principles of communication. Basic communication models. Forms of communication: interpersonal, intrapersonal and impersonal. Barriers to communication and measures to overcome these barriers.

Practical
The students will be involved in developing and critically analysing different extension messages. They will practice different forms of communication in the class.

Recommended Books

AEE 501  COMMUNICATION AND LEADERSHIP SKILLS IN AGRICULTURAL EXTENSION  3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend various types of communication
- Demonstrate improved communication/leadership skills

Theory
Types of communication i.e. written, verbal, and non-verbal. Communication skills: Speaking, listening, writing and reading. Speaking

Practical
Micro-teaching---Students will plan and practice extension teaching in small groups. They will also maintain a practical notebook regarding preparation of instructional designs.
Interviewing ---Students will interview farmers and extension workers to identify their problems. Writing Skills---Students will prepare various registers including stock register, store book, etc. and will prepare different types of reports required for the job of extension worker including maintenance of office records.

Recommended Books

AEE 502 AGRICULTURAL JOURNALISM 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
• Understand the concept of agricultural journalism
• Develop news, news stories, and articles
• Critically analyse various news stories and articles
Theory

Practical
The student(s) will prepare and report agricultural information in the form of news, news stories, news articles, and/or documentaries.

Recommended Books

AEE 503 INTRODUCTION TO EXTENSION EDUCATION METHODS

Course Objectives
At the completion of this course, the students will be able to:
- Develop an instructional plan
- Understand the teaching-learning process
- Select and apply various extension methods under different situations

Theory
Teaching as a process of facilitating learning, developing an instructional plan for extension teaching. Classification of extension teaching methods: individual, group and mass contact methods. Merits and demerits of various extension methods. Critical analysis of various extension methods. Planning, conducting and follow up of various extension methods.
Practical
Each student will develop an instructional plan for a given extension-teaching situation. The student(s) will be involved in micro teaching/field situation concerning agricultural extension.

Recommended Books

AEE 504 ADULT LEARNING 3(3-0)

Course Objectives
At the completion of this course, the students will be able to:
• Differentiate between active and passive learners
• Demonstrate the working knowledge of learning theories
• Evaluate the learners’ achievements


Recommended Books
Publishers, Singapore.

AEE 505 HISTORY AND PHILOSOPHY OF AGRICULTURAL EXTENSION 3(3-0)

Course Objectives
At the completion of this course, the students will be able to:
- Explain the philosophical roots of agricultural extension education
- Describe the historical perspective of agricultural extension
- Analyse Islamic philosophy of extension education


Recommended Books

AEE 506 EXTENSION PROGRAMME DEVELOPMENT 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Understand the concept of programme development and PCs
- Describe principles of effective programme development
- Analyse various programme development models
- Plan an extension programme
Theory

Practical
The students will conduct situational analysis and needs assessment. They will plan extension programs based on prioritized needs of extension clientele. They will also submit a PC-1 on the given programme/project.

Recommended Books

AEE 507 RURAL DEVELOPMENT PROGRAMMES IN PAKISTAN

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend philosophy of rural development programmes
- Identify various rural development programmes
- Critically analyse government plans and policies related to rural development

Concept, philosophy, importance and objectives of rural development. Main approaches/programmes of rural development in Pakistan i.e. V-AID, Basic Democracies, Rural Works Programme, IRDP, Social Action Programme, People Works Programme, Tameer-e-Watan Programme, Khushhal Pakistan Programme, Village Cooperatives, Supervised Credit Scheme, participatory rural development projects, community based organizations. Current rural development programs: rural support and
rural development programs of NGOs, National Programme for Improvement of Water Courses, National Programme of Integrated Pest Management, Crop Maximization Programme. A critical analysis of current government plans and policies for rural development. Emerging trends of rural development in Pakistan.

Recommended Books

AEE 508 RURAL YOUTH IN AGRICULTURAL DEVELOPMENT

Course Objectives
At the completion of this course, the students will be able to:
- Understand the meaning and philosophy of rural youth work
- Describe rural youth clubs/work in global perspective
- Develop guidelines for involving youth in agricultural extension
- Establish and manage youth clubs for agricultural development

Theory

Practical
The students will be assigned projects involving youth in agricultural development and submit the report.

Recommended Books
AEE 509     AGRICULTURAL TECHNOLOGY TRANSFER     3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend the scope, importance and process of technology transfer
- Identify barriers to technology transfer
- Analyse issues in technology transfer

Theory

Practical
Students will be required to demonstrate/present promising technologies in the class.

Recommended Books

AEE 510     POVERTY ALLEVIATION AND SUSTAINABLE DEVELOPMENT     3(3-0)

Course Objectives
At the completion of this course, the students will be able to:
- Describe the basic concepts of poverty alleviation and sustainable development
- Analyse the role of agricultural extension in poverty alleviation
- Evaluate the development efforts

Recommended Books

AEE 601 INTRODUCTION TO CYBER EXTENSION 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Use software related to farm management
- Inculcate computer literacy among farming community
- Demonstrate computer skills

Theory
and Communication Network model. Analysis of agricultural websites of Pakistan and other developing countries.

Practical
Students will participate in cyber extension related activities being undertaken by the concerned department on weekly basis. The students will examine different agricultural information portals and critically analyse their contents and functionality.

Recommended Books

AEE 602 INTRODUCTION TO PROGRAMME EVALUATION 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
• Comprehend the concept, types and forms of programme evaluation
• Analyse various evaluation techniques
• Develop plan for evaluation

Theory

Practical
The student(s) will be required to submit an evaluation plan of any social/development programme. The plan will then be presented before the class for critical analysis.
Recommended Books

AEE 603 HUMAN RESOURCE DEVELOPMENT 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend the principles of HRD
- Develop/conduct the HRD programmes
- Evaluate HRD programmes

Theory
Concept, scope and role of human resource development in agricultural extension. Purposes of training. Types of training i.e. pre-service, in-service, and follow-up. Determining training needs, Organizing, supervising and managing training programmes. Training of trainers: selecting, planning, and implementing training programmes; duties and responsibilities of trainers. Evaluating the training programmes: performance appraisal, job satisfaction, career planning, conflict management and resolution.

Practical
Students will plan and conduct training programmes for given situations.

Recommended Books
AEE 604 RESEARCH METHODS IN SOCIAL SCIENCES 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Describe the concept and types of research
- Develop research instruments
- Develop plan of work for conducting research
- Apply research skills in real scenario

Theory
Concept and types of research: basic, applied, action, quantitative, qualitative and mixed method. Research process and its steps: identification of research problem, formulation of objectives, review of literature, defining research population, sampling and its techniques, reliability, validity, research instrument (questionnaire, interview schedule, interview guide etc.), data collection, analysis and writing a report.

Practical
Each student will develop a research synopsis, prepare questionnaire/interview schedule/interview guide for data collection. He/she will collect data on limited scale, analyse and submit the research report.

Recommended Books
AEE 605 AGRICULTURAL ADVERTISING 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Understand the concept and significance of advertising in agriculture
- Comprehend various methods and techniques of advertising
- Demonstrate the advertising skills

Theory
Introduction, philosophy, origin and history of advertising. Purpose and techniques of advertisement. Consumer behaviour and psychology of advertising. Traditional and modern advertising methods. Effective strategies and models for advertising. Sale promotional activities in agriculture. Role of advertising in agriculture. Consequences of advertising. Various software used for preparing advertising material such as Corel Draw, Adobe, etc.

Practical
Students will prepare different advertisements by using related software for print and electronic media to promote agricultural products/technologies.

Recommended Books
AEE 606  BIODIVERSITY AND AGRICULTURAL EXTENSION  3(3-0)

Course Objectives
At the completion of this course, the students will be able to:

- Understand the concept and scope of biodiversity
- Identify various techniques to conserve agricultural biodiversity
- Demonstrate different extension methodologies for biodiversity management


Recommended Books
2. FAO. 2010. Sustainable Diets and Bio-Diversity: Directions and Solutions for Policy, Research and Actions. FAO, Rome, Italy.

AEE 607  AGRICULTURAL EXTENSION AND GENDER STUDIES  3(3-0)

Course Objectives
At the completion of this course, the students will be able to:

- Analyse women empowerment approaches
- Comprehend gender mainstreaming policies
- Plan income generating activities for rural women

Theory
Gender studies: definition, concept, importance, roles, issues and challenges in agricultural development. Gender discrimination, rural home economics, cottage industry and small businesses for rural women. Significance of gender analysis in agricultural extension, gender analysis:
tools and techniques. Gender empowerment dimensions, women empowerment index in agriculture, women empowerment through extension education, approaches to women empowerment, national and international gender empowerment policies, Constraints and women’s access to extension and advisory services. Gender mainstreaming in agricultural extension, Gender and agriculture value chains. Gender equality in agriculture. Gender sensitization in agriculture. Gender status in income generation.

Recommended Books

AEE-608 DISTANCE EDUCATION 2(1-1)

Course Objectives
At the completion of this course, the students will be able to:
- Understand and apply distance education
- Prepare the distance education material
- Evaluate and monitor various distance education programmes

Theory
Practical
Students will prepare instructional design for distance learning with the use of AV-Aids and submit and present a report

Recommended Books

AEE 609 FOOD SECURITY AND AGRICULTURAL EXTENSION 3(3-0)

Course Objectives
At the completion of this course, the students will be able to:
- Understand the concepts of food security and safety
- Demonstrate the role of agricultural extension in food insecurity and resource scarcity
- Identify and analyse food security and safety situation


Recommended Books


AEE 610 INTERNSHIP 4(0-4)

The students will be attached individually or in groups with the field staff of the Department of Agriculture (Extension), Nation Building Departments (NBDs), Non-Governmental Organizations (NGOs), etc. In addition, the students will visit various agricultural research stations and extension projects in the province/country with special reference to the following:

i. Field crop production and protection
ii. Farm machinery/workshops
iii. Livestock and poultry management
iv. Agro-forestry
v. Seed production and distribution
vi. Fish farming
vii. Fruit and vegetable production, preservation and processing
viii. Manures/chemical fertilizers/organic farming and its certification
ix. Soil reclamation and conservation
x. Water management
xi. Agriculture credit, business and marketing
xii. Cooperatives

Every student will write a comprehensive report based on his/her field experiences, according to the following guidelines:

i. Introduction
ii. Objectives
iii. Extension activities undertaken during training
iv. Problems faced by field staff (host institutes/department), farmers and internee
v. Relationship of agricultural extension service with other nation building departments, agencies and stakeholders.
vi. Future plans for extension work in the area
vii. Suggestions for improvement of internship programme
## SEMESTER WISE BREAK-UP

### 5th Semester

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<td>AEE 501</td>
<td>Communication and Leadership Skills in Agricultural Extension</td>
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<td>AEE 503</td>
<td>Introduction to Extension Education Methods</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 505</td>
<td>Philosophy of Agricultural Extension</td>
<td>3(3-0)</td>
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<tr>
<td>AEE 507</td>
<td>Rural Development Programmes in Pakistan</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>AEE 509</td>
<td>Agricultural Technology Transfer</td>
<td>3(2-1)</td>
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### 6th Semester

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<td>AEE 504</td>
<td>Adult Learning</td>
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</tr>
<tr>
<td>AEE 506</td>
<td>Extension Programme Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 508</td>
<td>Rural Youth in Agricultural Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 510</td>
<td>Poverty Alleviation and Sustainable Development</td>
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<td>AEE 603</td>
<td>Human Resource Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>AEE 605</td>
<td>Agricultural Advertising</td>
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<td>AEE 607</td>
<td>Agricultural Extension and Gender Studies</td>
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<td>AEE 609</td>
<td>Food Security and Agricultural Extension</td>
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### 8th Semester

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<tr>
<td>AEE 602</td>
<td>Introduction to Programme Evaluation</td>
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<tr>
<td>AEE 604</td>
<td>Research Methods in Social Sciences</td>
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<tr>
<td>AEE 606</td>
<td>Biodiversity and Agricultural Extension</td>
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<td>AEE 608</td>
<td>Distance Education</td>
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## SCHEME OF STUDIES
### FOR POST-GRADUATE COURSES IN AGRICULTURAL EXTENSION

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>AEE 701</td>
<td>Agricultural Extension Methods</td>
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<td>AEE 702</td>
<td>Programme Planning</td>
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<td>AEE 703</td>
<td>Supervised Field Experience</td>
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<td>AEE 704</td>
<td>Monitoring and Evaluation in Agricultural Extension</td>
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<td>Communication Strategies in Agricultural Extension</td>
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<td>AEE 706</td>
<td>Development of Training Programmes</td>
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<td>AEE 707</td>
<td>Scientific and Technical Writing</td>
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<td>AEE 708</td>
<td>Applications of ICTs in Agricultural Extension</td>
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<td>Human Resource Management</td>
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<td>AEE 710</td>
<td>Gender Mainstreaming for Community Development</td>
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<td>AEE 711</td>
<td>International Agricultural Extension Systems</td>
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<td>AEE 712</td>
<td>Adult and Continuing Education</td>
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<td>AEE 713</td>
<td>Management in Agricultural Extension</td>
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<td>AEE 714</td>
<td>Sustainable Rural Livelihoods</td>
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<td>AEE 715</td>
<td>Interviewing</td>
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<td>AEE 716</td>
<td>Advanced Research Methods</td>
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<td>AEE 717</td>
<td>Market-Led Agricultural Extension and Entrepreneurship</td>
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<td>AEE 718</td>
<td>Participatory Approach to Agricultural Extension &amp; Rural Development</td>
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<td>AEE 719</td>
<td>Special Problem</td>
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<td>AEE 720</td>
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DETAIL OF COURSES
FOR POST-GRADUATE STUDIES IN
AGRICULTURAL EXTENSION

AEE 701 AGRICULTURAL EXTENSION METHODS 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:

- Identify and practice various extension teaching methods
- Analyse the strengths and weaknesses of various extension teaching methods
- Involve local institutions in extension teaching

Theory
Extension teaching methods, their merits, demerits, and applicability. Comparing individual, group and mass media extension methods on the basis of their advantages and disadvantages. Effects of various extension teaching methods at different stages of adoption of farm and home practices. Personal versus impersonal extension teaching methods and their significance. Critical analysis of alternative extension methods. Recent advances in agricultural extension methods. Ways of involving local institutions in extension teaching.

Practical
Students will plan, analyse, and apply given extension teaching method(s) in simulated situation.

Recommended Books
AEE 702 PROGRAMME PLANNING 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:

- Understand the concept, scope and role of programme planning
- Analyse the role of change agents in programme planning
- Differentiate between long-term and short-term programme planning
- Apply various programme planning models in extension

Theory

Practical
The students will be given assignments to plan an agricultural extension education programme for a typical Pakistani village/farming community and will make presentation.

Recommended Books
AEE 703 SUPERVISED FIELD EXPERIENCE 3(0-3)

Course Objectives
At the completion of this course, the students will be able to:

- Observe and participate in real-life learning experience
- Develop on-the-job skills
- Develop and present field report

The students will be attached with experienced extension/development workers to learn on-the-job skills and gain experience in practical settings. Each student will observe/participate and report the activities carried out. The student(s) will be required to make a presentation in the class.

Recommended Books

AEE 704 MONITORING AND EVALUATION IN AGRICULTURAL EXTENSION 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:

- Understand the concepts, scope and role of monitoring and evaluation
- Analyse the importance of evaluation for the future programmes
- Develop data collection instruments and analysis procedures for programme evaluation
- Prepare the evaluation reports

Theory

Practical
The students will be required to review critically monitoring and evaluation
reports of development/research projects. They have to identify strengths and weaknesses of the report(s). Each student will select an extension programme/project/activity for evaluation. The student(s) will plan and conduct evaluation and submit the report.

**Recommended Books**

**AEE 705 COMMUNICATION STRATEGIES IN AGRICULTURAL EXTENSION 3(2-1)**

**Course Objectives**
At the completion of this course, the students will be able to:
- Comprehend communication process and models
- Analyse the components of an effective message
- Analyse and rectify barriers to communication
- Design persuasive messages

**Theory**
Analysis and application of various communication models. Variables in communication process: source variables, receiver variables (demographic analysis, personality analysis, interpersonal trust, listening ability and feed-back) and verbal message variables. The components of a persuasive message, factors affecting persuasive message, structuring a persuasive message. Non-verbal communication, functions of non-verbal communication, non-verbal communication as a global approach, non-verbal message variables and difficulties in their understanding. Obstacles to effective communication. Horizontal and vertical communication. The structures of communication process; face to face communication, small group communication, public address communication, mass communication.
Practical
Visits to various media centers and holding discussions with media personnel. The students will be required to prepare messages relating to different persuasive appeals and make presentation in the class. They will also be involved in non-verbal communication through role playing.

Recommended Books

AEE 706 DEVELOPMENT OF TRAINING PROGRAMMES 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Plan and conduct training programmes
- Develop trainings' support materials
- Evaluate training programmes

Theory

Practical
Students will prepare different training modules for farmers/professionals.

Recommended Books

AEE 707  SCIENTIFIC AND TECHNICAL WRITING  3(1-2)

Course Objectives
At the completion of this course, the students will be able to:
- Apply scientific writing skills
- Develop report writing and presentation skills
- Present research reports at appropriate forums

Theory
Writing as means of communication in professional and scientific fields. Differences between scientific and general writing. Alternative requirements and formats of synopses, theses, technical articles and research papers. Introduction to American Psychological Association (APA) and Council of Biological Editors (CBE) style manuals etc.

Practical
The students will be required to write technical articles/reports on given topics and present in the class. They will critically evaluate, edit and present reports prepared by other students.

Recommended Books

AEE 708  APPLICATIONS OF ICTs IN AGRICULTURAL EXTENSION  3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
• Understand the role of various ICTs in extension teaching
• Determine role of GIS and remote sensing in extension education
• Use given information technology for extension work

**Theory**

Overview of information and communication technologies (ICTs) used in extension education. Use of databases for agricultural products, computerized weather forecasting and usage, computerized map reading and interpretation, colour coding, spectroscopic study. Introduction to remote sensing and geographical information systems (GIS) for agricultural extension education. Role of remote sensing and GIS for agricultural resource management and rural development. Computerized mass media applications in agricultural extension education: teleconferencing, e-conferencing, knowledge portal, e-office, e-agriculture, e-business etc. Use of mobile communication for agricultural development and business. Recent trends and future of ICTs in Pakistan.

**Practical**

Student will be given hands-on training in various ICTs and submit comprehensive report and will present in the class.

**Recommended Books**


**AEE 709 HUMAN RESOURCE MANAGEMENT 3(2-1)**

**Course Objectives**

At the completion of this course, the students will be able to:

• Develop the job design and analysing skills
• Analyse the management styles
• Resolve group conflicts
• Understand behavioural change
Theory

Practical
The students will be required to analyse various management styles using different techniques and participatory approaches. The students will identify job design, analyse recruitment and selection process of any organization.

Recommended Books

AEE 710 GENDER MAINSTREAMING FOR COMMUNITY DEVELOPMENT 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend process of community development
- Identify constraints to gender mainstreaming
- Analyse the role of gender in community development

Theory
Community development: definition, concept, elements, past and current programmes. Essential elements in building a national programme of

**Practical**

Students will be assigned various projects related to community development and submit a comprehensive report.

**Recommended Books**


**AEE 711 INTERNATIONAL AGRICULTURAL EXTENSION SYSTEMS**

**Course Objectives**

At the completion of this course, the students will be able to:

- Compare various extension systems in selected countries
- Analyse strengths and weaknesses of the extension systems
- Identify limitations of agricultural extension systems

**Theory**

Review of extension: systems in selected Asian countries: agricultural extension in Pakistan, agricultural extension in Bangladesh; Farmers' Association in Malaysia, agricultural development through participation of small farmers in Afghanistan; farmers' training and functional literacy in India; agricultural extension service in Japan with special reference to training of rural youth. Farmers' training programmes in selected developing countries with special reference to small farmers. Agricultural extension systems in developed countries i.e. USA, Canada, UK, China etc.

**Practical**

The students will review and critically analyse extension systems of given countries. They will also present the same in the class.
Recommended Books

AEE 712 ADULT AND CONTINUING EDUCATION 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend principles of adult education
- Select and apply appropriate method(s) of adult education
- Monitor and evaluate adult education programmes

Theory

Practical
Students will design, present and submit report on assigned topics relating to adult and continuing educational programme.

Recommended Books

AEE 713 MANAGEMENT IN AGRICULTURAL EXTENSION 3(3-0)

Course Objectives
At the completion of this course, the students will be able to:
• Understand concept of management in agricultural extension
• Coordinate among nation building departments
• Apply principles of management in real life situation

Theory
Functions and objectives of extension management. The organization and administration of extension at different administrative tiers. Coordinative capacity of the Department of Agriculture (Extension) with the nation building departments, research organizations and related universities. Role of different administrative heads (agricultural extension) in planning and coordinating resources and delegating authority. Meaning and objectives of supervision. Principles of supervision. Staff recruitment, placement, training, counselling, job description, promotion and salary adjustment. Effective team building. Leadership vs management. Leadership theories and styles. Appraisal and improvement of administrative and supervisory activities.

Recommended Books
AEE 714   SUSTAINABLE RURAL LIVELIHOODS     3(3-0)

Course Objectives
After the completion of this course, the students will be able to:
- Apply sustainable livelihood framework
- Compare and contrast various livelihood approaches
- Analyse the role of agricultural extension in sustainable rural livelihoods

Theory
Livelihoods: definitions, core concepts and sustainability of livelihoods. Livelihood approaches: sustainable, right based, sector-wise etc. Sustainable livelihoods framework: origin, objectives, vulnerability, context, livelihood assets (human, natural, social, financial and physical), policies, institutions, process, strategies and outcomes. Conducting rural livelihood analysis: rapid and participatory methods, and sample surveys. Livelihood diversification. Comparison of livelihood approaches adopted by various development organizations such as Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), Department for International Development (DFID) etc. Agricultural development and rural livelihoods. Role of agricultural extension in poverty reduction and sustainable livelihoods.

Recommended Books

AEE 715   INTERVIEWING     3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend the interview process
- Design different research instruments
- Conduct different types of interviews
Theory

Practical
Students will plan and conduct interviews of different types in a simulated situation. They will also develop interview schedule and conduct interviews of farmers.

Recommended Books

AEE 716 ADVANCED RESEARCH METHODS 3(2-1)

Course Objectives
At the completion of this course, the students will be able to:
- Identify and synthesise research questions
- Collect, analyse and interpret research data
- Critically analyse various methods of qualitative and quantitative research
- Prepare research proposals

Theory
Introduction to research designs. Defining population and selecting samples. Choosing alternative methods for data collection. Determining reliability and validity of the research instrument. Selecting and applying appropriate statistical techniques for data analysis. Qualitative research design. Types of qualitative research: observations, key informant interviews, focused group discussions, life histories etc. Data collection techniques and instruments used in qualitative research. Qualitative data analysis: grounded theory, content analysis, ethnography etc. Using SPSS and Nvivo for data analysis.

Practical
The students will prepare and present brief research proposals, plan, and conduct pilot studies.

Recommended Books

AEE 717  MARKET-LED AGRICULTURAL EXTENSION  3(2-1)
AND ENTREPRENEURSHIP

Course Objectives
At the completion of this course, the students will be able to:
• Understand the concept, need and importance of market-led extension
• Comprehend the concept of entrepreneurship
• Identify and establish profitable enterprises

Public versus private extension in Pakistan. Market led agricultural extension: need, issues challenges, dimensions, tools, approaches and emerging perspectives. Public private linkages in market led agricultural extension. Agricultural entrepreneurship: concept, characteristics, approaches, theories, need for enterprises development. Traits of
entrepreneurs: risk taking and management, leadership, decision making, planning, organizing, coordinating and marketing. Types of entrepreneurs. Introduction to business incubation centres. Stages of establishing enterprise: identification of sound enterprise, steps to be considered in setting up an enterprise, feasibility report, product selection, risk management and market analysis and legal requirements. Role of extension worker in establishing an enterprise.

Practical
Students will prepare agri. business idea, present and submit the report.

Recommended Books

AEE 718 PARTICIPATORY APPROACH TO AGRICULTURAL EXTENSION & RURAL DEVELOPMENT

Course Objectives
At the completion of this course, the students will be able to:
- Comprehend the philosophy of self-reliant participatory approach
- Learn and apply various participatory techniques
- Identify and analyse the barriers of participatory approach
- Establish rural development models using participatory approach

Theory
Rural development: basic elements and indicators. Rural poverty: concepts, causes, biases, problems and opportunities. The changing role of the professionals; sitting, asking, listening and learning from the poor. Self-reliant participatory development: concept, philosophy, objectives and basic principles. Participatory rural appraisal (PRA) and rapid rural appraisal (RRA). Participatory tools and techniques. Participatory teaching

**Practical**

The students (in groups) will select a village to practise participatory techniques learnt in the classroom. They will organize a group of farmers, provide them opportunities for better interaction with each other and with professionals. They will finally submit a comprehensive report and give presentation in the class.

**Recommended Books**


**AEE 719 SPECIAL PROBLEM 1(0-1)**

The student(s) will be assigned problem(s) of special concern related to agricultural extension and community development.

**AEE 720 SEMINAR 1(0-1)**

Each student will prepare presentation on assigned topic and deliver seminar

**RESEARCH AND DISSERTATION 6-10(0-6/10)**
ANNEXURE - A

English I (Functional English)

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)**

**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 precise 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)**

**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 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).
Annexure - B

Pakistan Studies (Compulsory)

Introduction/Objectives

- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline

1. Historical Perspective
   b. Factors leading to Muslim separatism
   c. People and Land
      i. Indus civilization
      ii. Muslim advent
      iii. Location and geo-physical features

2. Government and Politics in Pakistan
   Political and constitutional phases:
   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999 onward

3. Contemporary Pakistan
   a. Economic institutions and issues
   b. Society and social structure
   c. Ethnicity
   d. Foreign policy of Pakistan and challenges
   e. Futuristic outlook of Pakistan

Recommended Books

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 worship
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-Baqara 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 of 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

Recommended Books
1. Hameed ullah Muhammad, “Emergence of Islam”, IRI, Islamabad
2 Hameed ullah Muhammad, "Muslim Conduct of State"
3 Hameed ullah Muhammad, 'Introduction to Islam
4 Mulana Muhammad Yousaf Islahi,”
5 Hussain Hamid Hassan, “An Introduction to the Study of Islamic Law” leaf Publication Islamabad, Pakistan.
6 Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
9 Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)
COMPULSORY MATHEMATICS COURSES FOR BS (4 YEAR)

(FOR STUDENTS NOT MAJORING IN MATHEMATICS)

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.


Recommended Books

2. MATHEMATICS II (CALCULUS)

Prerequisite(s): Mathematics I (Algebra)
Credit Hours: 3 + 0

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

Course Outline:


Recommended Books
4. Thomas GB, Finney AR, Calculus (11th ed.), 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

4. COURSE FOR NON-MATHMATICS MAJORS IN SOCIAL SCIENCES

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<th>MATHEMATICS</th>
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<td>SSC (Metric) level Mathematics</td>
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<td>Effective</td>
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Aims : To give the basic knowledge of Mathematics and prepare the students not majoring in mathematics.

Objectives : After completion of this course the student will be able to:
- Understand the use of the essential tools of basic mathematics;
- Apply the concepts and the techniques in their respective disciplines;
- Model the effects non-isothermal problems through different domains;

Contents :
1. Algebra
2. **Statistics**  

**Recommended Books**

5. **MATHEMATICS FOR CHEMISTRY**

**Credit Hours:** 3

**Prerequisites:** Mathematics at Secondary level

**Course Objectives**
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**
Integration by Substitution, Integration by Parts, Change of Variables in Indefinite Integrals. Least-Squares Line.

**Recommended Books**


**MATHMATICS FOR PHYSICS**

**Contents**

1. **Preliminary calculus**
   - Differentiation
     Differentiation from first principles; products; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz’ theorem; special points of a function; theorems of differentiation.
   - Integration
     Integration from first principles; the inverse of differentiation; integration by inspection; sinusoidal function; logarithmic integration; integration using partial fractions; substitution method; integration by parts; reduction formulae; infinite and improper integrals; plane polar coordinates; integral inequalities; applications of integration.

2. **Complex numbers and hyperbolic functions**
   - The need for complex numbers
   - Manipulation of complex numbers
     Additions and subtraction; modulus and argument; multiplication; complex conjugate; division
   - Polar representation of complex numbers multiplication and division in polar form
   - de Moivre’s theorem
Trigonometrical identities; finding the nth roots of unity; solving polynomial equations
- Complex logarithms and complex powers
- Applications to differentiation and integration
- Hyperbolic functions
  Definitions; hyperbolic-trigonometric analogies; identities of hyperbolic functions; solving hyperbolic equations; inverses of hyperbolic functions; calculus of hyperbolic functions

3. **Series and limits**
- Series
- Summation of series
  Arithmetic series; geometric series; arithmetico-geometric series; the difference method; series involving natural numbers; transformation of series
- Convergence of infinite series
  Absolute and conditional convergence; convergence of a series containing only real positive terms; alternating series test
- Operations with series
- Power series
  Convergence of power series; operations with power series
- Taylor series
  Taylor’s theorem; approximation errors in Taylor series; standard McLaurin series
- Evaluation of limits

4. **Partial differentiation**
- Definition of the partial derivative
- The total differential and total derivative
- Exact and inexact differentials
- Useful theorems of partial differentiation
- The chain rule
- Change of variables
- Taylor’s theorem for many-variable functions
- Stationary values of many-variable functions
- Stationary values under constraints

5. **Multiple integrals**
- Double integrals
- Triple integrals
- Applications of multiple integrals
- Areas and volumes; masses, centers of mass and centroi Pappus’ theorems; moments of inertia; mean values of functions
6. **Vector algebra**

- Scalars and vectors
- Addition and subtraction of vectors
- Multiplication by a scalar
- Basis vectors and components
- Magnitude of a vector
- Multiplication of vectors
  - Scalar product; vector product; scalar triple product; vector triple product
- Equations of lines and planes
  - Equation of a line; equation of a plane
- Using vectors to find distances
  - Point to line; point to plane; line to line; line to plane
- Reciprocal vectors

7. **Matrices and vector spaces**

- Vectors spaces
  - Basic vectors; the inner product; some useful inequalities
- Matrices
- The complex and Hermitian conjugates of a matrix
- The determinant of a matrix
  - Properties of determinants
- The inverse of a matrix
- The rank of a matrix
- Simultaneous linear equations
  - N simultaneous linear equations in N unknowns
- Special square matrices
  - Diagonal; symmetric and antisymmetric; orthogonal; Hermitian; unitary normal
- Eigen vectors and eigen values
  - of a normal matrix; of Hermitian and anti-Hermitian matrices; of a unitary matrix; of a general square matrix
- Determination of eigen values and eigen vectors

8. **Vector calculus**

- Differentiation of vectors
  - Composite vector expressions; differential of a vector
- Integration of vectors
- Space curves
- Vector functions of several arguments
- Surfaces
- Scalar and vector fields
- Vector operators
- Gradient of a scalar field; divergence of a vector field; curl of a vector field
- Vector operator formulae
- Vector operators acting on sums and products; combinations of grad, div and curl
- Cylindrical and spherical polar coordinates
- Cylindrical polar coordinates; spherical polar coordinates
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.

Practical
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 kenosis

Recommended Books
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
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 $X^2$ (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 Books
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
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

1. Introduction to Computers by Peter Norton, (6th International ed.).
   McGraw-Hill


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.
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 NCRC of Agricultural Extension formulated the following recommendations:

- The Higher Education Commission should provide financial help for conducting National Conferences of various stakeholders related to agricultural extension in all provinces of the country.
- Mobilizing the activities of Pakistan Association for the Advancement of Agricultural Extension Education (PAAAEE).
- Uniform nomenclature for graduate and post-graduate levels at all degree awarding institutions of HEC should be adopted to avoid any inconvenience in this respect.
- Establishment of independent department/institute of Agricultural Extension Education at all the degree awarding institutions in agriculture.
- Strengthening the infrastructure and related facilities where ever these are lacking for smooth running of the department.
- Uniform policy for awarding qualification allowance should be adopted in all institutions of HEC throughout the country. The said recommendation should be communicated to all the provincial departments.
- HEC should provide latest data analysis software such as SPSS, Nvivo etc. and software for preparing advertising materials such as Adobe, Corel Draw etc. to the affiliated universities.
- Rural Development degree programme is being offered by various universities at undergraduate and post graduate levels, it is therefore, recommended to constitute NCRC meeting for developing curriculum of the same.