Mathematical Economics

Workshop-1

Real Number System: Overview, Transcendental Number, Liouville's Approximation Theorem, Gelfond-schneider's constant

Set Theory: Definition, Cardinality, Types, Specification of Sets , rules of representing sets, cartesian Products, subsets, Union & Intersection, Indexed Sets, Well Ordering Principle,

Logic: Introduction of Logic, Russell's paradox, Statement, Open Statement, Law of excluded middle, Statement's forms, Conjunctions, Disjunctions & Negations, Conditionals & Biconditionals, Necessary & Sufficient, Quantifiers, Tautology, Negating Statements, Rules of Inference, Relations, Ordered Relations, Function

Reference Materials:

1.https://www.whitman.edu/mathematics/higher_math_online/chapter01.html

2. http://intrologic.stanford.edu/general/lessons.php

3.Questions:

https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/int/i

Workshop-2

Functions: Definition, Domain, Range, types of functions, inequality, limit, differentiation, sketching the curve, integration - Problems, multivariate limits & derivatives

Sequence & Series: Sequence, Convergence & Divergence of Sequence, Series-Definition, convergence & divergence of series, Lipshitz continuity

Reference Material:

1. https://tutorial.math.lamar.edu/
2. http://sites.science.oregonstate.edu/math/home/programs/undergrad/CalculusQuestStudyGuides/vcalc/254.html

Practice Questions:

https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/int/i

Extra Lecture: **Differential Equations:** Order, Degree, First order, Second Order, System of DE

Workshop-3

Optimization: Introduction, definitions, existence of optimum, Interior Optima, Two variables; one constraints,
Concavity & Convexity : Single variable Convexity, Quadratic forms
Topology: Metric Space, Infremum & Supremum
Reference Materials:

1. https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/ino/t

Practice Questions:
https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/toc

Workshop-4
Linear Algebra:
System of Linear Equations, Gauss-Jordan & Gauss Elimination Method, Linear dependence, Span, Vector Space, Subspaces, Null Space, Column-Space, Row-Space, Change of Basis, Eigenvalues, Eigenvectors, Inner Product, Orthogonal Matrices, Projection

Reference Materials:

1. https://www.math.ucdavis.edu/~linear/linear.pdf
2. https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/

Practice Questions:
https://mjo.osborne.economics.utoronto.ca/index.php/tutorial/index/1/toc
David C. Lay pdf

MACROECONOMICS

Workshop 1:

National Income Accounting: three approaches to measure Gross Domestic Product (value added, income method, expenditure method), real versus nominal GDP, price indices, National income accounting for open economy, balance of payment accounts; questions for practice.

Monetary Demand and Supply Functions of money, Instruments and objective of Monetary policy- price stability, economic growth, bank rates; Quantity Theory of Money (Fisher's Transaction approach and Cambridge Cash- Balance approach), determination of money supply and demand, Demand for money and Keynesian Liquidity preference Theory of Interest, credit creation and high powered money- deposit multiplier- money multiplier. Numericals for practice.

Closed Economy: Classical and Keynesian System; simple Keynesian model of Income determination: IS-LM Model- Goods market equilibrium & Money market equilibrium - Theory of Multiplier; role of Fiscal policy and monetary policy- three ranges of LM curve- elasticity of LM curve and the effectiveness of Monetary and Fiscal policies.

Reference:

Workshop 2:

Labour Market: and the effectiveness of Monetary and Fiscal policies. Labor market- Wage determination; wages, prices and employment, natural rate of unemployment; from employment to output, Nominal Wage rigidities, Phillips Curve, Okun's law; brief discussion on Rational expectations and sacrifice ratio.

Aggregate Demand - Aggregate Supply Model: Aggregate Demand Curve(with Price Flexibility)- Derivation of Aggregate Demand Curve- shift in AD Curve and multiplier effect; Three ranges of short run Aggregate supply curve - Shifts in AS Curve- long run AS curve- shift in long run AS Curve.

Reference:

Workshop 3:

Economic Growth: Harrod-Domar model; Solow model; Golden rule, technological progress ; ISI past year questions.
Open Economy: Short-run open economy models; Mundell-Fleming model; exchange rate determination; purchasing power parity; asset market approach; Dornbusch's overshooting model; monetary approach to balance of payments; international financial markets.

Reference:

Microeconomics

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.

Syllabus of Microeconomics

Workshop-1

Choice theory and Consumer Demand: Marshallian Demand Functions & Duality

1. Various types of Utility functions
2. Demand functions
3. Marshallian Demand
4. Indirect Utility function
5. Hicksein Demand function
6. Properties of Marshallian Demand Function
7. Lexicographic preferences(it's utility and demand function)(Imp)
8. Slutsky and Hicksian Substitution and Income Effect

& Inter temporal Choice problem: (Maximizing the utility of the consumer who is consuming in two different time periods for given budget constraints and his/her income in two time periods.)
Net Substitutes and Net Complements: Gross and Net Substitutes, Gross and Net Complements
Brief about Implicit Function Theorem/Comparative Statistics, Work Leisure Choice problem of Consumer

Reference materials:

1. http://youtubedia.com/Courses/View/5 - [Chapter 1 to 5]
2. https://www.youtube.com/watch?v=pofB56sJnS8&list=PL5B3KLQNAC5jcLG1VnaloHqGPXOU4JEoI&index=8&ab_channel=Bilkent%C3%9Cniversitesi [From Lecture video 1 to 24- Exclude 17]

Workshop-2

1. Choice under Uncertainty - The von-Neumann-Morgenstern axioms and expected utility theory, risk aversion, portfolio choice, how to measure risk aversion, Demand for insurance to avert risk.
    - Certainty equivalence and Risk aversion
2. Moral Hazard
3. Connection between Compensated and Uncompensated Demand Curve
4. Past year of topics till now.
5. Pareto Efficiency and Competitive Equilibrium

Reference materials:

Workshop-3

6. Production and Costs
    - Properties of Production set
    - Profit Maximization and Cost minimization
    - Industry Supply Curve
    - Consumer Surplus and Producer Surplus

Reference Materials:
https://www.economics.utoronto.ca/osborne/2x3/tutorial/THEORFRM.HTM

https://www.youtube.com/watch?v=pofB56sJnS8&list=PL5B3KLQNAC5jcLG1VnaloHqGPXOU4JEoI&index=8&ab_channel=Bilkent%C3%9Cniversitesi [From Lecture 26 to 39]

Workshop-4

7. Monopoly
    - Monopoly profit maximization
    - Monopoly and entry

- Natural Monopoly
- Lerner's Index
- Price Discrimination
- Multi-plant Monopolist

8. Oligopoly
    - Cournot Oligopoly
    - Stackelberg Oligopoly
    - Bertrand
    - Patent race/Innovation Race
    - Warranty
    - Tying
    - Differentiated Products
    - Peak Load pricing
    - Mergers
    - Collusion
    - Location model
    - Follower and leaders problem

Reference Materials:
https://www.economics.utoronto.ca/osborne/2x3/tutorial/THEORFRM.HTM

Intermediate Microeconomics Book : Hal A varian Pdf

Video Lectures:

1. https://www.youtube.com/watch?v=pPLOtrzMsDg&list=PLlvx_7HXFW92-jpGi-EPym6wgneREviI&ab_channel=BenZamzow [To Understand theory and logic]
2. https://www.youtube.com/watch?v=pofB56sJnS8&list=PL5B3KLQNAC5jcLG1VnaloHqGPXOU4JEoI&index=8&ab_channel=Bilkent%C3%9Cniversitesi [To solve examples]