

CURRICULUM

OF

AGRICULTURAL ECONOMICS

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

(Revised 2014)



HIGHER EDUCATION COMMISSION
ISLAMABAD

CURRICULUM DIVISION, HEC

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Composed by: Mr. Zulfiqar Ali, HEC, Islamabad

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PREFACE

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

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

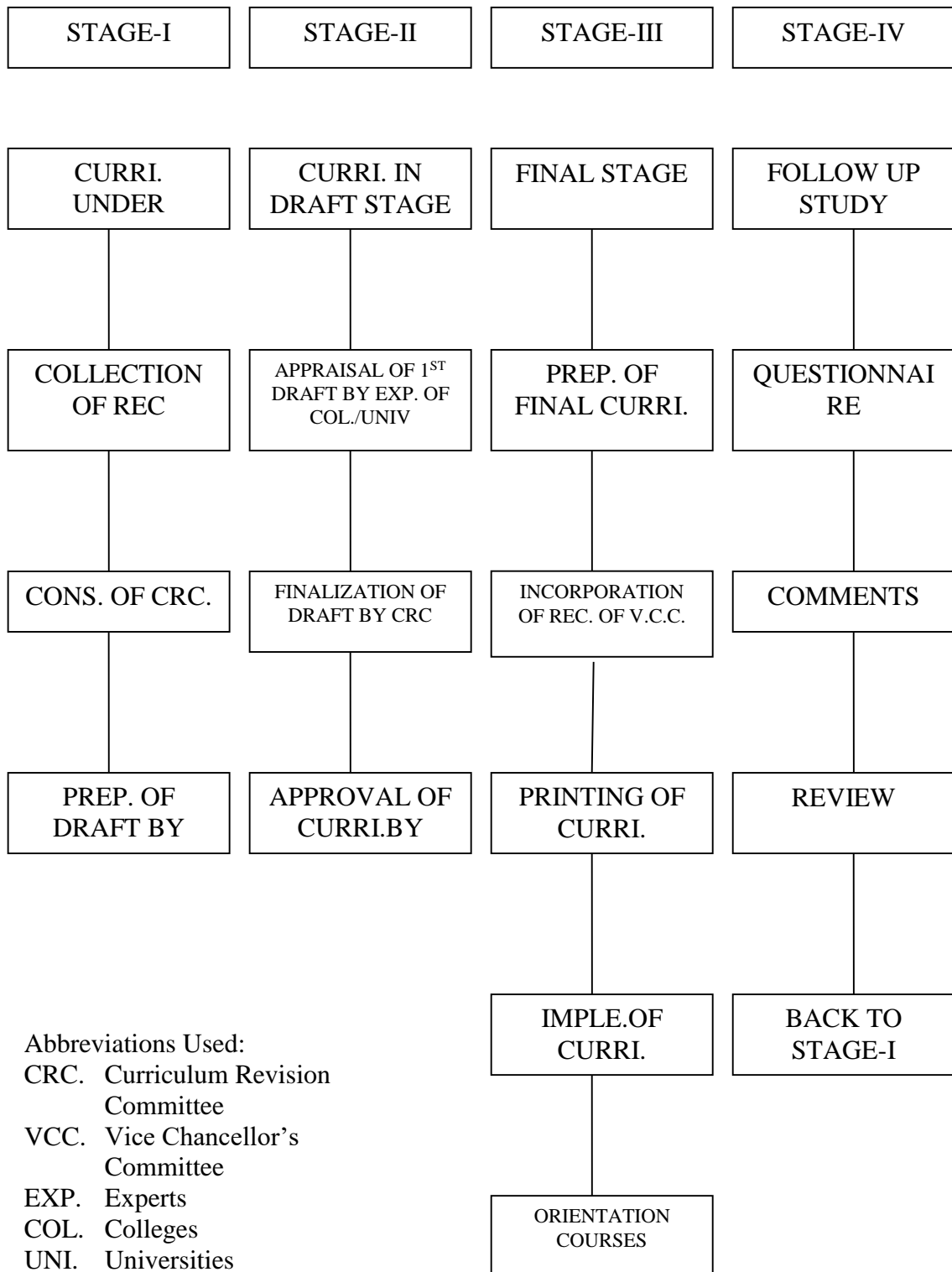
In compliance with the above provisions, the Curriculum Division of HEC undertakes the revision of curricula after every three years through respective National Curriculum Revision Committees (NCRCs) which consist of eminent professors and researchers of relevant fields from public and private sector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

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

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

(Fida Hussain)
Director General (Academics)

CURRICULUM DEVELOPMENT PROCESS



Abbreviations Used:
 CRC. Curriculum Revision Committee
 VCC. Vice Chancellor's Committee
 EXP. Experts
 COL. Colleges
 UNI. Universities
 PREP. Preparation

INTRODUCTION

In continuation of earlier meeting of National Curriculum Revision Committee (NCRC) in the discipline of Agricultural Economics held on November 6-8, 2013 at HEC Regional Centre, Lahore, final meeting was held on February 10-12, 2014 at Higher Education Commission, Regional Centre, Peshawar. Following attended:

Prof. Dr. Munir Ahmad, Joint Director, Pakistan Institute of Development Economics, Islamabad.	Convener
Prof. Dr. Munir Khan Department of Agricultural & Applied Economics, University of Agriculture, Peshawar	Member
Dr. Umar Farooq, Director General/CSO Pakistan Agriculture Research Council (PARC), Social Sciences Division, PARC, 20-Attaturk Avenue, G-5/1, P.O. Box 1031, Islamabad.	Member
Prof. Muhammad Ashfaq, Professor/Director Institute of Agricultural & Resource Economics, University of Agriculture, Faisalabad.	Member
Prof. Dr. Zahoor ul Haq, Faculty of Social Sciences, Abdul Wali Khan University, Mardan.	Member
Dr. Gobind M. Herani, Dean / Professor, Faculty of Management Sciences, Khadim Ali Shah Bukhari Institute of Tech, 84-B, SMCHS, Karachi.	Member
Dr. Ikram Ali Malik Associate Professor, Department of Agricultural Economics, PMAS Arid Agriculture University, Rawalpindi	Member
Mr. Nadeem Anwar, Assistant Professor/Incharge, Department of Agricultural Economics, University College of Agriculture, University of Sargodha, Sargodha.	Member

Dr. Sultan Ali Adil, Associate Professor, Institute of Agricultural & Resource Economics, University of Agriculture, Faisalabad.	Member
Dr. Habibullah Magsi, Assistant Professor, Department of Agricultural Economics Sindh Agriculture University, Tandojam.	Member
Dr. Dilawar Khan, Assistant Professor, Department of Economics, Kohat University of Science & Technology, Kohat 26000,	Member
Dr. M. Niamat Ullah Babar, Assistant Professor / Chairman Department of Agricultural Economics, Gomal University, Dera Ismail Khan, Khyber Paktunkhwa.	Member
Dr. Syed Muhammad Khair, Assistant Professor, Department of Economics, Balochistan University of IT & Management Sciences, Airport Road, Baleli, Quetta.	Member
Dr. Muhammad Rafiq, Assistant Professor, Department of Economics, Institute of Management Science, 1-A, Sector E-5, Phase VII, Hayatabad, Peshawar.	Member
Dr. Dawood Jan, Associate Professor / Chairman, Department of Agricultural & Applied Economics, University of Agriculture, Peshawar.	Secretary/Member

Meeting started with recitation from the Holy Quran by Mr. Abid Wahab Assistant Director Curriculum. Mr. Zaheer Ahmed Awan, Regional Director HEC Peshawar welcomed the participants and briefed them about the efforts of the Commission in revision and development of curricula. Mr. Abid Wahab, Assistant Director Curriculum, HEC, Islamabad explained the procedure for curriculum revision.

Prof. Dr. Munir Ahmad, Joint Director, Pakistan Institute of Development Economics, Islamabad and Dr. Dawood Jan, Associate Professor / Chairman, Department of Agricultural & Applied Economics, University of Agriculture, Peshawar were unanimously elected as Convener and Secretary, respectively.

After detailed deliberations, the committee agreed and recommended the followings:

1. Reviewed, revised and added/dropped the courses, their contents and recommended books and suggested changes in their contents, texts as well as reference books accordingly.
2. In addition the committee revised earlier scheme of studies and specifically recommended incorporation of two courses each of Microeconomics, Macroeconomics and Econometrics at BS/BSc (Hons) Agricultural Economics level.
3. The committee developed the courses of "*Economics of Climate Change*" and "*Ecological Economics*", and incorporated these as optional courses at BS/BSc (Hons) Agri. Economics.
4. The committee modified the course contents of "*Agricultural Economics*", "*Agribusiness & Trade*", "*Microeconomics-I*", "*Microeconomics-II*", "*Macroeconomics-I*", "*Macroeconomics-II*", "*Food and Agricultural Marketing*", "*Agricultural Production Economics*", "*Research Methods in Social Sciences*" and "*Agricultural issues and Policies of Pakistan*".
5. Similarly the committee reviewed the scheme of studies for MS/MSc (Hons) in Agricultural Economics and slashed the number of core courses from eight to six.
6. The committee developed the courses of "*Financial Economics*", "*Pakistan Economy*", "*Economics of Climate Change*" and "*Time-series Analysis*" at MS/MSc(Hons) level and incorporated these as optional subjects.
7. Similarly the committee recommended the inclusion of "*Mathematical Economics*" as a core course and "*Marketing and International Trade*" as optional course.
8. The committee also recommended "*Mathematical Programming*" as an optional course.
9. Specifically, the committee identified and recommended *TEXT BOOKS*: and *SUGGESTED READINGS*: for each and every course accordingly.

The meeting ended with a vote of thanks to and from the convener.

Standardized Scheme of Study for 4-Year BS/BSc (Hons) Agriculture

Mathematics / Biology	6 (3-0) (2-1) Credits
Statistics 1 & 2	6 (3-0) (3-0)
Computers / IT	3 (2-1)
Pak Studies	2 (2-0)
Islamic Studies	2 (2-0)
Communications Skills	3(3-0)
English	3(3-0)
Basic Agriculture	3(2-1)
Sub-Total	28

One subject from each of the following disciplines

Agronomy	3 (2-1)
Plant Breeding & Genetics	3 (2-1)
Entomology	3 (2-1)
Plant Pathology	3 (2-1)
Food Technology	3 (2-1)
Horticulture	3 (2-1)
Soil Sciences	3 (2-1)
Agricultural Economics	3 (2-1)
Sub-Total	24

Supporting Courses (6-8 courses (3 Cr. Hr) amongst below

Agriculture Extension	
Forestry & Range Management	
Animal Science	
Agri Business and Trade	
Rural Development	
Human Nutrition	
Agriculture Chemistry	
Agriculture Engineering	
Water Management	
Sub Total	18-24

Sub-total during the first four semesters	70 – 76
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Semester 5, 6, 7 & 8	56-60
Internship/Project	04

Grand Total:	130 - 140
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SCHEME OF STUDIES FOR BS/BSc (HONS). AGRICULTURAL ECONOMICS

Vision:

To achieve food security, and competitive and sustainable agricultural development by providing qualified professionals of agricultural economics to contribute in various national as well as international organizations for the purpose.

Program Objectives

The BSc Honors degree (Agricultural Economics) aims at equipping the students with the knowledge and skills required to analyze the agricultural economic issues for efficient use of scarce resources in agriculture sector and its development, consistent with the interest of all stake holders.

<u>Course Title</u>	<u>Credit Hours</u>
Introduction to Agricultural Economics	3(3-0)
Agribusiness & Trade	3(3-0)
Microeconomics – I	3(3-0)
Macroeconomics – I	3(3-0)
Mathematics for Economists	3(3-0)
Statistical Methods for Social Sciences	3(2-1)
Food and Agricultural Marketing	3(3-0)
Microeconomics –II	3(3-0)
Macroeconomics – II	3(3-0)
Agricultural Finance	3(3-0)
Mathematical Economics	3(3-0)
Agribusiness Management	3(3-0)
Econometrics – I	3(2-1)
Natural Resource Economics	3(3-0)
Development Economics	3(3-0)
Agricultural Production Economics	3(3-0)
Research Methods in Social Sciences	3(2-1)
Econometrics – II	3(2-1)
Agricultural issues and Policies of Pakistan	3(3-0)
Internship / Project	4(4-0)
 Optional Courses*	
Islamic Economics	3(3-0)
Economics of Livestock Production	3(3-0)
Agriculture & Rural Development	3(3-0)
Economics of Agro based Industries	3(3-0)
Economics of Rangeland and Pastures	3(3-0)
Economics of Climate Change	3(3-0)

Ecological Economics	3(3-0)
Operations Research	3(3-0)
Logic and Critical thinking	(3-0)
International Economics	3(3-0)

****These are a few examples, Universities could develop related course as optional course.***

SEMESTER WISE SCHEME OF STUDIES FOR BS/BSc (Hons) Agricultural Economics

General Courses (1st to 4th Semester)

Course Title	Credit Hours
Introduction to Agricultural Economics	3(3-0)
Agribusiness & Trade	3(3-0)

Major Courses (Fifth Semester)

Course Title	Credit Hours
Microeconomics – I	3(3-0)
Macroeconomics – I	3(3-0)
Mathematics for Economists	3(3-0)
Statistical Methods for Social Sciences	3(2-1)
Food and Agricultural Marketing	3(3-0)
Optional	3(3-0)
Total Credit Hours	18(17-1)

(Sixth Semester)

Course Title	Credit Hours
Microeconomics –II	3(3-0)
Macroeconomics – II	3(3-0)
Agricultural Finance	3(3-0)
Mathematical Economics	3(3-0)
Agribusiness Management	3(3-0)
Optional	3(3-0)
Total Credit Hours	18(18-0)

(Seventh Semester)

Course Title	Credit Hours
Econometrics – I	3(2-1)
Natural Resource Economics	3(3-0)
Development Economics	3(3-0)
Agricultural Production Economics	3(3-0)
Research Methods in Social Sciences	3(2-1)
Optional	3(3-0)
Total Credit Hours	18(16-2)

(Eighth Semester)

Course Title	Credit Hours
Econometrics – II	3(2-1)
Agricultural issues and Policies of Pakistan	3(3-0)
Internship / Project	4(0-4)
Total Credit Hours	10(5-5)

Optional Courses*

Course Title	Credit Hours
Islamic Economics	3(3-0)
Economics of Livestock Production	3(3-0)
Agriculture & Rural Development	3(3-0)
Economics of Agro based Industries	3(3-0)
Economics of Rangeland and Pastures	3(3-0)
Economics of Climate Change	3(3-0)
Ecological Economics	3(3-0)
Operations Research	3(3-0)
Logic and Critical Thinking	3(3-0)
International Economics	3(3-0)

**DETAIL OF COURSES
FOR
BS/BSc (HONS) AGRICULTURAL ECONOMICS**

INTRODUCTION TO AGRICULTURAL ECONOMICS 3 (3-0)

After completing the course, students will develop understanding of the basic concepts of Economics and their application in agriculture.

Definitions and overview of Economics and related terms; Subject matter & scope; Theory of consumer behavior; Scale of preferences; Utility, Indifference Curve & related concepts; Demand & Supply analysis; Elasticity of Demand and Supply; Market Equilibrium. Production, Factors of

Production, laws of return and their significance in agriculture.

Concept of macroeconomics; approaches to national income estimation; Growth, Unemployment & Inflation. Important macroeconomic issues in agriculture sector of Pakistan.

TEXT BOOKS:

1. Penson, J. B., Capps O. Rossen C. P., & Woodward, R. (2013). Introduction to Agricultural Economics. 5th Edition. New Jersey: Prentice Hall.
2. Samuelson, P. A., & Nordhaus, W. D. (2009). Economics. 19th Edition. New York: McGraw-Hills.
3. McConnel, C.R; Brue, S.L and Flynn, S.M. (2011). Economics: Principles, Problems and Policies 19th Edition. New York: McGraw-Hills.

SUGGESTED READINGS:

1. Mankiw, N. Gregory. (2011). Principles of Economics. 5th Edition. Mason: South-Western Cengage learning Publisher.
2. Cramer, G., Jensen C. W., & Southgate, D. D. (2001). Agricultural Economics and Agribusiness. 8th Edition. Wiley Publisher.
3. Pakistan, Government of. Economic Survey of Pakistan (Various Issues), Economics Advisor Wing, Ministry of Finance, Government of Pakistan.

AGRIBUSINESS AND TRADE

3(3-0)

After completing the course, students will be well equipped with the basic concepts of Agribusiness and Trade.

Definition, concepts, important features and scope of Agribusiness Management, Elements and Functions of Management; Forms of business organizations; Agribusiness financial management; Agricultural Marketing; Marketing channels, functionaries and margins. Role of agri. marketing in economic development; Agricultural marketing problems.

The changing world and interdependence; Basis of trade; gains from trade; Concept of absolute and comparative advantage; pattern of trade; Brief introduction of major trade agreements.

TEXT BOOKS:

1. Kohls, R.L., Uhl, J.N. & Hurt, C. (2007). Marketing of Agricultural Products. 10th Edition. New Jersey: Prentice Hall.
2. Salvatore, D., (2007) International economics. 9th Edition. Wiley Publisher.

SUGGESTED READINGS:

1. Hoekman, B. M., Mattoo, A., & English, P. (2002) Development, Trade and the WTO-A Hand Book. Washington D.C: The World Bank.
2. Downey, W.D. & Erickson, S. P. (2002). Agribusiness Management. Singapore: McGraw-Hill Education.

MICROECONOMICS – I

3(3-0)

After completing the course, students will be able to understand economic issues pertaining to households and firms.

Scope of Economics; Theory of Consumer's Behaviour – Approaches to Utility analysis. Laws of Demand and Supply; Various dimensions of Elasticity of Demand and Supply; Theory of Production; Cost concepts in the short run and long run; Market equilibrium analysis.

TEXT BOOKS:

1. Nicholson, W. & Snyder C. M. (2009). Intermediate Microeconomics and its application. 11th Edition. Mason: South-Western Cengage learning Publisher.
2. McConnel, C.R., Brue, S.L. & Flynn, S.M. (2011). Economics: Principles, Problems and Policies 19th Edition. New York: McGraw-Hills.

SUGGESTED READINGS:

1. Varian, H.R. (2009). Intermediate Microeconomic, 8th Edition. New York: W.W. Norton Company inc.
2. Pindyck, R. & Daniel, R. (2012). Microeconomics, 8th Edition, Prentice Hall publisher.
3. Leftwich, R. H. & Eckert, R. H. (1989). The Price System and Resource allocation, 10th Edition, Islamabad, Pakistan: National Book Foundation.

MICROECONOMICS - II

3(3-0)

The course intends to provide further insight about price and output determination under various market scenarios.

Characteristics and output/price determination under pure competition, monopoly, monopolistic competition and oligopoly; profit maximization under different market structures in both short run and long run perspectives. Price discrimination, regulation of monopoly. Game theory. Resource Market structure, demand and supply pattern in resource market (wage, rent, interest and profit determination). General equilibrium model. Welfare Economics, public goods and externalities. Microeconomics of Government.

TEXT BOOKS:

1. Nicholson, W. & Snyder C. M. (2009). Intermediate Microeconomics and its application. 11th Edition. Mason: South-Western Cengage learning Publisher.
2. McConnel, C.R., Brue, S.L., & Flynn, S.M. (2011). Economics: Principles, Problems and Policies 19th Edition. New York: McGraw-Hills.

SUGGESTED READINGS:

1. Varian, H.R. (2009). Intermediate Microeconomic, 8th Edition. New York:

W.W. Norton Company inc.

2. Pindyck, R., & Daniel, R. (2012). Microeconomics, 8th Edition, Prentice Hall publisher.
3. Leftwich, R. H. & Eckert, R. H. (1989). The Price System and Resource allocation, 10th Edition, Islamabad, Pakistan: National Book Foundation.

MACROECONOMICS – I

3(3-0)

After completing the course, students are supposed to have fundamental knowledge of economic issues at aggregate level.

An introduction to Macroeconomics and the economy. Microeconomics versus macroeconomics. The roots of macroeconomics. Structure of economy and circular flow of income. Measuring domestic output and national income. Product, expenditure and income approaches. Other national income accounts. Price indices, nominal and real GDP. Economic growth and instability: the business cycles, unemployment and its types, inflation and its types. The income consumption and income saving relationships, the real interest rate and investment relationship. The multiplier, accelerator and super-multiplier effect; The aggregate expenditure model.

TEXT BOOKS:

1. McConnel, C.R., Brue, S.L and Flynn, S.M. (2011). Economics: Principles, Problems and Policies 19th Edition. New York: McGraw-Hills.

SUGGESTED READINGS:

1. Dornbusch, R., Fischer, S. and Startz, R. (2013) Macroeconomics, 12th Edition, New York: McGraw-Hill.
2. Shapiro E. (2003). Macroeconomic Analysis, 5th Edition. HARCOURT BRACE publisher.
3. Abel, B. Andrew & Ben S. Bernanke. (2005). "Macroeconomics" 6th edition. McGraw-Hill Inc.
4. Rittenberg, L., & Tregarthen T. (2012). Principles of Macroeconomics Macroeconomics. Version: 2.0: Flat World Knowledge, Inc.

MACROECONOMICS – II

3(3-0)

After completing the course, students will have understandings of major Macroeconomic models.

Aggregate demand and aggregate supply patterns: Changes in AD and AS, equilibrium and dynamics of equilibrium in short run and long run. Money and Banking: functions of money, the components of money supply, money definitions M1, M2, M3, banking system, historical background and functions of different banks, commercial banks, and central bank. The IS-LM Model, equilibrium in the labour market, goods market and money market, Factors affecting IS and LM curves. General equilibrium in the complete model. The phenomenon of Phillips curve, The Okun's law, introduction to macroeconomic policies, monetary and fiscal policies, labour and wage

policies, international policy; International trade, balance of payments and causes of disequilibrium.

TEXT BOOKS:

1. McConnel, C.R., Brue, S.L., & Flynn, S.M. (2011). Economics: Principles, Problems and Policies 19th Edition. New York: McGraw-Hills.

SUGGESTED READINGS:

1. Dornbusch R, S. Fischer and R. Startz (2004) Macroeconomics, 9th Edition, McGraw-Hill.
2. Shapiro E. (2003). Macroeconomic Analysis, 5th Edition. Harcourt Brace publisher.
3. Abel, B. Andrew & Ben S. Bernanke. (2005). "Macroeconomics" 6th edition. McGraw-Hill Inc.
4. Rittenberg, L., & Tregarthen T. (2012). Principles of Macroeconomics Macroeconomics. Version: 2.0: Flat World Knowledge, Inc.

MATHEMATICS FOR ECONOMISTS

3(3-0)

After completing the course, students will have the basic understanding about the use of Mathematics in Economics.

The nature of mathematical economics, mathematical versus non-mathematical economics and econometrics, economic models and equilibrium analysis, matrix algebra, applications of derivatives: comparative static analysis in economics and economic models, derivatives of implicit functions, optimization problems, general constrained optimization, dynamic optimization & integration, convexity and optimization—multivariate optimization, mathematical programming: The concepts of linear and non-linear programming.

TEXT BOOKS:

1. Chiang, A. C. Fundamentals Methods of Mathematical Economics. 3rd Edition. 2005, International Edition, McGraw-Hill publications.

SUGGESTED READINGS:

1. Goshaw, M. (2008). Concepts of calculus with applications. 1st Edition. Singapore: Pearson Publisher.
2. Shannon, J. (1995). Mathematics for Business Economics and Finance, Australia: John Willey & Sons.

STATISTICAL METHODS FOR ECONOMISTS

3(2-1)

After completing the course, students will be able to apply the statistical tools and techniques in the field of Agricultural Economics.

Index numbers, the concept of Index Numbers, different types of indices and their uses; Random variables and their distribution, probability and density function, estimation of parameters, properties of estimators, confidence interval of means and proportions, variance of normal distribution, variance and covariance, hypothesis testing, Chi Square Test, Analysis of Variance (ANOVA), Correlation, Introduction to Regression Analysis; Application of software to various estimation techniques.

TEXT BOOKS:

1. Wonnacott, T.H., & Wonnacott. R. J. (1990). Introductory Statistics. 5th Edition New York: John Wiley Publishers.
2. Floyd, J.E. 2010. Statistics for economists: a beginning. University of Toronto.

SUGGESTED READINGS:

1. Aczel, A. D. (1995). Statistics, Concepts and Applications. USA: Richard D. Irwan Inc.
2. Newbold, P., Carlson, W., and Thorne, B., (2010). Statistics for Business & Economics. 8th Edition. Pearson Hall Publisher.

FOOD AND AGRICULTURAL MARKETING

3(3-0)

After completing the course, students will have the fundamental knowledge of different issues related to agricultural markets and marketing.

Basic concepts and principles of food and fiber marketing system and its role in development; marketing structure, marketing approaches and problems; Marketing functions; standardization, grading, packing coding, packaging, storage, transportation, information, legislation and management. Marketing margins and profitability; Market functionaries, marketing channels, price variation and stabilization; Concept of supply chain management. Review of agricultural marketing systems in Pakistan.

TEXT BOOKS:

1. Crawford, I.M. (1997). Agriculture and food marketing management. Africa: FAO publishers.
2. Kohls, R.L., & Uhl, J. N. (2002). Marketing of Agricultural Products. 9th Edition. New York: MacMillan.

SUGGESTED READINGS:

1. Clarkson, K.W., & Miller, R. L. (1997). Industrial Organization, Theory, Evidence and Public Policy, New York: McGraw-Hill.

2. Scarborough, V. & Kydd, J. (1992). Economic Analysis of Agricultural Markets: A Manual, Chatham, UK: Natural Resources Institute.
3. Shepherd, G. F. (2004). Marketing Farm Products- Economic Analysis, 4th Edition, Islamabad: National Book Foundation.

MATHEMATICAL ECONOMICS

3(3-0)

After completing the course, students will be in a position to apply the knowledge of mathematical tools for formulation of economic model(s) and analyses.

The nature of mathematical economics, mathematical versus non-mathematical economics, mathematical economics versus econometrics, economic models. Review of Matrix Algebra and its application to Business and Economics. Review of Differentiation: Rules of differentiation, maxima/minima of functions, partial/total derivatives and their applications in Business and Economics. Integration: Integrals and their applications in Business and Economics. Optimization Problems.

TEXT BOOKS:

1. Chiang, A. C., & Wainwright, K. (2004). Fundamental Methods of Mathematical Economics, 4th Edition. New York: McGraw-Hill, Irwin.
2. Silberberg, E. & Suen, W. (2001). The Structure of Economics: A Mathematical Analysis. 3rd Edition. New York: McGraw-Hill, Irwin.
3. Budnick, F. S. (1993). Applied Mathematics for Business, Economics and Social Sciences. New York: McGraw-Hill, Inc.

SUGGESTED READINGS:

1. Sydsaeter, K & Hammond, P. (2012). Essential Mathematics for Economic Analysis, 3rd Edition, Prentice Hall Publisher.

AGRICULTURAL FINANCE

3(3-0)

This course would help the students to develop an understanding of financial issues in agricultural sector.

Nature and scope of agricultural finance; Sources and types of financial instruments and intermediaries in Pakistan's perspective. Credit assessment and decision criteria; Agricultural credit markets; Agricultural credit policies and their problems; Role of central bank and other financial institutions in agricultural financing; Classification of loans; insurance in agricultural sector, Micro-credit and role of NGO's in agricultural lending and development. Nature and scope of financial management, time value of money, capital budgeting, capital and its cost, financial analyses, capital structure, liquidity and lender-borrower relationship and credit evaluation, risk management, financial markets.

TEXT BOOKS:

1. Reddy, S. S., & Ram, P Ragh. (1996). Agricultural Finance and Management, Oxford & IBH publisher Co.

SUGGESTED READINGS:

1. Barry, P. J., Ellinger, P. N., Hopkin, J.A., & Baker, C. B. (2000). Financial Management in Agriculture. 6th Edition. Prentice Hall.
2. Pandey, U.K. (1990). An Introduction to Agricultural Finance. New Delhi: Kalyani Publishers,
3. Downey, W.D. & Enieson, S.P. (2002). Agribusiness Management, Singapore: McGraw-Hill.

AGRIBUSINESS MANAGEMENT

3(3-0)

After completing the course, students will have developed some understanding of concepts, principles and issues in Business Management.

Scope and objectives of Agribusiness Management; Functions of management; Forms of business organizations; Principles and Techniques of farm planning, operation and management. Enterprise budgeting, resource constraints, optimum combinations and alternate business plans. Balance sheet, income statement and their analysis; Benefit cost analysis, uncertainty and risk in farm business; Risk management strategies; Supply chain management and relevant case studies. Role of Government in agribusiness management.

TEXT BOOKS:

1. Downey, W.D. & Erickson, S. P. (2002). Agribusiness Management. Singapore: McGraw-Hill Education.
2. Castle, E. N., Becker, M. H. & Nelson, A. G. (2002). Farm Business Management. New York: MacMillan.

RECOMMENDED BOOKS:

1. Kinsey, B. H. (2000). Agri. Business and Rural Enterprise. London: Croom Helm Ltd.
2. Goldberg, R. A., Wilson, L. M., & Austin, J. E. (1974) Agribusiness Management for Developing Countries. Cambridge, MA: Ballinger Publishing Company.
3. Buckett, M. (1981). An Introduction to Farm Organization and Management. Elsevier Science & Technology Books.
4. Kay, R., Edwards, W., & Duffy, P. (2007). Farm Management. 7th Edition. McGraw-Hill Education, EU.

ECONOMETRICS –I

3(2-1)

After completing the course, students will be in a position to apply the econometric tools and techniques in the field of Agricultural Economics.

Definition, scope and importance of econometrics; Basic concepts, properties of statistical estimators; Inferences, and hypothesis testing; Regression analysis, OLS estimation of simple and multiple regression; Dummy variables;

Specification bias and tests; Concepts of Multicollinearity; Heteroscedasticity and Autocorrelation.

TEXT BOOKS:

1. Gujarati, D.N. (2009). Essentials of Econometrics. 4th Edition, London: McGraw-Hill.
2. Wooldridge J.M. (2012). Introductory Econometrics: A Modern Approach. 5th Edition. USA: Cengage Learning Publisher.

SUGGESTED READINGS:

1. Mirar, T.W. (1990). Economic Statistics and Econometrics. New York: McMillan Publishing Co.
2. Ramanathan R. (2001). Introductory Econometrics with Applications. 5th Edition. South-Western College Publisher.
3. Butt A.R. (1999). Least Square Estimation of Econometric Models, Islamabad.

ECONOMETRICS – II

3(2-1)

The course will further enhance the capability of students towards applying econometric tools and techniques in the field of Agricultural Economics.

Overview of issues of Multicollinearity, heteroscedasticity and autocorrelation; Causes, effects, tests and remedial measures. Model specification issues, limited dependent variables (LPM, Tobit, Logit and Probit Models). Auto regressive and distributed lag models. Time series analysis. Simultaneous equation models and their estimation approaches. Panel data analysis

TEXT BOOKS:

1. Gujarati, D.N. (2009). Essentials of Econometrics. 4th Edition, London: McGraw-Hill.
2. Wooldridge J.M. (2012). Introductory Econometrics: A Modern Approach. 5th Edition. USA: Cengage Learning Publisher.

SUGGESTED READINGS:

1. Mirar, T.W. (1990). Economic Statistics and Econometrics. New York: McMillan Publishing Co.
2. Ramanathan R. (2001). Introductory Econometrics with Applications. 5th Edition. South-Western College Publisher.
3. Butt A.R. (1999). Least Square Estimation of Econometric Models, Islamabad.

DEVELOPMENT ECONOMICS

3(3-0)

After completing the course, students will have the knowledge about the development issues in general and developing countries in particular.

The concepts of economic development and economic growth; characteristics of developing economies; importance and challenges of the development process. Theories of economic growth and development. Education, technological change and economic development; Growth, poverty and Income distribution. Economics of population and development; Importance of trade for development. Globalization and its implications for development, Debt burden of developing countries. Governance and developmental experiences in Pakistan; NGOs and Development.

TEXT BOOKS:

1. Todaro, M. P., & Smith, S. C. (2008). Economic Development. 8th Edition. Singapore: Pearson Education Publisher.

SUGGESTED READINGS:

1. Jhingan, M.C. (2005). Economics of Development and Planning. New Delhi: Konark Publishers Pvt. Ltd.
2. Meier, G.M. (2005). Leading Issues in Economic Development. New York: Oxford University Press.
3. Zaidi, A.S. (2008). Issues in Pakistan's Economy. Karachi: Oxford University Press.
4. Dil, A. (2000). Hunger, Poverty and development (Life and work of Sartaj Aziz). A Ferozsons-Intercultural Forum Publication.
5. www.finance.gov.pk, & www.worldbank.org

AGRICULTURAL PRODUCTION ECONOMICS

3(3-0)

After completing the course, students will be able to understand the theoretical core of Production Economics.

Definition and scope of agricultural production economics; Assumptions of static and dynamic production economics. Production relationships, i.e. factor-product relationships, factor-factor relationship and product-product relationships; Economic decision making under various production relationships; Costs of production, returns to scale, technological change, resource allocation.

TEXT BOOKS:

1. Debertin, D.L (2012). Agricultural Production Economics. 2nd Edition. New York: McMillan Publishing Company,.
2. Beatie, B. R. Taylor, C. R., & Myles, W.J. (2009). The Economics of Production. New York: Krieger Publishing Company.

SUGGESTED READINGS:

1. Doll, J. P. & Orazem, F. (1992). Production Economics: Theory with Applications. 2nd Edition. New York: Krieger Publishing Company.

NATURAL RESOURCE ECONOMICS

3(3-0)

This course will enable the students to develop understanding on issues of natural resources and sustainability in agriculture.

Concepts of natural resources; optimal use of renewable and nonrenewable resources; Issues related to natural resources (soil, water, forest, fisheries and environment); Resource scarcity, prices, demand and supply of natural resources; Market equilibrium, economic efficiency; inter-temporal efficiency; Property rights; Environmental Economics; Natural resource exploitation; Economic approaches to conservation of natural resources; Benefit cost analysis.

TEXT BOOKS:

1. Bergstrom, J.C. & Randall, A. (2010). Resource Economics- An Economic Approach to Natural Resource and Environmental Policy. New York: Edward Elger Publishing.
2. Tietenberg, T. & Lewis, L. (2013). Environmental and natural resource economics. 9th Edition. Prentice Hall Publisher.

SUGGESTED READINGS:

1. Ashfaq, M., Griffith, G., & Hussain, I. (2009). Economics of Water Resources in Pakistan. Pakistan: Pak TM Publishers.
2. Compathy, R.S. and R.S. Ganapatty, (1990). Natural Resource Management. New Delhi: Mohan Pramlani for Oxford and IBH Publishing Co. Pvt.
3. Common, M., Perman, D. R., Ma, D. Y., Maddison, D. D., & Mcgilvray D. J. (2011). Natural Resource and Environmental Economics. 4th Edition. Longman Lt: Addison Wesley.

RESEARCH METHODS IN SOCIAL SCIENCES

3(2-1)

After completing the course, students will be in a position to understand the methods of conducting research in the field of Social Sciences

Foundation of Empirical Research, the scientific approach, the Conceptual foundation of Research, Research Ethics, review of literature and plagiarism; Research proposal and its contents, Sampling and Sample Design, survey methods, observation methods; Data Types, questionnaire construction process; Data collection: Data coding, entry and analysis; univariate, bivariate and multivariate analyses; Citation methods, Presentation and dissemination of research results.

TEXT BOOKS:

1. Nachmias, C. F. & Nachmias, D. (2007). Research Methods in the Social Sciences. 7th Edition, London: Worth Publisher.
2. Ethridge, D. E. (2004). Research Methodology in Applied Economics, 2nd Edition, Wiley-Blackwell.

SUGGESTED READINGS:

1. Baker, T. L. (1998). Doing Social Research. 3rd Editions. London: McGraw-Hill Social Science Series.
2. Vaus, D.A. (1993). Surveys in Social Research. Australia: Allen & Unwin Pvt. Ltd.
3. Goode, W.J & Hatt, P.K. (1999). Methods in Social Research. US: McGraw-Hill Inc.

AGRICULTURAL ISSUES & POLICIES OF PAKISTAN 3(3-0)

After completing the course, students will be in a position to understand the economic thought behind agricultural issues & policies in Pakistan's perspective.

Overview of Pakistan's economy and role of agriculture, major issues and problems in agriculture development of Pakistan. Agricultural policy, policy goals, policy instruments, policy formulation, tradeoffs between goals, land reforms, land tenure system, agricultural pricing policies, input-output pricing policies, policy of agricultural marketing; agro-based industries; Agri-Taxation and subsidies, agri. Credit and finance policies, trade policies for agricultural commodities, farm mechanization, agri. extension, research and educational policies, Irrigation policies of Pakistan, institutional reforms. Rural development policies; Past policies and their evaluation.

TEXT BOOKS:

1. Ellise, F. (1992). Agricultural Policies in Developing Countries. Cambridge: Cambridge University Press.
2. Eckert, J. B. (1990). Agricultural Policy Manual: A discussion of Agricultural Policies for Development, Workshop Manual Series No. 2. Published by the directorate of Agricultural Policy and Chemonics International Consulting Division for EAN/Economic Analysis Network Project.

SUGGESTED READINGS:

1. Naqvi, H.M. & Harold, J. National Conference on Agriculture Policies & Farmers in Pakistan May 19-21, 1992, Proceedings, Academy of Rural Development, Peshawar 1998.
2. Govt. of Pakistan, (1988). Report of the National Commission on Agriculture, Ministry of Food and Agriculture,.
3. Knutson, R.D., Penn, J.B. & Bocam, W.T. Agricultural and Food Policy. New Jersey, USA: Prentice Hall, Inc.
4. Salam, A. (2001). Support Price Policy in Pakistan: Rationale, Practice and Future Options, Agricultural Prices Commission Series No.196.
5. Raza, R. (2001). Pakistan in Perspective (1947-1997). Pakistan: Oxford University Press.

INTERNATIONAL ECONOMICS

3(3-0)

After qualifying the course, the students will be able to understand the theories and dimensions of International Economics.

Concept of International economics and trade. Market integration and challenges; Trade theories, free trade versus protectionism, tariff and non-tariff trade barriers, approaches to the measurement of protection, distortion and comparative advantage, the effects of exchange rates on the agricultural and food sectors, commodity and price instability and terms of trade, international commodity agreements. Balance of payment in Pakistan's perspective. International migration and remittances.

TEXT BOOKS:

1. Salvatore, D., (2007) International economics. 9th Edition. Wiley Publisher.
2. Krugman, P.R. & Obstfeld, M. (1998). International Economy: Theory and Policy. New York: Addison-Wesley Longman, Inc..

SUGGESTED READINGS:

1. Appleyard, R.D., Field, A. J. & Cobb, S. 2009. International Economics: 7th Edition, Irwin: McGraw-Hill Publisher.
2. Appleyard, R.D. (2006). International Economics: Trade, Theory and Policy. 3rd Edition. Illinois: Richard D. Irwin Inc.
3. Kindleberger, C.P. International Economics. Illinois: Richard D. Irwin, Inc.

Optional Courses

ISLAMIC ECONOMICS

3(3-0)

Course Objectives:

The objective is to provide students with knowledge of Islamic Economics in context of Islamic value system and behaviours at micro/macro level as well as policy framework specifically with reference to Pakistan.

Course Contents:

Definition, nature, comparison, basic values of islam, determinants of economic behaviour and policies in Islam, Islamic economic thought, consumer's behaviour, behaviour of the firm, market structure, basic macroeconomic concepts, monetary & fiscal policies in an Islamic framework, Islamic economic system, Islamization process in Pakistan

SUGGESTED READINGS:

1. Ahmed, Khurshid (1980). Studies in Islamic Economics Jeddah: King Abdul Aziz University and UK: The Islamic Foundation.
2. Ziauddin et al (1983Ed): Fiscal Policy and Revenue Allocation in Islam. Jeddah: King Abdul Aziz University and Islamabad: Institute of Policy Studies,.
3. Iqbal, Munawar (1986 Ed): Distributive Justice and Need Fulfilment in an Islamic Economy. Islamabad: IIIE, International Islamic University.

4. Sayyid Tahir et al (Ed): (1992). Readings in Microeconomics: An Islamic Perspective, Malaysia: Longman.
5. Siddiqui, M.N. (2001). Economics: An Islamic Approach. Islamabad: Institute of Policy Studies and UK: The Islamic Foundation.

ECONOMICS OF LIVESTOCK PRODUCTION

3(3-0)

Importance of livestock in the economy of Pakistan, comparative economics of livestock and crop enterprises, economics of livestock and poultry, economic analysis of livestock products, cost and profitability estimations procedures, labour-input estimate, capital input estimate, economics of milk, beef and hides and skins, economics of green fodder, dry fodder and concentrates, the livestock industry, structure and problems, economic losses due to various factors, techniques of estimation of losses, economic analysis of budgeting with different techniques, economics of genetic engineering in livestock, measures of economic efficiency, uncertainty and risk, trend and future of livestock and poultry.

TEXT BOOKS:

1. Ruhela, A. (2010). Livestock Economics. Oxford Book Company.
2. Ahmed, B., Ahmed, M. & Chaudhry, M. A. 1996. Economics of Livestock Production, Faculty of Agri. Economics and Rural Sociology, Faisalabad: University of Agriculture.
3. Debertin, D.L (2012). Agricultural Production Economics. 2nd Edition New York: McMillan Publishing Company,.

SUGGESTED READINGS:

1. Bernad, C.S. & Nix, J.S. (1979) Farm Planning and Control, 2nd Edition. Cambridge: University Press.
2. Kay, R. D., Edwards, W. & Duffy, P. (2007). Farm Management: Planning, Control and Implementation. 6th Edition, London: McGraw Hills.
3. Khan, M.J. & Rehman, H. (1982). Papers and Proceedings of the Workshop on Economics of Village Livestock.

AGRICULTURE AND RURAL DEVELOPMENT

3(3-0)

Development, rural development, study and analysis of rural development models, strategies and policies for rural development in Pakistan, delivery and receiving systems for agriculture and rural development, rural infrastructure, rural industrialization and development, role of land tenure and land reform in rural development, technology, output and employment potential in farm and non-farm sectors, role of women in rural development, planning and participation at grass root, local government and rural development.

TEXT BOOKS:

1. Singh, K. (2009). Rural Development: Principles, Policies and Management, 3rd Edition, SAGE Publication (Pvt) Ltd.

2. Khan, M. H. (2009). Participatory Rural Development in Pakistan: USA: Oxford University Press.

SUGGESTED READINGS:

1. Mosley, M. (2003). Rural Development, Principles and Practice. SAGE Publication (Pvt) Ltd.
2. Tripathy, S.N. (2000). Rural Development. India: Discovery Publishing House.
3. Ali, K. (1988). The Political Economy of Rural Development. Lahore: Vanguard Publications Limited.
4. Khan, S. S. (1980). Rural Development in Pakistan. Pakistan: Waqas Publishing House.

ECONOMICS OF AGRO BASED INDUSTRIES

3(3-0)

Role of industries for economic development, policies and growth of agro-based industries; performance of small & large scale industries, i.e. ginning and textile, sugar, vegetable ghee/edible oil, tobacco, fruits and vegetables processing, beverages, wheat flour and rice mills, feed mills, etc. Efficiency, productivity and capacity utilization; Overview of Pakistan industrial policies, quantitative & qualitative restrictions, tariff, protection; tax concessions and export subsidies, role of public and private sectors in rural industrialization; problems of agro based industries. Green supply chain.

TEXT BOOKS:/ SUGGESTED READINGS:

1. Khawaja, A. S. Economy of Pakistan (Latest Edition). Ilmi Kitab Ghar, Lahore.
2. Shahida W. (2003). Industrial Productivity. Pakistan: Oxford University Press.
3. Aslam, M. (2004). Perspective on Development planning in Pakistan". Lahore: Allied Book Centre, Urdu Bazar.
4. Khan, M. Z. (2001). Kick starting Pakistan's Economy. Lahore: Vanguard Books (Pvt) Ltd.
5. Rafi, R. (2001). Pakistan in Perspective 1947-97. Pakistan: Oxford University Press.
6. Khan, S. R. (2000). Fifty years of Pakistan's Economy. Pakistan: Oxford University Press.
7. Pakistan Economic Survey (Various issues).
8. SMEDA Website: www.smeda.org.pk.

ECONOMICS OF RANGELANDS AND PASTURES

3(3-0)

The rangelands/pastures of arid and semi-arid areas- an overview, condition and major problems of rangelands/pastures, causes of rangeland degradation: overgrazing and fuel wood harvesting. Pastoral economy, livestock and rangelands/pastures, sustainability of rangelands and pastures; Range and pasture improvement and management intervention, role of local institutions in regulating the use of ranges and pastures, optimal

use of ranges and pastures under arid and semi-arid conditions, economic analysis of rangelands and pastures conservation.

TEXT BOOKS:/SUGGESTED READINGS:

1. Khan, Irshad. (1987). Wasteland Afforestation. New Delhi Oxford and IHB Publisher Co.
2. Heady, F.H. & Child, R.D. (1999). Rangeland Ecology and Management. Colorado: Westview Press, Boulder.
3. Muhammad, N. (1989). Rangeland Management in Pakistan. Nepal: ICIMOD.
4. World Resources Institute. (1992). World Resources, 1994-95. New York: OUP.
5. FAO. (1987). Improving Productivity of Dryland Areas. FAO, Rome.

ECONOMICS OF CLIMATE CHANGE

3(3-0)

After qualifying the course, students will be aware of impacts of climate change on the agricultural sector and overall economic performance.

Climate change—concept, nature and indicators; Weather and climate; Climate change and variability; Climate change—importance, global warming, some observed trends of human vulnerability to climate; Forms of Climate changes: global warming, precipitation and evaporation, sea level rise, surface warming, extreme events (also shall be covered impacts thereof). Mitigation: limiting the climate change, the need of mitigation, mitigation options and obstacles, mitigation strategies in developing world; Adaptation to climate: adaptation concept and strategies, adaptation costs and benefits; Climate and developing world: adaptation capacity and increasing the adaptation capacity; Climate change and Development; Climate change and agriculture; Climate change and food security; Climate change and climate policy; Impact assessment of climate change; political economy of climate change; future perspective (way forward).

SUGGESTED READINGS:

1. Andrew Dessler, (2012). Introduction to Modern Climate Change (2nd edition New York, USA, Cambridge, University Press.
2. Andrew Dessler, Edward A. Parson, (2010) The Science and Politics of Global Climate Change: A Guide to the Debate (2nd Edition), UK Cambridge University Press,.
3. Erial Dinar and Robert Mendelsohn, Handbook on Climate Change and Agriculture Edward Elgar publishing Limited, (2011), Massachusetts, USA.
4. Kashav Laal Maharajan and Niraj Parkash Joshi, Climate Change, agriculture and Rural Livelihood in Developing Countries, Springer, 2013.
5. K. Raja Reddy, H. F. Hodges, Climate Change and Global Crop Productivity New York, USA: CABI publishing,.
6. Pradeep Kurukulasuriya, Shane Rosenthal, Climate Change and Agriculture: A Review of Impacts and Adaptations World Bank 2003.

ECOLOGICAL ECONOMICS

3(3-0)

This course will further develop the students' knowledge of areas of contemporary Ecological Economics as well as understanding and evaluation of environmental problems and issues.

Introduction to ecological economics; Ecological economics: rationale and problem. Towards an open future: ignorance, novelty and evolution. The dilemma of modern humans and nature: an exploration of the Faustian imperative, sustainable development: the roles of science and ethics, entropy: a unifying concept for ecological economics. The use of the entropy concept in ecological economics, evolution in biology, physics and economics: a conceptual analysis. On the conceptual foundations of ecological economics: a teleological approach, interdisciplinary research between economists and physical scientists: retrospect and prospect, humankind and the environment: an anatomy of surprise and ignorance. Experience, knowledge and the environment, linking ecology and economy: joint production in the chemical industry, reducing CO₂ emissions: analysis and policy. The Environmental footprint and international trade.

TEXT BOOKS:/RECOMMENDED TEXT:

1. Faber, M, Manstetten, R. & Proops, J. (1996) Ecological Economics: Concepts and Methods. Edward Elgar. Political Science/Sustainability/Economic critique/Measuring sustainability.
2. Clayton, A.M.H. and Radcliffe, N.J. (1996) Sustainability: a Systems Approach. Earthscan. [KB bookshop/library catalogue]
3. Reid, D (1997) Sustainable Development. Earthscan. [KB bookshop/library catalogue]
4. Meadows, D.H., Meadows, D.L. & Randers, J. (1992) Beyond the Limits. Earthscan. [KB bookshop/library catalogue]
5. Daly, H.E. & Cobb, J. B. (1989) For the Common Good. Green Print.
6. Edwards-Jones, G., Davies, B. and Hussain, S.S. (2000) Ecological economics. An Introduction. Blackwell: Oxford. Chapters 1-3 and 11.

OPERATIONS RESEARCH

3 (3-0)

The objective of this course is to enable the students to use the techniques of operations research in the field of Agricultural Economics.

Meanings and introduction to operations research. Linear programming models. Dual problem. Sensitivity analysis. Transportation problem. The assignment model. The transshipment model. Project scheduling. Arrow diagram representation, determination of critical path and floats construction of time chart and resource leveling. Probability and cost considerations in project scheduling. Project control. Inventory models, meaning and objectives of inventory model. Formulation of generalized inventory model. Types of inventory model.

SUGGESTED READINGS:

1. Gillet, Billy. E. (2002). Introduction to Operations Research,” 7th Edition. McGraw-Hill, and Prentice Hall.
2. HamdyTaha. A. (2008). Operations Research An Introduction,” 8th Edition. India: Pearson Education.
3. Wagner, Harvey. M. (2001). Principles of Operations Research. 2nd Edition, Prentice Hall.
4. Paul-A-Jensen & Jonathan F. Brad (2002) “Operations Research Models and Method” 1st Edition. Wiley.

LOGICAL AND CRITICAL THINKING

3 (3-0)

The objective of this course is to sharpen the intellect of the students, develop their reasoning ability, strengthen their understanding, and promote clear thinking

Definition of logic, logic as a science and an art, scope of logic. The laws of logic, Induction and essential characteristics of induction, categorical propositions and classes, quality, quantity and distribution. The traditional square of opposition, immediate inferences, conversion, obversion, contraposition, inversion existential import, symbolism and diagram for categorical proposition. Three basic uses of language, discourse serving multiple functions. The form of discourse, emotive words, kinds of agreement and disagreement, emotively neutral language. The purpose of definition, the types of definition, various kinds of meaning, techniques for defining, standard form categorical syllogisms. The formal nature of syllogistic arguments, Venn diagram techniques for testing syllogisms, rules and fallacies, reducing the number of terms in categorical syllogism, translating categorical proposition into standard forms, uniform translation, enthymemes. The dilemma, informal fallacies, fallacies of ambiguity, the avoidance of fallacies.

TEXT BOOKS:

1. Irving M. Copi: Introduction to logic
2. Karamat Hussain: A textbook of Deductive Logic
3. Karamat Hussain: A textbook of Inductive Logic

SCHEME OF STUDIES FOR MS/MSc (Hons.) AGRICULTURAL ECONOMICS

Program Objectives:

The program of studies is designed to produce economists well versed in economic theory and its applications to the economic issues in general and of agriculture in particular.

Core Courses	Credit Hrs.
Microeconomics	3(3-0)
Macroeconomics	3(3-0)
Econometrics	3(2-1)
Food & Agricultural Policy	3(3-0)
Production Economics	3(3-0)
Marketing & International Trade	3(3-0)
Seminar	1(1-0)
Thesis	06

Optional Courses:

Research Methods in Social Sciences	3(2-1)
Agricultural Development	3(3-0)
Environmental & Resource Economics	3(3-0)
Mathematical Economics	3(3-0)
Project Planning & Management	3(3-0)
Economic System of Islam	3(3-0)
Monetary & Fiscal Policy	3(3-0)
Financial Economics	3(3-0)
Economics of Land & Water Resources	3(3-0)
Mathematical programming	3(3-0)
Pakistan Economy	3(3-0)
Economics of climate change	3(3-0)
Time-series analysis	3(2-1)

Note:

All students pursuing M.Sc. (Hons.) in Agricultural Economics are required to qualify all the core courses. In addition, the departmental Board of Studies will decide the optional (within department) and minor courses (from other relevant departments).

The minimum requirement of credit hours for M.Sc. (Hons.) in Agricultural Economics degree is 31, including 25 credit hours of course work and 06 for thesis/dissertation. However, institutions can go beyond this threshold according to the requirement of the students/institutions.

DETAIL OF COURSES MS/MSc (Hons) AGRICULTURAL ECONOMICS

MICROECONOMICS

(3-0)

After qualifying this course, students should have good understanding of micro economic theory and its application.

Economic activity and economic theory; Organization of an economic system; Theory of consumer behavior; Different approaches of consumer choice and demand. The theory of firm, production, cost and profit functions. Optimization. Firm and industry supply analysis; Determination of price and output under different market conditions; Models of perfect and imperfect competition; Introduction to game theory; Demand and supply for factors of production; Pareto optimality and choice under risk; Optimum distribution of resources/outputs; externalities and public goods.

TEXT BOOKS:

1. Nicholson, W. (2009). Microeconomic Theory, Basic Principles and Extensions 10th Edition, London: Dryden Press.
2. Varian H. R. (2008). Microeconomic Analysis. 6th Edition) New York: W.W. Norton Company.

SUGGESTED READINGS:

1. Silberberg, E. (2001). The Structure of Economics: A Mathematical Analysis. New York: McGraw-Hill Book Company.
2. Henderson, J. M. & Quandt, R. E. (1980). Microeconomic Theory: A Mathematical Approach. 3rd Edition. McGraw-Hill Book Company.

MACROECONOMICS

3(3-0)

The course aims to equip the students with skills and tools to analyze the macro economic issues.

Macro economic foundation; Major macroeconomic puzzles; Aggregate demand and supply analysis (In terms of monetary and real sectors; as well as wages, prices and employment); The interplay of monetary and fiscal policies in stabilizing the economy; IS-LM model of macroeconomic analysis; Consumption, saving, investment and theory of income determination. Level of investment, interest and money. Demand for money. Money and credit, stabilization policy. Macroeconomic dynamics. Inflation, unemployment, budget deficit and public debt. International adjustment and interdependence. Business cycle.

TEXT BOOKS:

1. Dornbush, R. & Fischer, S. (2010). Macroeconomics, Tenth Edition, McGraw-Hill, New York, USA.
2. Romer, D. (2006). Advanced Macroeconomics. 3rd Edition, New York/London: McGraw-Hill,

SUGGESTED READINGS:

1. Branson, W.J. & Litvack, J.M. (1988). Macroeconomics, New York/USA: Harper and Row Publisher.
2. Gordon. R.J. (1990). Macroeconomics, Scott, Fores man/Little, Brown Higher Education, London.
3. Froyen, R. T. (2008). Macroeconomics, 8th Edition Pearson education inc.

ECONOMETRICS

3(2-1)

After completing the course students will be able to apply the econometric techniques for the micro and macro analysis.

The nature of simple and multiple regression analysis; Violation of basic assumptions, single equation regression models and their applications in economics. Problems of estimation and hypotheses testing, regression of dummy variables; limited dependent variables; Multicollinearity, heteroscedasticity, autocorrelation and model specification problems; Distributed and autoregressive lag models, finite and infinite distribution lags. Adaptive expectations, partial adjustment and rational expectations models; Simultaneous equation models; Identification problems; Indirect least squares, 2SLS, 3SLS and seemingly unrelated regression models; Qualitative response models, Panel data, Time series analysis.

TEXT BOOKS:

1. Green, W.H. (2007). Econometric Analysis, 6th Edition, Prentice Hall Publishers.
2. Maddala, G.S., & Lahirir, K. (2009). Introduction to Econometrics. 4th Edition. John Wiley and Sons, Ltd.
3. Griffiths, W.E. Hill, R.C. & Judge, G.G. (1993). Learning and Practicing Econometrics, New York: J. Wiley and Sons.

SUGGESTED READINGS:

1. Ramanathan, R. (1992). Introductory Econometrics with Applications. The Dryden Press, New York.
2. Pindyek, R.S. & Rubinfeld, D.L. (1997). Econometrics Models and Economic Forecasts, New York: McGraw-Hill.
3. Studenmund, A. H. (2005). Using Econometrics: A practical guide. 5th Edition. Addison Wesley.
4. Gujrati. D. N. (2009). Basic Econometrics. 5th Edition. McGraw-Hill Book Company.

FOOD AND AGRICULTURAL POLICY

3(3-0)

Dimensions of food security; Trends in global food production; Food and Agricultural policies and their objectives; Impact of Policy; Macroeconomic policies and agriculture; Frameworks for assessing policy distortions and its implications, modeling of agriculture sector: economic models of policy

analysis for the examination of the impact of commodity, farm input, international trade and economic policies on Agriculture and the whole economy. Multi-market models for the analysis of equity, efficiency, self-sufficiency and balance of payment effects of agriculture policy.

Trends towards trade liberalization and programs of policy reforms and their impact of trade performance of the “agriculture sector, household’s welfare and food security. Analysis of agricultural policies and programs under trade liberalization in developing countries. Adjustment of Pakistan’s agriculture sector under trade liberalization scenario.

TEXT BOOKS:

1. Just, R.E., Hlieth, D.L., & Schmitz, A. (1982) Applied Welfare Economics and Public policy. Prentice-Hall, INC. Englewood Cliffs, N.J. 07632.

SUGGESTED READINGS:

1. Schiff, M. & Valdes, A. (1991). The Political Economy of Agricultural Pricing Policy. Vol. 4. A synthesis of the Economics in Developing Countries. Published for World Bank. The John Hiftand University Press, Baltimore and London. 1991.
2. Goldman R.H., Gradzins, C. & Mann, C. (1990). Agricultural Policy Analysis, A Training Manual, USA: Harvard Institute for International Development.
3. FAO. (1990). Agricultural Policy: a Training Manual, Produced for FAO by the Harvard Institute for International Development.
4. Krugman, P.R. & Obstfeld, M. (1997) International Economy: Theory and Policy. New York: Addison-Wesley Longman, Inc.
5. Tsakok, I. (1990). Agricultural Price Policy: A guide to partial equilibrium analysis, The Cornell University Press.
6. McCalla, A.F., & Josling, T.E. Agricultural Policies and World Markets. New York: MacMillan.
7. Grimwade, N. (2000). International Trade: New Patterns of Trade Production and Investment.
8. Tweeten, L. (1992). Agricultural Trade: Principles and Policies. USA: West View Press Boulder.

PRODUCTION ECONOMICS

3(2-1)

The course will help the students in applying the important theories of production at broader level of agricultural economics.

Overview of the concepts of production economics; Production functions and functional forms; Cost, profit and revenue functions; Inputs demand and supply functions; Statistical measurement: primal functions; Dual functions; and efficiency and productivity—technical and allocative efficiency, productivity growth and technical change.

TEXT BOOKS:

1. Debertin, D.L (2002 or recent issue). Agricultural Production Economics 2nd Edition. New York: McMillan Publishing Company.
2. Coelli, T.J., Rao, D. S., Donnell, P. C., & Battese, J. O. G. An Introduction to Productivity and Efficiency Analysis, 2nd Edition. Springer.

SUGGESTED READINGS:

1. Beatie, B. R. Taylor, C. R., and Myles, W.J. (2009). The Economics of Production. New York: Krieger Publishing Company
2. Doll, J.P. & Orazem, F. (1992). Production Economics: Theory with Applications, 2nd Edition, New York: Krieger Publishing Company.
3. Heady, E.O. & Dillon, J.L. (1969). Agricultural production Functions. Ames Iowa: Iowa State University Press.
4. Dillon, J.L. & J.R. Anderson. (1990). The Analysis of Response In Crop and Livestock Production, Pergamon Press, Oxford.
5. Rosegger, G. (1996). The Economics of Production & Innovation. Oxford : Butterworth-Heinemann Ltd.

MARKETING & INTERNATIONAL TRADE

3(3-0)

Introduction and overview of agricultural commodities marketing, demand functions and the law of demand, agricultural production and marketing, elasticity of demand and the elasticity of supply, nominal and real prices; The inflation rate and CPI, marketing margins and farm, processing, wholesaling and retailing, marketing as a value-added process. The Role of Futures; The hedger and the speculator; Relationships between cash and futures prices; The basis: perfect and imperfect hedges; Temporal aspects of agricultural markets, spatial dimensions of prices.

The world food system and international agricultural trade, macroeconomic theories of international trade, international agricultural market fundamentals and the partial equilibrium trade model, Government intervention and the partial equilibrium trade model

Multilateral Trade Negotiations: the World Trade Organization, its history, current issues and controversies, preferential trade agreements (PTAs), sanitary and phyto-sanitary measures, GMOs, animal diseases, aid and trade

TEXTBOOKS:

1. Tomek, W.G., & Robinson, K. L. (2003). Agricultural Product Prices, 4th Edition. Ithaca, NY: Cornell University Press
2. Suranovic, S. (2010). International Economics Theory and Policy. Flatword knowledge Publisher.

SUGGESTED READINGS:

1. Kohls, R. L. and J. N. Uhl. (1990). Marketing of Agricultural Products. 7th Edition, New York, Max-Well. McMillan.

2. Paul R. Krugman (2008) - International Economics: Theory and Policy.

Seminar

1(1-0)

OPTIONAL COURSES

RESEARCH METHODS IN SOCIAL SCIENCES

3(2-1)

After completing the course, students will be able to utilize the tools and techniques in conducting research.

The research process, identification of research problem, formulation and testing of hypotheses. Statistical methods, sampling techniques; Probabilistic and non-probabilistic, research design process, measurement of variables, questionnaire development, data collection and sources of data, types of surveys, development of research proposal, data processing and analysis, interpretation of results and report writing.

TEXT BOOKS:

1. Ferber, R. & Verdoorn P.G., (1962). Research Methods in Economics and Business, (Latest Edition).
2. Nachmias, C. F. & Nachmias, D. (2007). Research Methods in the Social Sciences. 7th Edition, London: Worth Publisher.

SUGGESTED READINGS:

1. Ethridge, D. E. (2004). Research Methodology in Applied Economics, 2nd Edition, Wiley-Blackwell Publisher.
2. Sekaran, U. (1992). Research Methods for Business. New York: John Wiley & Sons, Inc.
3. Khan, M. A. Research Methodology for Business and Social Problems (Latest Edition).

AGRICULTURAL DEVELOPMENT

3(3-0)

The objective of this course is to provide students basic understandings of the role of agriculture in development and the study of alternatives for accelerating agricultural development.

Inter-sectoral linkages of agriculture, agricultural development in historical perspective; Nature of traditional agriculture; Green revolution; Rational peasants; Determinants of urban rural disparity; Models of agricultural growth; Role of technology in agricultural growth; Interdependence between agricultural growth and economic growth; Growth, inequality and poverty; Models for the analysis of food security and sustainable agriculture; Agricultural development issues in Pakistan; Foreign aid and food aid. Value chain for agricultural development.

TEXT BOOKS:

1. Ghatak, S., & Ingersen, S. (1984). Agriculture and Economic Development. Harvester Press.

SUGGESTED READINGS:

1. Hayami, Y. & Ruttan, W. W. (1985). Agricultural Development: An International Perspective. Johns Hopkins University Press.
2. Todaro, M. P. & S.C. Smith. (2012). Economic Development. 11th Edition. Singapore: Pearson Education.
3. World Development Report, (2008). Agriculture for Development. The World Bank, Washington D.C.
4. Eicher, G.K. and Staatz, J.M. (1990). Agricultural Development in the Third World. Baltimore, USA: The Johns Hopkins University Press.
5. Dil, A. (2000). Hunger, Poverty and Development. Feroze Sons, Lahore, Pakistan.
6. Meier, G.M. (1997). Leading issues in Economic Development, New York: Oxford University Press.

ENVIRONMENTAL AND RESOURCE ECONOMICS 3(3-0)

This course will enable the students to develop the understanding of environmental issues arising due to natural resources degradation and ways for a sustainable development.

Economics and the environment, a framework for environmental analysis, environmental microeconomics and macroeconomics, a brief history and future of economic growth and the environment, common property, open access, and property rights, the environment as a public good, the global commons, allocation of non-renewable resources, Hotelling's rule and time discounting, greening the national income accounts, environmentally-adjusted net domestic product, agriculture's impact on the environment, sustainable agriculture for the future, the supply of non-renewable resources, economic theory of non-renewable resource use, principles of renewable resource management, the economics of pollution control, policies for pollution control, the green economy: introduction, the relationship between economy and environment, does protecting the environment harm the economy? creating a green economy, environmental impacts of trade, trade and environment: policy and practice, trade agreements and the environment, strategies for sustainable trade, the concept of sustainable development, the economics of sustainable development

TEXT BOOKS:

1. Harris, J.M., & Roach, B. (2006). Environmental and Natural Resource Economics: Contemporary Approach; 2nd edition. Boston: Houghton Mifflin Company.
2. Kahn, J.R. (1998). Economic Approach to Environment and Natural Resources. 2nd Edition. Fort Worth: Dryden Press.

SUGGESTED READINGS:

1. Common, M. (2006). Environmental and Resource Economics, An Introduction. Addison Wesley Longman Ltd.
2. Bergstorm, J.C. & Randall, A. (2010). Resource Economics- An Economic Approach to Natural Resources and Environmental Policy. Edward Elger Publishing. New York.
3. Titenberg, T. & Lewis, L. (2013). Environmental and Natural Resource Economics. Pearson New International Edition.

MATHEMATICAL ECONOMICS

3 (3-0)

The objective is to confront the students to advanced mathematical techniques so as to enable them to handle economic models, interpret the results and solve complex problems.

Differential Equations

Linear differential equations: with constant coefficient & constant term, with variable coefficient and variable terms, qualitative approach: concept of phase diagrams, types of time paths and the dynamic stability of equilibrium, exact differential equations: solution and verification, non-linear differential equations of the first order and first degree, Bernoulli equation, separable variables, economic application: dynamics of market models, Solow growth model.

Solution and verification of second order linear differential equations with constant coefficients and constant terms, real and imaginary roots, distinct, repeated roots and complex roots, dynamic stability of equilibrium, economic applications: market models with price expectations, the interaction of inflation and unemployment in continuous time, higher order differential equations, convergence and the Routh theorem, solution of simultaneous difference equations.

Difference Equations

First order linear difference equations: solution and verification of results, conditions for dynamic stability of equilibrium, types of time paths, economic applications: the cobweb model, market model with inventory, model with price ceiling, nonlinear difference equations, the qualitative/graphic approach and phase diagrams.

Solution and verification of second-order linear difference equations with constant coefficients and constant terms, real and imaginary roots, distinct, repeated and complex roots, the convergence and divergence of the time paths. Economic applications: models of business cycles, the Multiplier-Acceleration interaction model, inflation-unemployment model in discrete time, higher order difference equations and their solutions, convergence and the Schurz's theorem, solution of simultaneous difference equations.

TEXT BOOKS:

1. Chiang, A. C., & Wainwright, K. (2004). *Fundamental Methods of Mathematical Economics*, 4th Edition. New York: McGraw-Hill, Irwin.

SUGGESTED READINGS:

1. Dowling, E. T. (1981). *Mathematics for Economics: Schaum Series*.
2. Gandolfo, G. (1980). *Economic Dynamics: Methods and Models*. Latest Edition North Holland Publishing Company
3. Weber, E. J. (2011). *Mathematical Analysis, Business and Economic Application* (latest edition), Netherlands: Harper and Row Publishers,
4. Siberberg, E. & Suen, W. (2001). *The Structure of Economics: A Mathematical Analysis* (3rd Edition). McGraw Hill Publishing Company.
5. Sydsaeter, K. & Hammond, P. (2008). *Essential mathematics for Economic Analysis*. 3rd Edition. Prentice Hall Publisher.

PROJECT PLANNING AND MANAGEMENT

3(3-0)

Introduction, economic and ethical foundations of public and private investment. Techniques of project planning. Characteristics of development projects. Project identification, preparation and appraisal. Identification of costs, benefits and pricing analysis, measures of comparing costs and benefits and their application, monitoring and evaluation, SWOT analysis. CPM Techniques/Project Evaluation and Review Techniques, Management and implementation problems of development projects. Costs recovery and sustainability. Social, economic and environmental impact of projects. Equity and Efficiency consideration of agriculture Projects. Case studies. Preparation of feasibility of credit institution.

TEXT BOOKS:

1. Sinden, J. A. & Thampalillai, D.J. (1995). *Introduction to Benefit-Cost Analysis* Longmans, Melbourne.

SUGGESTED READINGS:

1. Gittinger, J. P. (1993). *Economic Analysis of Agricultural Project*, Johns Hopkins University Press.
2. ADB. (1997). *Guidelines for the Economic Analysis of Projects*. Asian Development Bank.
3. FAO. (1996) *Guidelines for Design of Agricultural Investment Projects*. FAO Investment Centre, Technical Paper 7.
4. Perkins, F. (1994). *Practical Benefit-Cost Analysis; Basic Concepts and Applications*. Melbourne: MacMillan Publishers.
5. Pakistan, Government of. *Manual for Project Planning*. Planning and Development Division, Islamabad.
6. FARMOD. (1998). *Manual for Economic and Financial Analysis*. World Bank, Washington DC,
7. Aslam, M. (2002). *Development Planning in Pakistan* (Revised Edition). Lahore: Allied Book Centre, Urdu Bazaar.

ECONOMIC SYSTEM OF ISLAM

3(3-0)

Principles of Islamic Economy, Social responsibilities, Social equality, economic cooperation. Wide circulation of wealth, Ethical validity of choices, distribution of wealth and income, interest free economy, private ownership and property. Role of State, revenue and expenditure of an Islamic State, Islam, Capitalism and Socialism. Islamic Banking and Finance, instruments, institutions, policies and implications in riba free financing.

TEXT BOOKS:

1. Ayub, M. Islamic Banking and Finance: Theory and Practice. State Bank of Pakistan, Karachi. Available at: <http://www.sbp.org.pk/publications/islamic/book1/index.htm>. 2002.
2. Naqvi, S. N. H. (1981). Ethics and Economics – An Islamic Synthesis (Latest Edition).
3. Khurshid Ahmad (Ed) Studies in Islamic Economics (Latest Edition).
4. Lewis, A. (1994). Ethics and Economic Affairs.
5. Usmani, M. I. Ashraf. (2002). Islamic Banking. Karachi Pakistan: Darul Ishaat.
6. Various Publications of Islamic Economics Research Institute (IER), Islamabad.

MONETARY AND FISCAL POLICY

3 (3-0)

Definition and objectives. Functions of Monetary and Fiscal Policy. Sectoral analysis of the economy: the product sector, the factor sector, and the monetary sector. Changes in the equilibrium level of income and output. Pre-requisite for a successful fiscal and monetary policy. Monetary and Fiscal Policy Tools. Mechanics of monetary and fiscal policy. Criteria for the conduct of monetary and fiscal policy with implications. Substitutability of monetary and fiscal policy. Current monetary and fiscal issues with reference to Pakistan.

TEXT BOOKS:

1. Persson T. (1994). Monetary and Fiscal Policy. Boston: Mit Printers.
2. Pathak, H.D. (2000) Monetary Policy and Free-Market Economics.

SUGGESTED READINGS:

1. Atkinson. (2000). Public Finance in Theory and Practice. McGraw-Hill Company.
2. Musgrave, R. A. (1959). Theory of Public Finance. A Study in Public Economy. New York: McGraw-Hill book Co.
3. Walsh, C.E. (1998). Monetary theory and Policy.
4. Cohen, A.J. (1997) Money, Financial Institutions and Macro Economics.
5. Nomani, Farhad and Rehnema, Ali. Dollars, Debt and Deficits (Latest Edition). Vanguard, Lahore.
6. Hussain, I. (2003) Pakistan: The Economy of an Elitist State. Oxford University Press.

FINANCIAL ECONOMICS

3(3-0)

Overview of the Financial Markets/Instruments, Introduction to Statistical tools used for Portfolio Analysis, Basic tools for Portfolio Analysis, Portfolio Diversification reduces the variance Limitations of Diversification, The relationship between Risk and Return.

Efficient Frontier of risky assets and minimum-variance portfolio, The difference between mean-variance analysis and CAPM, Solving the required return of common stock using the CAPM, Interpretation and meaning of Stock's Beta, Decomposition of variance of an asset's return, Basic concepts of Arbitrage, Empirical evidence on the CAPM and market efficiency, Time series modeling, Random walk model, Unit root and stationarity concept, Co-integration and error correction models, The application of time series tools in Purchasing Power Parity (PPP).

SUGGESTED READINGS:

1. A. Kane, Z. B. & Marcus, A.J. (2007), Investments, Irwin: McGraw-Hill
2. Enders, W. (2004) Applied Econometrics, Wiley's Publisher.

ECONOMICS OF LAND AND WATER RESOURCES 3 (3-0)

Introduction to land economics, principles of land utilization, land resources evaluation, man-land relationship, present and future land requirements, present land use and its problems. Institutional arrangements affecting land use and reclamation. Conservation and improvement. Planning, zoning and efficient use of land resources; Land reforms.

Water as a scarce resource, water markets, principles of water pricing, estimation of alternative water use returns, water policy and resources allocation problems; Water resource development, planning and management. Surface and ground water resources in Pakistan; Methods of water application and water use efficiency. Water losses and measures. Investment strategies for irrigation; Water logging and salinity issues; Drainage of irrigated soils; Environmental, social and political dimensions of water use.

TEXT BOOKS:

1. Ashfaq, M., Griffith, G. & Hussain, I. (2009). Economics of Water Resources in Pakistan. Pakistan: Pak TM Publishers.
2. Tietenberg, T. & L Lewis (2008). Environmental and Natural Resource Economics, 8th Edition, Pearson Company Publisher.
3. Griffin, R. C. (2006). Water Resource Economics: the analysis of scarcity, policies and projects. MIT Press.

SUGGESTED READINGS:

1. Ahmad, N. (1993). Water Resources of Pakistan and Their Utilization.

2. Gibbon, E.C.(1986). The Economic Value of Water. Resources for Future INC, Washington, DC.
3. Dorfman, R. & Dorfman, N.S. (1990). Economics of Environment. Toronto, Canada: W. Norton and Company, Inc.
4. Newson, M.(1997). Land, Water and Development. London: Routledge Publisher.

MATHEMATICAL PROGRAMMING

3 (2-1)

Introduction to linear programming (LP): formation of LP problem; Assumptions of linear programming, the simplex methods; Dual linear programming; interpretation of linear programming solution. Post-optimality analysis, sensitivity analysis, parametric programming. Transportation problem, diet/feed mix problem, joint products, assembly and disassembly problems, sequencing and storage problems. Integer and Nonlinear Programming: integer programming, duality and integer programming, nonlinear programming, quadratic programming, Introduction to Goal Programming. Application of Tora Software.

TEXT BOOKS:

1. McCarl, B. A., & Spreen, T. H. (1997) Applied Mathematical Programming. Latest Edition.
2. Nesa, Wu. L & Coppins, R.(1981) Linear Programming and Extension McGraw-Hill Co.
3. Hillier, F. S., & Lieberman, G. J. (1995) Introduction to Mathematical Programming. New York: McGraw Hill International Editions.

PAKISTAN ECONOMY

3(3-0)

Identification of major economic issues; Development pattern, policy and emergence of economic issues, poverty, unemployment and inflation etc. neglect of human development; financial allocation, strategies and priorities. Financial restructuring in Pakistan: financial reforms, autonomy of central bank, privatization of financial institutions. Resource mobilization and public debt, text structure: direct and indirect excess. Deficits and inflation crises. Public debt sustainability, fiscal responsibility law. Fiscal relations after devolution plan. Neglect of institutions development and its impacts: state, market and civil institutions. Balance of payment, deficit, trade stability, foreign trade and development. Resilience of Pakistan's external sector, remittances inflow and its impact, export competitiveness and diversification. Recent trends in international trade. Major sources of economics growth in Pakistan, research and development poverty and income distribution. Governance issue, politics and economic development. Unemployment and under employment. Current economic policies and economic development.

TEXT BOOKS:

1. Zaidi, S. A. Issues in Pakistan's Economy, (Latest eds.).

SUGGESTED READINGS:

2. Aslam C. M. & Hameed, A. (1999), Human Resource Development and Management in Pakistan. Lahore: Feroze Sons Publisher,
3. Aslam C. M. & Eatzaz A. (2004), Globalization: WTO and Economic Reforms in Pakistan, Feroz Sons, Lahore Pakistan
4. Hussain, I. (1999), Pakistan: Economy of an Elitist State
5. State Bank of Pakistan Annual and Quarterly Reports
6. Ministry of Finance (Government of Pakistan) Economic Survey
7. Troubled Times in the Age of Extremes published by Sustainable Development Policy Institute, Islamabad. 2006
8. 50 Years of Pakistan Economy, State Bank of Pakistan 2006

ECONOMICS OF CLIMATE CHANGE

3 (3-0)

Concept, nature and indicators of climate change; Sources of climate change (CO₂ emissions etc); Climate change and developing countries: *the contribution and burden*; Climate change and agriculture; The vulnerability of the agriculture to climate: *the nature and channels*; Climate variability and livestock; Climate change and food security; Climate change impact assessment: *models and data issues, production function, ricardian approach- a comparative perspective*; Adaptation to climate: *meaning, approaches and obstacles*; Mitigating climate change impacts: *meaning, strategies and alternatives*; Mitigation vs. adaptation: *a comparison*; Developing countries and adaptation to climate: *a case study of Pakistan*; Agriculture adaptation to climate: *the need, the meaning and the role of irrigation*; Adaptation through science: *the technological innovation*; adaptation through conscience: *crop mixing, Institutionalizing the adaptability*; climate change and the role of institution in fighting climate change; Food security and adaptation to climate change; Climate change, agriculture and the policy response: *a case of Pakistan*; Economic impact assessment of climate change: *an introduction to alternative approaches (brief introduction)*.

SUGGESTED READINGS:

1. Dinar, E & Mendelsohn, R. (2011) Handbook on Climate Change and Agriculture. USA. Massachusetts: Edward Elgar Publishing Limited.
2. Reddy, K. R., & Hodges, H. F. (2000). Climate Change and Global Crop Productivity. New York/USA: CABI publishing.
3. Kurukulasuriya, P., & Rosenthal, S. (2003). Climate Change and Agriculture: A Review of Impacts and Adaptations World Bank.
4. Dinar, E. & Mendelsohn, R. (2011). Climate Change and Agriculture: an economic analysis of global impacts, adaptations and distributional effects USA Massachusetts: Edward Elgar publishing limited.
5. Kashav Laal Maharajan. & Joshi, N. (2013). Climate Change, agriculture and Rural Livelihood in Developing Countries, Springer,.
6. Dessler, A. (2012) Introduction to Modern Climate Change. 2nd edition, New York, USA: Cambridge University Press.

General linear regression model; Ordinary least square and summary statistics. Generalized least squares and maximum likelihood estimation; Dummy variables and structural shifts; Non-linear models and estimation algorithms, panel data seemingly unrelated equations and simultaneous equations; Estimation with limited dependent variables, data censoring and selectivity bias. Concept of stationary, analysis of stationary and integrated data, generalizing process, ARIMA models, forecasting and time series decomposition; Analysis and decomposition of forecast errors. ARCH and GARCH models and risk return analysis; VAR models. Casualty influence, response analysis and multivariate decomposition and co-integration and error correction analysis. Autoregressive and Distributed Lag (ARDL) Models.

TEXT BOOKS:

1. Green, W.H. (2007). *Econometric Analysis*. 6th Edition). Prentice Hall Publishers.
2. Maddala, G.S., & Lahirir, K. (2009). *Introduction to Econometrics*. 4th Edition. John Wiley and Sons, Ltd.
3. Griffiths, W.E. Hill, R.C. & Judge, G.G. (1993). *Learning and Practicing Econometrics*. New York: J. Wiley and Sons.

SUGGESTED READINGS:

1. Ramanathan, R. (1992). *Introductory Econometrics with Applications*. New York: The Dryden Press.
2. Pindyek, R.S. & Rubinfeld, D.L. (1997). *Econometrics Models and Economic Forecasts*, New York: McGraw-Hill Publisher.
3. Studenmund, A. H. (2005). *Using Econometrics: A practical guide*. 5th Edition. Addison Wesley Publisher.
4. Gujrati. D. N. (2009). *Basic Econometrics*. 5th Edition. McGraw Hill Book Publishers.
5. Asteriou, D. and Hall, S.G. (2011). *Applied Econometrics: a modern approach using Eviews and Microsoft revised edition*. Palgrave Macmillan Publisher.

**Compulsory courses in English
for undergraduate level**

English I (Functional English)

Credit Hours: 3

Objectives: Enhance language skills and develop critical thinking.

Course Contents:

Basics of Grammar
Parts of speech and use of articles
Sentence structure, active and passive voice
Practice in unified sentence
Analysis of phrase, clause and sentence structure
Transitive and intransitive verbs
Punctuation and spelling

Comprehension

Answers to questions on a given text

Discussion

General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)

Listening

To be improved by showing documentaries/films carefully selected by subject teachers

Translation skills

Urdu to English

Paragraph writing

Topics to be chosen at the discretion of the teacher

Presentation skills

Introduction

Note: Extensive reading is required for vocabulary building

Recommended Books:

1. **Functional English**
 - a) Grammar
 1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
 2. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

- b) Writing
 1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.
- c) Reading/Comprehension
 1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking

English II (Communication Skills)

Credit Hours: 3

Objectives: Enable the students to meet their real life communication needs.

Course Contents:

Paragraph writing

Practice in writing a good, unified and coherent paragraph

Essay writing

Introduction

CV and job application

Translation skills

Urdu to English

Study skills

Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension

Academic skills

Letter/memo writing, minutes of meetings, use of library and internet

Presentation skills

Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review

Recommended Books:

Communication Skills

- a) Grammar
 1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.

- b) Writing
1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
 2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
- c) Reading
1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
 2. Reading and Study Skills by John Langan
 3. Study Skills by Richard York.

English III (Technical Writing and Presentation Skills)

Credit Hours: 3

Objectives: Enhance language skills and develop critical thinking

Course Contents:

Presentation skills

Essay writing

Descriptive, narrative, discursive, argumentative

Academic writing

How to write a proposal for research paper/term paper

How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)

Technical Report writing

Progress report writing

Note: Extensive reading is required for vocabulary building

Recommended Books:

Technical Writing and Presentation Skills

- a) Essay Writing and Academic Writing
1. Writing. Advanced by Ron White. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 435407 3 (particularly suitable for discursive, descriptive, argumentative and report writing).
 2. College Writing Skills by John Langan. McGraw-Hill Higher Education. 2004.

3. Patterns of College Writing (4th edition) by Laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.

b) Presentation Skills

c) Reading

The Mercury Reader. A Custom Publication. Compiled by Northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharon. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).

**ISLAMIC STUDIES
(Compulsory)**

Objectives:

This course is aimed at:

- 1 To provide Basic information about Islamic Studies
- 2 To enhance understanding of the students regarding Islamic Civilization
- 3 To improve Students skill to perform prayers and other worships
- 4 To enhance the skill of the students for understanding of issues related to faith and religious life.

Detail of Courses

Introduction to Quranic Studies

- 1) Basic Concepts of Quran
- 2) History of Quran
- 3) Uloom-ul-Quran

Study of Selected Text of Holly Quran

- 1) Verses of Surah Al-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 Holy Prophet in Madina
- 3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction to Sunnah

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

Selected Study from Text of Hadith

Introduction to Islamic Law & Jurisprudence

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

Islamic Culture & Civilization

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

Islam & Science

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

Islamic Economic System

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

Political System of Islam

- 1) Basic Concepts of Islamic Political System
- 2) Islamic Concept of Sovereignty
- 3) Basic Institutions of Govt. in Islam

Islamic History

- 1) Period of Khlaft-E-Rashida
- 2) Period of Ummayyads
- 3) Period of Abbasids

Social System of Islam

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

Reference Books:

- 1) Hameed ullah Muhammad, "Emergence of Islam", IRI,

Islamabad

- 2) Hameed ullah Muhammad, "Muslim Conduct of State"
- 3) Hameed ullah Muhammad, 'Introduction to Islam
- 4) Mulana Muhammad Yousaf Islahi,"
- 5) Hussain Hamid Hassan, "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.
- 6) Ahmad Hasan, "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)
- 7) Mir Waliullah, "Muslim Jurisprudence and the Quranic Law of Crimes" Islamic Book Service (1982)
- 8) H. S. Bhatia, "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi (1989)
- 9) Dr. Muhammad Zia-ul-Haq, "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad (2001)

Pakistan Studies (Compulsory)

Introduction/Objectives

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

Course Outline

1. Historical Perspective

- a. Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah.
- b. Factors leading to Muslim separatism
- c. People and Land
 - i. Indus Civilization
 - ii. Muslim advent
 - iii. Location and geo-physical features.

2. Government and Politics in Pakistan

Political and constitutional phases:

- a. 1947-58
- b. 1958-71
- c. 1971-77
- d. 1977-88
- e. 1988-99
- f. 1999 onward

3. Contemporary Pakistan

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

Recommended Books:

1. Burki, Shahid Javed. *State & Society in Pakistan*, The MacMillan Press Ltd 1980.
2. Akbar, S. Zaidi. *Issue in Pakistan's Economy*. Karachi: Oxford University Press, 2000.
3. S. M. Burke and Lawrence Ziring. *Pakistan's Foreign policy: An Historical analysis*. Karachi: Oxford University Press, 1993.
4. Mehmood, Safdar. *Pakistan Political Roots & Development*. Lahore, 1994.
5. Wilcox, Wayne. *The Emergence of Bangladesh*, Washington: American Enterprise, Institute of Public Policy Research, 1972.
6. Mehmood, Safdar. *Pakistan Kayyun Toota*, Lahore: Idara-e-Saqafat-e-Islamia, Club Road, nd.

7. Amin, Tahir. *Ethno - National Movement in Pakistan*, Islamabad: Institute of Policy Studies, Islamabad.
8. Ziring, Lawrence. *Enigma of Political Development*. Kent England: Wm Dawson & sons Ltd, 1980.
9. Zahid, Ansar. *History & Culture of Sindh*. Karachi: Royal Book Company, 1980.
10. Afzal, M. Rafique. *Political Parties in Pakistan*, Vol. I, II & III. Islamabad: National Institute of Historical and cultural Research, 1998.
11. Sayeed, Khalid Bin. *The Political System of Pakistan*. Boston: Houghton Mifflin, 1967.
12. Aziz, K. K. *Party, Politics in Pakistan*, Islamabad: National Commission on Historical and Cultural Research, 1976.
13. Muhammad Waseem, *Pakistan Under Martial Law*, Lahore: Vanguard, 1987.
14. Haq, Noor ul. *Making of Pakistan: The Military Perspective*. Islamabad: National Commission on Historical and Cultural Research, 1993.

**COMPULSORY MATHEMATICS
COURSES FOR BSc (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:

1. Dolciani MP, Wooton W, Beckenback EF, Sharron S, *Algebra 2 and Trigonometry*, 1978, Houghton & Mifflin, Boston (suggested text)
2. Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
3. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

2. MATHEMATICS II (CALCULUS)

Prerequisite(s): Mathematics I (Algebra)

Credit Hours: 3 + 0

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

Course Outline:

Preliminaries: Real-number line, functions and their graphs, solution of equations involving absolute values, inequalities. *Limits and Continuity:* Limit of a function, left-hand and right-hand limits, continuity, continuous functions.

Derivatives and their Applications: Differentiable functions, differentiation of polynomial, rational and transcendental functions, derivatives.

Integration and Definite Integrals: Techniques of evaluating indefinite integrals, integration by substitution, integration by parts, change of variables in indefinite integrals.

Recommended Books:

1. Anton H, Bevens I, Davis S, *Calculus: A New Horizon* (8th edition), 2005, John Wiley, New York
2. Stewart J, *Calculus* (3rd edition), 1995, Brooks/Cole (suggested text)
3. Swokowski EW, *Calculus and Analytic Geometry*, 1983, PWS-Kent Company, Boston
4. 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:

1. Abraham S, *Analytic Geometry*, Scott, Freshman and Company, 1969
2. Kaufmann JE, *College Algebra and Trigonometry*, 1987, PWS-Kent Company, Boston
3. Swokowski EW, *Fundamentals of Algebra and Trigonometry* (6th edition), 1986, PWS-Kent Company, Boston

Note:

1. Two courses will be selected from the following three courses of Mathematics.
2. University may make necessary changes in the courses according to the requirements as decided by the Board of Studies.

Statistics-I

Credit 3 (2-1)

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

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

Measure of Central tendency, Definition and calculation of Arithmetic mean, Geometric mean, Harmonic mean, Median quantiles and Mode in grouped and 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
- 3. A. Concise Course in A. Level Statistic with world examples by J. Crashaw and J. Chambers (1994)
- 4. Basic Statistics an Inferential Approach 2nd Ed. (1986) Fran II. Dietrich-II and Thomas J. Keans

Statistics-II

Credit 3 (2-1)

Sampling Probability and non-Probability Sampling, Simple random sampling stratified random sampling Systematic sampling error, Sampling distribution of mean and difference between two means. Interference Theory: Estimation and testing of hypothesis, Type—I and type-II error, Testing of hypothesis about mean and difference between two means using Z-test and t-test, Paired t-test, Test of association of attributes using X² (chi-square) Testing hypothesis about variance.

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
3. Principles and Procedures of Statistics A Bio-material approach, 2nd Edition, 1980 by R. G. D Steal and James H. Tarric
4. Statistical Procedures for Agricultural Research 2nd Edition (1980) by K. A. Gomez and A. A. Gomez

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 Edition, McGraw-Hill
2. Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, 6th Edition, McGraw-Hill
3. Computers, Communications & information: A user's introduction by Sarah E. Hutchinson, Stacey C. Swayer
4. Fundamentals of Information Technology by Alexis Leon, Mathews Leon, Leon Press.

Functional Biology-I Credit Hours 3+0

Biological Methods

Principles of Cellular Life

Chemical Basis

Structure and Function

Principles of Metabolism

Energy Acquisition

Principles of Inheritance

Mitosis and Meiosis

Chromosomes

Observable Inheritance Patterns

DNA Structure and Function

RNA and Proteins

Genes

Genetic Engineering and Biotechnology

Biodiversity

Fundamental Concept of Biodiversity

One or two examples of each of the following from commonly found organism

Prions

Viruses

Bacteria

Protistans

Algae

Fungi

Plants

Crops

Animals

Invertebrates

Vertebrates

Reading:

1. Roberts, M.M., Reiss and G. Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Functional Biology-II Credit Hours 3+0

Myths and Realities of Evolution

Microevolution

Speciation

Macroevolution

Level of Organization

Plants

Tissues

Nutrition and Transport

Reproduction

Growth and Development

Animals

Tissue, Organ System and Homeostasis

Information Flow and Neuron

Nervous System

Circulation and Immunity

Nutrition and Respiration

Reproduction and Development

Ecology and Behavior

Ecosystems

Biosphere

Social Interactions

Community Interactions

Human Impact on Biosphere

Environment Conservation

Reading:

1. Roberts, M.M., Reiss and G. Monger. 2000. Advanced Biology, Nelson.
2. Starr, C, and R, Taggart, 2001. Biology: The Unity and Diversity of Life Brooks and Cole.
3. Campbell, N.A., J.B, Reece, L.G. Mitchell, M.R, Taylor. 2001. Biology: Concepts and Connections. Prentice-Hall.

Note:

Universities may make necessary changes in the courses according to the requirement as decided by the Board of Studies.

RECOMMENDATIONS

The NCRC 2013 appreciates the efforts of HEC for the uplift of academic standards across the universities in Pakistan. The committee strongly recommends the followings:

1. The committee identified weaknesses in the areas like, environmental economics, climate change economics, public policy/agricultural policy, recommends that at least 10 scholarships be allocated in each of the above mentioned disciplines.
2. Teaching Assistants to be financed by HEC may be provided to facilitate the faculty in their teaching and research activities to improve their performance.
3. It is strongly recommended that the work load of the university teachers may be rationalized as per international standards.
4. The committee recommends to limit the number of research students up to 8 under the supervision of a faculty member at a time, including MS/MSc (Hons)/MPhil and PhD.
5. The committee expressed concern for not taking any concrete steps for provision of facility of computer software packages as recommended by the NCRC 2010. The committee reiterated the provision of computer software such as Arcview, Microfit, E-Views, SPSS, SAS, STATA, LimDep and Tora, to the departments/faculty so as to train the graduate students.
6. The universities may support to establish/strengthen the independent departmental libraries/computer labs.
7. The graduates of agricultural economics may also be considered for appointment at par with that of economics for recruitment in various national departments.
8. Nomenclature of the degrees of BSc (Hons) and MSc (Hons) may be changed to BS and MS as per international standards.

