

COURSE CURRICULUM OF BS PROGRAMME IN ECONOMIC SCIENCES

Semester I

Course No.	Course Title	Credit
Mandatory courses		
HSS101	English for Communication	2
MTH101	Calculus of One Variable	3
PT101	Physical Training	0
ECO101	Principles of Economics - I	3
Optional Courses (any four)		
BIO101	Biology I: Biomolecules	3
CHE101	Engineering Design and Drawing	3
CHM101	General Chemistry	3
PHY101	Mechanics	3
EES101	Earth Materials and Processes	3
Total Credits		20

Semester II

Course No.	Course Title	Credit
Mandatory courses		
ECS102	Introduction to Programming	3
MTH102	Linear Algebra	3
ECO102	Principles of Economics - II	3
Optional Courses (Any three)		
BIO102	Biology II: Fundamentals of Cell Biology	3
CHM112	Basic Organic Chemistry	3
EES102	Introduction to Environmental Sciences	3
PHY102	Modern Physics	3
Total Credits		18

Semester III

Course No.	Course Title	Credit
MTH201	Multivariable Calculus	3
ECO201	Econometrics I	4 (3+1)
	Minimum 12 credits from 2 nd year courses of other disciplines	12
Total Credits		19

Semester IV

Course No.	Course Title	Credit
ECO202	Microeconomics I	4
ECO204	Macroeconomics I	4
	Minimum 12 credits from 2 nd year courses of other disciplines	12
Total Credits		20

Semester V

Course No.	Course Title	Credit
ECO301	India in the World Economy	3
ECO303	Microeconomics II	4
ECO305	Econometrics II	4
ECO307	Game Theory	4
*****	Open Elective I	3/4
Total Credits		18/19

Semester VI

Course No.	Course Title	Credit
ECO302	Macroeconomics II	4
ECO304	International Economics	4
ECO306	Development Economics	4
ECO***	Departmental Elective I	4
*****	Open Elective II	3/4
Total Credits		19/20

Semester VII

Course No.	Course Title	Credit
ECO***	Departmental Elective II	4
ECO***	Departmental Elective III	4
ECO***	Departmental Elective IV	4
*****	Open Elective III	3/4
*****	Open Elective IV	3/4
Total Credits		18/19/20

Semester VIII

Course No.	Course Title	Credit
ECO***	Departmental Elective V	4
ECO***	Departmental Elective VI	4
ECO***	Departmental Elective VII	4
*****	Open Elective V	3/4
*****	Open Elective VI	3/4
Total Credits		18/19/20

DEPARTMENT OF ECONOMIC SCIENCES

Course Outline for BS in Economic Sciences

ECO101: Principles of Economics I (3 cr.)

Learning Objectives:

1. Introduction to the definition and concepts of Economics
2. Demand, supply and equilibrium, elasticity and its applications
3. Consumer behavior and utility maximization/expenditure minimization, the production process and cost minimization/profit maximization, the costs of production
4. Perfectly competitive markets, imperfect competition, markets and welfare, externalities and market inefficiency, public goods, the design of the tax system
5. The labor market, and other factors of production, income inequality and poverty

Course Contents:

Introduction to the definition and concepts of Economics: definitions of economics; scarcity and efficiency; microeconomics and macroeconomics; positive and normative economics; market, command and mixed economies, laissez-faire; opportunity costs; marginal concept; input-output and production possibility frontier; interdependence and gains from trade; post-hoc fallacy, ceteris paribus principle, fallacy of composition; economic growth, unemployment, inflation

Demand, supply and equilibrium, elasticity and its applications: demand schedule and the law of demand; determinants of household demand, income and prices; normal and inferior goods; substitutes and complements; shifts of demand curves; market demand; supply schedule and the law of supply; determinants of supply, factors of production, cost of production and technology; shifts of supply curves; market supply; excess demand, excess supply and market equilibrium; changes in equilibrium due to shifts in demand and supply curves; price elasticity of demand; elastic and inelastic demand; the midpoint formula for calculating elasticity; elasticity and total revenue; determinants of demand elasticity, substitutes and complements; income elasticity of demand; cross-price elasticity of demand; elasticity of supply; elasticity of labor supply; applications of elasticity with some examples like impact of tax on equilibrium price and quantity, minimum floors and maximum ceilings etc.

Consumer behavior and utility maximization/expenditure minimization, the production process and cost minimization/profit maximization, the costs of production: budget constraint/line, budget set; preferences or tastes; changes in budget line due to change in prices or income; utility function, marginal utility, law of diminishing marginal utility; utility maximization subject to budget constraint; diminishing marginal utility and downward-sloping demand; income and substitution effects; profit, total revenue, total cost; profit maximization, market prices of output, production technology (labor intensive or capital intensive production technology), prices of inputs; total product, marginal product and average product; law of

diminishing returns; constant, increasing and decreasing returns to scale; short run and long run production decisions; productivity and economies of scale; nature of the firm, individual proprietorship, partnership and limited liability partnership, corporation; ownership, control and executive compensation in firms; profit maximization/cost minimization; total and average fixed cost, total and average variable cost; total cost, average cost and marginal cost in the short-run and in the long-run; output decisions in the short-run and in the long-run.

Perfectly competitive markets, markets and welfare, externalities and market inefficiency, public goods, the design of the tax system, imperfect competition: competitive market, perfect competition; supply behavior of the competitive firm, total cost and the shutdown condition; short-run and long-run competitive equilibrium; efficiency (Pareto) of competitive equilibrium, welfare of market participants, consumer surplus, producer surplus, the deadweight loss of taxation, the Laffer curve; international trade, the winners and losers from trade, the effects of tariffs, the arguments for restricting trade; externalities, positive and negative externalities, public policies towards externalities like market based policies of corrective taxes and subsidies, tradable pollution permits, private solutions to externalities, the Coase theorem; public (social) goods and private goods, common resources, the free rider problem, the tragedy of the Commons; taxes and inefficiency, taxes and equity, the benefits principle, the ability to pay principle, vertical equity, horizontal equity, the tradeoff between equity and efficiency, tax incidences and optimal taxation; monopoly, the welfare costs of monopolies, price discrimination, public policy towards monopolies, monopolistic competition, product differentiation, advertising, oligopoly, the economics of cooperation, public policy towards oligopolies, antitrust policy.

The labor market, and other factors of production, income inequality and poverty: factor incomes, personal income, the nature of factor demands, the demand and supply of factors of production, real wage, demand and supply of labor, determinants of supply, wage differentials, labor quality, the economics of labor unions, economic analysis of labor discrimination; the capital market, physical or tangible capital, social capital or infrastructure, intangible capital, human capital, investment and depreciation, interest rate, bonds and stocks, mortgages and the mortgage market, the demand for new capital and investment decision; land markets, rent and value of output produced on land; utilities possibilities frontier, sources of household income, minimum wage, unemployment, the distribution of income, income inequality, Lorenz curve and the Gini coefficient, causes of increased inequality, poverty and poverty line, the redistribution debate, redistribution programs and policies.

Selected Readings:

1. *Economics* by Paul A Samuelson and William D Nordhaus (Mcgraw Hill)
2. *Principles of Economics* by Karl E. Case, Ray C. Fair and Sharon E Oster (Pearson)
3. *Principles of Economics* by N. Gregory Mankiw (Cengage)
4. *Economics* by D. Acemoglu, D. Laibson and J. List (Pearson)

ECO102: Principles of Economics II (3 cr.)

Learning Objectives:

1. Introduction to macroeconomics, measuring national output, national income, unemployment, inflation and long-run growth
2. Aggregate expenditure and equilibrium output, the government and fiscal policy, saving, investment, money demand, money supply and equilibrium interest rate
3. Aggregate demand in the goods and money markets, aggregate supply and the equilibrium price level, the labor market in the macro economy
4. International trade, comparative advantage, and protectionism, open economy macroeconomics, exchange rate, balance of payments, foreign trade and economic activity, equilibrium in the open economy

Course Contents:

Introduction to macroeconomics, measuring national output, national income, unemployment, inflation and long-run growth: aggregate output, expansion or boom, contraction, recession or slump, depression, business cycle, output growth; unemployment, inflation, hyperinflation, deflation, transfer payments, goods-and-services market, labor market, money market, fiscal policy, monetary policy, a brief history of the world economy like the great depression and the subprime crisis; national income and product accounts, gross domestic product (GDP), final goods and services, intermediate goods, value added, the three methods of calculating GDP: the sum of final goods and services (the expenditure approach), the sum of value added, the sum of incomes in a given period within an economy, personal consumption expenditures (durable and nondurable goods, services), gross private domestic investment (nonresidential, residential investment, change in business inventories), depreciation, gross investment, net investment, government consumption and government gross investment, net exports, national income, personal income, compensation of employees, proprietors' income, rental income, corporate profits, net interest, indirect taxes minus subsidies, net business transfer payments, surplus of government enterprises, disposable personal income or after-tax income, personal saving, personal saving rate, current dollars, gross national product (GNP), net national product (NNP), nominal and real GDP, calculating real GDP, the GDP deflator, gross national income, limitations of the GDP concept; employed, unemployed, not in the labor force, labor force, unemployment rate, labor force participation rate, discouraged worker effect on unemployment, frictional, structural, and cyclical unemployment, the costs of unemployment; consumer price index (CPI), inflation rate, producer price index (PPI), nominal and real interest rate, the costs of inflation, long-run output growth, productivity growth.

Aggregate expenditure and equilibrium output, the government and fiscal policy, saving, investment, money demand, money supply and equilibrium interest rate: aggregate output and aggregate income, the Keynesian theory of consumption, consumption function, marginal propensity to consume (MPC), aggregate saving, marginal propensity to save (MPS), planned investment, actual investment, the determination of equilibrium output (income), planned aggregate expenditure, equilibrium aggregate output, the saving/investment approach to equilibrium,

exogenous variable, the multiplier; fiscal policy, monetary policy, discretionary fiscal policy, net taxes, disposable or after-tax income, budget deficit, adding taxes to the consumption function, the determination of equilibrium output (income) with taxes, savings/investment approach to equilibrium with taxes, government spending multiplier, tax multiplier, balanced-budget multiplier; the federal budget, federal surplus and federal deficit, federal debt, economy's influence on the government budget, automatic stabilizers, fiscal drag, full employment budget, structural deficit, cyclical deficit; the demand for money, transaction motive, non-synchronization of income and spending, speculation motive, the total demand for money, the effect of income and the price level on the demand for money, the supply of money, equilibrium interest rate, changing money supply to affect the interest rate, tight monetary policy, easy monetary policy.

Aggregate demand in the goods and money markets, aggregate supply and the equilibrium price level, the labor market in the macro economy: money market, planned investment schedule, planned aggregate expenditure and the interest rate, effect of interest rate on equilibrium investment, aggregate expenditure and output, equilibrium in both the goods and money markets, policy effects in the goods and money markets, expansionary fiscal policy and expansionary monetary policy effects, crowding-out effect, interest sensitivity or insensitivity of planned investment, contractionary fiscal policy and contractionary monetary policy effects, macroeconomic policy mix; the aggregate demand (AD) curve, reasons for downward sloping aggregate demand curve, aggregate expenditure and aggregate demand, shifts of the aggregate demand curve; the aggregate supply (AS) curve, aggregate supply in the short-run, shifts of the short-run aggregate supply curve, cost shock or supply shock, the equilibrium price level, the long-run aggregate supply curve, potential output or potential GDP, short-run equilibrium below potential output, monetary and fiscal policy effects on AD-AS equilibrium, causes of inflation, demand-pull inflation, cost-push or supply-side inflation, stagflation, expectations and inflation, money and inflation, the behavior of the central bank, controlling the interest rate, inflation targeting; unemployment rate, frictional, structural, and cyclical unemployment, labor demand curve, labor supply curve, the equilibrium wage, the classical view of the labor market, explaining the existence of unemployment, sticky wages, social, or implicit contracts, relative-wage explanation of unemployment, explicit contracts, efficiency wage theory, minimum wage laws, the short-run relationship between the unemployment rate and inflation, the Phillips curve, AD-AS analysis and the Phillips curve, expectations and the Phillips curve, the long-run AS curve, potential output, and the natural rate of unemployment, the nonaccelerating inflation rate of unemployment (NAIRU).

International trade, comparative advantage, and protectionism, open economy macroeconomics: balance of payments and exchange rates, equilibrium in the open economy: trade surplus, trade deficit, the economic basis for trade, Corn Laws, Ricardo's theory of comparative advantage, absolute advantage vs. comparative advantage, gains from mutual absolute advantage, gains from comparative advantage, why does Ricardo's plan work, terms of trade, exchange rate, trade and exchange rates in a two-country/two goods world: an example, Heckscher-Ohlin theorem, trade barriers: tariffs, export subsidies and quotas, free trade or protection; foreign exchange, balance of payments, the current account and the capital account, balance of trade, trade deficit, balance on current account, balance on capital account,

equilibrium output (income) in an open economy, planned aggregate expenditure in an open economy, net exports of goods and services, determining the level of imports, marginal propensity to import (MPM), equilibrium output (income) in an open economy, the open-economy multiplier, imports, exports, and the trade feedback effect, import and export prices and the price feedback effect, the open economy with flexible exchange rates, floating, or market –determined exchange rates, the market for foreign exchange, appreciation of a currency, depreciation of a currency, the equilibrium exchange rate, factors that affect exchange rates, law of one price and the purchasing-power-parity theory, relative interest rates, exchange rate effects on imports, exports, and real GDP, exchange rates and the balance of trade: the J curve, exchange rates and prices, monetary policy with flexible exchange rates, fiscal policy with flexible exchange rates

Selected Readings:

1. *Economics* by Paul A Samuelson and William D Nordhaus (Mcgraw Hill)
2. *Principles of Economics* by Karl E. Case, Ray C. Fair and Sharon E Oster (Pearson)
3. *Principles of Economics* by N. Gregory Mankiw (Cengage)
4. *Economics* by D. Acemoglu, D. Laibson and J. List (Pearson)

ECO201: Econometrics I (4 cr.)

Learning Objectives:

What is the effect of reducing class size on test scores of students? Is a tax on alcohol effective in tackling drunk driving? What is the effect of a job-training program on wages of the trainees? After taking this course a student will be able to answer such questions. So the objective of this introductory course on Econometrics is to be able to find quantitative answers to sound important quantitative questions. This would require that students learn statistical methods for evaluating economic relationships, testing economic theories and evaluating government and business policy. This course will be supplemented by lab sessions where students will learn to explore data and analyze relationships (by running regressions) using statistical software. Hence this course will provide both theoretical and practical training to students.

Course Contents:

Economic Questions and Data: Economic Questions, Causal effects and Idealized Experiments, Data Sources and Type

Probability Theory: Random Variables (Discrete and Continuous) and Probability Distributions, Moments and Moment Generating Function (MGF), The Normal, Chi-Squared, Student T and F distribution, Joint distributions, Random Sampling, Large Sample Properties and Limit Theorems.

Statistical Inference: Estimation of the Population Mean, Hypothesis Testing, Confidence Intervals, Comparing Means of Different Populations, Scatterplots and Sample Covariance and Sample Correlation.

Linear Regression with One Regressor: Linear Regression Model and its Estimation by OLS, OLS Assumptions, Measures of Fit, Sampling Distribution of the OLS estimator, Asymptotic Distribution of the OLS estimator, Hypothesis Testing and Confidence Interval of the Regression Coefficient, Gauss Markov Theorem.

Linear Regression with Multiple Regressors: The Multiple Regression Model and its estimation, Omitted Variable Bias, the OLS Assumptions in Multiple Regression Model, Measures of Fit, Distribution of the OLS Estimators in Multiple Regression Model, Multicollinearity. Hypothesis testing and Confidence Interval for a Single Coefficient, Tests of Joint Hypothesis, Model Specification in Multiple Regressions. Consistency. OLS Asymptotics and Large Sample Inference, Asymptotic Efficiency of OLS.

Weighted Least Squares (WLS): Heteroskedasticity, WLS with known Heteroskedasticity, WLS with Heteroskedasticity of known Functional Form (Feasible Generalized Least Squares (FGLS)), Heteroskedasticity Robust Standard Errors.

Selected Readings:

1. *Statistical Inference* by Casella and Berger (Cengage)
2. *Statistical Methods* by Hogg and Craig (Pearson)
3. *Introduction to Econometrics* by James H. Stock and Mark W. Watson (Pearson)
4. *Introductory Econometrics: A Modern Approach* by Jeffrey M. Wooldridge (Cengage)
5. *Mostly Harmless Econometrics: An Empiricist's Companion* by Angrist and Pischke (Princeton University Press)

ECO202: Microeconomics I (4 cr.)

Learning Objectives:

This introductory course teaches the fundamentals of microeconomics. Students are introduced to consumer's decision-making process, market structure and equilibrium concepts and their properties. Topics include consumer theory, producer theory, market equilibrium, monopoly, and the role of the government in the economy. We aim to cover following topics in this course:

1. The Firm and the Supply Function
2. Consumer Choice and Demand
3. Monopoly and Competitive Markets

4. General Equilibrium
5. Equilibrium, Taxes and Welfare

Course Contents:

Consumer Choice and Demand: Limits of consumer choice - the budget constraint. Reasons for choice – preferences, Representation of preferences - Utility Functions, The choice - The formal problem of maximization of preferences and derivation of the demand function, The Slutsky equation - Income and substitution effects, Income and substitution effects of Hicks, Revealed preference and Slutsky equation, Weak and Strong axioms of revealed preference, Price indices, Consumer surplus and market demand, Consumer surplus - Discrete goods and continuous goods, Market demand - Aggregation of individual demands

The Firm and the Supply Function: Technology, Technological constraint, Different types of technology, Marginal product and marginal rate of technical substitution, Returns to scale, Benefit maximization and cost minimization, The formal problem of profit maximization and cost minimization, Cost functions - marginal cost and average cost, Supply curve, Supply function of a competitive firm, The relation of the supply with marginal costs, The producer surplus, Supply curve of an industry.

Monopoly and Competitive Markets: Basic Game Theory, Welfare and output, Quality choice, Price discrimination, First-degree price discrimination, Second-degree price discrimination, The competitive firm, The profit maximization problem, The industry supply function, Welfare analysis, Pareto efficiency

General Equilibrium: Pure Exchange Economy. One-consumer-One-producer Economy, The 2×2 production model, General Versus Partial Equilibrium Theory

Equilibrium, Taxes and Welfare: Agents and goods, Walrasian equilibrium, The First Fundamental Theory of Welfare Economics, The Second Welfare theorem, Pareto Optimality and Social Welfare Optima, The compensation criterion, Optimal Taxation.

Selected Readings:

1. *Intermediate Microeconomics: A Modern Approach* by Hal R. Varian. (W W Norton)
2. *Microeconomic Analysis* by Hal R. Varian. (W W Norton)
3. *A Course in Microeconomic Theory* by David Kreps. (Princeton University Press)
4. *Microeconomic Theory: Basic Principles and Extensions* by Walter Nicholson & Christopher Snyder (Pearson)
5. *Microeconomics* by Satya Ranjan Chakravarty (Allied Pub.)

ECO204: Macroeconomics I (4 cr.)

Learning Objectives:

This course aims to provide a formal treatment of the macroeconomic concepts. The students were introduced to preliminary concepts and definitions in understanding the aggregate economy in their first year course, Principle of Economics II. This course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It discusses the various alternative theories of output, employment and interest rate determination in a closed economy in the short run, medium run as well as the long run. It also introduces students to various micro-foundations of macroeconomic theories.

Course Contents:

Economy in the very Long run – Economic Growth: Harrod-Domar model, Solow Growth Model, Golden rule of Capital Accumulation, Solow growth models with growth in population and technical progress, Growth Accounting, Cross-country growth and convergence

Economy in the Long run – Classical Model: Production and Output, Labor Market, Money Market (Quantity Theory of Money), Classical Dichotomy - Money neutrality

Economy in the short run – Business Cycles: Building the IS-LM model, Aggregate Demand, Aggregate Supply and the Philips curve, Aggregate demand-Supply (AD-AS) models, Fiscal and Monetary Policies

Micro-foundations: Theories of Consumption – Inter-temporal Choice and Consumption, Keynesian Consumption theory, Life Cycle Hypothesis, Permanent Income Hypothesis, Random Walk Hypothesis, Behavioral Consumption theories. Theories of Investment, Theories of Money Demand

Selected Readings:

1. *Macroeconomics: Policy and Practice* by F. S. Mishkin (Pearson)
2. *Macroeconomics* by N. G. Mankiw (Macmillan)
3. *Macroeconomics* by A. B. Abel and B. Bernanke (Pearson)
4. *Macroeconomics* by R. Dornbush, S. Fisher & R. Startz (McGraw Hill)
5. *Macroeconomics* by O. Blanchard (Pearson)
6. *Economic Growth* by R. J. Barro and X. Sala-i-Martin (MIT Press)
7. *Advanced Macroeconomics* by D. Romer (McGraw Hill)

ECO301: India in the World Economy (3 cr.)

Learning Objectives:

This course will cover the history of Indian economic development and the current progress, challenges and strategy going forward. This course will help in developing an in-depth understanding of the Indian economy- its history, recent developments, and impending challenges. The participants will become proficient in understanding and analyzing macroeconomic developments and policy. They will also become familiar with the current dominant thoughts and tools used for economic policy making and research.

Course Contents:

Colonial Legacy: The Economic History of India, The Impact of Colonial Rule on the Indian Economy

Evolution of Economic Planning in India: The five year plans, 2nd plans and industrialization, Nehru-Mahalanobis Plan Model, Choice of Industrialization Strategies, Economic Growth in the Nehru Era, Selective Import Liberalization (under the 7th five year plan)

Indian Agriculture: Agricultural Policy: Issues, Concepts and Instruments, Land reform, Green revolution, Agricultural pricing and policies, Indian Public Distribution System, Agricultural Crisis and Farmer Suicides

Structural Change: Manufacturing, Services & Urbanization, Manufacturing vs. Services in India, Framework for comparing sectors, Low Skill Manufacturing, Deindustrialization

Emerging Economies of the East, fall of Soviet Union, and Initiation of Globalization: Changing economic and political climate in India

Indian Economic Crisis: Reforms of 1990 and the Economic Transformation in India, Financial-Economic Crises and Indian Experience, Effects of the Twin Balance Sheet Crisis, Successful and Unsuccessful Central Banking Experiences.

India versus China in the 21st Century: Sources of India's Export Growth in Pre-and Post-Reform Periods. India and China - Changing Patterns of Comparative Advantage Intensive and extensive margins of exports

Global Financial Crisis: Capital account management in India, Contagion, decoupling and the spillover effects of the US financial crisis

Emergence of Inward looking policies: Brexit and other international political changes

Demonetization: Objective and Background, Costs and Benefits, and Markers of Success.

Selected Readings:

1. *Economic Surveys of India*, Department of Economic Affairs, Ministry of Finance, Govt. of India
2. *The Economic History of India 1857-1947* by Tirthankar Roy (Oxford University Press, 3rd edition, 2011)
3. *The emerging giant* by A. Panagariya (Oxford University Press, 2008)
4. *The Concise Oxford Companion to Economics in India* by K. Basu and A. Maertens (eds.) (Oxford University Press, 2011)
5. *The Oxford Companion to Politics in India* by Niraja Gopal Jayal and Pratap Bhanu Mehta (eds.) (Oxford University Press, 2011)
6. *Reforms and Economic Transformation in India* by J. Bhagwati and A. Panagariya (Oxford University Press, 2013)
7. *In Defense of Globalization*, J. Bhagwati (Oxford University Press, U.K. 10. ILO 2004)
8. *Agricultural Crisis and Farmer Suicides* by R S Deshpande and Saroj Arora (eds.) (Sage, New Delhi, 2010)
9. *India's Economic Development Since 1947* by Uma Kapila (eds.) (Academic Publishers, 3rd Ed. or latest version)
10. *Development Planning: The Indian Experience*, S Chakraborty. 1987. Clarendon Press.
11. *Agrarian Question* by Kaushik Basu (eds.) (Oxford University Press, 2000)
12. *The Indian Economy: Problems and Prospects*, Bimal Jalan (ed.) (Penguin, 2004)
13. *India: Development and Participation* by Jean Dreze and Amartya Sen (Oxford University Press, 2nd edition, 2002)
14. *India Planning for Industrialization*, by J. Bhagwati and Desai: OUP.

ECO302: Macroeconomics II (4 cr.)

Learning Objectives:

This course aims to familiarize students to the quantitative tools used in modern macroeconomics. The course is quantitative in nature, and significant amount of time will be spent on teaching students dynamical systems and dynamic optimization. In doing so, appropriate examples from various macroeconomic models will be covered. The examples in the course introduce students to long-term micro-founded theories of growth and introduction to Business Cycles using the Dynamic Stochastic General Equilibrium (DSGE) model. Students may also be introduced to some computational methods in macroeconomics using some standard software.

Course Contents:

Dynamical Systems: Differential equations, First Order Ordinary Differential Equations (ODE), Systems of Linear ODE, Deterministic and Stochastic Difference equations, Markov Processes

Dynamic Optimization: Dynamic Optimization in Continuous time – Finite and Infinite horizon, Markov Decision Processes model, Dynamic Programming - Finite and Infinite horizon

Exogenous Growth Model: Review Solow Growth Model with Golden rule of capital accumulation and dynamic inefficiency, Neo-Classical Growth Model, Overlapping Generations Model

Endogenous Growth Models: One sector models of Endogenous Growth – AK Model, One sector Human and Physical capital model, Learning by Doing and Knowledge Spillovers, Public services and Endogenous growth

Dynamic Stochastic General Equilibrium (DSGE) Model: Real Business Cycle, New Keynesian models

Selected Readings:

1. *Economic Dynamics in Discrete Time* by J. Miao (MIT Press)
2. *Economic Growth* by R. J. Barro and X. Sala-i-Martin (MIT Press)
3. *Intertemporal Macroeconomics* by C. Azariadis (Wiley-Blackwell Publishers)
4. *Advanced Macroeconomics* by D. Romer (McGraw Hill)
5. *Lectures on Macroeconomics* by O. J. Blanchard and S. Fisher (MIT Press)
6. *Introduction to Modern Economic Growth* by D. Acemoglu (Princeton University Press)
7. *Recursive Macroeconomic Theory* by L. Ljungqvist and T. J. Sargeant (MIT Press)
8. *Recursive Method in Economic Dynamics* by N. Stokey, R.E. Lucas and E. Prescott (Harvard University Press)
9. *Applied Computational Economics and Finance* by M. J. Miranda and P. L. Fackler (MIT Press)

ECO303: Microeconomics II (4 cr.)

Learning Objectives:

1. Classical Demand Theory
2. Choice Under Uncertainty
3. Adverse Selection, Signalling, and Screening
4. The Principle-Agent Problem
5. Externalities and Public Goods
6. General Equilibrium Under Uncertainty

Course Contents:

Classical Demand Theory: Preference Relations - Basic Properties, Preference and utility. The Utility Maximization Problem. Duality. Relationship between Demand,

Indirect Utility, and Expenditure Functions. Integrability. Welfare Evaluation and Economic Changes. The Strong Axiom of Revealed Preference.

Choice Under Uncertainty: Expected Utility Theory, Money Lotteries and Risk Aversion, Comparison of Payoff Distributions in Terms of Return and Risk, State-dependent Utility.

Adverse Selection, Signalling, and Screening: Information Asymmetries and Adverse Selection, Signalling, Screening.

The Principal-Agent Problem: Hidden Action, Hidden Information, Hidden Actions and Hidden Information - Hybrid Models.

Externalities and Public Goods: Bilateral Externalities, Public Goods, Multilateral Externalities, Private Information and Second-Best Solutions, Efficient Provision of a Discrete Public Goods, Private Provision of a Discrete Public Good, voting for a Discrete Public Good, Demand Revealing Mechanisms, Demand Revealing Mechanism with a Continuous good.

General Equilibrium Under Uncertainty: Equilibrium with certainty, Equilibrium with Uncertainty, A Market Economy with Contingent Commodities, Arrow-Debreu Equilibrium, The Capital Asset Pricing Model, The Arbitrage Pricing Theory. Incomplete market.

Welfare Economics: Utility possibility set. Social Welfare Functions and Social Optima. Invariance Property of Social Welfare Functions. Coalition Bargaining - The Shapley Value.

Selected Readings:

1. *Microeconomic Analysis* by Hal R. Varian (W W Norton)
2. *Microeconomic Theory* by Andrew Mas-collel, Michael D. Whinston & Jerry R. Green (Oxford University Press)
3. *Advanced Microeconomic Theory* by Geoffrey A. Jehle and Philip J. Reny (Pearson)
4. *A Course in Microeconomic Theory* by David Kreps (Princeton University Press)
5. *Microeconomics Behavior, Institutions, and Evolution* by Samuel Bowles (Princeton University Press)
6. *Microeconomics* by Satya Ranjan Chakravarty (Allied Publishers)

ECO304: International Economics (4 cr.)

Learning Objectives:

The core objective of this course is to explain the reasons for trade and explanation of trade patterns and the gains accruing from trade or from restricting trade. Considerable attention is also given to understand the impact of trade on market structure, factor movement, income distribution, taxation and growth. The European Union (EU), World Trade Organization (WTO), the United Nations Conference on Trade and Development (UNCTAD) and The Organization for Economic Co-operation and Development (OECD) are institutionally involved in trade policy and taxation issues and their major concerns are included in the syllabus. The main topics covered in this course are:

1. The Theory of International Trade
2. Welfare and Trade Policy
3. Money and Balance of Payments
4. Scale Economies and Imperfect Competition

Course Contents:

Theory of International Trade: Gains from Trade and the Law of Comparative Advantage. The Ricardian Model. Factor Proportion Theory. The Heckcher-Ohlin Model. Trade Theory with Firm-Level Heterogeneity. Gravity Models and the Gains from Trade. Trade Costs. Offshoring and Fragmentation of Production. Economic Geography.

Welfare and Trade Policy: Trade Policy and Trade Agreements. Political Economy of Trade Policy and the WTO. Optimal Tariff and Domestic Taxes. Coordination of tax policies. Policy Responses to Distortions and Constraints. Partial Reforms and Policies. Free Trade Agreements. Preferential Trade Agreements. Custom Unions. Intellectual Property Rights. Compulsory License. International Protection of Intellectual Property. Regional and National Exhaustion of Intellectual Property. Intellectual Property Rights and Foreign Direct Investments. Trade Policies Coherence and Access to Essential Products.

Money and Balance of Payments: The small Country Case. General Equilibrium and Comparative Statistics. Stability of the Long-Run Equilibrium. Small Country with Sticky Wages. International Equilibria.

Scale Economies and Imperfect Competition: Trade and Competition. Product Selection. Product Differentiation and Intra-Industry Trade. Trade Protection and Domestic Market Power. Foreign Market Power. Strategic Export and Import Policies. Intra-Industry Trade.

Selected Readings:

1. *Theory of International Trade* by Avinash Dixit and Victor Norman. (Cambridge University Press, 1980)

2. *Trade Policy and Market Structure* by Helpman, Elhanan, and Paul Krugman (MIT Press, 1989)
3. *The Economics of the World Trading System* by Bagwell, Kyle, and Robert W. Staiger (MIT Press, 2004)
4. *International Trade Theory and Policy* by Paul Krugman, Maurice Obstfeld, Marc Melitz (Pearson)
5. *Foundations of International Macroeconomics* by M. Obstfeld and K. Rogoff (MIT Press)
6. *Integration with the Global Economy: The case of Turkish Automobile and Consumer Electronic Industries* by E. Taymaz and K. Yilmaz, Commission on Growth and Development Working Papers No. 37, 2008

ECO305: Econometrics II (4 cr.)

Learning Objectives:

This course builds on the material taught in Econometrics - I. Hence after taking this course students will have an in depth understanding of the regression models used by economists to answer quantitative questions. This course will also be supplemented by lab sessions where students will learn to explore data and analyze relationships (by running regressions) in statistical software used by economists. Hence this course will provide both theoretical and practical training to students.

Course Contents:

Review of Ordinary Least Squares and Weighted Least Squares: The Multiple Regression Model and its Estimation, Omitted Variable Bias, Measures of Fit, OLS Assumptions in Multiple Regression Model, Distribution of the OLS Estimators in Multiple Regression Model, Multicollinearity. Hypothesis Testing and Confidence Interval for a Single Coefficient, Tests of Joint Hypothesis, Model Specification in Multiple Regressions. OLS Asymptotics and Large Sample Inference, Asymptotic Efficiency of OLS. Heteroskedasticity, Weighted Least Squares with known Heteroskedasticity, Weighted Least Squares with Heteroskedasticity of known Functional Form (Feasible GLS), Weighted Least Squares or Heteroskedasticity Robust Standard Errors.

Regressions with Dummy Variables: A Single Dummy Variable, Dummy Variable for Multiple Categories, Interactions Involving Dummy Variables, Linear Probability Model, Introduction to Program Evaluation.

Specification and Data Issues: Functional Form Misspecification, Measurement Error, Logarithmic Functional Form, Models with Quadratics, Models with Interactions, Adjusted R squared, Controlling for too many Regressors, Prediction and Residual Analysis.

Limited Dependent Variable Models: Logit and Probit Models for Binary Response, Maximum Likelihood Estimation of Logit and Probit models, Tobit Model, The Poisson Regression Model.

Instrumental Variable Estimation and Two Stage Least Squares: Omitted Variable in a Simple Regression Model, Statistical Inference with IV, Properties of IV with a Poor Instrumental Variable, IV estimation in the Multiple Regression Model, Two Stage Least Squares. Testing for Endogeneity and Testing Over identifying Restrictions.

Panel Data Methods: Two Period Panel Data Analysis, Policy Analysis with Two Period Panel Data, Differencing with More than Two Time Periods, Fixed Effect Estimation, Fixed Effect or First Differencing, Random Effect Models.

Time Series Regression and Forecasting: Time Series Data and Serial Correlation, Autoregressions, Autoregressive Distributed Lag Model, Lag Length Selection Using Information Criteria, Non-stationarity

Selected Readings:

1. *Introduction to Econometrics* by James H. Stock and Mark W. Watson (Pearson)
2. *Introductory Econometrics: A Modern Approach* by Jeffrey M. Wooldridge (Cengage)
3. *Econometric Analysis* by William H. Greene (Pearson)
4. *Econometric Analysis of Cross Section and Panel Data* by Jeffrey M. Wooldridge (MIT Press)
5. *Mostly Harmless Econometrics- An empiricist's companion* by Joshua Angrist and Jorn-steffen Pischke (Princeton University Press)
6. *Mastering Metrics* by Joshua Angrist and Jorn-steffen Pischke (Princeton University Press)

ECO306: Development Economics (4 cr.)

Learning Objectives:

In this course we investigate the microeconomics and macroeconomics of development that enables us to dig below and deeper the "big questions" of economic development. While we explore the very rich economics that emerges from understanding, at the micro level, at the same time it tries to understand the economy-wide perspectives on the nature of the development problem. The course is designed as a mix of development microeconomic and development macroeconomics. This course aims at developing the building blocks: household behavior (nutrition, health, education, gender, family), markets (land, credit, savings, insurance), and institutions. A proper understanding of the "big questions" of economic development should incorporate these building blocks into appropriate frameworks of the developing

countries. It also answers the "big questions" of economic development in a different way assuming no fundamental differences between two societies, but still they can evolve along very different paths depending on past expectations, aspirations or actual history.

Course Contents:

The Big Picture: Introduction to Development Economics, World Inequality, Convergence debate, Poverty and measurement of poverty, Globalization and poverty

Agriculture: Agricultural Organization and Productivity in Developing countries, Agrarian Organization, Land Rental Contracts, Land Reform, Property Rights, Land Acquisition, Interlinked transactions, Agricultural Technology Adoption

Savings, Credit and Insurance: Credit and investment, Microfinance, Savings and Insurance, Insurance Failures

Health: Health and Nutrition- Poverty Traps, Providing health services and medicines in developing countries, Health externalities and randomized experiments, HIV & the economics of risky behaviors

Education and Human capital: Education, Educational Interventions, Private and Public Education Choice, Public versus Private Investment in Education, Fertility, Child Labour

Labour and Migration: Labour markets, Migration

Institutions: Political and Legal institutions and development, Financial institutions and development

Political economy: Economic theory of conflict, Ethnicity and Conflict, Corruption, Aid, Public goods and Development, Policy debate

History, Growth and Development: History, Expectations and Development, Aspirations and Development, Inequality and Markets

Selected Readings:

1. *Understanding Poverty* by, A. Banerjee, R. Benabou, and D. Mookherjee, editors, (Oxford University Press)
2. *Development Economics* by D. Ray (Princeton University Press)
3. *Analytical Development Economics* by K. Basu, (MIT Press)
4. *Development Microeconomics* by P. Bardhan and C. Udry (Oxford University Press)
5. *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty* by A.V.Banerjee and E. Duflo
6. *Introduction to Readings in the Theory of Economic Development* by D. Mookherjee and D. Ray, (London: Blackwell)

7. *Development Economics* by D. Ray in *The New Palgrave Dictionary of Economics*, edited by L. Blume and S. Durlauf (Palgrave)

ECO307: Game Theory (4 cr.)

Learning Objectives:

1. The definition of a game, complete information, static games.
2. Nash equilibrium in pure and mixed strategies.
3. Extensive-form games, game trees, sub-game perfect Nash equilibrium.
4. Incomplete information, Bayesian games.

Course Contents:

The definition of a game, complete information, static games: normal-form games, pure strategies, mixed strategies, examples of games like prisoner's dilemma, rock-paper-scissors, Cournot duopoly, dominated strategies, beliefs, best responses, solutions concepts like iterated elimination of strictly dominated pure strategies, rationalizability.

Nash equilibrium in pure and mixed strategies: definition of Nash equilibrium in pure and mixed strategies, existence of Nash equilibrium, Cournot duopoly, Bertrand duopoly, median voter theorem.

Extensive-form games, game trees, subgame perfect Nash equilibrium: perfect and imperfect information, mixed and behavioral strategies, game trees, sequential rationality, backward induction, subgame perfect Nash equilibrium, centipede game, Stackelberg competition, finitely and infinitely repeated games, the folk theorem, strategic bargaining, contracts

Incomplete information, Bayesian games: Player's preference type, common prior, static and dynamic games of incomplete information, Bayesian Nash equilibrium, perfect Bayesian equilibrium, sequential equilibrium, adverse selection and signaling, auctions.

Selected Readings:

1. *Game Theory: An Introduction* by Steven Tadelis (Princeton University Press)
2. *An Introduction to Game Theory* by Martin J. Osborne (Oxford University Press)
3. *A Course in Game Theory* by Osborne and Rubinstein (MIT Press)
4. *Game Theory* by Fudenberg and Tirole (MIT Press)
5. *Microeconomic Theory* by Mas-Collel, Whinston and Green (Oxford University Press)
6. *A Primer in game Theory* by Robert Gibbons (Princeton University Press)

7. *Games of Strategy* by Avinash Dixit, David H. Reiley, and Susan Skeath (W W Norton)

ECO308 / ECO608: Behavioral Economics (4 cr.)

Learning Objectives:

This course provides an overview of behavioral economics. Behavioral economics incorporates descriptively accurate assumptions about cognitive ability, social interaction, moral motivation, and emotional responses into economic modeling and explores the implications of this for human behavior and economic outcomes. Empirical findings in psychology, sociology and related disciplines, as well as the field of experimental economics often motivate these assumptions. Behavioral economics seeks to generate theoretical insights, make more accurate predictions of field phenomena, and suggest welfare improving policies.

Course Contents:

Review of Decision-making: Economic decision-making of consumers and producers, Economics and Psychology in the decision-making perspective

Prospect Theory: Value and Weighting Function, Cumulative Prospect Theory, Economic Applications

Bounded Rationality: Mental Accounting, Limited Information and importance of feedback, Irrational decision-making and the psychology of price

Dual System Theory: Availability and Affect, Salience, Status quo bias and inertia

Temporal dimensions: Time discounting and present bias, Diversification bias and empathy gap, Forecasting and memory

Social dimensions: Trust and Dishonesty, Fairness and Reciprocity, Social Norms, Consistency and Commitment

Subjective Expectations: Role of subjective expectations in decision-making, Measurement and analysis of subjective expectations

Selected Readings:

1. *The Behavioral Economics Guide* (latest)
2. *The Foundations of Behavioral Economic Analysis* by Sanjit Dhami (Oxford University Press, 2016)
3. *Advances in Behavioral Economics* Colin F. Camerer, George Loewenstein & Matthew Rabin (Princeton University Press, 2000)
4. *Judgment Under Uncertainty: Heuristics and Biases* by Daniel Kahneman, Paul Slovic & Amos Tversky (Cambridge University Press, 1982)

5. *Choices, Values, and Frames* by Daniel Kahneman & Amos Tversky (Cambridge University Press, 2000)
6. *Misbehaving: The Making of Behavioral Economics* by Richard Thaler (W W Norton, 2016)
7. *Thinking, Fast and Slow* by Daniel Kahneman (Penguin, 2013)
8. *Nudge: Improving Decisions About Health, Wealth, and Happiness* by Richard H. Thaler & Cass R. Sunstein (Penguin, 2009)
9. *Predictably Irrational: The Hidden Forces That Shape Our Decisions* by Dan Ariely (Harper Collins, 2011)

ECO309 / ECO609: Industrial Organization (4 cr.)

Learning Objectives:

1. Introduction
2. Monopoly
3. Product Selection, Quality and Advertising
4. Vertical Control
5. Short-Run Price Competition
6. Pricing Tactics
7. Dynamic Price Competition, Collusion, Entry and Exit
8. Product Differentiation: Vertical Differentiation and Monopolistic Competition
9. Research and Development

Course Contents:

Introduction: Theory of Firm, Profit-Maximization, Principle-Agent Relationship, Law and Economics, Industrial Organization and International Trade.

Monopoly: Pricing Behavior, Cost Distortions, Rent-Seeking Behavior, Durable Goods and Limit on Monopoly Power, Welfare Effects.

Product Selection, Quality and Advertising: Product Selection, Quality and Information, Experience Goods, Advertising, Repeat Purchase

Vertical Control: Linear Prices versus Vertical Restraints, Externalities and Vertical Control, Intra-brand Competition, Inter-brand Competition, Competition-Reducing Restraints.

Short-Run Price Competition: The Bertrand Paradox, Capacity Constraints, Cournot Analysis, Concentration Indices and Industry Profitability, Quantity Competition. Limit pricing, Predation

Pricing Tactics: Perfect Price Discrimination, Multimarket (third-degree) Price Discrimination, Personal Arbitrage and Screening (Second-Degree Price Discrimination), Non-linear Pricing, Pricing in Two-Sided Markets, Pricing of Products with Network Effects, Price Dispersion, Search Theory

Dynamic Price Competition, Collusion, Entry and Exit: Static Approaches to Dynamic Price Competition, Supergames, Reputation for Friendly Behavior, Dynamic Games and Tacit Collusion, Mergers, Entry Barriers, Merger and Antitrust Law, Entry Deterrence and Antitrust Law

Product Differentiation - Vertical Differentiation and Monopolistic Competition: Spatial Competition, Monopolistic Competition, Advertising and Informational Product Differentiation, Vertical Differentiation and Monopolistic Competition.

Research and Development: Classification and Process Innovation, Innovation Race, Competition in R&D, Patent, Licensing and Innovation, Governments and International R&D Races, Patent Laws, R&D Joint Ventures, Legal Approach to R&D Joint Ventures

Selected Readings:

1. *The Theory of Industrial Organization* by Jean Tirole (MIT Press, 1988)
2. *Industrial Organization: Theory and Applications* by Oz Shy (MIT Press, 1995)
3. *Industrial Organization: Theory, Evidence and Public Policy* by Kenneth W Clarkson and Roger LeRoy Miller (McGraw Hill, 1982)
4. *Law and Economics Vol. 1 - Theory* by Shubhashis Gangopadhyay and V. Santhakumar (Sage, 2013)
5. *Law and Economics Vol. 1 - Practice* by Shubhashis Gangopadhyay and V. Santhakumar (Sage, 2013)

ECO310 / ECO610: Introduction to Quantitative Finance (4 cr.)

Learning Objectives:

The purpose of the course is to introduce students to modern data analysis with application to Quantitative Finance. In this course, the relevant concepts will be taught and familiarity with the statistical tool will be developed. This course will develop a working knowledge of tools in quantitative finance.

The prerequisites for this course are minimal, however it is expected that the students have been exposed to introductory course in statistics and are familiar with basic concepts in statistics, which include random variables, expectation, correlation, statistical inference (estimation, tests and confidence intervals) etc. Some basic notation related to linear algebra like vectors and matrix calculus will also be used in the course.

Course Contents:

Introduction to Statistical Programming Language: Using statistical software routines for data summary and exploration, graphical presentation and data modeling. Working with functions and packages related to the relevant software.

Risk Management: Introduction to financial assets and their distributions (including returns, volatility etc.). Methods of goodness of fit - including theoretical and graphical methods. Concepts of percentile to introduce notion of value at risk and conditional value at risk as used in financial sector in the industry.

Extreme Value Theory: Extreme value theory and its application in the financial markets. Heavy tail distributions - detection, estimation and simulation using financial data on a relevant statistical software.

Multivariate Models: Analysis of multivariate statistical distributions with the case of the well-known normal family. Studying the Correlation Coefficient and give some examples of financial dataset. Modeling the extremal behaviour of two or more (dependent) processes simultaneously.

Copulas and Dependence: Modelling of dependence with Copulas and application of Copulas in risk management and expected shortfall.

Principal Component Analysis: Identification of principal component analysis, factor rotation and illustrate an application in financial markets.

Selected Readings:

1. *Statistical Analysis of Financial Data in S-Plus* by R. A. Caromona (Springer, 2004)
2. *Modeling Extremal Events for Insurance and Finance* by P. Embrechts, C. Kluppelberg and T. Mikosch (Springer, 1997)
3. *An Introduction to Statistical Modeling of Extreme Values* by S. Coles (Springer, 2001)
4. *Quantitative Risk Management* by A. J. McNeil, R. Frey and P. Embrechts (Princeton University Press, 2015)
5. *Statistical Analysis of Extreme Values* by R. Reiss and M. Thomas (Springer, 2007)

ECO500 / ECO600: Law Relating to Intellectual Property and Patents (1 cr.)

The Course will begin with a general discussion on Law relating to Intellectual Property (hereinafter, 'IP') and then move on to discuss Law relating to Patents in particular.

The objectives of the Course is to make the students of Science and Technology aware of:

- (i) *the meaning and significance of IP in the knowledge society in which the power of mind rules supreme,*
- (ii) *the distinctive features of different types of IP, for, it has been observed that even educated people including scientists use the terminologies of IP indiscretely, e.g., phrases like “patenting of geographical indications,”*
- (iii) *whether IP in general and patents in particular help in the production of new knowledge and technology,*
- (iv) *whether IP and patents can help freedom from colonization of mind, and whether patents are the measure of progress and development of a country.*

Some of the objectives of the Course may seem to be too idealistic at first sight but they are not really so.

A tentative outline of the Course is as under:

1. Relevance of “Law relating to Intellectual Property and Patents” for the students of Science and Technology
2. Meaning and Characteristics of Intellectual Property Rights
3. Types of Intellectual Property Rights
4. Meaning and Characteristics of Patent
5. Substantive Patent Law
 - A. Patentable Subject Matter
 - B. Novelty
 - C. Inventive Step
 - D. Capability of Industrial Application
6. Procedural Patent Law
 - (A) When to go for a patent?
 - (B) Where to go for a patent?
 - (C) How to go for a patent?
 - i. Patent Application
 - ii. Specification
 - a. Written Description
 - b. Enablement
 - c. Best Mode
 - d. Claim(s)

The above-mentioned points may be covered in ten to twelve hours depending on the level of discussion in the class.

Suggested Books:

1. *Intellectual Property: Patents, Copyright, Trade Marks, and Allied Rights*, W. R. Cornish, 4th Ed. (London: Sweet & Maxwell, 1999).
2. *Intellectual Property Rights: Critical Concepts in Law*, D. Vaver, (London; New York: Routledge, 2006).
3. *Patent Law and Theory: A Handbook of Contemporary Research*, Toshiko Takenaka, (Cheltenham: Edward Elgar, 2008).

4. *Intellectual property rights and the Life Science Industries: A Twentieth Century History*, Graham Dutfield, (Hampshire: Ashgate, 2003).
5. *Principles of Patent Law: Cases and Materials*, Donald S Chisum, (New York: Foundation Press, 2001).
6. *Chisum on Patents: A Treatise on the Law of Patentability, Validity, and Infringement*, Donald S Chisum, (New York: Lexis Pub., 1978).
7. *Nimmer on Copyright: A Treatise on the Law of Literary, Musical and Artistic Property, and the Protection of Ideas*, Melville B Nimmer & David Nimmer, (New York: M. Bender, 1978).
8. *Walker on Patents*, Ernest Bainbridge Lipscomb, et al; (Rochester, N.Y.: Lawyers Co-operative Pub. Co., 1984).
9. *Copinger and Skone James on Copyright*, Walter Arthur Copinger & E. P. Skone James, (London: Sweet & Maxwell, 1999)
10. *Software Patents*, Gregory A. Stobbs, (Gaithersburg: Aspen Law & Business, 2000).