6

Core courses

6.1 Microeconomic Theory: EC001

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

  The purpose of this course is to give students a rigorous introduction to modern microeconomic theory.

- **Course Learning Outcomes**

  Three main learning outcomes are envisaged. First, the student should develop a sound understanding of the core concepts that economists use to understand the world of business, trade and public policy. By the end of the course, thinking like an economist should become second nature. Second, the course will familiarize students with the mathematical techniques that economists routinely use in their analysis. Modern economics makes heavy use of mathematics and statistics that advanced students must master. Finally, we will try to illustrate the usefulness of the abstract ideas and concepts introduced in the course with the aid of suitable applications to real world problems.

- **Content: Unit-wise**

  1. Prices, Markets and Efficiency - Voluntary exchange, Pareto efficiency, quasilinear utility, cost functions, demand and supply, market equilibrium, comparative statics, taxes and subsidies, public goods, externalities.

  2. Choice theory and Consumer Demand - The axiomatic approach, utility representation, demand and expenditure functions, duality, Slutsky decomposition, testable implications.

  3. Production, Costs and the Firm - Production possibility sets, cost minimization and profit maximization, input demand and output supply, non-profit motives.

  4. Monopoly - Profit maximization, dead-weight loss, price discrimination, monopolistic screening.

5. Choice under Uncertainty - The von-Neumann-Morgenstern axioms and expected utility theory, risk aversion, portfolio choice.

6. General Equilibrium Analysis: Barter; Core of Exchange economy; Market exchange; General equilibrium models of exchange and production; Existence of competitive equilibria; Competitive equilibrium as Core allocation Uniqueness and Stability of Competitive equilibrium; Comparative statics.

   Welfare Properties of Competitive Equilibria - First and Second Fundamental Theorems of Welfare Economics; Efficiency and fairness of Market wage; Factor Price Equalization Theorem.

7. Welfare Economics: Welfare Criteria - Fairness; Pareto optimality; Kaldor efficiency; Scitovsky Criterion; Samuelson Criterion; Cost Benefit Analysis.

   Social Choice; Social Welfare Function; Arrow's Impossibility Theorem and the related results.

8. Market Failures: Market failure; Sources of market failure and their implications Externalities; Public Good.

- **Suggested Readings**

  Bolton, P. and M. Dewatripont (2005): *Contract Theory.* MIT Press.

  Diamond P. and Stiglitz J. (1974): Increases in risk and in risk aversion, *Journal of Economic Theory* 8, 337-360.

  Jehle, G. and P. Reny (2001): *Advanced Microeconomic Theory*, Addison Wesley.

  Laffont, J-J, and D. Martimort (2002): *The Theory of Incentives - the Principal Agent Model*, Princeton University Press.

  Laffont, J-J and J. Tirole (1986): Using Cost Observation to Regulate Firms, *Journal of Political Economy*, 94(3): 614-41.

  Mas-Collel, A., M. Whinston and J. Green (1995): *Microeconomic Theory*, 2nd ed. Oxford University Press

  Maskin, E. and J. Riley (1984): Monopoly with Incomplete Information, *Rand Journal of Economics*, 15: 171- 96.

  Mirrlees, J. (1971): An exploration in the theory of optimum income taxation,*Review of Economic Studies* 38: 175-208.

  Pratt, J. (1964): Risk aversion in the small and in the large, *Econometrica* 32, 122-136.

6.2   Mathematics for Economics: EC002

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

  The objective is to rigorously introduce and teach several areas of mathematics that are widely-used in Microeconomics, Macroeconomics and Econometrics.

- **Course Learning Outcomes** The approach of the course will be analytical, so that we expect as a learning outcome that students can go beyond cookbook procedures when modelling and analyzing economic problems. A second learning outcome will be the acquisition of some mathematical sophistication, in understanding and writing proofs. These will be complemented by a basic learning outcome, which is to understand the main optimization and other tools used in a variety of economic applications.

- **Content: Unit-wise**

  1. Preliminaries: Sets, relations, functions.
  2. Linear Algebra:
     Vector spaces, subspaces.
     Convex sets, concave and quasiconcave functions, their characterisations.
     Linear independence. Linear mappings and matrix representation. Range, null space, rank-nullity theorem.
     Projection mappings and inverse mappings. Solutions of linear equations.
     Inner product and normed spaces. Orthogonality. Orthogonal projectors and distance-minimising property. Symmetric matrices. Quadratic forms.
     Spectrum of matrix, diagonalisation, similarity of matrices.
  3. Basic Real Analysis:
     In normed spaces, notions of open, closed and compact sets, continuous functions, their optima and their existence.
     Notions of differentiability of mappings between Euclidean spaces, chain rule, higher order derivatives.
     Implicit and inverse function theorem, comparative statics.
  4. Optimization:
     Characterisations of differentiable concave and quasiconcave functions. Characterisation of interior optima.
     Lagrange characterisation of optima subject to equality constraints.
     Karush-John-Kuhn-Tucker characterisation of optima subject to inequality constraints.
  5. Differential Equations: First-order and systems of first-order differential equations (linear and nonlinear); some stability theory.

- **Suggested Readings**

  Abbott, S. (1997): *Understanding Analysis*, Springer.

  Apostol, T. (1991): *Calculus, Volumes 1 and 2*, Wiley.

Simmons, G. and Krantz, S. (2006): *Differential Equations*, McGraw Hill.

Strang, G. (2006):*Linear Algebra and its Applications*, Thomson Brooks/Cole.

Sundaram, R. (1996): *A First Course in Optimization Theory*, Cambridge University Press.

6.3   Introductory Econometrics: EC003

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

  The first half of the course covers basic concepts in probability and mathematical statistics that are needed for the study of econometrics. The second half introduces basic econometric techniques commonly used in the empirical analysis of economic relationships and other social sciences.

- **Course Learning Outcomes**

  Students would acquire theoretical knowledge of statistics and basic econometric techniques used in the empirical analysis of economic relationships. They will undergo hands-on training in the use of software to select random samples, compute numerical counterparts of theoretical results and estimate empirical models.

- **Content: Unit-wise**

  1. Probability, Random Variables, Distributions:
     Sample spaces, Counting methods, Conditional Probability, Bayes' Theorem.
     Discrete, continuous and mixed random variables, marginal and conditional distributions, multivariate distributions, distributions of functions of random variables. Expectations, conditional expectations and other moments.

  2. Estimation: Properties of estimators, sufficient statistics, maximum likelihood estimation.

  3. Sampling Distributions, Aymptotic Distribution Theory:
     Large Sample Results: Laws of large numbers and central limit theorems.
     Sampling Distributions of Estimators: The Chi-square, t and F distributions.

  4. Hypothesis Testing: Definition of a statistical test. Size, significance and power. Likelihood ratio tests and the Neyman Pearson Lemma. Uniformly most powerful tests, t and F tests for moments of a distribution.

  5. Linear Regression:
     Simple Linear Regression - Ordinary Least Squares (OLS) Estimation; Desirable properties of least squares estimators; Goodness-of-Fit; Normality assumption for the errors; Maximum likelihood estimation.

Multiple Linear Regression: Ordinary Least Squares (OLS) Estimation; Underlying assumptions; Goodness-of-Fit.

Dummy variables in regression models: Qualitative regressors; qualitative and quantitative regressors; interaction terms.

Multicollinearity, Heteroscedasticity, Autocorrelation: Nature; implications; detection; remedies

6. Dynamic Models:

ARIMA models: AR, MA, and ARMA processes

Distributed lag models

7. Model specification: Model selection criteria

8. Panel data regression: Fixed effects LSDV model; Fixed effects within-group model; Random effects model.

- **Suggested Readings**

DeGroot, Morris H. and Schervish, Mark. J. (2012): *Probability and Statistics*, 4th edition, Addison-Wesley.

Gujarati, D.N. and Porter, D.C. (2008): *Basic Econometrics*, McGraw-Hill, New York.

Hogg, Robert V.; Makean, J and Craig, Allen T. (2014): *Introduction to Mathematical Statistics*, Prentice Hall, 7th edition

Hwang, Jessica and Blitzstein, Joseph (2014): *Introduction to Probability*, CRC Press.

Stock, James H. and Watson, Mark W. (2011): *Introduction to Econometrics*, Pearson Education Inc.

Wooldridge, Jeffrey (2012):*Introductory Econometrics: A Modern Approach*, South-Western.

6.4 Macroeconomic Theory: EC004

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

The objective of the course is to familiarise the students with (a) the concepts and issues in modern macroeconomics, as is applied in theory and practice across the world; (b) the major mathematical tools used in modern macro analyses.

The course has two modules of 4 units each. The first module begins with a brief discussion of the short run (static) aggregative macro frameworks and explore the implications of different policy changes for the macroeconomy. It then focuses on long run output dynamics, i.e., issues related to economic growth. The second module focuses on medium run dynamics as captured by business cycles, paying special attention to the Real Business Cycles theory and the New Keynesian framework.

- **Course Learning Outcomes**

Two central questions that motivate Macroeconomics are: (i) What causes aggregate output and employment levels in an economy to fluctuate/change over time? (ii) how effective are government policies in stabilizing the economy and/or generating steady growth? This course will provide the students with a deeper understanding of both these issues in the context of the real economy and will enable them to evaluate various macroeconomic policies and their implications on the basis of coherent theoretical frameworks.

- **Content: Unit-wise**

  1. Aggregative Macro Models: The classical system; the Keynesian system; Role of expectations in the aggregative framework; various theories of expectation formation; solving aggregative macro models with different assumptions about expectation formation and their policy implications.

  2. Mathematical Preliminaries:

     Methods of solving Ordinary Difference Equations; Systems of first-order difference equations; Steady states, Stability, Phase Diagrams, Linearization.

     Infinite Horizon Optimization in Discrete Time: Stationary Dynamic Programming with Discounting; Euler Equations and Transversality Condition; Solution techniques.

  3. Microfounded Macro Models:

     Lucas Critique and the need for microfoundations; the Dynamic General Equilibrium (DGE) approach to macro analysis: optimization problem of a representative household; optimization problem of a representative firm.

  4. Growth and Overlapping Generations models:

     Neoclassical Growth Models - The Solow model; The Ramsey-Cass-Koopmans model; The Samuelson-Diamond Overlapping Generations model.

     Endogenous Growth Models - the Basic AK-Model; Models with Externalities.

  5. Basic Factors of Business Cycles: Evidence and Issues

  6. Stochastic difference equations: First-Order Linear Systems; Scalar Linear Rational Expectations Models; Multivariate Linear Rational Expectations Models.

  7. Real Business Cycle Theory - basic structure with and without labour; Money in utility; Effectiveness of Monetary Policy.

  8. New Keynesian Model - basic framework, price stickiness (Calvo and Rottenberg), optimum pricing, dynamic IS and new Philips curve, monetary policy effectiveness. Monetary Policy Design: Rule vs Discretion. Sticky Wages and Unemployment.

- **Suggested Readings**

Acemoglu, D. (2009): *Introduction to Modern Economic Growth*, Princeton University Press.

Gali, Jordi (2015): *Monetary Policy, Inflation, and the Business Cycle*, 2nd Edition, Princeton University Press.

Galor, O. (2010): *Discrete Dynamical Systems*, Springer-Verlag.

Minford, P. and Peel. D. (2019): *Advanced Macroeconomics: A Primer*, 2nd Edition, Edward Elgar.

Romer, D. (2012): *Advanced Macroeconomics*, 4th edition, New York: McGraw Hill.

Sorensen, P.B. and Whitta-Jacobsen, H.J. (2010): *Introducing Advanced Macroeconomics: Growth and Business Cycles*, 2nd Edition, McGraw-Hill.

Wickens, M. (2011): *Macroeconomic Theory*, 2nd edition, Princeton University Press.

6.5 Introduction to Game Theory: EC005

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

  Game theory, which systematically studies strategic interactions, is an important tool for economists. The main goal of this course is to introduce the basic concepts of Game theory and to illustrate its importance in explaining various kinds of economic and social phenomena.

- **Course Learning Outcomes**

  To learn static and dynamic game models with complete and incomplete information. Learn and apply the main equilibrium concepts of noncooperative game theory, as well as learn procedures of iterated dominance. Learn some major applications such as Auctions, Bargaining, Repeated Games, Signaling and Screening.

- **Content: Unit-wise**

  1. Games with perfect information

     (a) Strategic form games: Dominated strategy, Nash and mixed strategy Nash equilibrium, Iterated elimination
     (b) Extensive form games: Action and strategy, Nash Equilibrium, Subgame perfect Nash equilibrium, One-deviation property and backward induction
     (c) Repeated games: Finitely and infinitely repeated game,
     (d) Bargaining: Alternating offers bargaining: Finite and infinite horizon

  2. Games with Imperfect Information

     (a) Imperfect information and Subgame perfection: Information Set, Mixed and behavioural strategies
     (b) Static games of incomplete information: Bayesian Nash equilibrium, Harsanyi transformation, Auction

(c) Dynamic games of incomplete information: Perfect Bayesian Equilibrium, Signaling games, Reputation games, Intuitive Criterion

(d) Information Economics: Adverse selection, Monopolistic Screening, Moral hazard

- **Suggested Readings**

  Fudenberg, D. and Tirole, J. (1991), *Game Theory*, MIT Press.

  Gibbons, R. (1992), *A Primer in Game Theory*, Prentice-Hall.

  Mas-Colell, A.; Whinston, M. and Green, J. (2006): *Microeconomic Theory*, Oxford University Press.

  Osborne, M. (2004): *An Introduction to Game Theory*, Oxford University Press.

  Osborne, M. and Rubinstein, A. (1994): *A Course in Game Theory*, MIT Press.

6.6   Economic Development and Policy in India: EC006

- **Marks**: Assignments - 30, Exam - 70

- **Duration (per week)**: 6 hours.

- **Credits** : 6.

- **Course Objectives**

  The aim of this course to familiarise students with recent research on issues concerning economic development and policy in India, with an emphasis on contemporary debates, and to train them in the conduct of policy analysis using the tools of economics. In particular, the course will help students to understand the application of economic theory, and the statistical and econometric techniques that they are taught in other courses. The approach is modular, and will vary with time, depending on the nature of current policy discourse and the expertise of the instructor.

- **Course Learning Outcomes** Students will have the tools to understand current policy debates and contribute to policy making in an informed way. They will also learn how to conduct independent research in these areas.

- **Content: Unit-wise**

  1. Poverty and inequality
  2. Food and nutrition
  3. Economic reforms and industrial performance
  4. Agriculture

- **Suggested Readings**

  Aghion,P.; Burgess, R.; Redding, S.J. and Zilibotti F. (2008): The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India, *American Economic Review.*

  Birthal, P.; Negi, D.; Khan, Md. and Agarwal, S. (2015): Is Indian agriculture becoming resilient to droughts? Evidence from rice production systems, *Food Policy.*

  Chaurey, R. (2015): Labor regulations and contract labor use: Evidence from Indian firms, *Journal of Development Economics.*

  Das, S.; Ghate, C. and Robertson, P. (2015): Remoteness, urbanization and India's unbalanced growth, *World Development.*

  Fishman, R.; Lall, U.; Modi, V. and Parikh, N. (2016): Can electricity pricing save India's groundwater? Evidence from a novel policy mechanism in Gujarat, *Journal of the Association of Environmental and Resource Economists.*

  Gaiha, R.; Jha, R. and Kulkarni, V. (2015): Affluence, Obesity and Non-communicable diseases in India, in Gaiha et al., Diets,*Malnutrition and Disease*, Oxford University Press.

  Gangopadhyay, S. Lensink, R. and Yadav, B. (2015): Cash or in-kind transfers? Evidence from a randomised control trial in Delhi, India, *Journal of Development Studies.*

  Kaushal, N. and Muchomba, F. (2015): How consumer price subsidies affect nutrition, *World Development.*

  Mukim, M. (2015): Coagglomeration of formal and informal industry: Evidence from India, *Journal of Economic Geography.*

  Sanga, P. and Shaban, A. (2017): Regional divergence and inequalities in India, *Economic and Political Weekly.*