

# Pakistan Institute of Development Economics

## Course Contents

### PIDE School of Economics

#### PhD Economics

##### **Program Structure**

Total Credit Hours: 18

Core Courses Credit Hours: 09                      Elective Courses Credit Hours: 09

Minimum (Normal) Duration: 3 Years (Six Semesters)

Maximum Duration: 6Years (12 Semesters)

S. No	Course	Credits	S. No	Course	Credits
<b>Semester-I</b>			<b>Semester-II</b>		
1.	Advance Microeconomic Theory-II	3	4.	Econometric Methods-II	3
2.	Advance Macroeconomic Theory-II	3	5.	Elective-II	3
3.	Elective-I	3	6.	Elective-III	3
<b>Comprehensive Examination: Microeconomic Theory and Macroeconomic Theory (Two attempts)</b>					
7.	Thesis Proposal/ Dissertation				

#### CORE COURSES

##### **E601: ADVANCED MICROECONOMIC THEORY-II..... (Credits 3)**

Following topics are covered in this course: Theories of choice and production, General Equilibrium Theory, Fundamental theorems of Welfare Economics, Problems of market failure in the presence of externalities and public goods and Economics of information.

Prerequisite: E600

**E611: ADVANCED MACROECONOMIC THEORY-II.....(Credits 3)**

Economic Growth, Business Cycles, Nominal Rigidities and Economic Fluctuations, Competitive Equilibrium Business Cycles, Overlapping Generation Model (with and without money), Monetary and Fiscal Policy Issues.

Prerequisite: E610

**E641: ECONOMETRIC METHODS II .....(Credits 3)**

Simple and Multiple Regression Analysis, Violation of basic assumptions, Estimation with deficient data, Formulation and Estimation of Special Models (qualitative response models), Generalized Linear Regression Model and its Application, Simultaneous Equation Systems, Time Series Analysis, Dynamic Econometric Model.

Prerequisite: E640

**ELECTIVE COURSES**

**E700: TOPICS IN MICROECONOMIC THEORY.....(Credits 3)**

Household Production, Linear Expenditure System, Altruism within Family, Trends in Housework and Family care, Market Production Systems, Dynamic Evolution of Prices and Production, Externalities, General Equilibrium and dis-equilibrium, Welfare Economics, and CGE models.

Prerequisite: E600 & E601

**E701: MATHEMATICAL ECONOMICS.....(Credits 3)**

This course will focus on the mathematical underpinnings of the general equilibrium theory with a view to imparting an ability to formalize economic ideas in a precise and rigorous fashion. Different mathematical structures in general equilibrium theory will be analyzed, including a detailed treatment of classical competitive and Cournot-Nash equilibria and extensions of these concepts to non-ordered preferences. Particular attention will be paid to the study of existence and optimality of these equilibria through the use of real analysis. In addition, the fundamental welfare and equivalence theorems will be discussed at some length.

Prerequisite: E601 & E700

**E702: TOPICS IN MACROECONOMIC THEORY .....(Credits 3)**

Consumption, Saving, Investment, Employment, Economic Growth, Natural Resources, Environmental Issues, Overlapping Generation Models, Multiple Equilibria-Bubbles and Stability, Welfare and Taxation, Public Debt, Macroeconomic Policies.

Prerequisite: E610 & E611

**E 710: PUBLIC FINANCE .....(Credits 3)**

Government revenue and expenditure; public debt; taxation (including issues of ecotaxation); feasibility and implications of public spending policies. Financing of government spending: finance through taxation, borrowing, and money creation. Major issues affecting each tax system, the issues of equity, efficiency, stabilization, and growth. Issues in publicly provided goods, public debt management, and fiscal transfer systems. Fiscal coordination: vertical and horizontal. Comparison of systems: developed and underdeveloped countries, private enterprise, and socialist economics.

Prerequisite: E 600 & E 610.

**E 711: PUBLIC POLICY ..... (Credits 3)**

The key topics are: Measurements of Changes in Welfare; Economy-wide Incidence of Taxes; Taxation, Risk-taking and Investments; Corporate Taxation; Effects of Taxation on Financial Markets; Taxation of Goods and Services; Taxation of Income, Taxation and Savings; Problems of Redistribution; Tax Arbitrage, Tax Avoidance, Tax Evasion, and the Underground Economy; Application of Social Cost-Benefit Analysis to Public Policy; Applied Capital Theory (with applications); Social Opportunity Cost of Capital and Labour, Social Cost of Unemployment and the Inflation Tax

Prerequisite: E 710.

**E 720: MONETARY ECONOMICS..... (Credits 3)**

The course will include the following topics. Money and Interest rates; Banking and Finance, and Global Linkages; Money and Credit; Financial Liberalisation and Globalization; Stabilization Policies; Dynamic Macroeconomic Models with Heterogeneous Agents; Business Cycle Models; Vintage Capital and Technology Adoption Models; Firm Evolution and Industry Dynamics; Financial Markets; and Political Economy Models. Recent research papers on different issues using these techniques will also be discussed.

Prerequisite: E 610.

**E 721: MONETARY POLICY ..... (Credits 3)**

A survey of equilibrium models of money and their implications for monetary and fiscal policies, Cash-in-Advance, Overlapping Generations models, Turnpike, Search models will be studied. Modigliani-Miller and Ricardian 'Irrelevance' theorems, Exchange Rate Determinacy, Dynamic Laffer Curves, and arrangements for coordinating monetary and fiscal policies will be studied, as will the problem of optimal taxation under incomplete markets.

Prerequisite: E 610 & E 720.

**E 722: FINANCIAL ECONOMICS..... (Credits 3)**

Foundations of Risk Analysis; Measuring Risk; Application of Risk Analysis; the Portfolio Selection Problem; the Capital Asset Pricing Model; the Arbitrage Pricing theory; Common Stocks; Preferred Stocks; Bonds; Capital Structure theories; the goal of the Firm; the Economic Evaluation of Investment Proposals; the traditional Mundell Fleming Model; the Dynamic-Optimising model with Price Flexibility; Intertemporal Model with Price Stickiness; Currency Crises; External Crises: Fiscal Policies and Taxation in the Open Economy; International Capital Flows under Asymmetric Information; and International Growth Convergence.

Prerequisite: E 721.

**E 730: INTERNATIONAL ECONOMICS..... (Credits 3)**

The Ricardian model; the Heckscher-Ohlin model; the Specific Factor model; Many Goods and Factors Model; Economies-of-Scale and Monopolistic Competition; Non-traded Goods Model; Theories of Protection; International Factor Mobility; and the Gains from Trade.

Prerequisite: E 600.

**E 731: INTERNATIONAL FINANCE ..... (Credits 3)**

Balance of Payments; Foreign Exchange Markets; International Adjustment Mechanisms; Macroeconomic Policies and the Open Economy; Capital Flows, FDI vs. Portfolio Investment, Global Financial System, Offshore Banking; International Monetary System and Reforms; International Monetary System and Reforms.

Prerequisite: E 730.

**E732: TRADE POLICY..... (Credits 3)**

New World Trading Environments; Globalization; WTO and its Implications for Pakistan, Trade Regimes in Pakistan.

Prerequisite: E 730 & E 731.

**E 740: HUMAN RESOURCE DEVELOPMENT-I..... (Credits 3)**

Issues in Labour Supply and Demand; Wage Determination; Efficiency Wage Hypothesis; Theory of Equalising Differences and Spatial Equilibrium; Principal-Agent Problems and Employment Contracts; Assignment and Matching Theory; Occupational Dynamics and Income Distribution.

Prerequisite: E 600.

**E 741: HUMAN RESOURCE DEVELOPMENT-II..... (Credits 3)**

This course examines following issues: Level and Composition of Employment; Job Search, Unemployment, Labour Mobility, Role of Public Policies like Unemployment Insurance, Welfare, Trade Policy, and Tax Policy; Determination of Rent in the Employment Relationship; Efficiency Wage, Rent Sharing, Matching, and Specific Human Capital Models; the Economics of Intra-household Allocation; Notions of Collective Choice; Collective Models of Household Behaviour; Collective Models of Labour Supply; the Role of Uncertainty in Household Decisions; Bargaining Approaches and Empirical Application.

Prerequisite: E 740.

**E 742: ECONOMICS OF POPULATION..... (Credits 3)**

The topics include the Effects of Demographic Changes on: Markets for Labour and Capital, on Savings Rates and the Structure of Investment, on Pensions and Health-care Costs, on Taxes and Government Expenditure, and Household Behaviour; Population Planning with a view to the consequences of population changes, including methods of forecasting, are considered. Additional topics include: Community Participation; Impact of Changes in Population on Poverty and Distribution; and Environmental Sustainability.

Prerequisite: E 740.

**E 750: INDUSTRIAL ECONOMICS..... (Credits 3)**

Topics include: Theory of the Firm, Multi-product Cost Functions, Natural Monopoly, Oligopoly, Strategic Behaviour, Monopolistic Competition, Network Externalities, Transaction Costs, and Technical Change; Development of Microeconomic Models to explain the Structure and Performance of Markets; Conditions under which Monopoly Power can be exercised; Relationship between Profit Rates and Concentration or Sizes; the Persistence of Profits over time; Industry Turnover and Inter-industry comparisons; Game theory and its applications.

Prerequisite: E 600.

**E 751: INDUSTRIAL POLICY ..... (Credits 3)**

Empirical approaches with emphasis on theoretical underpinnings. Topics include: Technology and Industrial Structure; Vertical Integration; Application of Oligopoly; Cartels, Collusion, and Horizontal mergers; Price Discrimination; Product Differentiation; Imperfect Information; Externalities; Environmental Issues; Impact of Trade and Industrial Policies; and Industrial Policy in Pakistan.

Prerequisite: E 750.

**E 760: DEVELOPMENT ECONOMICS ..... (Credits 3)**

Harrod-Domar and Neoclassical Models; Technical Progress, Optimum Savings, and the Golden Rule; Savings and Capital Accumulation Development theories; Measuring Contributions to Growth; Population Growth; Labour and Employment; Investment in Human Capital; Entrepreneurship; Industrialisation,; the Choice of Technology; Agriculture and Agrarian Reforms; Development Strategies; Development, Equity, and Welfare; Food Aid, Saving Disincentives; Foreign Investment and MNCs; Decision Models; Balanced and Unbalanced Growth; Migration from LDCs; Political Economy of Trade and Development; North-South Models.

Prerequisite: E 600 & E 610.

**E 761: DEVELOPMENT POLICY ..... (Credits 3)**

This course covers following topics: Role of Institutions governing the Allocation of Resources (e.g., land, labour, credit, and insurance); Enforcement of Property Rights and Contracts in Developing Economies and evaluates their effect on Economic Efficiency. It will also draw on recent research in development economics, microeconomic models of household behaviour, contract theory, game theory, planning models, and the experience of developed and developing countries, East-Asian growth experience, crisis of governance, Role of NGOs.

Prerequisite: E 760.

**E 770: APPLIED ECONOMETRICS(Credits 3)**

This course develops and applies the following econometric methods designed for analysing dynamic models of economic time series: Estimation Methods such as Maximum Likelihood and Generalised Method of Moments; Models of Consumption and Investment; Models connecting Asset Market data to Economic Aggregates and Models of the underlying Sources of Economic Fluctuations; the Estimation of Demand and Supply Equations; Estimation of Production Relationship; Estimation of Pricing Equations in Finance and Labour Economics; and Calibration of General Equilibrium Models.

Prerequisite: E 640.

**E 771: TOPICS IN ADVANCED ECONOMETRICS ..... (Credits 3)**

The course provides an introduction to the large-sample (asymptotic theory), maximum likelihood estimation, and generalized method of moments. Various micro-econometric models, including discrete choice, panel data, and duration models, bootstrapping, and kernel estimation will also be discussed.

Prerequisite: E 770.

**E 780: AGRICULTURAL DEVELOPMENT ..... (Credits 3)**

Models of Agricultural growth, Determinants of Urban Rural Disparity, Role of Technology in Agricultural growth, Interdependence between Agricultural Growth and Economic Growth, Models for the Analysis of Food Security and Sustainable Agriculture.

Prerequisite: E 600.

**E 781: AGRICULTURAL POLICY ..... (Credits 3)**

Review of Agricultural System and Policies in Pakistan, Agricultural supply topics including: Product and Factor Prices, Analysis of Policy Options, Price Support and Input Subsidies, Price Policy and Adoption of New Technologies, Interrelated Commodities, Water Pricing and Project Evaluation Principles as applicable to Third World Countries.

Prerequisite: E 600 & E780.

**E 790: ECONOMIC GROWTH AND DISTRIBUTION ..... (Credits 3)**

The course includes: Historical development in the theory of economic growth like growth models developed by Harrod-Domer, Solow, and others; Recent developments in the theory of economic growth like Endogenous Growth Models, Increasing Returns to Scale; Empirical studies of the determinants of productivity and economic growth at aggregate and sectoral, regional level.

Prerequisite: E 600, E610 & E611.

## MPhil Economics

### Program Structure

Total Credit Hours: 36

Core Courses Credit Hours: 15                      Elective Courses Credit Hours: 09

Minimum (Normal) Duration: 2 Years (Four Semesters)

Maximum Duration: 3 Years (Six Semesters)

S. No	Course	Credits	S. No	Course	Credits
<b>Semester-I</b>			<b>Semester-II</b>		
1.	Advance Microeconomic Theory-I	3	5.	Econometrics Methods-I	3
2.	Advance Macroeconomic Theory-I	3	6.	Research Methodology	3
3.	Advance Mathematics	3	7.	Elective-II	3
4.	Elective-I	3	8.	Elective-III	3
<b>Summer Internship:</b> Since PIDE has various research divisions, the students can be attached with any of them for research learning.					
<b>Semester-III</b>					
9.	Thesis	12			

### CORE COURSES

#### **E 600: ADVANCED MICROECONOMIC THEORY-I ..... (Credits 3)**

The course covers topics under the following broad heads: Theory of Consumer Behaviour; Theory of Firm; Market Equilibrium; Uncertainty and Information Asymmetry. The theory of consumer behavior includes: Direct and Indirect Utility Functions, Derivation of Marshallian and Hicksian Demand Curves; Consumer Surplus. Theory of Firm includes constrained optimization of Production, Cost and Profit Functions; Derivation of Input Demand Functions, Returns to Scale, Perfect and Imperfect Market Competition. Game theoretic concepts are discussed with reference to Oligopolistic Markets.

#### **E610: ADVANCED MACROECONOMIC THEORY-I ..... (Credits 3)**

Classical vs. Keynesian economics, IS-LM model, Consumption, Investment, Inflation and Unemployment, Money and Financial Markets, Macroeconometric Models, Rational Expectation Models, Imperfect Information, Real Business Cycles, Sectoral Shifts, Fixed Prices and General Disequilibrium, Labour Contracts and Sticky Wages, Monopolistic Competition and Sticky Prices.



**E 630: ADVANCED MATHEMATICS.....(Credits 3)**

Real Analysis, Linear Algebra and Matrices, Calculus, Classical Optimization, Non-linear Programming, Convex Analysis, Integral Calculus, Differential Equations and Dynamic Optimization.

**E640: ECONOMETRIC METHODS-I.....(Credits 3)**

Simple and Multiple Regression Analysis, Violation of basic assumptions, Estimation with deficient data, Formulation and Estimation of Special Models (qualitative response models), Generalized Linear Regression Model and its Application, Simultaneous Equation Systems, Time Series Analysis, Dynamic Econometric Model.

Prerequisite: E620

**ELECTIVE COURSES**

**E700: TOPICS IN MICROECONOMIC THEORY.....(Credits 3)**

Household Production, Linear Expenditure System, Altruism within Family, Trends in Housework and Family care, Market Production Systems, Dynamic Evolution of Prices and Production, Externalities, General Equilibrium and Dis-equilibrium, Welfare Economics, and CGE models.

Prerequisite: E600 & E601

**E701: MATHEMATICAL ECONOMICS.....(Credits 3)**

This course will focus on the mathematical underpinnings of the general equilibrium theory with a view to imparting an ability to formalize economic ideas in a precise and rigorous fashion. Different mathematical structures in general equilibrium theory will be analyzed, including a detailed treatment of classical competitive and Cournot-Nash equilibria and extensions of these concepts to non-ordered preferences. Particular attention will be paid to the study of existence and optimality of these equilibria through the use of real analysis. In addition, the fundamental welfare and equivalence theorems will be discussed at some length.

Prerequisite: E601 & E700

**E702: TOPICS IN MACROECONOMIC THEORY .....(Credits 3)**

Consumption, Saving, Investment, Employment, Economic Growth, Natural Resources, Environmental Issues, Overlapping Generation Models, Multiple Equilibria-Bubbles and Stability, Welfare and Taxation, Public Debt, Macroeconomic Policies.

Prerequisite: E610 & E611

**E 710: PUBLIC FINANCE .....(Credits 3)**

Government revenue and expenditure; public debt; taxation (including issues of ecotaxation); feasibility and implications of public spending policies. Financing of government spending: finance through taxation, borrowing, and money creation. Major issues affecting each tax system, the issues of equity, efficiency, stabilization, and growth. Issues in publicly provided goods, public debt management, and fiscal transfer systems. Fiscal coordination: vertical and horizontal. Comparison of systems: developed and underdeveloped countries, private enterprise, and socialist economics.

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**E 711: PUBLIC POLICY ..... (Credits 3)**

The key topics are: Measurements of Changes in Welfare; Economy-wide Incidence of Taxes; Taxation, Risk-taking and Investments; Corporate Taxation; Effects of Taxation on Financial Markets; Taxation of Goods and Services; Taxation of Income, Taxation and Savings; Problems of Redistribution; Tax Arbitrage, Tax Avoidance, Tax Evasion, and the Underground Economy; Application of Social Cost-Benefit Analysis to Public Policy; Applied Capital Theory (with applications); Social Opportunity Cost of Capital and Labour, Social Cost of Unemployment and the Inflation Tax.

Prerequisite: E 710.

**E 720: MONETARY ECONOMICS..... (Credits 3)**

The course will include the following topics. Money and Interest rates; Banking and Finance, and Global Linkages; Money and Credit; Financial Liberalisation and Globalization; Stabilization Policies; Dynamic Macroeconomic Models with Heterogeneous Agents; Business Cycle Models; Vintage Capital and Technology Adoption Models; Firm Evolution and Industry Dynamics; Financial Markets; and Political Economy Models. Recent research papers on different issues using these techniques will also be discussed.

Prerequisite: E 610.

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A survey of equilibrium models of money and their implications for monetary and fiscal policies, Cash-in-Advance, Overlapping Generations models, Turnpike, Search models will be studied. Modigliani-Miller and Ricardian 'Irrelevance' theorems, Exchange Rate Determinacy, Dynamic Laffer Curves, and arrangements for coordinating monetary and fiscal policies will be studied, as will the problem of optimal taxation under incomplete markets.

Prerequisite: E 610 & E 720.

**E 722: FINANCIAL ECONOMICS..... (Credits 3)**

Foundations of Risk Analysis; Measuring Risk; Application of Risk Analysis; the Portfolio Selection Problem; the Capital Asset Pricing Model; the Arbitrage Pricing theory; Common Stocks; Preferred Stocks; Bonds; Capital Structure theories; the goal of the Firm; the Economic Evaluation of Investment Proposals; the traditional Mundell Fleming Model; the Dynamic-Optimising model with Price Flexibility; Intertemporal Model with Price Stickiness; Currency Crises; External Crises: Fiscal Policies and Taxation in the Open Economy; International Capital Flows under Asymmetric Information; and International Growth Convergence.

Prerequisite: E 721.

**E 730: INTERNATIONAL ECONOMICS..... (Credits 3)**

The Ricardian model; the Heckscher-Ohlin model; the Specific Factor model; Many Goods and Factors Model; Economies-of-Scale and Monopolistic Competition; Non-traded Goods Model; Theories of Protection; International Factor Mobility; and the Gains from Trade.

Prerequisite: E 600.

**E 731: INTERNATIONAL FINANCE ..... (Credits 3)**

Balance of Payments; Foreign Exchange Markets; International Adjustment Mechanisms; Macroeconomic Policies and the Open Economy; Capital Flows, FDI vs. Portfolio Investment, Global Financial System, Offshore Banking; International Monetary System and Reforms; International Monetary System and Reforms.

Prerequisite: E 730.

**E732: TRADE POLICY..... (Credits 3)**

New World Trading Environments; Globalization; WTO and its Implications for Pakistan, Trade Regimes in Pakistan. [credits 3]

Prerequisite: E 730 & E 731.

**E 740: HUMAN RESOURCE DEVELOPMENT-I..... (Credits 3)**

Issues in Labour Supply and Demand; Wage Determination; Efficiency Wage Hypothesis; Theory of Equalising Differences and Spatial Equilibrium; Principal-Agent Problems and Employment Contracts; Assignment and Matching Theory; Occupational Dynamics and Income Distribution.

Prerequisite: E 600.

**E 741: HUMAN RESOURCE DEVELOPMENT-II..... (Credits 3)**

This course examines following issues: Level and Composition of Employment; Job Search, Unemployment, Labour Mobility, Role of Public Policies like Unemployment Insurance, Welfare, Trade Policy, and Tax Policy; Determination of Rent in the Employment Relationship; Efficiency Wage, Rent Sharing, Matching, and Specific Human Capital Models; the Economics of Intra-household Allocation; Notions of Collective Choice; Collective Models of Household Behaviour; Collective Models of Labour Supply; the Role of Uncertainty in Household Decisions; Bargaining Approaches and Empirical Application.

Prerequisite: E 740.

**E 742: ECONOMICS OF POPULATION..... (Credits 3)**

The topics include the Effects of Demographic Changes on: Markets for Labour and Capital, on Savings Rates and the Structure of Investment, on Pensions and Health-care Costs, on Taxes and Government Expenditure, and Household Behaviour; Population Planning with a view to the consequences of population changes, including methods of forecasting, are considered. Additional topics include: Community Participation; Impact of Changes in Population on Poverty and Distribution; and Environmental Sustainability.

Prerequisite: E 740.

**E 750: INDUSTRIAL ECONOMICS..... (Credits 3)**

Topics include: Theory of the Firm, Multi-product Cost Functions, Natural Monopoly, Oligopoly, Strategic Behaviour, Monopolistic Competition, Network Externalities, Transaction Costs, and Technical Change; Development of Microeconomic Models to explain the Structure and Performance of Markets; Conditions under which Monopoly Power can be exercised; Relationship between Profit Rates and Concentration or Sizes; the Persistence of Profits over time; Industry Turnover and Inter-industry comparisons; Game theory and its applications.

Prerequisite: E 600.

**E 751: INDUSTRIAL POLICY ..... (Credits 3)**

Empirical approaches with emphasis on theoretical underpinnings. Topics include: Technology and Industrial Structure; Vertical Integration; Application of Oligopoly; Cartels, Collusion, and Horizontal mergers; Price Discrimination; Product Differentiation; Imperfect Information; Externalities; Environmental Issues; Impact of Trade and Industrial Policies; and Industrial Policy in Pakistan.

Prerequisite: E 750.

**E 760: DEVELOPMENT ECONOMICS ..... (Credits 3)**

Harrod-Domar and Neoclassical Models; Technical Progress, Optimum Savings, and the Golden Rule; Savings and Capital Accumulation Development theories; Measuring Contributions to Growth; Population Growth; Labour and Employment; Investment in Human Capital; Entrepreneurship; Industrialisation,; the Choice of Technology; Agriculture and Agrarian Reforms; Development Strategies; Development, Equity, and Welfare; Food Aid, Saving Disincentives; Foreign Investment and MNCs; Decision Models; Balanced and Unbalanced Growth; Migration from LDCs; Political Economy of Trade and Development; North-South Models.

Prerequisite: E 600 & E 610.

**E 761: DEVELOPMENT POLICY ..... (Credits 3)**

This course covers following topics: Role of Institutions governing the Allocation of Resources (e.g., land, labour, credit, and insurance); Enforcement of Property Rights and Contracts in Developing Economies and evaluates their effect on Economic Efficiency. It will also draw on recent research in development economics, microeconomic models of household behaviour, contract theory, game theory, planning models, and the experience of developed and developing countries, East-Asian growth experience, crisis of governance, Role of NGOs.

Prerequisite: E 760.

**E 770: APPLIED ECONOMETRICS..... (Credits 3)**

This course develops and applies the following econometric methods designed for analysing dynamic models of economic time series: Estimation Methods such as Maximum Likelihood and Generalised Method of Moments; Models of Consumption and Investment; Models connecting Asset Market data to Economic Aggregates and Models of the underlying Sources of Economic Fluctuations; the Estimation of Demand and Supply Equations; Estimation of Production Relationship; Estimation of Pricing Equations in Finance and Labour Economics; and Calibration of General Equilibrium Models.

Prerequisite: E 640.

**E 771: TOPICS IN ADVANCED ECONOMETRICS ..... (Credits 3)**

The course provides an introduction to the large-sample (asymptotic theory), maximum likelihood estimation, and generalized method of moments. Various micro-econometric models, including discrete choice, panel data, and duration models, bootstrapping, and kernel estimation will also be discussed.

Prerequisite: E 770.

**E 780: AGRICULTURAL DEVELOPMENT ..... (Credits 3)**

Models of Agricultural growth, Determinants of Urban Rural Disparity, Role of Technology in Agricultural growth, Interdependence between Agricultural Growth and Economic Growth, Models for the Analysis of Food Security and Sustainable Agriculture.

Prerequisite: E 600.

**E 781: AGRICULTURAL POLICY ..... (Credits 3)**

Review of Agricultural System and Policies in Pakistan, Agricultural supply topics including: Product and Factor Prices, Analysis of Policy Options, Price Support and Input Subsidies, Price Policy and Adoption of New Technologies, Interrelated Commodities, Water Pricing and Project Evaluation Principles as applicable to Third World Countries.

Prerequisite: E 600 & E780.

**E 790: ECONOMIC GROWTH AND DISTRIBUTION ..... (Credits 3)**

The course includes: Historical development in the theory of economic growth like growth models developed by Harrod-Domer, Solow, and others; Recent developments in the theory of economic growth like Endogenous Growth Models, Increasing Returns to Scale; Empirical studies of the determinants of productivity and economic growth at aggregate and sectoral, regional level.

Prerequisite: E 600, E610 & E611.

## Phd ECONOMETRICS

### **Academic Program**

Total Credit Hours: 18

Course Work: 18

Duration: 3 Years

Total Courses: 6

Core Courses: 3(First semester 2, Second Semester 1)

Elective Courses: 3(First semester 1, Second Semester 2)

### **Course Work Structure Semester Wise**

<b>1<sup>st</sup> Semester (Fall)</b>	<b>2<sup>nd</sup> Semester (Spring)</b>
<b>ETS-840 Micro Econometrics</b> (3 credit hours)	<b>ETS-771 Topics in Advance Econometrics</b> (3 credit hours)
<b>ETS-841 Macro Econometrics</b> (3 credit hours)	<b>Elective II</b> (3 credit hours)
<b>Elective I</b> (3 credit hours)	<b>Elective III</b> (3 credit hours)
<b>9 Credits</b>	<b>9 Credits</b>

### **Deficiency Courses**

1. The students not having M.Phil. in Econometrics from PIDE shall have to qualify in the following deficiency courses
2. ETS-600 Microeconomic Theory (3 credit hours)
3. ETS-610 Macroeconomic Theory (3 credit hours)

- ETS-620 Quantitative Foundation for Econometrics (3 credit hours)

1. ETS-640 Econometrics Methods (3 credit hours)
2. ETS-770 Applied Econometrics (3 credit hours)
3. ETS-638 Data Visualization (3 credit hours)
4. The students shall have to apply for removal of the deficiency course if he/she has qualified the course (or equivalent course) during his/her MS/MPhil coursework with minimum 3.0/4.0 GPA or 65% marks.

2.1. A course shall be considered equivalent to a deficiency course if 75% of the course contents are similar (or as per HEC criterion)

2.2. This similarity shall be determined by the concerned Departmental Council.

3. The student applying for removal of deficiency course shall have to take an exam conducted by the Departmental Council and shall pass the exam with at least 65% marks. In case the student clears the exam, the Departmental Council can remove the deficiency.
4. If the student fails to qualify the deficiency course exam he/she shall have to study the course as a regular course.
5. A student having MPhil Economics/Econometrics from respective department of PIDE shall also have to study the deficiency courses in which he/she has scored less than 65% marks.
6. The student can apply for removal of deficiency through prescribed form in any one or all the defined deficiency courses.
7. The deficiency courses shall not be counted toward the CGPA.

On fulfilling the required criteria, the department council may allow for the removal of the deficiency. The Head of Department will recommend the case to the competent authority for elimination of deficiency courses, if feasible otherwise.

### **Comprehensive Exam**

After completion of prescribed coursework, a student must pass comprehensive examinations in Econometric Theory and Applied Econometrics. The comprehensive examinations shall be composed of two parts – a written examination and an oral examination. The oral examination shall be taken after one week of written examination. The marks distribution shall be:

Written (Marks)	Viva-Voce (Marks)	Total Marks	Passing Marks
85	15	100	65

In normal circumstances, the comprehensive examination must be taken after the completion of the core courses: ETS-840 Micro Econometrics, ETS-840 Macro Econometrics, ETS-640 Econometrics Methods, ETS-638 Data Visualization, ETS-620 Quantitative Foundation for Econometrics, ETS-770 Applied Econometrics and ETS-771 Topics in Advance Econometrics.

### **Core Course Contents**

**ETS- 610: MACROECONOMIC THEORY.....(CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

Introduction to Classical Economics-Utopian world of Demand and Supply, Quantity theory of money, Why supply and demand does not work in the labor market – Efficiency Wage Theories, Factors that led to Great Depression, Nonexistent demand and supply model, Household debt, Bubble in the assets market, Keynesian Economics, -Wage – Price rigidities and malfunctioning of demand – supply model, Role of money in economic activity, Government role as a leader in investment activities, Chicago plan and Islamic Chicago Plan. Post Keynesian Economics and the first Neo-Classical synthesis, Convergence



and stability debate, Monetarists counter revolution, Redefining role of money, New classical economics, Rational expectations hypothesis, Policy irrelevance proposition, Macroeconomic modeling based on microeconomic foundations, New Keynesian Economics and the second Neo-Classical synthesis: The Era of Great Moderation, Rational expectations and micro foundations as norms in macroeconomics, Wrong perception of the role of money, Interest rate as monetary policy instrument despite its limited role, DSGE models and neglecting the distributional issues, , Inflation targeting regime, How did economists get it wrong, Misperception of the role of money: Werner's theory, Limitations of interest rate targeting, Misuse of rational expectations hypothesis, Monopoly of private banks and money creation process, Explaining bubble as great moderation, Financial crisis and Great Recession, Fiscal austerity in Europe, Role of free trade in European crisis, Ideological battle in Macroeconomics.

### **Recommended Books:**

1. Romer, D. (2011), Advanced Macroeconomics. McGraw-Hill.
2. William M. Scarth (1988) Macro Economics. An Introduction to Advanced Methods.
3. Blanchard and Fischer (1989), Lectures on Macroeconomics. MIT Press.
4. Sargent, Thomas (1987), Dynamic Macroeconomics Theory. Harvard Univ. Press.

### **Other Books**

1. Obstfeldt, M. and K. Rogoff (1996). Foundations of International Economics. MIT Press.
2. Barro, R. and X. Sala-i-Martin (1995). Economic Growth. McGraw-Hill .
3. Sorensen, P.B. and Whitta-Jacobsen, H. J. (2005), Introducing Advanced Macroeconomics: Growth and Business Cycles. McGraw Hill.
4. Heijdra, B. and Ploeg, F. (2009), The foundations of Modern Macroeconomics. Oxford University Press.

### **Reading Material**

1. Winning Ideas: Lessons from Free Market Economics. Alkire, Sabina and Ritchie, Angus (2007), OPHI Working Paper No. 6.
2. Efficiency Wage Hypothesis – the case of Pakistan by Zaman, Asad and Syed Kanwar Abbas, (2005), Pakistan Development Review, Vol 44 number 4, 1051-1066
3. A Quick Refresher Course in Macroeconomics by N. Gregory Mankiw, *Journal of Economic Literature* (Dec 1990).
4. Revolution and Evolution in 20<sup>th</sup> Century Macroeconomics by Michael Woodford, Princeton, 1999.
5. Gordon, Robert J. "What Is New-Keynesian Economics?" *Journal of Economic Literature* 28, no. 3 (September 1990): 1115-71.
6. Keynes, John Maynard. The General Theory of Employment, Interest, and Money. 1936.

“The Counter-Revolution in Monetary Theory” (1970) by Milton Friedman, IEA Occasional Paper no. 33.

**ETS-620: QUANTITATIVE FOUNDATION FOR ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

Arbitrary Ranking ,Sorting, Ranking and Percentiles Concept and importance of Sorting, Ranking and Percentiles , REPRESENTING: (Mean, Median and Mode), Mean, Median and Mode, Measures of Spread, and Outliers Various measures of spread are discussed like IQR Standard Deviation, Measures of Spread and Outliers, Boxplots Histograms Bivariate, Relationships , Comparison of Visual graphics. Probability, Random Variables and Probability Distribution, Distribution Functions of Random Variables, General Notion of Expectation, Stochastic Processes, Limit theorems, Statistical Inference, Properties of Estimators, Estimation Methods, Hypothesis Testing and Confidence Regions, Measures of Spread, and Outliers various measures of spread are discussed like IQR Standard Deviation, The Introduction to Econometric Modelling, Statistical Models in Econometrics. The Gauss Linear Model, The Linear Regression Model- Specification, Estimation and Testing, The Dynamic Linear Regression Model, Random sampling, Bernoulli sequence, Discrete Random Variable, Continuous RV, Expectations, Moments and MGF, Central Limit theorem

**Recommended Books**

1. Zaman, Asad. (2016), Introduction to Statistics an Islamic Approach.
2. Mood, A.M., Graybill, F.A. and Boes, D.C. Introduction to the Theory of Statistics 3<sup>rd</sup> edition
3. Freedman, David, Robert Pisani, and Roger Purves. *Statistics*. 4<sup>th</sup> Edition, Norton, 2007.
4. OpenIntro Statistics – free download from: <https://www.openintro.org/stat/>
5. The Cartoon Guide to Statistics 1st Edition by Larry Gonick, Woollcott Smith
6. Intro Stats (2nd Edition) by Richard D. De Veaux, Paul F. Velleman , David E. Bock
7. Spanos, A.(1986), Statistical Foundations of Econometric Modelling, Cambridge University Press.
8. Hogg, R.V., and Craig, A.T. (2005), Introduction to Mathematical Statistics, 5<sup>th</sup> Ed., Macmillan.
9. Mittelhammer, R.C. (2001), The Mathematical Statistics for Economics and Business, Springer.

**Other Books**

1. Herman J. Bierens, Introduction to the Mathematical and Statistical Foundations of Econometrics, Cambridge University Press.
2. Orley Ashenfelter, Phillip B. Levine, David J. Zimmerman (2006), Statistics and Econometrics: Methods and Applications, John Wiley & Sons.

**ETS-640: ECONOMETRIC METHODS .....(CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline**

Introduction, Stochastic Assumptions of Econometrics: Simple and Multiple Regression Analysis, Ordinary Least Squares, Maximum Likelihood and Method of Moments Estimators of Parameters of the Classical General Linear Regression Model, Estimation of Non-Linear Regression Models. Properties Linear and Non-Linear Models Regression Model, Heteroscedasticity, Autocorrelation, Multicollinearity and Endogeneity: Structure, Causes, Consequences, Tests and Estimation; Structure and Assumptions of Generalized Regression Models. Generalized Least Squares (GLS) and Feasible GLS methods and Its Application, Two-Stage Least Squares (2SLS) and Instrumental Variables Least Squares (IVLS) estimators; Likelihood Ratio, Lagrange Multiplier and Wald tests; Model Selection: Choice of Variables

and Choice of Functional Form, Hausman test; Testing Between Nested and Non-Nested Models; Qualitative Response Models; Dummy variables, Structural Shifts, Seasonality, Tests of Structural Shifts and Model Stability, Splines functions; Pooled Time Series and Cross Section Data: Structure, Assumptions and Estimation Techniques; Dynamic Models Involving Pooled Data and GMM Estimation; Simultaneous Equations: Structure, Identification and Estimation; Seemingly Unrelated Regression Models: Structure, Assumptions and Estimation; Limited Dependent Variables: Linear and Non-Linear Probability Models for Bivariate and Multivariate Models, Data Censoring and Selectivity Bias, Bayesian Econometrics.

## **ETS-638: DATA VISUALIZATION..... (CREDIT HOURS 3)**

**Pre requisite:** Nil

### **Course Outline:**

Introduction Course Setup : What is data visualization? How can data be visualized, How can Data Visualization be used? When data visualization is suitable? Econometrics, Data Visualization and Data Science, Tools for data visualization for this course (R-Studio and R library ggplot2),

- Explorative Data Analysis Start tutorials,
- R Graphics I, R Graphics II, ggplot2
- Which Chart to use When
- Visualizing Categorical and Continuous data
- Time series visualization
- Scatter plots, residuals, regression discontinuity designs, nonlinearities
- Geospatial data visualization
- Advanced Charts: Treemap, Classification Trees, Heatmapsetc
- De-Clutter Graphs for Better Data Insights
- Making use of colors , facets, aesthetics, legends
- Interactive Data Visualization Using plotly/R shiny
- Dashboard Designs
- Telling Story With Data Visualization

Note: Additional resources like Excel for graphics can be used but main software to be used is R (ggplot2) as coding will help students in their data analytics in other courses as well. We shall mainly follow book Winston Chang and Nathan Yau (both use R language for data visualization).

### **Books**

1. Chang, W. (2013). R Graphics Cookbook. O'Reilly. <http://www.cookbook-r.com/>
2. Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis (2nd). Springer. <http://ggplot2.org/book/>;
3. Yau, N. (2011). Visualize This: The FlowingData Guide to Design, Visualization, and Statistics. Wiley. <http://book.flowindata.com/>
4. Scott Berinato (2016) Good Charts: The HBR Guide to Making Smarter, More Persuasive Data Visualizations , Harvard Business Review

**ETS - 770: APPLIED ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline**

Estimation Methods; Maximum Likelihood and Generalised Method of Moments; Models of Consumption and Investment; Models Connecting Asset Market Data to Economic Aggregates and Models of the Underlying Sources of Economic Fluctuations; The Estimation of Demand and Supply Equations; Estimation of Production Relationship; Estimation of Pricing Equations in Finance and Labour Economics and Calibration of General Equilibrium Models, Monte Carlo Simulations and Computer Programming. House hold demand Models

**ETS-840: MICRO ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline**

Discrete choice models: The Binary and Multinomial Response Models for unordered and ordered choices. The utility basis of such models. Other Limited Dependent Variables Models, e.g., for models for Count and Duration Data. Truncated and censored regression models; Duration models; Quantile regression; Variance estimation and power; Bootstrapping; Non-parametric regression and matching; Heckman bivariate normal selection model; Instrumental variables models; Regression discontinuity designs; Difference-in-differences and panel data models; Missing Data and Selection Problems. Censored and Truncated Regression models; switching regression (Roy model).Basic Concepts of Causal Inference - Experimental data - Performing social experiments - Imperfect compliance; Observational data with selection on observables - Regression and matching.

**ETS-845: MACROECONOMETRICS .....(CREDIT HOURS 3)**

**Pre Requisite:** ETS-640: Econometric Methods, ETS-641: Time Series Analysis

**Course Outline**

Time series properties of macro data, time series models, filtering and applications to business cycle. Simultaneous equation model, application to equilibrium model of demand and supply, wage- price inflation, Keynesian model.Vector Auto-Regressions and impulse responses, with applications to business cycle, monetary policy analysis and the dynamics of aggregate demand and supply shocks. Applications of the structural VAR-X for impulse response functions to structural shocks, multiplier analysis of the exogenous variables, forecast error variance decomposition. Structural breaks and model selection, applications to Non-Accelerating Inflation Rate of Unemployment (NAIRU), technology and monetary policy shocks. Structural estimation of macroeconomic models. Time series models with latent variables: economic implication of Kalman Filter to leading indicators. Forecasting and structural breaks and applications to the Phillips curve, forecasting of GDP growth and inflation dynamics. Multivariate tests for unit roots and cointegration: Application to Stochastic trends and economic fluctuations.

**ETS- 771: TOPICS IN ADVANCE ECONOMETRICS.....(CREDIT HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline**

Introduction to Large-Sample (Asymptotic Theory), Maximum Likelihood Estimation, and Generalized Method of Moments. Various Micro-Econometric Models, Including Discrete Choice, Panel Data, and Duration Models, Bootstrapping, Kernel Estimation. Calibration Methods, Probabilistic Structure of Time Series Data, Identification problem in macro econometrics. Estimation approaches: Commission approach, LSE approach. VAR approach. Inter-temporal optimization, Extrimum Estimators.

**Optional Courses**

**ETS 641: TIME SERIES ANALYSIS .....(CREDITS HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Introduction of Time Series Analysis, Transformation of Variables, Decomposition Analysis, Spectral Analysis, Box-Jenkins Methodology; AR, MA, ARMA, ARIMA, Seasonal ARMA, and Seasonal ARIMA Models, Unit Roots Analysis, Multiple Time Series, Transfer Functions, Cointegration, Dynamic Specification, Distributed Lagged Models, Vector Autoregressive (VAR), Impulse Response Function, Testing of Structural Change, Causality Analysis, ARCH Models, Panel Unit Root And Panel Cointegration, Forecasting; Univariate and Cointegrated System, Testing Forecasting Accuracy, Exogeneity – Weak, Strong and Supper- Analysis

**Recommended Books:**

1. Box, Jenkins and Reinsel (2008), Time Series Analysis- Forecasting and Control, Prentice Hall.
2. Enders, W. (2010), Applied Econometrics Time Series. John Wiley & Sons.
3. Hamilton, J. D., (1994), Time Series Analysis, Princeton University Press.

**Other Books**

1. Anderson (1979), Forecasting, North-Holland Company.
2. Chatfield (1996), The Analysis of Time Series- An Introduction, Chapman-Hall.
3. Clements and Hendry (1998), Forecasting Economic Time Series, Cambridge University Press.
4. Franses (1998), Time Series Models for Business and Economic Forecasting, Cambridge University Press.
5. Ghysels and Osborn (2001), The Econometric Analysis of Seasonal Time Series.
6. Greene (2007) Econometric Analysis, 6th Ed., Cambridge University Press.
7. Harris, R. and Sollis, R. (2003). Applied Time Series Modeling and Forecasting. John Wiley & Sons. UK.
8. Hendry (1995), Dynamic Econometrics, Oxford University Press.
9. Hendry and Morgan (1997), The Foundations of Econometric Analysis, Cambridge University Press.
10. Hendry and Nielsen (2007), Econometric Modeling A Likelihood Approach, Princeton University.

11. Johansen (1995), Likelihood-Based Inference in Cointegrated Vector Autoregressive Models, Oxford University Press.
12. Johnston and DiNardo (1997), Econometric Methods, McGraw- Hill / Irwin.
13. Juselius (2006), The Cointegrated VAR Model, Methodology and Applications, Oxford University Press.
14. Maddala, G.S. and Kim, L. (1998), Unit Roots, Cointegration, and Structural Change. Cambridge University Press.
15. Patterson (2000), An Introduction to Applied Econometrics, Palgrave Macmillan.
16. Richard Harris and Robert Sollis (2003), Applied Time Series Modelling and Forecasting, John Wiley & Sons.
17. Wooldridge (2009), Econometrics: A Modern Approach, 4th Ed., South – Western Publisher.

**ETS-800 PANEL DATA ECONOMETRICS (credits 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline:**

Introduction to Panel Data, One-Way Error Component Regression Model, Two-Way Error Component Regression Model, Test of Hypotheses with Panel Data, Heteroscedasticity and Serial Correlation in the Error Component Model, Seemingly Unrelated Regressions with Error Components, Simultaneous Equations with Error Components, Dynamic Panel Data Models, Unbalanced Panel Data Models, Panel Unit root, Panel Cointegration.

**Recommended Books:**

1. Arellano, M. (2003), Panel Data Econometrics, Oxford University Press.
2. Baltagi, B.H. (2006), Panel Data Econometrics: Theoretical Contributions and Empirical Applications, Emerald Group Publishing.
3. Hsiao, C. (2003), Analysis of Panel Data, Cambridge University Press.

**Other Books**

1. Frees (2004), Longitudinal and Panel Data, Cambridge University Press.
2. Wooldridge (2008), Econometric Analysis of Cross Section and Panel Data, 2nd Ed., MIT Press.

**ETS-810 FINANCIAL ECONOMETRICS .....(CREDITS HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Understanding Financial Data, Asset Returns and their Empirical Properties, Linear Regression Tests of Financial Models, Efficient portfolio and Capital Asset Pricing Model, Multifactor Pricing Models, Intertemporal Equilibrium and Stochastic Discount Models, Simulation Methods for Financial Derivatives, Linear Time Series Methods, An Introduction to Volatility, Risk and Volatility Models,

Value at Risk, ARCH Models, GARCH and EGARCH Models, Forecast and Management of Market Risks, Modeling Long-Run Relationships in Finance, Trading Strategies and High Frequency Data Review.

### **Recommended Books:**

1. Brooks, Chris (2008), Introductory Econometrics for Finance, 2<sup>nd</sup> Ed., Cambridge University Press.
2. Campbell, J. Y., A. W. Lo, and A. C. MacKinlay (1997), The Econometrics of Financial Markets, Princeton University Press.
3. Cuthbertson, K., and Nitzsche, D. (2005), Quantitative Financial Economics, John Wiley & Sons.

### **Other Books**

1. Cuthbertson, K., S. G. Hall and M.P. Taylor (1992), Applied Econometric Techniques, Philip Allan.
2. Davidson, R. and J. G. MacKinnon (1993), Estimation and Inference in Econometrics, Oxford University Press, Oxford.
3. Davidson, R. and J. G. MacKinnon (2004), Econometric Theory and Methods, Oxford University Press, Oxford.
4. Favero, C.A. (2001), Applied Macroeconometrics, Oxford University Press, Oxford.
5. Goldberger, A. S. (1991), A Course in Econometrics, Harvard University Press, Cambridge, MA.
6. Gourieroux, C. and J. Jasiak (2001), Financial Econometrics, Princeton University Press.
7. Hamilton, J. D. (1994), Time Series Analysis, Princeton University Press.
8. Judge, G.G., W.E. Griffiths, R.C. Hill, H. Lutkepohl, T.-C. Lee (1995), The theory and Practice of Econometrics, Wiley & Sons, New York.
9. Mills, T. C. (1999), The Econometric Modelling Of Financial Time series, 2nd Ed., Cambridge University Press.
10. Rachev, S.T., Mittnik, S., Fabozzi, F.J., Focardi, S.M., Teo, J. (2007), Financial Econometrics: From Basics to Advanced Modeling Techniques, John Wiley & Sons.
11. Taylor, S. J. (2005), Asset Price Dynamics, Volatility, and Prediction, Princeton University Press.
12. Tsay, R. S. (2005), Analysis of Financial Time Series, John Wiley & Sons.
13. Verbeek, M. (2004), A Guide to Modern Econometrics, Wiley & Sons.

## **ETS-820 SPATIAL ECONOMETRICS.....(CREDITS HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

### **Course Outline:**

Introduction to spatial econometrics: Spatial Econometrics, Spatial Dependence, Spatial Heterogeneity, Linear Regression Model with Spatial Data, Spatial Autoregressive Models: First-Order Spatial AR Model, Mixed Autoregressive Model, Spatial Error Model, General Spatial Model, Bayesian Spatial Autoregressive Models: Bayesian Regression Model, Bayesian FAR Model, other Spatial Autoregressive Models, Locally Linear Spatial Model: Spatial Expansion, DARP Models, Non-Parametric Locally Linear Models, Limited Dependent Variable Models: Gibbs Sampler, Heteroscedasticity Models, VAR and Error Correction Models.

**Recommended Books:**

1. Anselin, L., Florax, R.J.G.M. and Rey, S.J. (2004), *Advances in Spatial Econometrics: Methodology, Tools and Applications*, Springer.
2. Arbia, G. and Baltagi, B.H. (2009), *Spatial Econometrics: Methods and Applications*, Springer.
3. Haining, R. (2003), *Spatial Data Analysis: Theory and Practice*. Cambridge University Press: New York.
4. LeSage, J.P. and Pace, R.K. (2009), *Introduction to Spatial Econometrics*, CRC Press.

**Other Books**

1. Fischer, M.M. and Getis, A. (2010), *Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications*, Springer.

**ETS-830 NON-PARAMETRIC AND SEMI PARAMETRIC ECONOMETRICS(CREDITS HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

The Empirical Distribution Function, Likelihood, Influence Functions, Jackknife and Bootstrap Confidence Intervals and Tests, Permutation Tests, Rank Tests, Bias-Variance Tradeoff, Cross- Validation, Kernel Density Classification and Estimation, Curse Of Dimensionality, Nonparametric Regression, Basis Expansions, Splines, and Penalized Regression, Quantile Regression, Nonparametric Approaches to Multiple Regressions, Generalized Additive Models, Nonparametric Analysis of Longitudinal Data.

**Recommended Books:**

1. Hagmann M. (2003), *Introduction to Nonparametric Econometrics*.
2. Li and Racine (2007), *Nonparametric Econometrics: Theory and Practice*.
3. Wayne W. Daniel, (1990)*Applied Nonparametric Statistics*. Duxbury Classic Series.

**Other Books**

1. Agresti, A. (1990), *Categorical Data Analysis*, John Wiley and Sons.
2. Conover, W.J. (1980), *Practical Nonparametric Statistics*, 2ndEd, John Wiley and Sons.
3. E. L. Lehmann, *Nonparametrics Statistical Methods Based on Ranks*.
4. Fan and Gijbels (1996), *Local Polynomial Modeling and Its Applications*, Chapman and Hall.
5. Gao (2007), *Nonlinear Time Series: Semiparametric and Nonparametric Methods*.
6. Green and Silverman (1994), *Nonparametric Regression and Generalized Linear Models*, Chapman and Hall.
7. Hollander, M. and D.A. Wolfe. (1999), *Nonparametric Statistical Methods*, 2ndEd. John Wiley and Sons.
8. Horowitz (1998), *Semiparametric Methods in Econometrics*.
9. Jianqing Fan and Qiwei Yao (2003), *Nonlinear Time Series: Nonparametric and Parametric Methods*.
10. Long, J.S. (1997), *Regression Models for Categorical and Limited Dependent Variables*. Sage.
11. Pagan and Ullah (1999), *Nonparametric Econometrics*.
12. Racine J.S.(2008), *Nonparametric Econometrics. A Primer*.
13. Song (2007), *Correlated Data Analysis: Modeling, Analytics and Applications*, Springer.
14. Thomas P. Hettmansperger, *Statistical Inference Based on Ranks*.
15. W.J. Conover (1999), *Practical Nonparametric Statistics*, 3rd Ed., Wiley.



16. Wand and Jones (1995), Kernel Smoothing, Chapman and Hall.
17. Yatchew A.(2003), Semiparametric regression for the applied econometrician .

**ETS-850 MULTIVARIATE ANALYSIS .....(CREDITS HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline:**

Introduction to Multivariate Methods & Fundamental Concepts, Multivariate Normal Distribution Theory, Distribution of Linear Function of Normal Variates, Distribution of Quadratic Forms, Wishart Distribution, Hotelling's  $T^2$  distribution, Confidence Regions and Simultaneous Confidence Intervals, Hypothesis Testing, MANOVA, Likelihood Ratio Test, Principle Component Analysis: Objectives, Analysis, Factor Analysis: Principle Factor Analysis , Canonical Correlation Analysis: Mathematical Development and Analysis, Discriminant Analysis: Estimation, Fisher's Linear Discriminant Function, Probabilities of Misclassification, Cluster Analysis: Probabilistic Formulation, Hierarchical Methods: Single Linkage, Complete Linkage, Average Linkage.

**Recommended Books:**

1. Anderson, T.W. (2003), An Introduction to Multivariate Statistical Analysis, John Wiley, New York.
2. Chatfield, C. and Collins, A.J. (1980), Introduction to Multivariate Analysis, Chapman and Hall, London.
3. Richard A. Johnson & Dean W. Wichern (1998), Applied Multivariate Statistical Analysis, Prentice Hall.

**Other Books**

1. Afifi, A. A. and Clark Virginia (2000), Computer Aided Multivariate Analysis, Lifetime learning publications, Belmont California.
2. Mardia, K.V., Kent, J.T. and Bobby, J.M. (1979), Multivariate Analysis, Academic Press, London.
3. Morrison, F. (1990), Multivariate Statistical Methods, McGraw Hill, New York.
4. R. Gnanadesikan (1997), Methods for data analysis of multivariate observations, 2nd Ed., John Wiley and Sons.

**ETS- 870 STATIC AND DYNAMIC OPTIMIZATION .....(CREDITS HOURS 3)**

**Pre requisite:** Nil

**Course Outline:** Basic mathematical tools, integration and differential equations, Qualitative theory, Control theory, Ramsey problem of optimal consumption, Dynamic programming, Lucas' model of endogenous growth, Stochastic models in discrete time, Discrete-time optimization, Overlapping-generations, Real-business-cycles, Stochastic models in continuous time, Stochastic differential equations and rules for differentials, Merton's model of growth under uncertainty, Stochastic dynamic control problems, Optimal saving under uncertainty.

**Recommended Books:**

1. Chang, Fwu-Ranq, Stochastic optimization in continuous time, Cambridge Univ. Press, 2004.
2. Sydsaeter, Knut, Peter Hammond, AtleSeierstad, and Arne Strom, Further Mathematics for Economic Analysis, Prentice Hall, 2008.

**ETS-880 OPERATIONS RESEARCH.....(CREDITS HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

Introduction; Linear programming and modelling; Simplex method; Sensitivity Analysis; Decision analysis; Game theory; Queuing systems; Optimization theory; Post-optimal analysis; Dynamic programming; Network Optimization models: Critical Path Method (CPM), PERT; Project Management with PERT/CPM; Simulation; Planning over Time, Uncertainty and Forecasting; Markov Decision Process; Operations Research Applications.

**Recommended Books:**

1. Hamdi A. Taha (2010), Operations Research: An Introduction, Cambridge University Press.
2. H. A. Eiselt and Carl-Louis Sandblom (2012), Operations Research: A Model-Based Approach, Springer texts in business and economics.
3. Frederick S. Hillier and Gerald J. Lieberman (2001), Introduction to Operations Research, 7th edition, McGraw Hill.

**OtherBooks**

1. Wayne L. Winston (2003), Operations Research: Applications and Algorithms, 4th edition,
2. R. Ravindran (2009), Operations Research Applications, CRC press.
3. Yasar A. Ozcan (2009), Quantitative Methods in Health Care Management: Techniques and Applications, 2nd edition.

**ETS-890 STRUCTURAL EQUATION MODELLING .....(CREDITS HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline:**

**Fundamentals of Structural Equation Modeling:** Basic concepts, Latent versus observed variables, Exogenous versus endogenous latent variables, The factor analytic model, The full latent variable model, General purpose and process of statistical modeling, The general structural equation model, Symbol notation, The path diagram, Structural equations, Nonvisible components of a model, Basic composition,

The formulation of covariance and mean structures. **Path Analysis:** Introduction, Path Diagrams, Rules for Determining Model Parameters, Parameter, Estimation, Parameter and Model Identification, Model-Testing and -Fit Evaluation, Example Path Analysis Model, Modeling Results, Testing Model Restrictions in SEM, Model Modifications. **AMOS:** Getting to Know the AMOS Program, Structure of Input Files for SEM Programs, Introduction to the AMOS Notation and Syntax, Introduction to the AMOS Notation, Introduction to the AMOS Notation and Syntax. **Confirmatory Factor Analysis:** What Is Factor Analysis? Factor Analysis Model, Identification, estimation, Model Evaluation, Modeling Results, and Testing Model Restrictions: True Score Equivalence. **Structural Regression Models:** What Is a Structural Regression Model? An Example Structural Regression Model, Modeling Results, Factorial Invariance across Time in Repeated Measure Studies. **Latent Change Analysis:** Measuring change in individual growth over time: The general notion, The hypothesized dual-domain LGC model, Modeling intra individual change, Modeling inter-individual differences in change, Testing latent growth curve models: A dual-domain model, The hypothesized model, Selected AMOS output: Hypothesized model, Testing latent growth curve models: Gender as a time-invariant predictor of change. **Mediation** : Introduction, Applications of the Mediation Model, Single Mediator Model, Single Mediator Model Details, Multiple Mediator Model, Path Analysis Mediation Models, Latent Variable Mediation Models, Longitudinal Mediation Models, Multilevel Mediation Models, Mediation and Moderation, Mediation in Categorical Data Analysis, Computer Intensive Methods for Mediation Models, Causal Inference for Mediation Models. **Moderation:** Introduction, Applications of the Moderation Model, Estimation, interpretation. **MIMIC Modeling:** Multiple Indicators Multiple Causes (MIMIC) model involves using latent variables that are predicted by observed variables. **Bootstrapping as an aid to non-normal data:** Basic principles underlying the bootstrap procedure, Benefits and limitations of the bootstrap, Procedure, Caveats regarding the use of bootstrapping in SEM Modeling with AMOS Graphics, The hypothesized model, Characteristics of the sample, Applying the bootstrap procedure, Selected AMOS output, Parameter summary, Assessment of normality, Statistical evidence of non-normality, Statistical evidence of outliers, Parameter estimates and standard errors, Sample ML estimates and standard errors, Bootstrap ML standard errors, Bootstrap bias-corrected confidence intervals

### **Recommended Books:**

1. A First Course in Structural Equation Modeling Second Edition Tenko Raykov, Michigan State University and George A. Marcoulides California State University, Fullerton
2. Introduction to Statistical Mediation Analysis by David P. Mackinnon
3. Structural Equation Modeling with AMOS, SECOND EDITION, Barbara M. Byrne
4. Principles and Practice of Structural Equation Modeling, Third Edition, Rex B. Kline

## **ETS-622 SAMPLING DESIGN AND ANALYSIS.....(CREDITS HOURS 3)**

**Pre requisite:** ETS – 620 Quantitative Foundation for Econometrics

### **Course Outline:**

Basic Concepts of population, Target Population, A sample, Sampling frame, Probability and non-probability sampling, Design of the survey, Sampling techniques such as random sampling, stratified random sampling, systematic sampling, Areas aping etc. Estimation of ratio and regression estimators, Comparisons of various estimators, Response and non-response errors and imputation.

### **Recommended Books:**

1. Cochran, W.G. (1997), Sampling Techniques, John Willey and Sons.
2. Mukhopadhaya, P. (1998), Theory and Methods of Survey Sampling, Prentice Hall of India.
3. Kish, L. (1992). Survey Sampling, John Wiley, New York.

### **Other Books**

1. Sharon, L. Lohr. (1999), Sampling Designs and Analysis, Duxbury Press.
2. Raj, D. & Chandhok, P. (1998), Sample Survey Theory, Narosa Publishing House, New Delhi.
3. Singh, R. and Singh N, (1996), Elements of Survey Sampling, Kulwar Academic Publisher, Dodrecht.
4. Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985), Sampling Theory of Survey with Application. Iowa State University Press.

## **ETS-624 NUMERICAL ANALYSIS AND STOCHASTIC SIMULATIONS .....(CREDITS HOURS 3)**

**Pre requisite:** ETS-620 Quantitative Foundation for Econometrics

### **Course Outline:**

General Issues in Simulation, Model Building; Bias-Variance Tradeoff; Model Selection; Fisher Information Matrix. Stochastic Simulations: Generating Random Variables, Simulating Normal, Gamma and Beta Random Variables. Generating Random Variables From Failure Rates. Simulating Multivariate Distributions, MCMC Methods and Gibbs Sampler, Simulating Random Fields. Comparison of Algorithms to Generate Random Variables. Resampling Methods. Variance Reduction. Discrete-Event Systems and Simulations. Simulation-Based Optimization; Regenerative Systems; Brief Introduction to SPSA. Simulation-Based Optimization by Gradient-Free Methods (FDSA And SPSA); Common Random Numbers. Simulation-Based Optimization by Gradient-Based Methods (IPA/LR and Sample Path). Markov chain Monte Carlo. Optimization Using Monte Carlo Methods, Simulated Annealing for Optimization. Solving Differential Equations by Monte Carlo Methods Input Selection and Optimal Experimental Design for Linear Models. Input Selection and Optimal Experimental Design for nonlinear Models. Statistical Methods for Selecting the Best Option Using Simulation Runs.

### **Recommended Books:**

1. Christopher, Z. Mooney. (1997), Introduction to Monte Carlo Methods, Sage Publications.
2. Gentle, James E. (2003), Random Number Generation and Monte Carlo Methods, Springer.
3. Morgan, B. J. T. (1984), Elements of Simulation, Chapman and Hall.

**Other Books**

1. Fishman, G.S. (1996), Monte Carlo: Concepts, Algorithms, and Applications, Springer.
2. Chen, Ming-Hui, Shao, Qi-Man, Ibrahim, Joseph G. (2000), Monte Carlo Methods in Bayesian Computation, Springer.
3. M. E. J. Newman and G. T. Barkema. (1999), Monte Carlo Methods in Statistical Physics, Oxford University Press.
4. Neal Madras. (2000), Monte Carlo Methods, AMS Books.
5. Ripley B.D. (1987), Stochastic Simulations, John Wiley & Sons.
6. Ross, S. M. (2002), Simulation, Academic Press.
7. Rubinstein, R.Y. (1981), Simulation and the Monte Carlo Method, John Wiley & Sons.

**ETS-626 ADVANCED PROBABILITY THEORY .....(CREDITS HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Probability Review, Convergence of Sequences, Characteristics Function, Transformation of Random Variables, Discrete and Continuous Probability Models, Pearsonian System of Distributions, Cheybyclev-Hermetic Polynomials, Gram-Charlier Series, Order Statistics and Their Sampling Characteristics, Distribution of Extreme Values and Noncentral chi, t and F Distributions.

**Recommended Books:**

1. Stirzaker, D. (1999), Probability and Random Variables, Cambridge University Press, Cambridge.
2. Stuart, A., and Ord, K. (1998), Advanced Theory of Statistics Vol. I, Charles Griffin and Co.
3. Feller, W. (1968), Introduction to Probability Theory and its Applications Vol. 1, John Wiley and Sons.

**Other Books**

1. Khan, M.K. (1994), Probability Theory with Applications, Ilmi Kitab Khanna, Lahore, Pakistan .
2. Rohatgi, S. (1976), Introduction to Probability Theory, McGraw Hill.

**ETS-630 ADVANCED STATISTICAL INFERENCE .....(CREDITS HOURS 3)**

**Pre requisite:** ETS-620 Quantitative Foundations for Econometrics

**Course Outline:** Comparison of Point Estimators: The framework for parametric inference, Mean Square Error, Unbiased estimators, Sufficiency, Factorisation Theorem, Minimal sufficiency. Distribution Theory: Conditional distributions and expectations, Central Limit Theorem. Minimum variance unbiased estimation: Rao-Blackwell Theorem, Exponential Families, Lehmann-Scheffé Theorem. Likelihood, Fisher Information and the Cramér-Rao Inequality: The Efficient Score, Fisher Information, Cramér-Rao lower bound, Attainment of the Cramér-Rao lower bound, Multi-dimensional Cramér-Rao inequality. Maximum likelihood

estimators: Elementary properties, Consistency and asymptotic efficiency. Hypothesis Testing: Definitions, The Neyman-Pearson lemma, Tests of composite hypotheses, Likelihood ratio tests. Confidence Sets: Relationship with hypothesis tests, pivotal quantities.

**Recommended Books:**

1. Mood, A.M., Graybill, F.A. and Boes, D.C.: Introduction to the Theory of Statistics, McGraw Hill,
2. DeGroot, M.H. and Schervish, M. J.: Probability and Statistics, Addison-Wesley, 2002.
3. Casella, G. and Berger, R.L.: Statistical Inference, 2<sup>nd</sup> ed., Duxbury Press, 2001.
4. Silvey, S.D.: Statistical Inference, Chapman & Hall, 1978.
5. Statistical Theory: B W Lindgren, Collier MacMillan

**ETS-634 BIG DATA ANALYSIS .....(CREDITS HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

What Big Data Means? When Do You Have a Big Data Problem? Characteristics, Sources and importance of Big Data Analysis. Compare and contrast the roles of: data-at-rest processing, data-in- motion processing, data-warehouse processing, and contextual search. Tools available for Big Data Analytics. Ingesting and integrating data, Storage and compute platforms. **Presentation and visualization:** Understand the purpose of various types of data visualization, ranging from infographics to visual analytics, Apply design principles to design visualization techniques, Use visualization tools to perform visual analysis. **Algorithms and analytics:** Identify Big Data problems that require Statistical Techniques, Apply the Statistical Techniques correctly on Big Data Problems, Understand the properties of these techniques, and the role of assumptions, Interpret the conclusions properly, Programme in “R”, Neural nets, Support vector machines. **Understand methods from machine learning:** Classification and regression trees, decision trees and decision forests, Random forests, clustering and topic modelling, logistic regression and deep learning, matrix factorization and time series analysis & spatio-temporal event modelling, Boosting, Bagging, Spike and slab regression? Penalized regression (*e.g.*, the lasso, lars, and elastic nets). **Apply the methods in advanced techniques:** text analytics, image and video analytics and recommendation, Apply the techniques in large scale use-cases. Security and privacy.

### Recommended Books:

1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer-Verlag, 2 edition, 2009.
2. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. An Introduction to Statistical Learning with Applications in R. Springer, New York, 2013.
3. Graham Williams. Data Mining with Rattle and R. Springer, New York, 2011.
4. Xindong Wu and Vipin Kumar, editors. The Top Ten Algorithms in Data Mining. CRC Press, 2009.
5. Bill Howe. Introduction to data science. Technical report, University of Washington, 2013.
6. W. N. Venables and B. D. Ripley. Modern Applied Statistics with S. Springer-Verlag, New York, 4 edition, 2002.
7. Varian, Hal R. "Big data: New tricks for econometrics." The Journal of Economic Perspectives (2014): 3-27.
8. Einav, Liran, and Jonathan D. Levin. The data revolution and economic analysis. No. w19035. National Bureau of Economic Research, 2013.

### ETS-643 FORECASTING METHODOLOGY .....(CREDITS HOURS 3)

**Pre Requisite:** ETS-640 Econometrics Methods

#### Course Outline:

**An introduction to different forecasting methods:** Guessing, Extrapolation, Leading indicators, Surveys, Time-series models, Econometric systems. **Forecasting in univariate processes:** Stationary stochastic processes, Stochastic non-stationarity processes, deterministic non-stationarity, Forecasting fractionally integrated processes. **Forecasting with non-linear models:** Regime Switching Models SETAR and MS-AR models, Forecasting with ARCH errors. **Forecasting in cointegrated systems:** Systems for non-stationary variables, Forecasting based on the VMA representation, Forecasting based on the VAR. **Forecasting using leading indicators. Forecasting with large-scale macroeconomic models:** The economic system and forecasting models. **Taxonomy of forecast errors:** Open systems, Sources of forecast uncertainty: Parameter change, Model mis-specification, Estimation uncertainty, Variable uncertainty, Error accumulation, Large-scale model evaluation techniques. **Combining forecasts:** The combination of forecasts: The regression method, The variance-covariance approach, Serial correlation in the combining equation. Forecast encompassing: Encompassing, Forecast encompassing and conditional efficiency, Invariance of forecast encompassing tests. **Testing forecast accuracy:** Testing for predictive failure, Box-Tiao test: scalar case with multiple forecast periods, Box-Tiao test: a single horizon for a vector process, Box-Tiao test: multiple horizons for a vector process. Tests of comparative forecast accuracy: Encompassing tests, Variance-based tests. **Forecasting practice on M3 competition.**

### Recommended Books:

1. Understanding Economic Forecast by David F. Hendry and K. Anders Ericsson (2003).
2. Forecasting Non-Stationary Economic Time Series by Michael P. Clements and David F. Hendry (2001).
3. Forecasting Economic Time Series By Michael P. Clements And David F. Hendry (1998).
4. Forecasting: Methods and Applications, 3rd Edition by Spyros G. Makridakis, Steven C. Wheelwright, Rob J. Hyndman (1998).

**Others**

Makridakis, S., Hibon, M. (2000), The M3-competition: results, conclusions and implications. International Journal of Forecasting, 16, 451-76.

**ETS-835 BAYESIAN ECONOMETRICS .....(CREDITS HOURS 3)**

**Pre Requisite:** ETS- 640 Econometrics Methods

**Course Outline:**

The overall aim of this subject is to familiarize students with essential concepts and techniques used in Bayesian inference. The course will provide students with the necessary programming skills to implement Bayesian estimation and inference for econometric model using suitable software. The formal course description is:

Foundations of Probability, Bernoulli & Binomial RV's, Conventional Inference for Surveys, From Data to Densities, Prior to Posterior updating in Beta-Binomial Model, Assessment of Binomial Models, Bayesian Econometrics Multiple Matches, Match Binomial Model to Real World, Bayesian Econometrics Testing Independence, Bayesian Econometrics Chi-Square Test, Review of Normal Distribution, Bivariate Normal Distribution, Bayesian calculations for normal data, normal prior, Bayesian Calculations with Normal-Gamma Priors, Fundamental Formulas for Bayesian & Conventional Inference with IID Normal, Principles for Applications of Normal Inference on Real Data, IID Normal Inference with Real Data, Bayesian inference using IID Normal Models for real Data, Introduction to Empirical Bayes, Empirical Bayes for Panel IID Normal Data, Empirical Bayes & Stein Estimation, Empirical Bayes on Recession Probabilities and Fire Alarms, Empirical Bayes Quality Control, Empirical Bayes in Regression Models, Hierarchical Bayes and Gibbs Sampler.

**Recommended Books:**

1. Asad Zaman (1996) Statistical Foundations of Econometric Techniques
2. William M. Bolstad (2007) Introduction to Bayesian Statistics
3. Sharon B. McGrayne (2011) The Theory That Would Not Die. Yale University Press.
4. Gary Koop (2003) Bayesian Econometrics: John Wiley and Sons
5. Lancaster, T. (2004). An Introduction to Modern Bayesian Econometrics, published by Blackwell.
6. Edward Greenberg, (2008). Introduction to Bayesian Econometrics, Cambridge University Press
7. Geweke, John (2005): Contemporary Bayesian Econometrics and Statistics, John Wiley & Sons.
8. Koop, Gary M., Dale J. Poirier and Justin L. Tobias (2007): Bayesian Econometric Methods, Cambridge University Press.
9. David L., Christopher J., Nicky B., Andrew T., David S. (2007) A Practical Introduction to Bayesian Analysis



## **ETS-635 ASYMPTOTIC THEORY AND SIMULATIONS .....(CREDITS HOURS 3)**

**Pre Requisite:** ETS – 640 Econometric Methods,  
ETS- 620 Quantitative Foundations for Econometrics

### **Course Outline:**

The purpose of this course is to enable students to understand what asymptotic theory is and how it is used to design and analyze the statistical tests and estimators. However, asymptotic could fail to perform for two reasons (a) asymptotic theory is the large sample theory and could not be very good in small/medium sizes (b) the asymptotic theory could be sometimes too complicated to be analytically solved. Simulations could serve as a substitute for the asymptotic theory where it fails to perform. The second half of the course is about simulation, where, the students will be taught how to solve econometric problems using simulation methods.

### **Asymptotic Theory**

This part will cover selected chapters from William H Greene (Econometric Analysis), Johnston and Dinardo (Econometric Methods) and Peter Kennedy (A Guide to Econometrics) including topics: Maximum likelihood principal and applications, Properties of maximum likelihood estimators, Wald, Lagrange Multiplier and Likelihood Ratio tests, Large sample theory, Central Limit theorem, Law of Large Numbers, Convergence in Probability, Convergence in Distribution, Convergence of Function of Random Variables, Large Sample Properties of Least Square, Instrumental Variables and GLS, More on Maximum Likelihood, Estimating Asymptotic Variance of Maximum Likelihood Estimator, 2 step maximum likelihood.

### **Simulations**

This part will cover what is simulation? Simulating mean, median, mode and matching it with theoretical properties of the random variables, Central Limit Theorem: Verification by simulations. Properties of OLS using Monte Carlo simulations: Unbiasedness, and Consistency; biasedness in overspecified and underspecified models. Testing Correlation: Pearson and Rank Order Correlation, Computing Simulated Critical Values and Power of correlation tests, comparison of power of the two tests and choice of test. Introduction to MATLAB: How to write function and program files, loops, matrices, conditions, Using MATLAB to simulate unit root tests and cointegration tests, Introduction to R programming: comparison of features of MATLAB and R. Using built in packages of R  
Helping Material: Excel Lecture Notes, MATLAB user manual, R-user manual

### **Recommended Books:**

1. Greene (2007) Econometric Analysis, 6th Ed.
2. Johnston and DiNardo (1997), Econometric Methods
3. Kennedy (2003) , A Guide to Econometrics, 4th ed., Blackwell.

**ETS-722 FINANCIAL ECONOMICS.....(CREDITS HOURS 3)**

**Pre Requisite:** Nil

**Course Outline:**

Foundations of Risk Analysis; Measuring Risk; Application of Risk Analysis; the Portfolio Selection Problem; the Capital Asset Pricing Model; the Arbitrage Pricing theory; Common Stocks; Preferred Stocks; Bonds; Capital Structure theories; the goal of the Firm; the Economic Evaluation of Investment Proposals; the traditional Mundell Fleming Model; the Dynamic- Optimizing model with Price Flexibility; Intertemporal Model with Price Stickiness; Currency Crises; External Crises: Fiscal Policies and Taxation in the Open Economy; International Capital Flows under Asymmetric Information; and International Growth Convergence.

**ETS-625 ELEMENTS OF STATISTICAL LEARNING .....(CREDITS HOURS 3)**

**Pre Requisite:** Nil

**Course Outline:**

Introduction to Modern Statistical Learning Approaches, Summary of different methods we will cover in the course, what is Statistical Learning?, Inference vs. Prediction, Supervised vs. Unsupervised Learning Problems ,Regression vs. Classification, Introduction to R, Basic Commands, Graphics, Indexing Data, Loading Data, Assessing the Accuracy of a Statistical Learning Method, Less Flexible vs. More Flexible Methods, Bayes Classifier,Bias/Variance ideas, Review of Linear Regression, Linear Regression, Logistic Regression, Using the Logistic Function for Classification, Linear Discriminant Analysis, Logistic Regression and LDA, Resampling Methods (Finite Sample Theory), The Cross-Validation and the Bootstrap (Finite Sample Theory), kNN, Best Subset Regression, Shrinkage and Dimension Reduction Methods, Shrinkage Methods, General Linear Methods, Generalized Additive Models, Polynomial Regression, Splines and GAM, Tree Methods, Bagging and Boosting, Tree Methods,Clustering Methods.

**Reference Books:**

1. Elements of Statistical Learning by James, Witten, Hastie, and Tibshirani
2. Econometrics by Baltagi , 2<sup>nd</sup> Edition , Springer Verlag (1999)
3. An Introduction to Statistical Learning with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, Springer Science&Business Media New York (2013)

## ETS-745 AGENT BASED MODELING .....(CREDITS HOURS 3)

**Pre Requisite:** Nil

### **Course Outline:**

This course is designed to understand wide variety of complex adaptive systems using agent based modelling. During the course, power of ABM in understanding the real world behavior amenable to complex system analysis will be explored. This course will help students to learn studying economic and social phenomenon through ABM. [NetLogo](#) programming language which is developed at [Northwestern University](#) will be used for building ABM. No programming background/knowledge is required for student to register the course.

Why do we need to understand agent Based modelling? What Is Agent-Based Modeling? Creating Simple Agent-Based Models, Complex Adaptive Systems, Introduction, logic and need of Modelling, Exploring and Extending Agent-Based Models, Creating Agent-Based Models, The Components of Agent-Based Modeling, Analyzing Agent-Based Models, Verification, Validation, and Replication, Advanced Topics and Applications, Sensitivity, Uncertainty, and Robustness Analysis, Tragedy of the Commons, Networks, Diffusion of Innovation, Fads and Fashion, Collective Action, Labor market Job search and wage distribution, Growth Theories, Stock Market.

### **Recommend texts:**

1. Wilensky, U., & Rand, W. (2015). *An introduction to agent-based modeling: modeling natural, social, and engineered complex systems with NetLogo*. MIT Press. (IABM)
2. Hamill, L., & Gilbert, N. (2015). *Agent-Based Modelling in Economics*. John Wiley & Sons. (ABME)
3. Jansen M. A., (2013) Introduction to Agent Based Modelling [eBook](#) (ABMMJ)

### **Additional Resources:**

1. Railsback, S. F., & Grimm, V. (2011). *Agent-based and individual-based modeling: a practical introduction*. Princeton university press. (ABIM)
2. Tesfatsion, L. (2002). Agent-based computational economics: Growing economies from the bottom up. *Artificial life*, 8(1), 55-82.
3. Tesfatsion, L., & Judd, K. L. (Eds.). (2006). *Handbook of computational economics: agent-based computational economics* (Vol. 2). Elsevier.
4. Ehrentreich, N. (2007). *Agent-based modeling: The Santa Fe Institute artificial stock market model revisited* (Vol. 602). Springer Science & Business Media. (ABMSF)

### **Online- Resources:**

1. NetLogo software package and community models are available <https://ccl.northwestern.edu/netlogo/>
2. The videos are freely available on YouTube (<https://www.youtube.com/channel/UCCqW98YIsST73jnB3WuUjbw>).
3. The Santa Fé institute also offers ABM and related courses (<https://www.complexityexplorer.org/courses>).
4. ABM by TU Delft (<http://wiki-app1.tudelft.nl/bin/view/Education/SPM955xABMofCAS/Spm4530>).
5. Other great resources are: the [journal of artificial societies and social simulation](http://jasss.soc.surrey.ac.uk/JASSS.html) (<http://jasss.soc.surrey.ac.uk/JASSS.html>),
6. A platform (<https://www.openabm.org/on>) which free working models are posted.
7. Agent Based Computational Economics: <http://www2.econ.iastate.edu/tesfatsi/afinance.htm> (ABCE)

# **M.PHIL ECONOMETRICS**

**Academic Program**

Total Credit Hours: 39

Course Work: 27

Thesis: 12

Duration: 2 Years

Total Courses: 9

Core Courses: 7 (First Semester: 4, Second Semester: 2, Third Semester, 1)

Elective Courses: 2 (Second Semester: 2)

Note: A student will qualify for thesis if he/she attains minimum 3 CGPA in course work after completion of 2<sup>nd</sup> semester (excluding Research Methodology).

### **Program Structure Semester Wise**

<b>1<sup>st</sup> Semester (Fall)</b>	<b>2<sup>nd</sup> Semester (Spring)</b>	<b>3<sup>rd</sup> Semester (Fall)</b>	<b>4<sup>th</sup> Semester (Spring)</b>	
<b>ETS-600 Microeconomic Theory</b> (3 credit hours)	<b>ETS-771 Applied Econometrics</b> (3 credit hours)	<b>Research Methodology</b> (3 credit hours)	<b>Thesis</b> (9credit hours)	
<b>ETS-610 Macroeconomic Theory</b> (3credit hours)	<b>ETS-638 Data Visualization</b> (3 credit hours)			
<b>ETS-620 Quantitative Foundation for Econometrics</b> (3 credit hours)	<b>Elective I</b> (3 credit hours)	<b>Thesis</b> (6 credit hours)		
<b>ETS-640 Econometrics Methods</b> (3 credit hours)	<b>Elective II</b> 3 credit hours			
<b>12 Credits</b>	<b>12 Credits</b>	<b>9 Credits</b>		<b>9 Credits</b>

**Core Course Contents**

**ETS-600: MICROECONOMIC THEORY ..... (CREDIT HOURS 3)**

**Pre Requisite:** Nil

**Course Outline:**

Theory of Consumer Behaviour; Theory of Firm; Market Equilibrium; Uncertainty and Information Asymmetry. The theory of consumer behavior includes: Direct and Indirect Utility Functions, Derivation of Marshallian and Hicksian Demand Curves; Consumer Surplus. Theory of Firm includes constrained optimization of Production, Cost and Profit Functions; Derivation of Input Demand Functions, Returns to Scale, Perfect and Imperfect Market Competition. Game theoretic concepts are discussed with reference to Oligopolistic Markets.

## ETS- 610: MACROECONOMIC THEORY..... (CREDIT HOURS 3)

**Pre requisite:** Nil

### **Course Outline:**

Introduction to Classical Economics-Utopian world of Demand and Supply, Quantity theory of money, Why supply and demand does not work in the labor market – Efficiency Wage Theories, Factors that led to Great Depression, Nonexistent demand and supply model, Household debt, Bubble in the assets market, Keynesian Economics,-Wage – Price rigidities and malfunctioning of demand – supply model, Role of money in economic activity, Government role as a leader in investment activities, Chicago plan and Islamic Chicago Plan. Post Keynesian Economics and the first Neo-Classical synthesis, Convergence and stability debate, Monetarists counter revolution, Redefining role of money, New classical economics, Rational expectations hypothesis, Policy irrelevance proposition, Macroeconomic modeling based on microeconomic foundations, New Keynesian Economics and the second Neo-Classical synthesis: The Era of Great Moderation, Rational expectations and micro foundations as norms in macroeconomics, Wrong perception of the role of money, Interest rate as monetary policy instrument despite its limited role, DSGE models and neglecting the distributional issues, , Inflation targeting regime, How did economists get it wrong, Misperception of the role of money: Werner’s theory, Limitations of interest rate targeting, Misuse of rational expectations hypothesis, Monopoly of private banks and money creation process, Explaining bubble as great moderation, Financial crisis and Great Recession, Fiscal austerity in Europe, Role of free trade in European crisis, Ideological battle in Macroeconomics.

### **Recommended Books:**

1. Romer, D. (2011), Advanced Macroeconomics. McGraw-Hill.
2. William M. Scarth (1988) Macro Economics. An Introduction to Advanced Methods.
3. Blanchard and Fischer (1989), Lectures on Macroeconomics. MIT Press.
4. Sargent, Thomas (1987), Dynamic Macroeconomics Theory. Harvard Univ. Press.

### **Other Books**

1. Obstfeldt, M. and K. Rogoff (1996). Foundations of International Economics. MIT Press.
2. Barro, R. and X. Sala-i-Martin (1995). Economic Growth. McGraw-Hill .
3. Sorensen, P.B. and Whitta-Jacobsen, H. J. (2005), Introducing Advanced Macroeconomics: Growth and Business Cycles. McGraw Hill.
4. Heijdra, B. and Ploeg, F. (2009), The foundations of Modern Macroeconomics. Oxford University Press.

### **Reading Material**

1. Winning Ideas: Lessons from Free Market Economics. Alkire, Sabina and Ritchie, Angus(2007), OPHI Working Paper No. 6.
2. Efficiency Wage Hypothesis – the case of Pakistan by Zaman, Asad and Syed Kanwar Abbas, (2005), Pakistan Development Review, Vol 44 number 4, 1051-1066
3. A Quick Refresher Course in Macroeconomics by N. Gregory Mankiw, *Journal of Economic Literature* (Dec 1990).
4. Revolution and Evolution in 20<sup>th</sup> Century Macroeconomics by Michael Woodford, Princeton, 1999.
5. Gordon, Robert J. "What Is New-Keynesian Economics?" *Journal of Economic Literature* 28, no. 3 (September 1990): 1115-71.
6. Keynes, John Maynard. *The General Theory of Employment, Interest, and Money*. 1936.
7. “The Counter-Revolution in Monetary Theory” (1970) by Milton Friedman, IEA Occasional Paper no. 33.

**ETS-620: QUANTITATIVE FOUNDATION FOR ECONOMETRICS ..... (CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

Arbitrary Ranking ,Sorting, Ranking and Percentiles Concept and importance of Sorting, Ranking and Percentiles , REPRESENTING: (Mean, Median and Mode), Mean, Median and Mode, Measures of Spread, and Outliers Various measures of spread are discussed like IQR Standard Deviation, Measures of Spread and Outliers, Boxplots Histograms Bivariate, Relationships , Comparison of Visual graphics. Probability, Random Variables and Probability Distribution, Distribution Functions of Random Variables, General Notion of Expectation, Stochastic Processes, Limit theorems, Statistical Inference, Properties of Estimators, Estimation Methods, Hypothesis Testing and Confidence Regions, Measures of Spread, and Outliers various measures of spread are discussed like IQR Standard Deviation, The Introduction to Econometric Modelling, Statistical Models in Econometrics. The Gauss Linear Model, The Linear Regression Model-Specification, Estimation and Testing, The Dynamic Linear Regression Model, Random sampling, Bernoulli sequence, Discrete Random Variable, Continuous RV, Expectations, Moments and MGF, Central Limit theorem

**Recommended Books**

1. Zaman, Asad. (2016), Introduction to Statistics an Islamic Approach.
2. Mood, A.M., Graybill, F.A. and Boes, D.C. Introduction to the Theory of Statistics 3<sup>rd</sup> edition
3. Freedman, David, Robert Pisani, and Roger Purves. *Statistics*. 4<sup>th</sup> Edition, Norton, 2007.
4. OpenIntro Statistics – free download from: <https://www.openintro.org/stat/>
5. The Cartoon Guide to Statistics 1st Edition by Larry Gonick, Woollcott Smith
6. Intro Stats (2nd Edition) by Richard D. De Veaux, Paul F. Velleman , David E. Bock
7. Spanos, A.(1986), Statistical Foundations of Econometric Modelling, Cambridge University Press.
8. Hogg, R.V., and Craig, A.T. (2005), Introduction to Mathematical Statistics, 5<sup>th</sup> Ed., Macmillan.
9. Mittelhammer, R.C. (2001), The Mathematical Statistics for Economics and Business, Springer.

**Other Books**

1. Herman J. Bierens, Introduction to the Mathematical and Statistical Foundations of Econometrics, Cambridge University Press.
2. Orley Ashenfelter, Phillip B. Levine, David J. Zimmerman (2006), Statistics and Econometrics: Methods and Applications, John Wiley & Sons.

**ETS-640: ECONOMETRIC METHODS ..... (CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline**

Introduction, Stochastic Assumptions of Econometrics: Simple and Multiple Regression Analysis, Ordinary Least Squares, Maximum Likelihood and Method of Moments Estimators of Parameters of the Classical General Linear Regression Model, Estimation of Non-Linear Regression Models. Properties Linear and Non-Linear Models Regression Model, Heteroscedasticity, Autocorrelation, Multicollinearity and Endogeneity: Structure, Causes, Consequences, Tests and Estimation; Structure and Assumptions of Generalized Regression Models. Generalized Least Squares (GLS) and Feasible GLS methods and Its

Application, Two-Stage Least Squares (2SLS) and Instrumental Variables Least Squares (IVLS) estimators; Likelihood Ratio, Lagrange Multiplier and Wald tests; Model Selection: Choice of Variables and Choice of Functional Form, Hausman test; Testing Between Nested and Non-Nested Models; Qualitative Response Models; Dummy variables, Structural Shifts, Seasonality, Tests of Structural Shifts and Model Stability, Splines functions; Pooled Time Series and Cross Section Data: Structure, Assumptions and Estimation Techniques; Dynamic Models Involving Pooled Data and GMM Estimation; Simultaneous Equations: Structure, Identification and Estimation; Seemingly Unrelated Regression Models: Structure, Assumptions and Estimation; Limited Dependent Variables: Linear and Non-Linear Probability Models for Bivariate and Multivariate Models, Data Censoring and Selectivity Bias, Bayesian Econometrics.

**ETS-638: DATA VISUALIZATION..... (CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

Introduction Course Setup : What is data visualization? How can data be visualized, How can Data Visualization be used? When data visualization is suitable? Econometrics, Data Visualization and Data Science, Tools for data visualization for this course (R-Studio and R library ggplot2),

- Explorative Data Analysis Start tutorials,
- R Graphics I, R Graphics II, ggplot2
- Which Chart to use When
- Visualizing Categorical and Continuous data
- Time series visualization
- Scatter plots, residuals, regression discontinuity designs, nonlinearities
- Geospatial data visualization
- Advanced Charts: Treemap, Classification Trees, Heatmapsetc
- De-Clutter Graphs for Better Data Insights
- Making use of colors , facets, aesthetics, legends
- Interactive Data Visualization Using plotly/R shiny
- Dashboard Designs
- Telling Story With Data Visualization

Note: Additional resources like Excel for graphics can be used but main software to be used is R (ggplot2) as coding will help students in their data analytics in other courses as well. We shall mainly follow book Winston Chang and Nathan Yau (both use R language for data visualization).

### **Books**

1. Chang, W. (2013). R Graphics Cookbook. O'Reilly. <http://www.cookbook-r.com/>
2. Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis (2nd). Springer. <http://ggplot2.org/book/>;
3. Yau, N. (2011). Visualize This: The FlowingData Guide to Design, Visualization, and Statistics. Wiley. <http://book.flowingdata.com/>
4. Scott Berinato (2016) Good Charts: The HBR Guide to Making Smarter, More Persuasive Data Visualizations , Harvard Business Review

**ETS- 770: APPLIED ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline**

Estimation Methods; Maximum Likelihood and Generalised Method of Moments; Models of Consumption and Investment; Models Connecting Asset Market Data to Economic Aggregates and Models of the Underlying Sources of Economic Fluctuations; The Estimation of Demand and Supply Equations; Estimation of Production Relationship; Estimation of Pricing Equations in Finance and Labour Economics and Calibration of General Equilibrium Models, Monte Carlo Simulations and Computer Programming. House hold demand Models

**Optional Courses**

**ETS 641 TIME SERIES ANALYSIS.....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Introduction of Time Series Analysis, Transformation of Variables, Decomposition Analysis, Spectral Analysis, Box-Jenkins Methodology; AR, MA, ARMA, ARIMA, Seasonal ARMA, and Seasonal ARIMA Models, Unit Roots Analysis, Multiple Time Series, Transfer Functions, Cointegration, Dynamic Specification, Distributed Lagged Models, Vector Autoregressive (VAR), Impulse Response Function, Testing of Structural Change, Causality Analysis, ARCH Models, Panel Unit Root And Panel Cointegration, Forecasting; Univariate and Cointegrated System, Testing Forecasting Accuracy, Exogeneity – Weak, Strong and Supper- Analysis

**Recommended Books:**

1. Box, Jenkins and Reinsel (2008), Time Series Analysis- Forecasting and Control, Prentice Hall.
2. Enders, W. (2010), Applied Econometrics Time Series. John Wiley & Sons.
3. Hamilton, J. D., (1994), Time Series Analysis, Princeton University Press.

**Other Books**

1. Anderson (1979), Forecasting, North-Holland Company.
2. Chatfield (1996), The Analysis of Time Series- An Introduction, Chapman-Hall.
3. Clements and Hendry (1998), Forecasting Economic Time Series, Cambridge University Press.
4. Franses (1998), Time Series Models for Business and Economic Forecasting, Cambridge University Press.
5. Ghysels and Osborn (2001), The Econometric Analysis of Seasonal Time Series.
6. Greene (2007) Econometric Analysis, 6th Ed., Cambridge University Press.
7. Harris, R. and Sollis, R. (2003). Applied Time Series Modeling and Forecasting. John Wiley & Sons. UK.
8. Hendry (1995), Dynamic Econometrics, Oxford University Press.
9. Hendry and Morgan (1997), The Foundations of Econometric Analysis, Cambridge University Press.
10. Hendry and Nielsen (2007), Econometric Modeling A Likelihood Approach, Princeton University.



11. Johansen (1995), Likelihood-Based Inference in Cointegrated Vector Autoregressive Models, Oxford University Press.
12. Johnston and DiNardo (1997), Econometric Methods, McGraw- Hill / Irwin.
13. Juselius (2006), The Cointegrated VAR Model, Methodology and Applications, Oxford University Press.
14. Maddala, G.S. and Kim, L. (1998), Unit Roots, Cointegration, and Structural Change. Cambridge University Press.
15. Patterson (2000), An Introduction to Applied Econometrics, Palgrave Macmillan.
16. Richard Harris and Robert Sollis (2003), Applied Time Series Modelling and Forecasting, John Wiley & Sons.
17. Wooldridge (2009), Econometrics: A Modern Approach, 4th Ed., South – Western Publisher.

**ETS-800 PANEL DATA ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

**Course Outline:**

Introduction to Panel Data, One-Way Error Component Regression Model, Two-Way Error Component Regression Model, Test of Hypotheses with Panel Data, Heteroscedasticity and Serial Correlation in the Error Component Model, Seemingly Unrelated Regressions with Error Components, Simultaneous Equations with Error Components, Dynamic Panel Data Models, Unbalanced Panel Data Models, Panel Unit root, Panel Cointegration.

**Recommended Books:**

1. Arellano, M. (2003), Panel Data Econometrics, Oxford University Press.
2. Baltagi, B.H. (2006), Panel Data Econometrics: Theoretical Contributions and Empirical Applications, Emerald Group Publishing.
3. Hsiao, C. (2003), Analysis of Panel Data, Cambridge University Press.

**Other Books**

1. Frees (2004), Longitudinal and Panel Data, Cambridge University Press.
2. Wooldridge (2008), Econometric Analysis of Cross Section and Panel Data, 2nd Ed., MIT Press.

**ETS-810 FINANCIAL ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Understanding Financial Data, Asset Returns and their Empirical Properties, Linear Regression Tests of Financial Models, Efficient portfolio and Capital Asset Pricing Model, Multifactor Pricing Models, Intertemporal Equilibrium and Stochastic Discount Models, Simulation Methods for Financial Derivatives, Linear Time Series Methods, An Introduction to Volatility, Risk and Volatility Models, Value at Risk, ARCH Models, GARCH and EGARCH Models, Forecast and Management of Market Risks, Modeling Long-Run Relationships in Finance, Trading Strategies and High Frequency Data Review.

### **Recommended Books:**

1. Brooks, Chris (2008), Introductory Econometrics for Finance, 2<sup>nd</sup> Ed., Cambridge University Press.
2. Campbell, J. Y., A. W. Lo, and A. C. MacKinlay (1997), The Econometrics of Financial Markets, Princeton University Press.
3. Cuthbertson, K., and Nitzsche, D. (2005), Quantitative Financial Economics, John Wiley & Sons.

### **Other Books**

1. Cuthbertson, K., S. G. Hall and M.P. Taylor (1992), Applied Econometric Techniques, Philip Allan.
2. Davidson, R. and J. G. MacKinnon (1993), Estimation and Inference in Econometrics, Oxford University Press, Oxford.
3. Davidson, R. and J. G. MacKinnon (2004), Econometric Theory and Methods, Oxford University Press, Oxford.
4. Favero, C.A. (2001), Applied Macroeconometrics, Oxford University Press, Oxford.
5. Goldberger, A. S. (1991), A Course in Econometrics, Harvard University Press, Cambridge, MA.
6. Gourieroux, C. and J. Jasiak (2001), Financial Econometrics, Princeton University Press.
7. Hamilton, J. D. (1994), Time Series Analysis, Princeton University Press.
8. Judge, G.G., W.E. Griffiths, R.C. Hill, H. Lutkepohl, T.-C. Lee (1995), The theory and Practice of Econometrics, Wiley & Sons, New York.
9. Mills, T. C. (1999), The Econometric Modelling of Financial Time series, 2<sup>nd</sup> Ed., Cambridge University Press.
10. Rachev, S.T., Mittnik, S., Fabozzi, F.J., Focardi, S.M., Teo, J. (2007), Financial Econometrics: From Basics to Advanced Modeling Techniques, John Wiley & Sons.
11. Taylor, S. J. (2005), Asset Price Dynamics, Volatility, and Prediction, Princeton University Press.
12. Tsay, R. S. (2005), Analysis of Financial Time Series, John Wiley & Sons.
13. Verbeek, M. (2004), A Guide to Modern Econometrics, Wiley & Sons.

## **ETS-820 SPATIAL ECONOMETRICS.....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

### **Course Outline:**

Introduction to spatial econometrics: Spatial Econometrics, Spatial Dependence, Spatial Heterogeneity, Linear Regression Model with Spatial Data, Spatial Autoregressive Models: First-Order Spatial AR Model, Mixed Autoregressive Model, Spatial Error Model, General Spatial Model, Bayesian Spatial Autoregressive Models: Bayesian Regression Model, Bayesian FAR Model, other Spatial Autoregressive Models, Locally Linear Spatial Model: Spatial Expansion, DARP Models, Non-Parametric Locally Linear Models, Limited Dependent Variable Models: Gibbs Sampler, Heteroscedasticity Models, VAR and Error Correction Models.

### **Recommended Books:**

1. Anselin, L., Florax, R.J.G.M. and Rey, S.J. (2004), Advances in Spatial Econometrics: Methodology, Tools and Applications, Springer.
2. Arbia, G. and Baltagi, B.H. (2009), Spatial Econometrics: Methods and Applications, Springer.

3. Haining, R. (2003), Spatial Data Analysis: Theory and Practice. Cambridge University Press: New York.
4. LeSage, J.P. and Pace, R.K. (2009), Introduction to Spatial Econometrics, CRC Press.

**Other Books**

1. Fischer, M.M. and Getis, A. (2010), Handbook of Applied Spatial Analysis: Software Tools, Methods and Applications, Springer.

**ETS-830 NON-PARAMETRIC AND SEMI PARAMETRIC ECONOMETRICS(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

The Empirical Distribution Function, Likelihood, Influence Functions, Jackknife and Bootstrap Confidence Intervals and Tests, Permutation Tests, Rank Tests, Bias-Variance Tradeoff, Cross- Validation, Kernel Density Classification and Estimation, Curse Of Dimensionality, Nonparametric Regression, Basis Expansions, Splines, and Penalized Regression, Quantile Regression, Nonparametric Approaches to Multiple Regressions, Generalized Additive Models, Nonparametric Analysis of Longitudinal Data.

**Recommended Books:**

1. Haggmann M. (2003), Introduction to Nonparametric Econometrics.
2. Li and Racine (2007), Nonparametric Econometrics: Theory and Practice.
3. Wayne W. Daniel, (1990)Applied Nonparametric Statistics. Duxbury Classic Series.

**Other Books**

1. Agresti, A. (1990), Categorical Data Analysis, John Wiley and Sons.
2. Conover, W.J. (1980), Practical Nonparametric Statistics, 2ndEd, John Wiley and Sons.
3. E. L. Lehmann,Nonparametrics Statistical Methods Based on Ranks.
4. Fan and Gijbels (1996), Local Polynomial Modeling and Its Applications, Chapman and Hall.
5. Gao (2007), Nonlinear Time Series: Semiparametric and Nonparametric Methods.
6. Green and Silverman (1994), Nonparametric Regression and Generalized Linear Models, Chapman and Hall.
7. Hollander, M. and D.A. Wolfe. (1999), Nonparametric Statistical Methods, 2ndEd. John Wiley and Sons.
8. Horowitz (1998), Semiparametric Methods in Econometrics.
9. Jianqing Fan and Qiwei Yao (2003), Nonlinear Time Series: Nonparametric and Parametric Methods.
10. Long, J.S. (1997), Regression Models for Categorical and Limited Dependent Variables. Sage.
11. Pagan and Ullah (1999), Nonparametric Econometrics.
12. Racine J.S.(2008), Nonparametric Econometrics. A Primer.
13. Song (2007), Correlated Data Analysis: Modeling, Analytics and Applications, Springer.
14. Thomas P. Hettmansperger, Statistical Inference Based on Ranks.
15. W.J. Conover (1999), Practical Nonparametric Statistics, 3rd Ed., Wiley.
16. Wand and Jones (1995), Kernel Smoothing, Chapman and Hall.
17. Yatchew A.(2003), Semiparametric regression for the applied econometrician .

## **ETS-850 MULTIVARIATE ANALYSIS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

### **Course Outline:**

Introduction to Multivariate Methods & Fundamental Concepts, Multivariate Normal Distribution Theory, Distribution of Linear Function of Normal Variates, Distribution of Quadratic Forms, Wishart Distribution, Hotelling's  $T^2$  distribution, Confidence Regions and Simultaneous Confidence Intervals, Hypothesis Testing, MANOVA, Likelihood Ratio Test, Principle Component Analysis: Objectives, Analysis, Factor Analysis: Principle Factor Analysis , Canonical Correlation Analysis: Mathematical Development and Analysis, Discriminant Analysis: Estimation, Fisher's Linear Discriminant Function, Probabilities of Misclassification, Cluster Analysis: Probabilistic Formulation, Hierarchical Methods: Single Linkage, Complete Linkage, Average Linkage.

### **Recommended Books:**

1. Anderson, T.W. (2003), An Introduction to Multivariate Statistical Analysis, John Wiley, New York.
2. Chatfield, C. and Collins, A.J. (1980), Introduction to Multivariate Analysis, Chapman and Hall, London.
3. Richard A. Johnson & Dean W. Wichern (1998), Applied Multivariate Statistical Analysis, Prentice Hall.

### **Other Books**

1. Afifi, A. A. and Clark Virginia (2000), Computer Aided Multivariate Analysis, Lifetime learning publications, Belmont California.
2. Mardia, K.V., Kent, J.T. and Bobby, J.M. (1979), Multivariate Analysis, Academic Press, London.
3. Morrison, F. (1990), Multivariate Statistical Methods, McGraw Hill, New York.
4. R. Gnanadesikan (1997), Methods for data analysis of multivariate observations, 2nd Ed., John Wiley and Sons.

## **ETS- 870 STATIC AND DYNAMIC OPTIMIZATION .....(CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:** Basic mathematical tools, integration and differential equations, Qualitative theory, Control theory, Ramsey problem of optimal consumption, Dynamic programming, Lucas' model of endogenous growth, Stochastic models in discrete time, Discrete-time optimization, Overlapping-generations, Real-business-cycles, Stochastic models in continuous time, Stochastic differential equations and rules for differentials, Merton's model of growth under uncertainty, Stochastic dynamic control problems, Optimal saving under uncertainty.

### **Recommended Books:**

1. Chang, Fwu-Ranq, Stochastic optimization in continuous time, Cambridge Univ. Press, 2004.
2. Sydsaeter, Knut, Peter Hammond, Atle Seierstad, and Arne Strom, Further Mathematics for Economic Analysis, Prentice Hall, 2008.

## **ETS-880 OPERATIONS RESEARCH.....(CREDIT HOURS 3)**

**Pre requisite:** Nil

### **Course Outline:**

Introduction; Linear programming and modelling; Simplex method; Sensitivity Analysis; Decision analysis; Game theory; Queuing systems; Optimization theory; Post-optimal analysis; Dynamic programming; Network Optimization models: Critical Path Method (CPM), PERT; Project Management with PERT/CPM; Simulation; Planning over Time, Uncertainty and Forecasting; Markov Decision Process; Operations Research Applications.

### **Recommended Books:**

1. Hamdi A. Taha (2010), Operations Research: An Introduction, Cambridge University Press.
2. H. A. Eiselt and Carl-Louis Sandblom (2012), Operations Research: A Model-Based Approach, Springer texts in business and economics.
3. Frederick S. Hillier and Gerald J. Lieberman (2001), Introduction to Operations Research, 7th edition, McGraw Hill.

### **OtherBooks**

1. Wayne L. Winston (2003), Operations Research: Applications and Algorithms, 4th edition,
2. R. Ravindran (2009), Operations Research Applications, CRC press.
3. Yasar A. Ozcan (2009), Quantitative Methods in Health Care Management: Techniques and Applications, 2nd edition.

## **ETS-890 STRUCTURAL EQUATION MODELLING.....(CREDIT HOURS 3)**

**Pre requisite:** ETS-640 Econometric Methods

### **Course Outline:**

**Fundamentals of Structural Equation Modeling:** Basic concepts, Latent versus observed variables, Exogenous versus endogenous latent variables, The factor analytic model, The full latent variable model, General purpose and process of statistical modeling, The general structural equation model, Symbol notation, The path diagram, Structural equations, Nonvisible components of a model, Basic composition, The formulation of covariance and mean structures. **Path Analysis:** Introduction, Path Diagrams, Rules for Determining Model Parameters, Parameter, Estimation, Parameter and Model Identification, Model-Testing and -Fit Evaluation, Example Path Analysis Model, Modeling Results, Testing Model Restrictions in SEM, Model Modifications. **AMOS:** Getting to Know the AMOSProgram, Structure of Input Files for SEM Programs, Introduction to the AMOS Notation and Syntax, Introduction to the AMOS Notation, Introduction to the AMOSNotation and Syntax. **Confirmatory Factor Analysis:** What

Is Factor Analysis? Factor Analysis Model, Identification, estimation, Model Evaluation, Modeling Results, and Testing Model Restrictions: True Score Equivalence. **Structural Regression Models:** What Is a Structural Regression Model? An Example Structural Regression Model, Modeling Results, Factorial Invariance across Time in Repeated Measure Studies. **Latent Change Analysis:** Measuring change in individual growth over time: The general notion, The hypothesized dual-domain LGC model, Modeling intra individual change, Modeling inter-individual differences in change, Testing latent growth curve models: A dual-domain model, The hypothesized model, Selected AMOS output: Hypothesized model, Testing latent growth curve models: Gender as a time-invariant predictor of change. **Mediation :** Introduction, Applications of the Mediation Model, Single Mediator Model, Single Mediator Model Details, Multiple Mediator Model, Path Analysis Mediation Models, Latent Variable Mediation Models, Longitudinal Mediation Models, Multilevel Mediation Models, Mediation and Moderation, Mediation in Categorical Data Analysis, Computer Intensive Methods for Mediation Models, Causal Inference for Mediation Models. **Moderation:** Introduction, Applications of the Moderation Model, Estimation, interpretation. **MIMIC Modeling:** Multiple Indicators Multiple Causes (MIMIC) model involves using latent variables that are predicted by observed variables. **Bootstrapping as an aid to non-normal data:** Basic principles underlying the bootstrap procedure, Benefits and limitations of the bootstrap, Procedure, Caveats regarding the use of bootstrapping in SEM Modeling with AMOS Graphics, The hypothesized model, Characteristics of the sample, Applying the bootstrap procedure, Selected AMOS output, Parameter summary, Assessment of normality, Statistical evidence of non-normality, Statistical evidence of outliers, Parameter estimates and standard errors, Sample ML estimates and standard errors, Bootstrap ML standard errors, Bootstrap bias-corrected confidence intervals

**Recommended Books:**

1. A First Course in Structural Equation Modeling Second Edition TenkoRaykov, Michigan State University and George A. Marcoulides California State University, Fullerton
2. Introduction to Statistical Mediation Analysis by David P. Mackinnon
3. Structural Equation Modeling with AMOS, SECOND EDITION, Barbara M. Byrne
4. Principles and Practice of Structural Equation Modeling, Third Edition, Rex B. Kline

**ETS-622 SAMPLING DESIGN AND ANALYSIS.....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 620 Quantitative Foundation for Econometrics

**Course Outline:**

Basic Concepts of population, Target Population, A sample, Sampling frame, Probability and non-probability sampling, Design of the survey, Sampling techniques such as random sampling, stratified

random sampling, systematic sampling, Areas aping etc. Estimation of ratio and regression estimators, Comparisons of various estimators, Response and non-response errors and imputation.

### **Recommended Books:**

1. Cochran, W.G. (1997), Sampling Techniques, John Willey and Sons.
2. Mukhopadhaya, P. (1998), Theory and Methods of Survey Sampling, Prentice Hall of India.
3. Kish, L. (1992). Survey Sampling, John Wiley, New York.

### **Other Books**

1. Sharon, L. Lohr. (1999), Sampling Designs and Analysis, Duxbury Press.
2. Raj, D. & Chandhok, P. (1998), Sample Survey Theory, Narosa Publishing House, New Delhi.
3. Singh, R. and Singh N, (1996), Elements of Survey Sampling, Kulwar Academic Publisher, Dodrecht.
4. Sukhatme, P.V, Sukhatme, B., Sukhatme, S., and Asok, A. (1985), Sampling Theory of Survey with Application. Iowa State University Press.

## **ETS-624 NUMERICAL ANALYSIS AND STOCHASTIC SIMULATIONS .....(CREDIT HOURS 3)**

**Pre requisite:** ETS-620 Quantitative Foundation for Econometrics

### **Course Outline:**

General Issues in Simulation, Model Building; Bias-Variance Tradeoff; Model Selection; Fisher Information Matrix. Stochastic Simulations: Generating Random Variables, Simulating Normal, Gamma and Beta Random Variables. Generating Random Variables From Failure Rates. Simulating Multivariate Distributions, MCMC Methods and Gibbs Sampler, Simulating Random Fields. Comparison of Algorithms to Generate Random Variables. Resampling Methods. Variance Reduction. Discrete-Event Systems and Simulations. Simulation-Based Optimization; Regenerative Systems; Brief Introduction to SPSA. Simulation-Based Optimization by Gradient-Free Methods (FDSA And SPSA); Common Random Numbers. Simulation-Based Optimization by Gradient-Based Methods (IPA/LR and Sample Path). Markov chain Monte Carlo. Optimization Using Monte Carlo Methods, Simulated Annealing for Optimization. Solving Differential Equations by Monte Carlo Methods Input Selection and Optimal Experimental Design for Linear Models. Input Selection and Optimal Experimental Design for nonlinear Models. Statistical Methods for Selecting the Best Option Using Simulation Runs.

### **Recommended Books:**

1. Christopher, Z. Mooney. (1997), Introduction to Monte Carlo Methods, Sage Publications.
2. Gentle, James E. (2003), Random Number Generation and Monte Carlo Methods, Springer.
3. Morgan, B. J. T. (1984), Elements of Simulation, Chapman and Hall.

### **Other Books**

1. Fishman, G.S. (1996), Monte Carlo: Concepts, Algorithms, and Applications, Springer.
2. Chen, Ming-Hui, Shao, Qi-Man, Ibrahim, Joseph G. (2000), Monte Carlo Methods in Bayesian Computation, Springer.

3. M. E. J. Newman and G. T. Barkema. (1999), Monte Carlo Methods in Statistical Physics, Oxford University Press.
4. Neal Madras. (2000), Monte Carlo Methods, AMS Books.
5. Ripley B.D. (1987), Stochastic Simulations, John Wiley & Sons.
6. Ross, S. M. (2002), Simulation, Academic Press.
7. Rubinstein, R. Y. (1981), Simulation and the Monte Carlo Method, John Wiley & Sons.

**ETS-626 ADVANCED PROBABILITY THEORY .....(CREDIT HOURS 3)**

**Pre requisite:** ETS – 640 Econometric Methods

**Course Outline:**

Probability Review, Convergence of Sequences, Characteristics Function, Transformation of Random Variables, Discrete and Continuous Probability Models, Pearsonian System of Distributions, Chebychev-Hermetic Polynomials, Gram-Charlier Series, Order Statistics and Their Sampling Characteristics, Distribution of Extreme Values and Noncentral chi, t and F Distributions.

**Recommended Books:**

1. Stirzaker, D. (1999), Probability and Random Variables, Cambridge University Press, Cambridge.
2. Stuart, A., and Ord, K. (1998), Advanced Theory of Statistics Vol. I, Charles Griffin and Co.
3. Feller, W. (1968), Introduction to Probability Theory and its Applications Vol. 1, John Wiley and Sons.

**Other Books**

1. Khan, M.K. (1994), Probability Theory with Applications, Ilmi Kitab Khanna, Lahore, Pakistan .
2. Rohatgi, S. (1976), Introduction to Probability Theory, McGraw Hill.

**ETS-630 ADVANCED STATISTICAL INFERENCE .....(CREDIT HOURS 3)**

**Pre requisite:** ETS-620 Quantitative Foundations for Econometrics

**Course Outline:** Comparison of Point Estimators: The framework for parametric inference, Mean Square Error, Unbiased estimators, Sufficiency, Factorisation Theorem, Minimal sufficiency. Distribution Theory: Conditional distributions and expectations, Central Limit Theorem. Minimum variance unbiased estimation: Rao-Blackwell Theorem, Exponential Families, Lehmann-Scheffé Theorem. Likelihood, Fisher Information and the Cramér-Rao Inequality: The Efficient Score, Fisher Information, Cramér-Rao lower bound, Attainment of the Cramér-Rao lower bound, Multi-dimensional Cramér-Rao inequality. Maximum likelihood estimators: Elementary properties, Consistency and asymptotic efficiency. Hypothesis Testing: Definitions, The Neyman-Pearson lemma, Tests of composite hypotheses, Likelihood ratio tests. Confidence Sets: Relationship with hypothesis tests, pivotal quantities.

**Recommended Books:**



1. Mood, A.M., Graybill, F.A. and Boes, D.C.: Introduction to the Theory of Statistics, McGraw Hill,
2. DeGroot, M.H. and Schervish, M. J.: Probability and Statistics, Addison-Wesley, 2002.
3. Casella, G. and Berger, R.L.: Statistical Inference, 2<sup>nd</sup> ed., Duxbury Press, 2001.
4. Silvey, S.D.: Statistical Inference, Chapman & Hall, 1978.
5. Statistical Theory: B W Lindgren, Collier MacMillan

**ETS-634 BIG DATA ANALYSIS .....(CREDIT HOURS 3)**

**Pre requisite:** Nil

**Course Outline:**

What Big Data Means? When Do You Have a Big Data Problem? Characteristics, Sources and importance of Big Data Analysis. Compare and contrast the roles of: data-at-rest processing, data-in- motion processing, data-warehouse processing, and contextual search. Tools available for Big Data Analytics. Ingesting and integrating data, Storage and compute platforms. **Presentation and visualization:** Understand the purpose of various types of data visualization, ranging from infographics to visual analytics, Apply design principles to design visualization techniques, Use visualization tools to perform visual analysis. **Algorithms and analytics:** Identify Big Data problems that require Statistical Techniques, Apply the Statistical Techniques correctly on Big Data Problems, Understand the properties of these techniques, and the role of assumptions, Interpret the conclusions properly, Programme in “R”, Neural nets, Support vector machines. **Understand methods from machine learning:** Classification and regression trees, decision trees and decision forests, Random forests, clustering and topic modelling, logistic regression and deep learning, matrix factorization and time series analysis & spatio-temporal event modelling, Boosting, Bagging, Spike and slab regression? Penalized regression (*e.g.*, the lasso, lars, and elastic nets). **Apply the methods in advanced techniques:** text analytics, image and video analytics and recommendation, Apply the techniques in large scale use-cases. Security and privacy.

**Recommended Books:**

1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Springer- Verlag, 2 edition, 2009.
2. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani. An Introduction to Statistical Learning with Applications in R. Springer, New York, 2013.
3. Graham Williams. Data Mining with Rattle and R. Springer, New York, 2011.
4. Xindong Wu and Vipin Kumar, editors. The Top Ten Algorithms in Data Mining. CRC Press, 2009.
5. Bill Howe. Introduction to data science. Technical report, University of Washington, 2013.
6. W. N. Venables and B. D. Ripley. Modern Applied Statistics with S. Springer-Verlag, New York, 4 edition, 2002.

7. Varian, Hal R. "Big data: New tricks for econometrics." *The Journal of Economic Perspectives* (2014): 3-27.
8. Einav, Liran, and Jonathan D. Levin. *The data revolution and economic analysis*. No. w19035. National Bureau of Economic Research, 2013.

**ETS-835 BAYESIAN ECONOMETRICS .....(CREDIT HOURS 3)**

**Pre Requisite:** ETS- 640 Econometrics Methods

**Course Outline:**

The overall aim of this subject is to familiarize students with essential concepts and techniques used in Bayesian inference. The course will provide students with the necessary programming skills to implement Bayesian estimation and inference for econometric model using suitable software. The formal course description is:

Foundations of Probability, Bernoulli & Binomial RV's, Conventional Inference for Surveys, From Data to Densities, Prior to Posterior updating in Beta-Binomial Model, Assessment of Binomial Models, Bayesian Econometrics Multiple Matches, Match Binomial Model to Real World, Bayesian Econometrics Testing Independence, Bayesian Econometrics Chi-Square Test, Review of Normal Distribution, Bivariate Normal Distribution, Bayesian calculations for normal data, normal prior, Bayesian Calculations with Normal-Gamma Priors, Fundamental Formulas for Bayesian & Conventional Inference with IID Normal, Principles for Applications of Normal Inference on Real Data, IID Normal Inference with Real Data, Bayesian inference using IID Normal Models for real Data, Introduction to Empirical Bayes, Empirical Bayes for Panel IID Normal Data, Empirical Bayes & Stein Estimation, Empirical Bayes on Recession Probabilities and Fire Alarms, Empirical Bayes Quality Control, Empirical Bayes in Regression Models, Hierarchical Bayes and Gibbs Sampler.

**Recommended Books:**

1. Asad Zaman (1996) *Statistical Foundations of Econometric Techniques*
2. William M. Bolstad (2007) *Introduction to Bayesian Statistics*
3. Sharon B. McGrayne (2011) *The Theory That Would Not Die*. Yale University Press.
4. Gary Koop (2003) *Bayesian Econometrics*: John Wiley and Sons
5. Lancaster, T. (2004). *An Introduction to Modern Bayesian Econometrics*, published by Blackwell.
6. Edward Greenberg, (2008). *Introduction to Bayesian Econometrics*, Cambridge University Press
7. Geweke, John (2005): *Contemporary Bayesian Econometrics and Statistics*, John Wiley & Sons.
8. Koop, Gary M., Dale J. Poirier and Justin L. Tobias (2007): *Bayesian Econometric Methods*, Cambridge University Press.
9. David L., Christopher J., Nicky B., Andrew T., David S. (2007) *A Practical Introduction to Bayesian Analysis*

## **ETS-635 ASYMPTOTIC THEORY AND SIMULATIONS .....(CREDIT HOURS 3)**

**Pre Requisite:** ETS – 640 Econometric Methods,  
ETS- 620 Quantitative Foundations for Econometrics

### **Course Outline:**

The purpose of this course is to enable students to understand what asymptotic theory is and how is it used to design and analyze the statistical tests and estimators. However, asymptotic could fail to perform for two reasons (a) asymptotic theory is the large sample theory and could not be very good in small/medium sizes (b) the asymptotic theory could be sometimes too complicated to be analytically solved. Simulations could serve as a substitute for the asymptotic theory where it fails to perform. The second half of the course is about simulation, where, the students will be taught how to solve econometric problems using simulation methods.

### **Asymptotic Theory**

This part will cover selected chapters from William H Greene (Econometric Analysis), Jhonston and Dinardo (Econometric Methods) and Peter Kennedy (A Guide to Econometrics) including topics: Maximum likelihood principal and applications, Properties of maximum likelihood estimators, Wald, Lagrange Multiplier and Likelihood Ratio tests, Large sample theory, Central Limit theorem, Law of Large Numbers, Convergence in Probability, Convergence in Distribution, Convergence of Function of Random Variables, Large Sample Properties of Least Square, Instrumental Variables and GLS, More on Maximum Likelihood, Estimating Asymptotic Variance of Maximum Likelihood Estimator, 2 step maximum likelihood.

### **Simulations**

This part will cover what is simulation? Simulating mean, median, mode and matching it with theoretical properties of the random variables, Central Limit Theorem: Verification by simulations. Properties of OLS using Monte Carlo simulations: Unbiasedness, and Consistency; biasedness in overs pecified and underspecified models. Testing Correlation: Pearson and Rank Order Correlation, Computing Simulated Critical Values and Power of correlation tests, comparison of power of the two tests and choice of test. Introduction to MATLAB: How to write function and program files, loops, matrices, conditions, Using MATLAB to simulate unit root tests and cointegration tests, Introduction to R programing: comparison of features of MATLAB and R. Using built in packages of R  
Helping Material: Excel Lecture Notes, MATLAB user manual, R-user manual

### **Recommended Books:**

1. Greene (2007) Econometric Analysis, 6th Ed.
2. Johnston and DiNardo (1997), Econometric Methods
3. Kennedy (2003) , A Guide to Econometrics, 4th ed., Blackwell.

**ETS-722 FINANCIAL ECONOMICS.....(CREDIT HOURS 3)**

**Pre Requisite:** Nil

**Course Outline:**

Foundations of Risk Analysis; Measuring Risk; Application of Risk Analysis; the Portfolio Selection Problem; the Capital Asset Pricing Model; the Arbitrage Pricing theory; Common Stocks; Preferred Stocks; Bonds; Capital Structure theories; the goal of the Firm; the Economic Evaluation of Investment Proposals; the traditional Mundell Fleming Model; the Dynamic- Optimizing model with Price Flexibility; Intertemporal Model with Price Stickiness; Currency Crises; External Crises: Fiscal Policies and Taxation in the Open Economy; International Capital Flows under Asymmetric Information; and International Growth Convergence.

**ETS-625 ELEMENTS OF STATISTICAL LEARNING .....(CREDIT HOURS 3)**

**Pre Requisite:** Nil

**Course Outline:**

Introduction to Modern Statistical Learning Approaches, Summary of different methods we will cover in the course, what is Statistical Learning?, Inference vs. Prediction, Supervised vs. Unsupervised Learning Problems ,Regression vs. Classification, Introduction to R, Basic Commands, Graphics, Indexing Data, Loading Data, Assessing the Accuracy of a Statistical Learning Method, Less Flexible vs. More Flexible Methods, Bayes Classifier, Bias/Variance ideas, Review of Linear Regression, Linear Regression, Logistic Regression, Using the Logistic Function for Classification, Linear Discriminant Analysis, Logistic Regression and LDA, Resampling Methods (Finite Sample Theory), The Cross-Validation and the Bootstrap (Finite Sample Theory), kNN, Best Subset Regression, Shrinkage and Dimension Reduction Methods, Shrinkage Methods, General Linear Methods, Generalized Additive Models, Polynomial Regression, Splines and GAM, Tree Methods, Bagging and Boosting, Tree Methods, Clustering Methods.

**Reference Books:**

1. Elements of Statistical Learning by James, Witten, Hastie, and Tibshirani
2. Econometrics by Baltagi , 2<sup>nd</sup> Edition , Springer Verlag (1999)
3. An Introduction to Statistical Learning with Applications in R by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, Springer Science&Business Media New York (2013)

## ETS-745 AGENT BASED MODELING .....(CREDIT HOURS 3)

**Pre Requisite:** Nil

### **Course Outline:**

This course is designed to understand wide variety of complex adaptive systems using agent based modelling. During the course, power of ABM in understanding the real world behavior amenable to complex system analysis will be explored. This course will help students to learn studying economic and social phenomenon through ABM. [NetLogo](#) programming language which is developed at [Northwestern University](#) will be used for building ABM. No programming background/knowledge is required for student to register the course.

Why do we need to understand agent Based modelling? What Is Agent-Based Modeling? Creating Simple Agent-Based Models, Complex Adaptive Systems, Introduction, logic and need of Modelling, Exploring and Extending Agent-Based Models, Creating Agent-Based Models, The Components of Agent-Based Modeling, Analyzing Agent-Based Models, Verification, Validation, and Replication, Advanced Topics and Applications, Sensitivity, Uncertainty, and Robustness Analysis, Tragedy of the Commons, Networks, Diffusion of Innovation, Fads and Fashion, Collective Action, Labor market Job search and wage distribution, Growth Theories, Stock Market.

### **Recommend texts:**

1. Wilensky, U., & Rand, W. (2015). *An introduction to agent-based modeling: modeling natural, social, and engineered complex systems with NetLogo*. MIT Press. (IABM)
2. Hamill, L., & Gilbert, N. (2015). *Agent-Based Modelling in Economics*. John Wiley & Sons. (ABME)
3. Jansen M. A., (2013) Introduction to Agent Based Modelling [eBook](#) (ABMMJ)

### **Additional Resources:**

4. Railsback, S. F., & Grimm, V. (2011). *Agent-based and individual-based modeling: a practical introduction*. Princeton university press. (ABIM)
5. Tesfatsion, L. (2002). Agent-based computational economics: Growing economies from the bottom up. *Artificial life*, 8(1), 55-82.
6. Tesfatsion, L., & Judd, K. L. (Eds.). (2006). *Handbook of computational economics: agent-based computational economics* (Vol. 2). Elsevier.
7. Ehrentreich, N. (2007). *Agent-based modeling: The Santa Fe Institute artificial stock market model revisited* (Vol. 602). Springer Science & Business Media. (ABMSF)

### **Online- Resources:**

8. NetLogo software package and community models are available <https://ccl.northwestern.edu/netlogo/>
9. The videos are freely available on YouTube (<https://www.youtube.com/channel/UCCqW98YIsST73jnB3WuUjbw>).
10. The Santa Fé institute also offers ABM and related courses (<https://www.complexityexplorer.org/courses>).
11. ABM by TU Delft (<http://wiki-app1.tudelft.nl/bin/view/Education/SPM955xABMofCAS/Spm4530>).
12. Other great resources are: the [journal of artificial societies and social simulation](http://jasss.soc.surrey.ac.uk/JASSS.html) (<http://jasss.soc.surrey.ac.uk/JASSS.html>),
13. A platform (<https://www.openabm.org/on>) which free working models are posted.
14. Agent Based Computational Economics: <http://www2.econ.iastate.edu/tesfatsi/afinance.htm> (ABCE)

## **Academic Program:**

<b>Total Credit Hours:</b>	<b>36</b>
Core Course Credit hrs:	12
Elective Course Credit hrs:	12
Thesis/Research Work	12

**Duration: 3 years (with the provision of six months extension)**

### **Core Courses**

#### **DS-600 Development: History, Theory and Policy**

This course is designed to identify, locate, understand, and analyse the major theoretical and historical models and shifting paradigms of Development. Going beyond the circumscribed views of defining Development on GNP/Capita thresholds, this course aims to nutshelling unorthodox discourses of Development with all their interconnections and intricacies to provide alternative explanations (as well as to challenge) the technocratic measures of development.

Historical and theoretical contexts will impart to students the well-rounded knowledge of conventional discourses theorising Development in which the conception of the term Development, the early experiences of Development, the Colonial legacies, the post-Second World War havoc, the modernisation and modernity, the Development/Underdevelopment divide, the First World/Third World divide and the Global South/Global North divide will be taught. On the theoretical side, theories of modernisation, keynesianism, neoliberalism, structuralism, post-structuralism, dependency and world system propositions, Marxism, Socialism and the Soviet model, Maoism and the Chinese model, African Socialism, and Afro-Marxism are some of the broader areas which will be covered. In addition, the deconstructionist approach will deal with the recent and more concurrent themes of grassroots development (basic needs, human development, decentralisation, participatory development, empowerment and agency, social capital, role of civil societies and NGOs) and socio-cultural dimensions (sociology of development, anthropology and development, ethnology of development, ethno development, gender and development, and rights-based development). The concepts of post colonialism, postmodernism, post developmentalism, 'Other and Othering', subaltern, and discourses of marginalisation will be covered in detail to enrich students' understanding about the emerging areas of development. A key part of the course is development policy through which we intend to apply a pragmatic approach through delving into the current policy issues, social change and development, social policy, demographic transition, globalisation and development, culture and development, institutions and development, politics of international aid, and violence/security/conflict concerns.

#### **DS- 610 Research Methods for Development Studies/Essential Skills for Research**

This course is designed to provide an opportunity for students to establish and advance their understanding of social research through critical exposition of research designs, research methods and approaches. The course will help students in understanding the discourse and philosophical underpinnings of social research, and the elements of research processes situated in qualitative research paradigm. The students will utilise these theoretical, conceptual and methodological approaches to:

1. Attain a clear idea of what constitutes social research.
2. Understand epistemological and ontological orientations concurrent to the discourse of social research.
3. Get a clear idea of the difference/s between different types of research strategies.
4. Critically review literature relevant to their fields of interest and generate conceptual framework through it.
5. Determine how research findings are useful in forming their understanding of theory and learn to bridge a link between research findings and existing body of knowledge.
6. Develop an understanding of the ethical dimension of applied research.
7. Identify various ways of extracting data and analyse through various data analysis techniques/tools.

#### **DS-621 Economic Theory and Practice**

The course is designed to understand economic theory and practice in the light of contemporary debates existing in Pakistan economy. The course intends to impart knowledge on macro- and micro-economic theory and policy with focus on Pakistan.

More specifically, the objectives of the course are to:

- Reflect on the existing micro- and macro-economic theories.
- Learn about heterodox approaches to understand economic processes and phenomena.
- Understand contemporary debates in Pakistan economy.
- Reflect on existing economic policies of Pakistan and devise operable frameworks for economic growth and development.

### **DS-630 Anthropology and Development**

This course is designed to provide an opportunity for students to establish and advance their understanding of concepts of Anthropology, Development and the interaction between the two. In the end of this course, the students will be able to:

1. Understand the theoretical paradigms as applicable to the field of development and change.
2. Understand development on a comparative cross-cultural basis based on case studies from different areas of the world.
3. Integrate the concepts and theoretical models of Anthropology and Development and acknowledge the contributions made by classical Anthropologists as well as present day Anthropologists to the analysis of development issues.
4. Outline the differences between the proponents of Development Anthropology and Anthropology of Development.
5. Understand the contemporary debates around the articulation of Development and Anthropology.

### **DS 620 Development Economics**

Development Economics has long been bewildering social scientists and development practitioners. How development economics evolved down the decades? How have measures of development evolved since the inception of the field of development studies? Are development and underdevelopment two sides of the same coin? Why does mass poverty persistent in a world of affluence? What role did colonialism and nationalism play- and what roles do they continue to play- in shaping economic institutions and outcomes? What economic development strategies have been most widely adopted and why? What has been the effect of these policies? How to unmask the gender face of development? Is development concealed in international Darwinism? How dirigiste dogma turns the debates on development? How capacity curve affects the learning curve? These are few of the questions standing ever inclusive fueling the debates on development and development economics.

### **Optional Courses**

#### **DS-745 Power, Governance and Development**

Power as interpersonal relationship. Power comparability. Power as the ability to control. Power as a tool of creating and resolving conflict. Power as consent. Power and social structures. Power as vehicle of intended and unintended consequences. The Idea of power and the power of ideas by Barrett, Stockholm and Burke Complicity with domination by Hong and Murray. The Concept of power by Dahl. Luke's theory of power and authority. Marxist theory of power and authority. Weber's theory of power and authority. Foucault's theory of power and authority. Post Foucauldian theories. Network theory of power.

Agency theories of power. Different definitions and dimensions of governance. Public administration, new public management & governance. Governance beyond the government. Good governance and obstacles therein. Good governance and sustainable human development. Characteristics, strategies and critique of good governance. Transnational Environmental governance. International institutions of political and economic governance. The issue

of legitimacy in global governance. Globalisation and sustainable development. Basic human rights and liberties. The advocacy role of civil society

Civil society and poverty reduction. Participatory governance. Power, politics and wealth. Colonialism and development. Competitive governance and development exercise. Governance and sustainable development. Power and participatory development. Development project governance. Three approaches of project governance. Project governance and operational management. Project governance, economic pressures and management demands

### **DS-795 Quantitative Techniques for Development Research**

Introduction to Econometrics. Difference between Mathematics, Statistics and Econometrics

The Structure of Economic Data. Need for different estimation techniques for different data sets. Limitations of empirical quantification. Data handling and Descriptive Statistics. Introduction to Simple. Linear Regression. Asymptotic Properties of Least Squares (The Gauss-Markov Theorem). Hypothesis testing and confidence intervals. The overall goodness of fit. Presentation of regression results. Multiple Regression Analysis. Mechanics and Interpretation of OLS. Violations of the Classical Assumptions. Omitted variables in simple regression. Properties of Instrumental Variable. Estimation of the Multiple Regression Model. Analysis with Qualitative Information: Binary (or Dummy) Variables. Sampling and different types of sampling techniques. Introduction to SPSS

### **DS-735 Tourism and Development**

Defining Tourism and Development. Current Discourse in Tourism and Development. Debates in the Field. Theoretical and Contextual Issues. Tourism and Public Policy. Rock Art Tourism. Religious Tourism in Pakistan. Heritage Tourism. Tourism and Poverty Reduction. Terrorism and Tourism in Pakistan. Tourism Planning and Development Processes. Tourism and Sustainable development. Globalisation and Tourism. Community Response to Tourism. Environment, Poverty and Tourism. The consumption of tourism

### **DS-755 Sustainable Development and Economic Policy**

Environment and Environment Economics. Consequences of Unsustainable Practices (Environment Degradation Status of Pakistan). Theories of Economic Growth and Development. 'Conventional' economic interpretations of the growth process and a critical review of some standard growth models and their ecological coherence (or otherwise) systems and subsystem. Concepts and Determinants of Genuine Saving. Economic Growth and Welfare. General Equilibrium Model (Consumers, Producers, Equilibrium and Pareto Efficiency). What is Sustainability and Sustainable Development? Brundtland Sustainable Development, Similarities and Contrasts. Afforestation and Sustainability. Participatory Development. Participatory Disaster Management. Strong vs Weak form of Sustainability. The categorisation of resources and means-based criteria for sustainability. Review of the main issues involved in the 'sustainability' debate and the challenges posed by aspirations towards economic development/growth. What are the key issues? Market Failure and Pareto Optimality. The basic economic theory of the management of renewable resources. The basic economic theory of optimal depletion of non-renewable resources and its implications. Hotelling rents: Extension to forestry. The economic theory of externalities' (local and global including climate change) and applications to pollution control. Defining and Measuring Progress. Greenhouse gases, climate change and the potential rewriting of economic geography. The potential influence and implications of the 'Stem Report'. Energy options and policy. The interpretation of energy statistics. Supply side vs. demand side adjustments. Carbon trading and rationing. The role of Nuclear power: necessary or avoidable? Complement or substitute? Waste management and recycling. The role for life cycle analysis.

### **DS 730 Gender and Development**

Liberal Feminist Theory. Marxist Feminist Theory. Radical Feminist Theory. Multicultural Feminism. Eco-Feminism. Psycho-analytical Feminism. Economic Theories of Development. Socio-Political Theories of Development. Gender Mainstreaming. Politics of Development. Effects of Globalisation on Women. Capital on the Move. Articulation between environmental use, preservation and women. Women, Environment and Sustainable



Development by Hausler. Action and Independent Thinking. Politics and Female Subjectivities. Women and Law in Pakistan. Hudood Ordinance and Beyond.

### **DS 770 Globalisation and Development**

Introduction to Globalisation and Development. Defining Globalisation and Development. History of Globalisation. Economic Globalisation. Cultural Globalisation. Social Movement. Globalisation and Education. Globalisation and Human Rights. Globalisation and State. Globalisation and Identity. Globalisation and Post-colonialism. Diaspora. Globalisation, INGOs and Civil Society. Urgent Issues in Development

### **DS-751 Politics and Development**

Political Economy of Development. Institutions. Institutions and Development. South Asian Politics. Corruption. Globalization, Politics and Development. Politics and Development in Pakistan. Politics and Development: Policy Perspectives

### **DS-771 Diaspora and Development**

Introduction to Globalisation. Cultural Global Flows. Definitions of Diaspora. Types of Diaspora. African Diaspora. Middle Eastern Diaspora. South Asian Diaspora. Pakistani Diaspora. Human Security and Diaspora. Human Rights and Diaspora. Gender and Diaspora. Economy and Diaspora. Nostalgia, Identity and Diaspora. Human Development and Diaspora

### **DS-762 Culture, Health and Development**

Medical Anthropology. Political Economy of Health. Health Disparities. Identity and Health. HIV/AIDS. Commodification of Health. Anthropology of Health and Healthcare. Poverty and Health. Body Politics. Health and Population

### **DS-763 Communities and Development**

What are Communities? Community Development. Participatory Development. Social Capital. Community Capital. Empowerment and Agency. Community Driven Participatory Research. Community, Gender, and Development. Community, Power and Development. Community, Development and Pakistan

### **DS-781 Development in Cities**

What are Cities? The History of World Cities. Urban Sociology. Space and Cities. Cities and Capitalism. Cities and Culture. Social Class and Cities. Political Economy of Cities. Gender and Cities. Housing in Cities. Cities of the Developing World. Pakistani Cities

### **DS-764 Culture and Development in South Asia**

Understanding Culture. Understanding South Asia. South Asian Cultures. Culture, Modernity, Development and South Asia. Culture, Society and South Asia. Anthropology of South Asia. Indigenous Knowledge and South Asia Development Interventions and South Asian Cultures. Social Movements of South Asia. Contemporary Debates in South Asia

### **DS-780 Development Management**

Development: from and about people at grassroots. The cultural context of Development. The political context of Development. Transition in various components of Project Cycles. Public Sector Organization. International Development Agencies. Non-Governmental Organizations. Organizational Change. Agriculture Sector. Health Sector. Education Sector

### **DS-735 Interdisciplinary Seminar in Disaster Management & Humanitarian Assistance**

Hazard, Vulnerability, Risk and Resilience. Anatomy of a Disaster II. International Perspectives on Disaster Management. Global Assessment on Disaster Risk Reduction. Case Study: Pakistan. Civil Military Operations.

Perspectives from the US. Special Panel Discussion on Pakistan. Representatives from NDMA and two academics (TBA). Class Wrap Up for International Component & Consultation

### **DS-790 Financial Inclusion, Poverty Alleviation and Development**

Rethinking Banking. Why Intervene In Credit Markets? Group Lending. Beyond Group Lending. Savings and Insurance. Gender Measuring Impacts. Subsidy and Sustainability. Measuring Microfinance. Microfinance and Health. Microfinance and Education. Social Business. Microfinance and Remittances Islamic Microfinance

### **DS-740 Human Resource Development**

Divided into four sections, this course, focuses on creating understanding of the issues and answering the questions raised above.

The first section provides conceptual understanding of human resources, human capital, human resources development, and the ingredients of human resources development. Current trends and levels of human resource development efforts across the regions are also a part of this section with special focus on Pakistan. The material covered in this first part of the course will help us explore concepts, dimensions, and significance of human resources.

The second section of the course focuses on a set of analytical readings exploring the policies adopted to develop human resources. A critical analysis of these policies will also be undertaken with special relevance to developing countries and Pakistan. Special attention is drawn towards recent human resources development policy of Pakistan. This material permits us to explore how and why some regions and countries have been able to defy conventional wisdom and develop, accumulate and utilize human resources in a way much better than the counterparts.

The third section of the course, the crux, concerns issues in human resources development and covers demographic transition and changing age patterns emerging from it as a base for human resources, migration/emigration, health, education and return on education, the labour market i.e. demand and supply of labour (especially the imperfections and distortion with reference to developing countries), efficiency wages hypothesis, formal and informal dimension of human resources development policies, income distribution in factor market, human resources development-the local vs. global context, inter generational mobility as endowments in labour market (in the name of father), human resources development and Sen's capabilities approach, measurement issues in human resources development and human capital, Education policy of Pakistan as foundation for human resources development, The role of social capital in setting bases for human resources development, knowing vs. knowing as per demand (market driven skills, vocational training)etc.

The final section concludes the course and includes the empirical evidence on role of human capital in economic growth (threshold level of human capital, human capital interaction with factors of growth, technology creation vs. technology adoption etc.) This section also provides a comparative analysis of recent growth patterns across the world in specific context of human resources development policies and human capital levels to draw policy implications. Human resources development policies adopted in Pakistan especially in education and health sector will also be analyzed.

This course is an attempt to figure out why some countries (Pakistan puts a best example) don't invariably implement policies as other countries with success stories did. Pat, easy, or formulaic answers will not do the purpose; the objective rather is to understand at very conceptual groundings and ignite a debate on the issues.

### **DS-755 Human Rights and Development**

The Basics. The Right to Development. Formulaic Resolutions: The Role of World Bank and UNDP. Human Rights and Good Governance. Freedom as Development. The Rights-based Approach. Poverty and Human Rights. Law and Human Rights. Institutions, Power and Human Rights. Disability and Human Rights. Gender and Human Rights. Social Protection and Human Rights. Conflict, Security and Human Rights. Policy and Human Rights

### **DS-765 NGOs Management**

## NGOs and their Management

- NGOs and Civil Society: definitions, contexts and their classification
- Claims of NGOs
- NGOs as a substitute to government or partner

## The Rise and Growth of NGOs

- Overseas aid and NGOs in the South
- NGOs in the North
- Transnational Civil Society and NGOs

## Managing Policies

- Donor policies (Multilateral, bilateral, foundations, Northern NGOs)
- State policies towards NGOs particularly in developing Asia
- Policy management by the NGOs

## Managing NGO Roles

- Key roles: Implementers, partners, catalysts
- Targeting, group formation, service delivery, and advocacy
- Innovation, effectiveness, evaluation

## Managing NGO Relationship

- NGOs and communities
- NGOs and the state
- NGOs and the business sector
- NGOs and donors
- NGOs and international humanitarianism

## Internal NGO Management

- Organizational Issues
- Capacity building
- People working for NGOs: Managing human resources, promoting staff welfare, the People in Aid Code

## Professionalism in NGO Work

- Working with donors, clients, state and media
- Preparing information documents
- Preparing project proposals
- Evaluating and monitoring projects and reporting to the donors

## NGOs and Civil society in Developing Asia

- Managing Asian NGOs: Current Trends and Future Prospects
- Lessons from case studies: Pakistan, Bangladesh, India, Nepal

## **DS-720 Qualitative Methods for Development Research**

Qualitative Research: Philosophy, Context, and Content. Methodological Frameworks in Development Studies. Idea Development, Operationalization & Validity & Reliability. Fieldwork and Observation. Ethics in Qualitative Research. Researcher Positionality and Reflexivity in Qualitative Research. Sampling & UDCs. Research Methods: Surveys, Interviews, & Focus Groups. Data Analysis

## **DS-760 Political Economy of Development**

What is Development? Critique: Development as Problem. Development as Knowledge. Intersection: Development & Anthropology. Political Economy: What Development Got to Do with it? Classical Debates: Capital and Labor. Classical Debates: Capital and Labor (continued). Capitalism. Physical Colonialism. Non-physical Colonialism. Dependency & Underdevelopment. Understanding institutions. Urbanization and institutions. Narrating Development via institutions. Problematizing Development. Globalization & Political Economy. Media & Political Economy. Health & Political Economy. Education & Political Economy. Power & Political Economy. Governance, Governmentality & Political Economy. Power & Politics

## MPhil Public Policy

### Academic Program:

A comprehensive coursework, practical exercises and field work will equip the students with the toolkit necessary to not only understand policy problems but solve them as well.

Total Credit Hours: 36

Core Credit Hours: 18

Elective Credit Hours: 06

Total Course Work: 24

Thesis: 12

Program Duration: 2 - 3 years

Course Code	Course Title	Credits Hours	Course Code	Course Title	Credits Hours
<b>SEMESTER-I</b>			<b>SEMESTER-II</b>		
<b>PP-601</b>	Microeconomics for Public Policy	03	<b>PP-620</b>	Macroeconomics for Public Policy	03
<b>PP-606</b>	Governance and Public Policy	03	<b>PP-631</b>	Evaluation and Monitoring of Policy Initiatives	03
<b>PP-616</b>	Public Policy Analysis	03	<b>PP-610</b>	Research Methods	03
	Elective-I	03	Elective 2		03
<b>SEMESTER-III</b>			<b>SEMESTER-IV</b>		
<b>PP-636</b>	<b>Workshop for Proposal Development*</b>	00	Thesis		
<b>Proposal Defense**/Thesis</b>		12			
<p><b>* Non-credit compulsory course; Rule for minimum attendance will be followed</b>  <b>** Students will be required to submit their proposal at the end of third semester</b></p>					

**Course Content:**

**PP 601: Microeconomics for Public Policy ..... (3 credits)**

The course covers the principles and techniques of microeconomic theory most relevant to the economic aspects of public policy. The topics covered in this course include; consumer theory, firm theory, resource allocation, welfare consequences associated with policies such as taxes, subsidies, regulation, and government transfers. Besides competitive models, the course will also cover deviations due to market failures. Case studies of government intervention in the economy will be used to illustrate the concepts and theories examined.

**PP 601: Governance and Public Policy ..... (3 credits)**

The course provides an Introduction to Public Policy and introduces participants to the theories of public policy. The political institutions and processes through which public policy is formulated generally in democratic countries and particularly in Pakistan, are studied in this course. The models and tools of policy analysis are applied to study specific policy areas like, economic policy and its various subcomponents, including fiscal, monetary and trade policy, mining and exploration, decentralization, social policy, including health care and education and the policy on environment and climate change.

The second important part of this course contains discussion on the Governance Issues. It will introduce the structure of Public and Civil Service in Pakistan and how these influence policy formulation and implementation. The inter linkages among rent seeking, corruption, patron- client relationship and the structure of public and civil service in Pakistan are discussed in this course. Salient ideas in institutional economics including; the role of institutions in determining the growth performance of a country, evolution of institutions, institutional change, transaction cost and the link between organization in public and private sector are also discussed in this course.

**PP 610: Research Methods..... (3 credits)**

This course has two components; the Quantitative Analysis and Qualitative Analysis. The first component focuses on techniques for the analysis of quantitative data. The course covers three main topics: (i) Introduction to statistics and analysis of data using a range of quantitative methods and practical exercises using statistical software packages; (ii) strengths, limitations and applications of specific quantitative techniques, (iii) the interpretation of quantitative data and the manner of dissemination to influence policy and practice.

The second part of the course develops an understanding of qualitative research skills through critical exploration of research techniques, management and analysis of the qualitative data, and the use of relevant software. This course enables students to review literature relevant to the field

of study, to collect information (data) and analyse it to transform into knowledge, and then present it in written and oral form. The contents include, Introduction to Social Research Methods, Doing Qualitative Research, Nature of Qualitative Research, Sampling in Qualitative Research, Data Collection in Qualitative Research, Qualitative Data Management & Analysis, and Writing & Presenting Research

**PP 616: Public Policy Analysis..... (3 credits)**

The course introduces participants to the theories of public policy processes; critically reviews the key ‘stages’ of the policy process including agenda setting, policy formulation, implementation, monitoring and policy evaluation. The influence of political power at every stage of the policy process forms a central strand running through the entire course. This course explains preparing, designing and selection of public policy. It is mainly focused on analytical approaches and methods that are intended to guide policy design and structure policy choice: argumentation analysis to understand, evaluate and construct policy arguments, including the consideration of values and other assumptions that are used and method to promote critical and creative thinking.

**PP 620:Macroeconomics for Public Policy ..... (3 credits)**

This course focuses on the working of the aggregate economy. One of the objectives of the course is to build understanding of the key determinants of business cycle fluctuations and of development and long-run growth. It will draw on the current economic research on the determination of macroeconomic variables such as output, employment, prices, and the interest rate—in the short, medium, and long run. The main emphasis of the course is on the impact of government policies on the macro economy.

**PP 631:Evaluation and Monitoring of Policy Initiatives ..... (3 credits)**

This course provides students the background in evaluation and will discuss: The major concepts of program evaluation (PE), Apply the principles of conducting PE, Explore qualitative and quantitative data collection methods for evaluation, Understand the processes of evaluation and best practices for participation of stakeholders

The course will also cover the project planning, implementation and monitoring process in Pakistan especially with reference to public sector projects - Stages of project planning, implementation and monitoring (PC-I to PC-V) – Conceiving a project, financial plan, use of capital budgeting techniques like BCR, NPV and IRR. The course will frequently use cases available with the Planning Commission of Pakistan to study the contents.

**PP 636 Workshops for Proposal Development..... (3 credits)**

The series of seminars will mainly include, Introduction to Social Research Methods, Published Research as Case Studies, Sampling, Data Collection techniques, Data Management & Analysis via NVivo, EViews and Stata, and Workshops for Writing & Presenting Research

**PP 711: Public Finance and Devolution ..... (3 credits)**

This course will comprise of two components. The first part will discuss topics from Public Finance including; The Role of Public Sector in Economics; Size and Scope of Government; Efficiency and Equity; Distribution; Economic Welfare; Externalities; Analysis of Expenditure Policy; Budget Analysis; Budgetary Process in Pakistan; Taxation; the Tax system in Pakistan; Tax Evasion;

The second component consists of topics from devolution and local development. Here the course focuses on the political, administrative and fiscal devolution in Pakistan. The course will cover the history of devolution in Pakistan, its consequences for governance and public sector efficacy, and empirical evidence on the effects of devolution on economic growth and public policy. Students will learn about the principles of fiscal federalism, multi-level government, political economy of fiscal decentralization, accountability, risk sharing, problems of multi- jurisdictional taxation, and intergovernmental fiscal transfers.

**PP 714: Public Financial and Tax Management ..... (3 credits)**

This course deals with the accounting aspects of public finance. Public Financial Management discusses the fiscal sustainability and appropriateness of various fiscal allocations. This course will discuss the operational management of public finance focusing on value for money, outcome of spending and strategic financial planning and management. The transparency and accountability aspects as well as the controls, compliance and oversight mechanisms in place are discussed with special reference to Pakistan hence topics like deficit financing, debt and debt management, PRSP, MTDF, MTBF would be discussed.

This course also discusses the recourse mobilization aspects and the matters related to taxation. The core will be to discuss the elasticities, incidence, impact and coping strategies. In addition, students will also be familiarized with the loopholes in the process. The course will discuss the experience from Pakistan and an international comparison.

**PP 717: International Finance and Development..... (3 credits)**

This course focuses on the role of development partners in international development. The course will cover the history of international development finance, emergence and role of the multilateral institutions, the role of private **sector** and NGOs, and the transformation of



international aid architecture and aid delivery system. This course will enable the participants to understand and evaluate issues related to aid including; modalities, policy networks, fragmentation, proliferation, volatility, fungibility, conditionality, transaction costs, visibility, and donor-donor coordination, etc. Pakistan, as a case, will be used to elaborate concepts and analyze policies.

**PP 720: Private Sector and Regulatory Policy ..... (3 credits)**

This course is based on the role of the private sector and the settings conducive to make private sector efficient. This course introduces the students to the role of private sector in the development of economy. In addition, it will explain the role and conduct of political and state institutions including; courts, legislatures, executives, bureaucracies and social movements. It will also highlight the demands for specific policies and interest groups. The role of different regulatory authorities in Pakistan like ORGA, NEPRA, PEMRA, PPRA, PTA etc. will be discussed.

**Field of Specialization- II**

**PP 723: Social Policy ..... (3 credits)**

This course will also introduce student to the economic concepts and analysis relevant to social policy especially health, education and social security. Topics will touch upon: the role of health/education in the production models; socio-economic effects of under-provision of health and education; the economic rationale of investing in human capital, the behaviour and influence of various participants (social service providers and users) on social service utilization and provision, the role of NGOs in the social sector services.

**PP 726: Poverty Reduction and Sustainable Development ..... (3 credits)**

This course will examine the nature and extent of poverty in the Pakistan, its causes and consequences, and the antipoverty effects of existing and proposed government programs and policies. Course content will include both qualitative and quantitative aspects of poverty-related research. The topics to be discussed include: poverty and its persistence; the interrelationships among poverty, family structure, inner city neighbourhoods, crime, labour market conditions and public policies; policies/approaches adopted to address poverty.

The course will also discuss the issue of food security and the situation around the world; malnutrition and its effects in the economy. Measures taken in the context of global response like MDGS and its progression to SDGs

**PP 729: Environmental and Natural Resource Management ..... (3 credits)**

Market failures and externalities, under and over-provision of goods with externalities, Environment and Issues related to its sustainability, the availability and quality of natural resources and services derived from it, issues concerning the availability and sustainability of land, water, air quality, energy, and minerals for basic human needs and sustained economic growth, pollution control, management of ecosystem, biodiversity, climate change, potential technologies of resource exploitation and maintaining environmental balance, the political, legal, and social dimensions of the management of resources and the environment.

**PP 732: Urban Development ..... (3 credits)**

This course concerns the policy-making and governance with reference to urban areas to understand the opportunities for the economy and challenges to sustainability and social inclusion. The course covers economic analyses of issues related to urbanization including; health, education, labour, poverty, crime, housing, slums, land-use planning, well-being of the members of society, mega cities and vulnerability of children, elderly and families living at society's margin. The opportunities that urbanization provides for prosperity through vertical expansion, networking, scale and clusters etc. will be the special focus of the course.

**PP 735: Transport and Infrastructure Development..... (3 credits)**

This course will provide basics introduction to the concepts and tools used in transports economics. It will discuss the role of transport in improving connectivity, better access to services and its relationship with economic performance and efficiency of agents. Elasticises, optimal speed, congestion and capacity utilization will be discussed. Informal and modern innovations (like Careem and Uber) will be analysed. Techniques for analysis will also be discussed. Similarly, analysing the role of infrastructure will also be a part of this course. The part played by government, private sector and the Public-Private partnership will be discussed. The theories, tools and techniques to explain the importance of infrastructure for development will be discussed

**PP 738: Network Governance ..... (3 credits)**

This course considers a network approach to problem solving and decision-making in the public sector. The concept of policy networks and meta-governance forms a central strand of the course. The course introduces participants to the theories of network governance; network management strategies; steering and managing networks; complex decision-making processes; and measuring the effectiveness of network governance.

**PP 741: Law and Public Affairs..... (3 credits)**

The course is designed to convey how laws should be used to correct market failures, protect property and encourage economic development. The contents include laws and institutions to Correct Market Failures; Contracts; Property Rights, Regulation of Externalities, The Coase Theorem, the Economics of Litigation, Motive to Commit Crimes, and the Optimal Governmental Response to Crime, the Trade-off between the Certainty and Severity of Punishment; the Choice between Ex-ante and Ex-post Sanctions; Negligence versus Strict Liability.

The course will also cover topics on the applied side like; Crime, insecurity, violence and terrorism; Justice as deterrence against crime, the use of force versus the threat of force. The economic, social and psychological effects of different types of insecurity and their intensity; historical trends in violence; the rationale and effects of punishment; what is the role of society, courts, law enforcing agencies, the government and the international community in taking care of injustices; how justice facilitates peaceful coexistence

**PP 744: Political Economy and Institutions..... (3 credits)**

This course provides an introduction to public policy making, its characteristics and consequences in the context of political economy of developing countries. The course will provide the theoretical foundations from economics of different approaches to looking at the growing literature on topics such as governance, corruption and rent seeking, role of the state, and different strategies for catching up. New institutional approaches to these issues and the mainstream policy agenda will be covered in this course. The course will also cover; Private Predation versus Public Predation, Limited Access Order versus Open Access Order, Parliament, Political Process and Policy Making, Constitutional Rules versus Operating Rules, Political Institutions as a Cause of Economic Institutions, Dictatorship versus Democracy, Democracy and Economic Incentives, Incentives and Economic Development, Civil Rights

**PP 747: Conflict Management and Peace Building..... (3 credits)**

The topics covered include; different types of conflicts (ethnic, racial, sectarian etc.) and their consequences; public policy used or required to handle conflicts. Terrorism; use of violence to achieve political goals, history, transformation of conflicts into terrorism; public interaction of terrorism and public policy.

The course will then discuss policies adopted for peace building. The foundations of negotiations including; negotiation strategy; planning and framing; the phases of a negotiation-identification and preparation etc. similarly, mechanisms in place for minor conflicts resolution like within organisations and with the clients; customers, and other stakeholders; hence the approaches available to resolve minor conflict.

**PP 750: Government and Foreign Policy..... (3 credits)**

This course focuses on strategic decisions made by Pakistan government in the field of politics and international relations. Led by course convener or and policy experts from relevant fields, participants of this course will explore the foreign policy related events, analyze the context and evaluate the socio-economic consequences.

**Thesis**

**CORE**

Note: Any deviation from the given Fields of Specialization may be allowed on special demand from the students with approval from the Department Council