INDIRA GANDHI INSTITUTE OF DEVELOPMENT RESEARCH

Semester: Aug-Dec Semester, 2023

Course Title: Microeconomics 1

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Course Description

The focus of the course will be on Microeconomic Theory and its applications. While the course will be theoretical in emphasis, its coverage will be at the intermediate graduate level. We will spend some time discussing the intuition behind the various concepts while we define the same with formal, precise statements.

Course Objectives

The course aims to

(I) provide a rigorous introduction to the essential tools and techniques used in Microeconomic Analysis

(II) prepare students to read academic papers on various topics in Microeconomic Theory and related fields

(III) help students develop a step-by-step problem-solving approach.

Course Outcomes

Upon completion of the course, students should be able to

(a) appreciate some of the important results in Microeconomic Theory

(b) construct theoretical models that analyze the behavior of individual economic agents in various settings and, if possible, test them with appropriate empirical techniques

(c) comprehend the underlying intuition behind the salient micro-level issues in a policy debate.

Course Requirements

Calculus; Set Theory; Probability Theory; Linear Algebra; Unconstrained Optimization over a Single Variable

Course Contents

PART ONE: INDIVIDUAL DECISION MAKING

1. Preference and Choice
2. Consumer Choice

Commodities
The Consumption Set
Competitive Budgets
Demand Functions and Comparative Statics
The Weak Axiom of Revealed Preference and the Law of Demand

3. Classical Demand Theory

Preference Relations: Basic Properties
Preference and Utility
The Utility Maximization Problem
The Expenditure Minimization Problem
Comparative Statics – Implicit Function Theorem
Duality: A Mathematical Introduction
Relationships between Demand, Indirect Utility and Expenditure Functions
Integrability
The Strong Axiom of Revealed Preference

4. Production

Production Sets
Profit Maximization and Cost Minimization
The Geometry of Cost and Supply in the Single-Output Case
Aggregation
Efficient Production

PART TWO: GAME THEORY

7. *Static Games of Complete Information*

7.1 Normal/Strategic form games and Nash Equilibrium
7.2 Pure and Mixed Strategies
7.3 Iterated Elimination of Strictly Dominated Strategies (IESDS)

7.4 Nash Equilibrium – pure and mixed strategies

8. *Dynamic Games of Complete Information*

8.1 Complete and Perfect Information
8.2 Game Trees/Extensive Form Representation
8.3 Backwards Induction
8.4 Complete and Imperfect Information
8.5 Subgame Perfection
8.6 Repeated Games
8.7 Renegotiation Proof Equilibrium

Evaluation

50% will be on the final examination, 30% on a mid-sem examination, and the remaining 20% on (four) assignments handed out in class.

Students may work together on homework assignments but must write their answers independently. Answers that are merely copies of one another will be treated as violations of academic integrity, and appropriate action will be taken.

As a general policy, there will be no make-up midterm exams. If you miss a midterm exam and have a valid excuse, your grade will be based on the remaining elements of the course. Students should plan to be on campus till the end of the semester. Travel plans do not constitute a valid excuse for missing an exam.

References

1. *Microeconomic Theory*, Andreu Mas-Colell, Michael D. Whinston and Jerry Green, Oxford University Press.

2. *Advanced Microeconomic Theory*, Geoffrey Jehle and Philip Reny, 2nd ed. Reading, MA: Addison-Wesley.

3. *Microeconomic Analysis*, Hal Varian, Third Edition, W.W. Norton and Company.

4. *Game Theory for Applied Economists*, Gibbons, Princeton.

5. *Game Theory*, Fudenberg and Tirole, MIT Press.

6. *A Course in Game Theory*, Osborne and Rubinstein, MIT Press.

7. *A First Course in Optimization Theory*, Rangarajan K. Sundaram, Cambridge University Press.

8. *Mathematics for Economists*, Carl P. Simon and Lawrence Blume, W.W. Norton and Co.

Expectations

I believe that learning is a team effort. Students are the most vital part of this effort. There is a lot that students can do to help create a good learning environment. This includes coming to lectures on time, handing in assignments on time, and participating actively in class discussions.

INDIRA GANDHI INSTIUTE OF DEVELOPMENT RESEARCH

SEMESTER: Fall 2023 (Aug-Dec 2023)

COURSE TITLE: Macroeconomics I

INSTRUCTOR: Sargam Gupta

TEACHING ASSISTANT: Ankita Mandal

COURSE DESCRIPTION: This course will cover the stylized facts governing the basics of output growth, consumption, investment and savings in various economies. It will later introduce the standard macroeconomic growth models to understand the mechanics of the empirical facts observed in the data both in closed and open economy set-up.

COURSE OBJECTIVES: This course intends to motivate students to learn the concepts and applications of major workhorse models of the macroeconomics discipline. The idea is to provide a solid grounding to tackle more complex and detailed material in this field.

COURSE OUTCOMES:

CO1 Understand and explore dynamics of the macroeconomic stylized facts

CO2 Get acquaint with the concept of equilibrium both dynamically efficient and inefficient

CO3 Comprehensive understanding of long-run growth models including exogenous and endogenous growth models.

COURSE REQUIREMENTS: Prerequisites for this course are a familiarity with multivariate calculus, real analysis and linear algebra.

COURSE CONTENTS: Broadly the lectures will cover the following macro-economic growth models:

- Solow-Swan growth model: theory and empirics
- Ramsey-Cass-Koopmans growth model and extensions

• Overlapping generations model

• AK model, Endogenous growth models

• Open economy macro growth model

Software: The course would also introduce the basic programming of macroeconomic models in MATLAB or GNU-Octave.

EVALUATION: Class Participation and attendance: 5%

Homeworks/ Quizzes: 15%

Mid-Term Exam: 35%

Final Exam: 45

REFERENCES:

Core textbooks

1. Acemoglu, Daron. (2010). Introduction to Modern Economic Growth Princeton University Press. ISBN: 9780691132921.

2. Barro, Robert J. and Xavier Sala-i-Martin (2004), Economic Growth, 2nd Edition.

3. Romer, David. (2012), Advanced Macroeconomics, 4th Edition.

Additional textbooks

1. Aghion, P and Howitt (1998), Endogenous Growth Theory, MIT Press.

2. Ljungqvist, L and T Sargent (2012), Recursive Macroeconomic Theory, MIT Press.

3. Stokey, N and R E Lucas (1989), Recursive Methods in Economic Dynamics, Harvard University.

4. Vegh, Carlos (2013),Open Economy Macroeconomics in Developing Countries, MIT Press.

Reading list

1. Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. Quarterly Journal of Economics, 70, 1, 65-94

2. Mankiw, N.G., D. Romer and D. N. Weil. (1992). A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics, 107, 2, 401-437.

3. Ramsey, F.P. (1928). A Mathematical Theory of Saving. Economic Journal. 38, 152, 543-559.

4. Cass, D. (1965). Optimum Growth in an Aggregative Model of Capital Accumulation. Review of Economic Studies. 32, 233-240.

5. Romer, P. M. (1986). Increasing Returns and Long-Run Growth. Journal of Political Economy. 94, 5, 1002-1037.

6. Barro, R.J. (1990). Government Spending in a Simple Model of Endogenous Growth. Journal of Political Economy. 98, 5, part 2, 103-125.

7. Jones, Charles I. (1995). RD-Based Models of Economic Growth. Journal of Political Economy. 103, 759-784

8. Jones, L. and R. Manuelli. (1990). A Convex Model of Equilibrium Growth. Journal of Political Economy. 98, 1008-1038.

9. Romer, P.M. (1990). Endogenous Technological Change. Journal of Political Economy. 98, 5, part 2, 71-102.

10. Aghion, P. and P. Howitt. (1992). A Model of Growth Through Creative Destruction. Econometrica. 60, 2, 323-351.

11. Young, A. (1991). Learning-by-doing and the Dynamic Effects of International Trade, Quarterly Journal of Economics. 106, 2, 369-406.

12. Grossman, G.M. and E. Helpman. (1990). Comparative Advantage and Long-Run Growth. American Economic Review. 80, 4, 796-815

13. Krugman, P.R. (1979). A Model of Innovation, Technology Transfer, and the World Distribution of Income. Journal of Political Economy. 87, 2, 253-266.

14. Grossman, G.M. and E. Helpman. (1991). Endogenous Product Cycles. Economic Journal. 101, 408, 1214-1229.

Reference books for Mathematics

1. Fuente, Angel de. (2000). Mathematical Methods and Models for Economists. Cambridge University Press.

2. Chiang, C. Alpha (1984). Fundamental Methods of Mathematical Economics. McGraw-Hill Publishing Co.

3. Pontryagin, Lev S., et al. (1962). The Mathematical Theory of Optimal Processes. New York: Interscience Publishers.

INDIRA GANDHI INSTIUTE OF DEVELOPMENT RESEARCH

SEMESTER: 1

COURSE TITLE: Econometrics - I

INSTRUCTOR: Bharti Nandwani

TEACHING ASSISTANT: Ishita Varma

COURSE DESCRIPTION: Designed for graduate students, the course will cover simple linear regression and multivariate regression, finite sample and asymptotic properties of OLS, inference and prediction, generalized and restricted least square, multicollinearity, heteroscedasticity and generalized methods of moments.

COURSE OBJECTIVES: The objective of the course is to give students an exposure to basic econometric theory and a practical understanding of the subject through examples and empirical applications.

COURSE OUTCOMES:

CO1 – Good understanding of OLS methodology and issues of endogeneity

CO2 – Good understanding of Econometric tools

CO3 – Analysing data

COURSE REQUIREMENTS: Elementary knowledge of probability, statistics, and matrix algebra would be helpful, but is not required. A review of the relevant concepts would be done as and when required.

COURSE CONTENTS:

Topic 1 (Lectures 1 to 5): Introduction

- Review of Probability Theory (Random variable, Joint and conditional distribution, independence, features of probability distribution, covariance, normal and related distributions) – Ref: WD Appendix B

- Primer on Matrix Algebra (Matrices, Matrix Differentiation, Inverse of a matrix, Rank, quadratic forms, positive definite matrices, Matrix Statistics) – Reference JJ Appendix A and B.

Topic 2 (Lectures 6 to 10): Classical Linear Regression Models

- Least squares: assumptions
- Estimation
- Statistical properties
- Hypothesis testing and Inference

Topic 3 (Lectures 11 to 14): Classical Linear Regression Models: Special Topics

- Partitioned regression
- Dummy variables
- Choice of Functional form and tests of model specification
- Omission of relevant variables
- Inclusion of irrelevant variables

Topic 4 (Lectures 15 to 20): Large sample theory

- Convergence concepts
- Classical regression model with large samples

Topic 5 (Lectures 21 to 24) Endogeneity

- Causes of Endogeneity
- Instrumental Variables Estimation methodology
- Two Stage Least Square Estimation

Topic 6 (Lecture 25 to 28) General Model: Free Variance - Covariance Matrix

- The Generalised least squares estimator
- Heteroskedasticity
- Autocorrelation (including spatial autocorrelation)
- Inference and testing

Topic 7 (Lecture 29 to 32) Non-linear Regression Models

- Non-linear regression
- Maximum Likelihood Estimation
- Generalised Methods of Moments

EVALUATION: Grading for the course will be based on home assignments (15%), one empirical project (15%), one midterm examination (30%), and a final examination (40%). Class participation will count for borderline grades. Regular attendance is required.

REFERENCES:

1. *Econometric Methods* (4th edition), Jack Johnston and John DiNardo, McGraw-Hill Publishers, ©1997. (Referred to as JJ below)
2. *W.H. Greene, Econometric Analysis, 7th. ed., Upper Saddle River, NJ: Pearson Education (Prentice-Hall), 2012* (Referred to as Gr below)
3. *Econometric analysis of cross section and panel data,* by Jeffrey M. Wooldridge, MIT press, 2010.
4. *Introductory Econometrics: A Modern Approach,* by Jeffrey M. Wooldridge, Cengage learning, 2015. (Referred to as WD below)
5. *Estimation and Inference in Econometrics*, by Russell Davidson and James G. Mackinon, Oxford University Press, 1993.
6. *Microeconometrics*, by A.C. Cameron and P.K. Trivedi, Cambridge University Press, 2005. (Referred to as CT below)

INDIRA GANDHI INSTIUTE OF DEVELOPMENT RESEARCH

SEMESTER 1 (2023-24)

Course Title: MATHEMATICS FOR ECONOMISTS **Instructor: G. Mythili**

Teaching Assistant: Ms. Snigdha Kalra

COURSE DESCRIPTION: This course is designed to familiarize students with mathematical rigor and problem solving tools necessary for learning advanced economics theory courses. The topics range over Optimization Problems of Classical, Linear and Non-linear to Dynamics. All the topics cover exercises involving economic applications.

COURSE OBJECTIVES: To enable students to learn and understand mathematical tools needed for Economics discipline and solve economics problems using the same.

COURSE OUTCOMES: At the end of the course, it is expected, students would be

CO1: able to mathematically formulate economics problem

CO2: able to solve the problem using one of the tools learnt during the course

CO3 : able to interpret the results

COURSE REQUIREMENTS: Basic knowledge in Algebra and Calculus

COURSE CONTENT:

1. **Basics :** Linear algebra, matrix and determinants, Simultaneous system of linear equations, Characteristic roots and vectors; Economic application: Input output model.
   Sets, Functions, Metric spaces, Convex analysis, Separation theorem.
   Quadratic forms: positive and negative definite matrices;
   Differential calculus, Integral calculus, Economic applications.

2. **Mathematical Programming**: Formulation, types of optima, Weierstrass theorem and local global theorem**; Classical programming**, unconstrained and constrained optimization; Economic applications.

3. **Linear and Non-linear programming:** Formulation, Fundamental theorems of LP, Duality; Simplex Method, Economic applications
   Non-linear Programming, Kuhn-Tucker Conditions, Constraint Qualification.
4. **Dynamics:** Difference and differential equations, Applications: cobweb model, stability of market equilibrium, Growth models.
5. **Dynamic Optimization**: Optimal control theory, free and fixed end points, Hamiltonian function and Pontryagin's maximum principle, problems with discounting, finite and infinite time horizon Models, Bellman's Equation, Economic Applications.

EVALUATION: The evaluation is based on tests, midterm exam and final exam.

Assessment weights

Class tests	15%
Mid-term exam	25%
Final exam	60%

REFERENCES:

Main Texts

Intriligator, M.D. *Mathematical Optimization and Economic Theory*. (This book is good for theoretical foundations, concepts and definition)

Simon, C.P. and Blume L. *Mathematics for Economists*. (for Basics, classical and non-linear programming)

Hoy, Michael *et.al., Mathematics for Economics*, Second Edition.(for difference and differential equations, Dynamic Optimization; Numerical problems and economic applications)

Chiang, A. *(3rd Edition) Fundamental Methods of Mathematical Economics* (Basics and Numerical problems in linear and non-linear programming, difference and differential equations, economic applications)

Supplemental Texts

Avinash Dixit , *Optimization in Economic Theory* (Chapters 10 and 11)

Dorfman, R. Samuelson P.A. and R.M. Solow, *Linear Programming and Economic Analysis* Mc Graw Hill.(classic book for linear programming with economic applications – transportation problem).

INDIRA GANDHI INSTIUTE OF DEVELOPMENT RESEARCH

SEMESTER: 1

COURSE TITLE: Energy and Environment 1

INSTRUCTOR: Manisha Jain

TEACHING ASSISTANT:

COURSE DESCRIPTION: This introductory course on Energy and Environment provides students with a comprehensive understanding of the fundamental concepts, challenges, and interconnections between energy use and environmental degradation. The course aims to equip students with the knowledge and critical thinking skills necessary to analyze and address the complex issues associated with environment, energy resources, sustainability, and environmental impact of human activities.

COURSE OBJECTIVES:

- To provide students with a foundational understanding of energy and environmental science
- To explore the interconnections between energy, environment, and sustainable development
- To develop students' skills in accounting for a country's energy use and emissions
- To introduce economic theory and its application to energy and environmental issues
- To familiarize students with climate change economics and modeling
- To examine energy and environmental policies
- To introduce students to consumer valuation methods

COURSE OUTCOMES:

- **CO1 –** Develop a strong foundation the concepts of energy use and environmental pollution
- **CO2 –** Develop ability to analyze and evaluate the issues in energy use, environmental impact for sustainable development both analytically and empirically
- **CO3 –** Acquire the necessary skills to analyse energy and environmental factors, such as creating energy balance tables, calculating emission inventories, and estimating emission factors
- **CO4** – Acquire concepts of economic modelling of energy and environment and understand the economic implications of energy and environmental policies,
- **CO5** - Learn to use various methods to assess the value of energy and environmental attributes from a consumer perspective.

COURSE REQUIREMENTS: NA

COURSE CONTENTS:

1. Module 1: Basics of energy and environment science
   1.1. Types of pollution – causes, trends and impacts
   1.2. Atmospheric composition, emissions and concentration
   1.3. Types of air pollutants and air quality index
   1.4. Greenhouse gases, global warming potential and radiative forcing,
   1.5. Energy use, air pollution and climate change
   1.6. Energy sources, types, flows and transformation

2. Module 2: Energy, environment and sustainable development
   2.1. United Nations Sustainable Development goals for energy and environment
   2.2. Climate change goals, Paris agreement, net-zero targets
   2.3. Energy environment and economy interactions

2.4. Kuznet curves

3. Module 3: Accounting in energy and environment
   3.1. Energy balance tables
   3.2. Calorific values of fuels
   3.3. Emissions inventories
   3.4. Emission factors

4. Module 4: Economic theory in energy and environment
   4.1. Public goods
   4.2. Externality
   4.3. Common property resources
   4.4. Discounting
   4.5. Cost benefit analysis

5. Module 5: Climate change economics and energy modelling
   5.1. Kaya identity and Drivers of CO2 emissions
   5.2. Marginal abatement cost curves
   5.3. Integrated Assessment Models
   5.4. Social cost of carbon
   5.5. Energy supply and consumption patterns
   5.6. Integrated energy planning

6. Module 6: Energy and environment policies
   6.1. Types of policy interventions in energy and environment
   6.2. Energy efficiency and renewable energy policies
   6.3. Regulations, taxes and cap and trade
   6.4. Climate change negotiations
   6.5. Carbon markets

7. Use of consumer valuation methods in energy and environment
   7.1. Discrete choice experiments
   7.2. Hedonic price models
   7.3. Contingent valuation method

EVALUATION:

Quizzes and presentations: 50%
Mid term: 20%
Final paper: 30%

REFERENCES:

- Energy, environment and development by Jose Goldemberg and Oswaldo Lucon, Earthscan from Routledge
- Zweifel Peter, Praktiknjo Aaron and Georg Erdmann, Energy Economics: Theory and Applications, Springer 2017
- The Energy system : Technology, economics, markets and policy by Bradford, Travis, - 2018, - MIT Pr
- Environmental and energy policy and the economy(Vol.1) by Kotchen, Matthew J. , Stock, James H. and Wolfram, Catherine D. , - 2020, - University of Chicago Pr (Chicago) – BOOK
- Energy economics: Concepts, issues, markets and governance by Bhattacharyya, Subhes C
- Climate Change: Global Risks, Challenges, and Decisions by Ed. by Katherine Richardson, Will Steffen and Diana Liverman, - 2014, - Cambridge Uni Pr (Cambridge)
- Environmental Kuznets Curve (EKC) : A Manual / by Ozcan, Burcu and Ozturk, Ilhan, - 2019, - Academic Pr (London)
- Introduction to sustainable development by Ossewaarde, Martin J, - 2018, - Sage (New Delhi)

- Turner R.K., D. Pearce and I. Batman, 1994, Environmental Economics, Harvester Wheatsheaf.
- Tietenberg Tom. 1996: Environment and Natural Resources Economics, Horper Collens Collage Publishers
- Baumol, W.J. and Oates, W.E., 1988, The Theory of Environmental Policy, Second Edition, Cambridge University Press.

Additional references:

- Peavy and Rowe, "Environmental Engineering" (Text book placed among the reading materials)
- Chandrasekhar M (2004), "Environmental Science", Hi-Tech Publishers, Hyderabad
- Energy, 1994, Aubrecht, Gordon J, Prentice Hall
- Energy Economics and Policy, 1986, Griffin and Steele, Academic Press
- Energy Economics: A modern introduction, 2000, Ferdinand E. Banks, Kluwer
- Kneese, A.V. and Sweeney, J., 1993, Handbook of Natural Resources and Energy Economics, North Holland.
- Fisher Anthony C.1981,Resource and Environmental Economics, Cambridge Univ. press.
- Canrad, J.M. and Clark, C.W., 1987, Natural Resources Economics, Cambridge University Press.
- Cline, W.R., 1992, The Economics of Global Warming, Institute for International Economics, Washington, D.C.
- Energy for Sustainable World, Goldberg, 1998, J, Johnson H, Reddy AKN and, Williams R, Wiley Eastern
- Energy Infrastructure: Priorities, Constraints, Strategies for India, 2009, Asian Development Bank (ADB), Oxford Uni Press,
- India's Energy Security, S D Muni and Girijesh Pant
- Energy, Environment and Sustainable Development – A Technological Perspective: Selected works of. Prof. Amulya K. N. Reddy, 2005, B. Sudhakara Reddy and P. Balachandra, Narosa Publications.
- Governance of Rural Electricity Systems In India, 2007, Haribandhu Panda, Academic Foundation
- Energy for the 21st Century: A Comprehensive Guide to Conventional And Alternative Sources, 2006, Roy L. Nersesian, M.E. Sharpe
- Renewable Energy: Power for Sustainable Future, 2004, Godfrey Boyle, Oxford Uni Press.
- Economics of technology diffusion and energy efficiency, 2005, Mulder Peter, Edward Elgar, Cheltenham,
- Energy, resources, and the long-term future, 2007, Avery, John Scales, World Scientific, New Jersey