



Dr. B.R. Ambedkar  
School of Economics  
University  
Bengaluru

*A Unitary University, Govt. of Karnataka*

# MSc Economics

## Course Structure and Syllabus

May 2024

### **MSc Economics program outline**

Dr. B. R. Ambedkar School of Economics University, Bengaluru aims to become a globally recognized institution of excellence in the field of Economics and allied academic disciplines. The University offers a 2 year MSc Economics program for candidates who are well motivated and seeks an in depth understanding in various subjects in the domain of Economics. The University have a quantitative orientation and the program is designed for students with Mathematics, Statistics and Econometrics background. Apart from the fundamental core courses, the students have the flexibility to choose elective papers that would enable them to pursue career in corporate, public policy and academics.

5 core papers are a part of the each of the first two semesters and 2 core papers are offered in the third semester. Students can choose 6 (or 7) electives or more in the 3<sup>rd</sup> and 4<sup>th</sup> semesters. An internship of two months duration in corporate/academic research/public policy is also a part of the curriculum. The 4<sup>th</sup> semester also requires students to complete a dissertation on a topic of their choice under the guidance of the faculty members.

Students following the NEP based five-year integrated MSc Economics would follow the same structure in both years. However, if the student wants to take the BSc Economics (honours) degree with Research, the student shall take up Dissertation (6 credits) in the 8<sup>th</sup> Semester in lieu of Advanced Research Methods and Programming with Python.

**Dr B. R. Ambedkar School of Economics University, Bengaluru**  
**MSc Economics Course**

	<b>Subject</b>	<b>Credits</b>
<b>Semester I</b>		
All core courses	Advanced Microeconomics [PE1401]	4
	Quantitative Techniques in Economics [PQ1401]	4
	Advanced Econometrics-I [PQ1402]	4
	Advanced Research Methods [PE1403]	4
	Programming with R [PQ1201]	2
<b>Semester II</b>		
All core courses	Advanced Macroeconomics [PE2401]	4
	Advanced Econometrics-II [PQ2401]	4
	Game Theory and Application [PQ2403]	4
	Public Economics [PE2402]	4
	Programming with Python [PQ2201]	2
	Internship [PS2201]	2
<b>Semester III</b>		
Core	International Trade and Finance [PE3401]	4
Core	Indian Economy [PE3402]	4
Electives	Monetary Economics [PD3401]	
	Behavioural Economics [PD3402]	
	Developmental Economics [PD3403]	
	Financial Econometrics [PD3404]	
	Global Financial Markets [PD3405]	

Economics of Banking and Finance [PD3406]

World Economic History [PD3407]

Labour Economics [PD3408]

Introduction to Big Data Analytics [PD3409]

Law and Economics [PD3410]

Data Analytics [PD3411]

Dissertation (optional) [PS3401]

#### **Semester IV**

Core

History of Economic Thought [PE4401]

4

Electives

Political Economy [PD4401]

Corporate Finance [PD4402]

Indian Economic Thought [PD4403]

New Institutional Economics [PD4404]

Gender and Economics [PD4405]

Health Economics [PD4406]

Agricultural Economics [PD4407]

Analysis of the Informal Economy [PD4408]

Introduction to Artificial Intelligence and Machine Learning [PD4409]

Natural Resource Analytics [PD4410]

Economics of Impact evaluation [PD4411]

Economics of climate change [PD4412]

Advanced Operations Research [PD4413]

Total core credits

18+20+8+4

50

Minimum elective credits (7 courses)	28	28
Minimum total credits		78

## **Semester I**

### **Advanced Microeconomics**

**Course Objective:** This course examines the economic decisions made by households and firms and their interaction. It also studies the equilibrium in presence of externalities/public goods and information asymmetry. Additionally, there will be a discussion of social choice theory and welfare economics.

#### **1. Theory of consumer behaviour:**

Preference and choice; Demand; Duality; Revealed preference; Aggregate demand

#### **2. Theory of the firm:**

Production sets; Profit maximization and cost minimization; Supply; Aggregation; Duality in production.

#### **3. Choice under uncertainty:**

Expected utility theory; Money lotteries; Risk aversion; Stochastic dominance

#### **4. Competitive markets**

Imperfect competition; Externalities

#### **5. Adverse selection:**

Market for Lemmons; Information and efficiency of market outcomes; Signaling; Screening; Moral hazard and Principal-agent problem under asymmetric information; Information and market performance

#### **6. General equilibrium:**

General equilibrium in competitive markets; General equilibrium theory in consumption and production, General equilibrium under uncertainty

#### **7. Welfare economics:**

Fundamental theorem of welfare economics, Social choice theory; Social Choice and Arrow's Theorem; Measurability, Comparability, and Invariance using Rawlsian form and Utilitarian form; Social Justice; Social choice and Gibbard-Satterthwaite Theorem.

## **Core Text**

Mas-Colell, A., Whinston, M. D., & Green, J. R. (1995). Microeconomic theory (Vol. 1). New York: Oxford university press.

## **Additional Readings**

Jehle, G. A. & Reny P. J. (2010). Advanced microeconomic theory, 3<sup>rd</sup> ed

Krugman, P., & Wells, R. (2010). Microeconomics (for AP). New York: Worth Publishers.

Rubinstein, A. (2012). Lecture notes in microeconomic theory: the economic agent. Princeton University Press.

Kreps, David M. Microeconomic Foundations I: Choice and Competitive Markets. Vol. 1. Princeton University Press, 2012.

Akerlof, G. A. (1978). The market for “lemons”: Quality uncertainty and the market mechanism. In Uncertainty in economics (pp. 235-251). Academic Press.

Bowles, S. (2009). Microeconomics: behavior, institutions, and evolution. Princeton University Press.

Jeffrey, M. P. (2017). MICROECONOMICS: Theory and Applications with Calculus Plus Myeconlab with Pearson Etext. Pearson

Varian, H. R. (1992). Microeconomic analysis (No. 338.5 V299m 1992). WW Norton.

## **Quantitative Techniques in Economics**

### **Course objective:**

This course is designed to teach students advanced quantitative techniques in statistics and mathematics. The course gives quick refresher to some of the fundamental concepts in mathematics and statistics before delving deeper into the application side. The program includes probability theory, differential calculus, multivariate calculus, optimization, and dynamics.

**Learning outcomes:** Help students to successfully use mathematics in economics and business applications and enhance their ability to communicate economic ideas and make economic arguments with the help of mathematical equations.

### **1. Probability Theorem**

Random variables; Conditional probability; Probability density & distributions -types; Central Limit Theorem; Stochastic process; Poisson process; Brownian Motion; Markov Chains; Montecarlo methods; Estimation- Maximum likelihood and method of moment estimation; Interval estimation.

### **2. Hypothesis testing**

Inferential statistics; Decision rules, alpha beta risk. p-values; Uni-, bi-, multi-variate tests for mean, variance and proportion; ANOVA; MANOVA, ANCOVA, MANCOVA; Tests of goodness of fit

### **3. Differential Calculus**

Single variable calculus and its applications; Functions and Real Analysis; Derivative, limit, inequalities, absolute values, limit theorems and continuity and differentiability of a function. Differentiation of function of several variables; higher order derivatives; Taylor's approximation; Euler's theorem; Exact differential equations. Non-linear differential equations of first orders the quantitative; Discrete time: First order difference equations. The dynamic stability of equilibrium.

### **4. Optimization and applications**

Unconstrained optimization – first order and second order conditions; global maxima and global minima; constrained optimization- equality and inequality constraints; mixed constraints; Kuhn Tucker formulation; Multiplier; Lagrange multiplier method; Envelope theorems; Homogeneous and Homothetic Functions; Concave and Quasiconcave Function; Economic applications; Linear and Non-linear Optimization; Hamiltonian; Duality theory; Linear programming

## **5. Dynamics**

Static input – output models – The genesis of dynamic systems. Solving simultaneous dynamic equations. Dynamic input-output models. Application to inflation – unemployment model. Linear programming – Graphical approach, the general LP problem, introduction to duality theory, the duality theorem-A general economic interpretation.

## **Reference**

Ross, S. M. (2014). Introduction to probability models. Academic press.

Freund, J. E., Miller, I., & Miller, M. (2004). John E. Freund's Mathematical Statistics: With Applications. Pearson Education India.

Chung, K. L. (2012). Elementary probability theory with stochastic processes. Springer Science & Business Media.

Freedman, D., Pisani, R., Purves, R., & Statistics, W. W. (1998). Norton & Company. New York.

Simon, C. and L. Blume, Mathematics for Economists, Norton, London, 1994

Sydsaeter, K., Hammond, P., Seierstad, A., & Strom, A. (2008). Further mathematics for economic analysis. Pearson education.

Wainwright, K. (2005). Fundamental methods of mathematical economics/Alpha C. Chiang, Kevin Wainwright. Boston, Mass.: McGraw-Hill/Irwin,.

Bartle, R. G., & Sherbert, D. R. (2000). Introduction to real analysis (Vol. 2). New York: Wiley.

## **Advanced Econometrics-I**

**Course objective:** This course is meant to familiarize students with advanced econometric techniques, commonly used in academic research. Each module includes lab sessions where students apply these concepts using relevant data. Understanding of Basic econometrics concepts and Statistics is a prerequisite for this course. The students shall be able to design the approach and methodology using in academic research.

### **1. Basic concepts of Econometrics**

Recap of OLS (using matrix method). The concept of data generating process - Stochastic process and Deterministic process, white noise process, stationary and non-stationary stochastic process – with and without intercept and trend, difference stationary and trend stationary process, concept of unit root, tests for detecting unit root.

### **2. Univariate Time Series Models**

Autoregressive (AR) model, Moving Average (MA) model, ARMA, ARIMA and SARIMA models, Box Jenkins Methodology – model identification, diagnostics, forecasting – dynamic vs static forecasts, Smooth transition models, applied extensions of ARIMA

### **3. Multivariate time series models**

Cointegration – Engle Granger and Johansen Juselius methodology, error correction model - VAR models –lag length selection, factorization – Cholesky decomposition and structural factorization, Causality tests in VAR framework, impulse response functions, variance decomposition - ARDL approach – cointegration with mix of  $I(0)$  and  $I(1)$  variables, bounds testing, error correction model; NARDL model.

### **4. Volatility modelling**

Modelling high frequency data; testing for ARCH effect, estimating ARCH models – ARCH, GARCH, ARCH – M, TGARCH, EGARCH, diagnostic checks.

### **5. Introduction to Spectral Analysis and Bayesian Approach**

Time domain and Frequency domain, The spectrum and its properties, Spectral representation for weekly stationary process, spectrum estimation, Wavelet coherence analysis. Bayesian analysis – Overview of classical and Bayesian views on probability, the role of priors, posterior estimation, Gibbs sampling, Markov Chain Monte Carlo (MCMC) methods, Application of Bayesian methods- Bayesian linear regression, Bayesian Vector Auto regression; Introduction to special econometrics.

**References:**

- Baltagi, B.H (2008). *Econometric Analysis of Panel Data*, John Wiley. 4th edition 2008.
- Kerry Patterson (2000), *An Introduction to Applied Econometrics*, Palgrave Macmillan.
- Chris Brooks (2002), *Introductory Econometrics for Finance*, Cambridge UP
- James D. Hamilton (1994), *Time Series Analysis*, Princeton University Press.
- Pesaran, M. H. (2015). *Time series and panel data econometrics*. Oxford University Press.
- Walter Enders (2015), *Applied Econometric Time Series*, 4<sup>th</sup> Edition, Wiley.
- Bernardo, Jose M. and Adrian F. M. Smith (1994): *Bayesian Theory*, Wiley Series in Probability and Statistics, John Wiley & Sons
- Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: methods and applications*. Cambridge university press.
- Chan, Joshua, Gary M. Koop, Dale J. Poirier and Justin L. Tobias (2019): *Bayesian Econometric Methods*, 2nd Edition, Cambridge University Press
- Davidson, R., & MacKinnon, J. G. (2004). *Econometric theory and methods* (Vol. 5). New York: Oxford University Press.
- Koopmans, L. H. (1995). *The spectral analysis of time series*. Elsevier.
- Peter Kennedy (2008) *A Guide to Econometrics*, 6<sup>th</sup> Edition, Blackwell Publishing
- Stock, J. H., & Watson, M. W. (2015). *Introduction to econometrics*.
- Verbeek, M. (2008). *A guide to modern econometrics*. John Wiley & Sons.
- Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach*. Nelson Education.

## **History of Economic Thought**

**Course objective:** This course is meant to give a bird's eye view of the entire subject of economics in order that the student may recognise the origins of the most foundational concepts in economics that illuminate the world for us. The value of in this lies in the students being in a position to carry out a more nuanced critique of scholarly and policy claims with regard to economic phenomena.

### **1. Introduction:**

Uses of the past; ways of doing history of economic thought

### **2. Early thought and methods:**

Plato's Republic; some instances of ancient Indian economic thought, Kautilya; motivations behind mercantilism, physiocracy

### **3. The automatic mechanism:**

Mandeville and the bees; the Scottish enlightenment and Smith; Ricardo's and Malthus' dismal world; Bentham; Say's law; Mill's individualism; Senior

### **4. The activists:**

Owen; Saint-Simon; Fourier; Marx;

### **5. Twentieth century giants:**

Keynes; Hayek; Kaldor; Schumpeter; Friedman; Piketty; Paul Krugman; Dani Rodrik;

## **References**

Blaug, M. (1997). Economic theory in retrospect. Cambridge university press.

Gide, C., & Rist, C. (2000). Early Histories of Economic Thought, 1824-1914: History of economic doctrines (Vol. 8). Taylor & Francis US.

Heilbroner, R. L. (2011). The worldly philosophers: The Lives, Times and Ideas of the Great Economic Thinkers. Simon and Schuster.

Hunt, E. K., & Lautzenheiser, M. (2015). History of Economic Thought: A Critical Perspective. Routledge.

Kishtainy, N. (2018). A little history of economics. Yale University Press.

Morgan, M. S. (2012). *The world in the model: How economists work and think*. Cambridge University Press.

Rodrik, D. (2015). *Economics rules: Why economics works, when it fails, and how to tell the difference*. OUP Oxford.

Schumpeter, J. A. (2006). *History of Economic Analysis*. Routledge.

Screpanti, E., & Zamagni, S. (2005). *An Outline of the History of Economic Thought*. Oxford University Press on Demand.

## **Programming with R**

**Course Objective:** This course aims to introduce students to programming using R. This program is a blend of probability theory and programming. Given the increasing importance of programming in corporate, policy and academic career, this program starts right from basic coding and proceeds to data visualizations, various regression techniques and decision trees.

### **1. Introduction to R**

Supervised vs. unsupervised learning; R basic commands; R Studio; R markdown, Quarto; Syntax, Strings, Math, Booleans, If- else; Vectors, Lists, Matrices, Arrays, Data frames, Factors; Data structures; Control structures, functions ; Loop functions, debugging tools ; Descriptive statistics; Data tabulation; Data cleaning- missing values, outliers, winzorization, merging and appending; Webscraping

Packages: dplyr, tidyverse, lubridate, reshape2, tidyr, purr, rvest

### **2. Data Visualization**

Continuous Data; Categorical data; Interactive plots and animated plots

Packages: ggplot2, plotly

### **3. Regression Analysis using R**

Regression libraries; Simple linear regression; Multiple regression; Qualitative predictors; Interaction terms; Diagnostic tests

### **4. Classification**

Discrete choice models; Logistic regression; Linear discriminant analysis; Quadratic discriminant analysis; K-nearest neighbours

### **5. Introduction to Machine Learning**

Basics of decision trees- Regression trees, Classification trees; Trees vs. linear models; Introduction to Bagging, Random forests, Boosting, SVM

### **Reference**

Grolemund, G., & Wickham, H. (2018). R for data science.

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning (Vol. 112, p. 18). New York: springer.

Teetor, P. (2011). R cookbook: Proven recipes for data analysis, statistics, and graphics. "O'Reilly Media, Inc."

Chang, W. (2018). R graphics cookbook: practical recipes for visualizing data. O'Reilly Media.

## **Semester II**

### **Advanced Macroeconomics**

**Course Objective:** The course aims at enabling students with methodological and analytical skills as well as policy applications. It discusses the macroeconomic frame work in the Keynesian and post Keynesian era. The role of expectations, the dynamics in consumption-savings are also dealt with. It also examines the various financial crisis and banking systems.

#### **1. Classical and Keynesian Economics**

Recap of various schools of thought: Classical school, Keynesian, Monetarist, New classical, New Keynesian; Goods market and Money market: IS-LM frame work, interaction of real and monetary sectors; Effectiveness of fiscal and monetary policy under IS-LM frame work; Crowding-out effect; Open economy IS-LM model; Unemployment and Labour market; Demand for labour; Supply of labour; Neoclassical labour market equilibrium; Keynesian labour market; All three markets together: Aggregate Demand and Aggregate Supply

#### **2. Role of expectation in macroeconomics**

Adaptive expectation hypothesis; Expectation augmented Philips curve; Rational expectation hypothesis and equilibrium approach; Lucas supply function; Policy ineffectiveness theorem; The Lucas critique; Real Business Cycle Theory; Role of News

#### **3. Microeconomic foundations of Macroeconomics**

Imperfect competition; Core propositions of New Keynesian Economics; Small menu cost model; Implicit wage contract model; Efficiency wage theory; Insider-outsider model; co-ordination failures and non-Walrasian theories; Introduction to DSGE model

#### **4. Consumption and Investment**

Consumption under Certainty: The Life-Cycle Hypothesis (LCH) and Permanent Income Hypothesis (PIH); Consumption under uncertainty: The Random Walk Hypothesis (RWH) – Two tests of Random Walk Hypothesis; Interest Rate and Saving; Consumption and risky assets; Alternative views of consumption; Investment and stock of capital; Investment with adjustment costs; Tobin's  $q$ ; Uncertainty and investments; Financial market imperfections; Basic Infinite Horizon Models of Consumption and Investment: The Ramsey problem; The Decentralized economy; The Government in the decentralized economy; The Overlapping Generations Model.

## **5. Credit market and Money market**

The consumption-saving decision and credit markets: Two period model of the Economy; Ricardian equivalence theorem; Credit market imperfections and consumption; Asymmetric information and the financial crisis; Limited commitment and the financial crisis; Social security programs; Financial sector and financial crisis; Fractional reserve banking; The theory of Bank runs; Theory of unconventional monetary policy

### **Core text**

Romer, David. Advanced macroeconomics. McGraw Hill, 2012.

Williamson, Stephen D. Macroeconomics, Sixth Edition, Pearson Publication, 2018.

Snowdon, Brian, and Howard R. Vane. Modern macroeconomics: its origins, development and current state. Edward Elgar Publishing, 2005.

### **Additional readings**

Schiller, Bradley, and Gebhardt, Karen. The Macro Economy Today, 15<sup>th</sup> Edition, McGraw-Hill Education, 2019.

Froyen, Richard T. Macroeconomics: Theories and Policies, 10<sup>th</sup> edition, Pearson Education, 2013.

Blanchard, Olivier, and David R. Johnson. Macroeconomics, Global Edition. Essex: Pearson Education Limited, 2013.

Canova, F. (2011). Methods for applied macroeconomic research. Princeton university press.

Cencini, A. (2005). Macroeconomic foundations of macroeconomics (Vol. 72). Psychology Press.

Clarida, Richard, Jordi Galí, and Mark Gertler. 1999. "The Science of Monetary Policy: A New Keynesian Perspective." *Journal of Economic Literature* 37(2): 1661–1707

Galí, J. (2015). Monetary policy, inflation, and the business cycle: an introduction to the new Keynesian framework and its applications. Princeton University Press.

Levin, A T, A Onatski, J C. Williams, and N Williams (2006), "Monetary Policy under Uncertainty in Micro-founded Macroeconomic Models", NBER Macroeconomics Annual 2005, MIT Press, 229-287.

Paul Levine, 2019. "The State of DSGE Modelling," School of Economics Discussion Papers 0319, School of Economics, University of Surrey.

Romer, P. (2016). The trouble with macroeconomics. *The American Economist*, 20, 1-20.

Sargent, Thomas J. *Dynamic macroeconomic theory*. Harvard University Press, 2009.

Wickens, Michael. *Macroeconomic Theory: A Dynamic General Equilibrium Approach*. Second Edition, Princeton University Press, 2012.

## **Advanced Econometrics-II**

**Course Objective:** This course focus on cross- section and panel data regression models. It also covers various models associated with qualitative dependent variables and quantile regression models. The main objective of this course is to provide a sound understanding of the econometric principles associated with these models along with applications.

**Learning outcomes:** students will be able to apply the advanced econometric tools to cross-section and panel data, and arrive at suitable inferences.

### **1. Qualitative Dependent Variable Models**

Limited dependent Variable – Logit Model (using ML perspective- confusion matrix, ROC, Accuracy score)– Probit Model - Tobit Model - Two-limit Tobit, truncated regression model - Heckman Two-step method - Hurdle model- Count data Model: Poisson, Negative Binomial and Zero-inflated model; Multinomial Logit model; Ordered logit model; Nested logit model;

Textbooks: Woolridge, Stock and Watson

### **2. Generalized Method of Moments**

Endogeneity in linear regression models, Instrumental Variables Approach- Instrumental variables, Instrumental variables estimator. Finite-sample and asymptotic properties of the IV estimator. Choice of instruments, Generalized Method of Moments (GMM) Estimator. Asymptotic properties of GMM estimator. Efficient GMM estimator. Test of overidentifying restrictions.

Textbooks: Woolridge, Johnston Dinardo, Stock and Watson

### **3. Panel Data Models**

Pooled regression, fixed effects; random effects, first difference models; Hausman test; Time series correlation in panel data; Panel unit root tests; Co- integration tests; Dynamic panel data model: panel IV, Arellano-Bond estimates, panel VAR; Panel ARDL Models; Heteroskedasticity and serial correlation in panel data; Spatial Panel Data

Textbook: Woolridge, Baltagi.

### **4. Quantile Regression.**

Review of Quantiles. Population Quantiles, Sample Quantiles. Conditional Quantile Function. Quantile Regression Estimator.

Textbook: Koenker , Mostly Harmless Econometrics

## **5. Advanced Models**

Difference-in-difference; Dimension reduction techniques- Propensity score matching; Principal component Analysis; non-parametric techniques; randomised control trials

Textbook: Mostly Harmless Econometrics

## **Reference**

Wooldridge, J.M, Econometric Analysis of Cross Section and Panel Data, MIT Press, Cambridge

Baltagi, B. (2008). Econometric analysis of panel data. John Wiley & Sons.

Long, J. Scott. 1997. Regression Models for Categorical and Limited Dependent Variables. Thousand Oaks, CA: Sage.

Agresti, A. (2018). An introduction to categorical data analysis. John Wiley & Sons.

Wooldridge, J.M, Econometric Analysis of Cross Section and Panel Data, MIT Press, Cambridge

Greene, W.H. (2011). Econometric analysis. 7th edition. Prentice Hall. New York.

Hsiao, C., Analysis of Panel Data, Cambridge University Press, 2nd ed, 2004; 3rd ed., 2014.

Pesaran, M.H., Time Series and Panel Data Econometrics. Oxford: Oxford Univ Press, 2015.

Koenker, R. (2005). Quantile Regression (Econometric Society Monographs). Cambridge: Cambridge University Press.

Koenker, Roger , Victor Chernozhukov , Xuming He and Limin Peng , "Handbook of Quantile Regression" (Boca Raton: CRC Press, 25 Oct 2017 ), accessed 13 Nov 2020 , Routledge Handbooks Online.

## **Public Economics**

**Course Objective:** This course discusses some facets of public economics from public goods to, social security and taxes. The paper covers, public goods and externalities associated with public goods in details. Course emphasises on the various social security measures and its implications. One of the prerequisite for this course is the basic understanding of public finance and tax mechanism.

### **1. Public goods**

Public finance and government; Public goods and efficient provision of public goods; Public versus private provisions; public goods and public choice; Externalities and public goods; externality theory, private-sector solutions to negative externalities, public-sector remedies for externalities; Allocation of resources, Arrow's Impossibility theorem- political equilibrium-voluntary exchange model; Tiebout mode, Cost-benefit analysis- measuring the costs of public projects, measuring the benefits of public projects; Market failures; Market failure vs. Government failure

### **2. Taxes**

Types of taxes; Tax systems, vertical and horizontal equity; Haig-Simons comprehensive income definition; ability-to-pay considerations; Tax incidence; partial equilibrium models; general equilibrium models; Tax efficiency; Excess burden; Taxation and economic efficiency; efficient and equitable taxation, optimal taxation; Taxes and labour supply; Taxes on savings; taxes on risk taking and wealth; taxation on business income; Tax benefit models

### **3. Public expenditure**

Theories of public expenditure, Cost Benefit Analysis, Social Rate of Discount, Shadow Prices; Social security; Social Security; consumption-smoothing benefits of social security, social security and retirement, optimal social insurance; unemployment benefits; health and insurance; income distribution and welfare programs; welfare policies in the India; moral hazard costs of welfare policy; cash transfers; universal basic income

### **4. Public Debt**

Budget deficit and public debt; Debt dynamics; Public debt management- centre and state; FRBM; Recent trends in public debt;

### **5. Federal Finance**

Theory of fiscal federalism; Function, Constitutional; vs Provisions; Sources of Revenue; Centre to state transfer mechanisms; Central state relationship; Fiscal federalism in India; Planning

Commission Vs. NITI Ayog; Finance Commission; GST framework; direct tax code

Budget Analysis

## **References**

Gruber, J. (2016) Public Finance and Public Policy, 5th edition, Worth Publishers.

Rosen, H. and Gayer, T. (2014) Public Finance, 10th edition, McGraw-Hill.

Stiglitz, J. and Rosengard, J. (2015) Economics of the Public Sector, 4th edition, W. W. Norton & Company.

Atkinson, A. and Stiglitz, J. (1980) Lectures on Public Economics, McGraw-Hill; reprinted by Princeton University Press (2015).

Feldman, Allan M. and Serrano, Roberto (2005). Welfare Economics and Social Choice Theory (2nd Edition), Springer, New York, USA.

Myles, G. (2008). Public Economics, Cambridge University Press.

Musgrave R. A and Musgrave PA, Public finance in theory and practice I.- 5th ed

Auerbach, A. and Feldstein M. (1985). Handbook of Public Economics, vol. 1,2,3,4,

Auerbach, A., Chetty, R., Feldstein M. and Saez, E. (2013). Handbook of public economics, vol. 5,

Government of India, Ministry of Finance: Economics Survey (of various years)

Government of India, Finance commission(various reports)

Basu K and Maertens, (2013),TheNew Oxford Companion to Economics in India, Oxford University Press.

Rangarajan, C., & Srivastava, D. K. (2011). Federalism and fiscal transfers in India. OUP Catalogue.

## **Game Theory & applications**

**Course Objective:** Game theory studies strategic interactions amongst rational decision-makers. Traditionally, game-theoretic tools have been applied to solve problems in Economics, Business, Political Science, Biology, Sociology, Computer Science, Logic, and Ethics. In recent years, applications of game theory have been successfully extended to several areas of engineered / networked systems such as wireline and wireless communications, static and dynamic spectrum auction, social and economic networks. This course is intended to provide students with a comprehensive treatment of game theory with specific emphasis on applications in Economics.

### **Learning outcomes**

1. To apply game theory concepts like Nash Equilibrium, mixed strategies, and dominant strategies to analyze decision-making processes in various scenarios, including markets, auctions, and voting systems.
2. To gain the skills to design games (strategic interactions) that encourage desired behaviors and understand the potential inefficiencies of equilibria compared to optimal social outcomes.

### **1. Strategic Games and Nash Equilibrium**

Theory of rational choice; Strategies, costs, and payoffs ; Strategic games; Examples (Prisoner's dilemma); Nash Equilibrium, concepts and examples; Best response functions; Dominant strategies; Pure strategy v/s Mixed strategy; Symmetric games and symmetric equilibria; Cournot's model of duopoly market; Bertrand's model of duopoly market; Electoral Competition; War of Attrition; Voting; Auctions; Accident Laws

### **2. Mixed Strategy Nash Equilibrium**

Introduction; Strategic games with randomisation; Mixed strategy Nash equilibrium: concept and examples; Dominated Actions; Formation of Players' beliefs

### **3. Extensive Games and Nash Equilibrium**

Introduction to extensive games; Strategies and outcomes; Nash equilibrium; Subgame perfect Nash equilibrium; Backward induction; Stackelberg model of duopoly markets; Ultimatum game

### **4. Designing games**

Repeated games; Bayesian games

Routing games; Selfish routing; Quantifying inefficiency of equilibria; Price of Anarchy; Social optimum; Price of stability; Scheduling games

Population games; Evolutionary game theory; Evolutionary stable strategy; Replicator dynamics

## **5. Cooperative and Non-Cooperative Games**

Cooperative game theory, Non-cooperative games; Nash bargaining; Adaptive decision making; Mechanism design; Algorithmic mechanism design; Distributed algorithmic mechanism design

### **References:**

Başar, T., & Olsder, G. J. (1998). Dynamic noncooperative game theory. Society for Industrial and Applied Mathematics.

Fudenberg, D., & Tirole, J. (1991). Game theory mit press. Cambridge, MA, 86.

Gibbons, R. (1992). A primer in game theory—Prentice-Hall.

Karlin, A. R., & Peres, Y. (2017). Game theory, alive (Vol. 101). American Mathematical Soc.

Leyton-Brown, K., & Shoham, Y. (2008). Essentials of game theory: A concise multidisciplinary introduction. Synthesis lectures on artificial intelligence and machine learning, 2(1), 1-88.

Osborne, M. J. (2004). An introduction to game theory (Vol. 3, No. 3). New York: Oxford university press.

Osborne, M. J., & Rubinstein, A. (1994). A course in game theory. MIT press.

Weibull, J. W. (1997). Evolutionary game theory. MIT press.

## **Advanced Research Methods**

**Course Objective:** The core objective of this course is to familiarize the students with the philosophy of research and prepare for academic research. This course begins by introducing the scientific research and the evolution of research methodology in Economics over the years. Apart from the conventional research methods, importance is given to case studies and randomized control trials. Special attention is given to research report/case study report writing, ethics in research and plagiarism.

### **1. Philosophy of Science & Research-**

Epistemology, Positivism, Empiricism and Interpretivism; Nature of Science- Karl Popper, Thomas Kuhn, Lakatos; Logic- Rules, Logical Fallacy; Models of Scientific Explanation: Hypothetico-Deductive Model, Deductive-Nomological Model, and Inductive Approach

### **2. Methodology of Economics**

Seven decades of Research Methodology in Economics; Types of research, types of knowledge and methods for the three types of research; Research process; Research Design; Research Literature; Identification of Research gap; Research Proposal

### **3. Data and Sampling**

Methods of sampling and Sampling Design; Data- types; Data collection tools; Questionnaire design; Sampling errors; Different data Sources

### **4. Probability distribution and testing hypothesis**

Testing of Hypothesis-Parametric Tests (Z Test, t-Test, Chi- square Test, F Test, One-Way & Two-Way ANOVA), Non-Parametric Tests (Run Test, Mann-Whitney U-Test, Wilcoxon Signed Rank Test, Kruskal-Wallis Test); Factor Analysis; Cluster Analysis; Multidimensional Scaling; Discriminant Analysis

### **5. Experimental Studies**

Case studies; Randomized control trials (RCT)

### **6. Research Results Reporting, Referencing Techniques and Plagiarism**

Types of research reports, Structure of a research report, Presentation of tabular data and figures; Preparing bibliography, foot notes and annexure; Style of reference writing; Ethics in research; Plagiarism in research; Avoiding plagiarism; Introduction to software packages of detecting plagiarism

## Reference

- Davis, J. B., Hands, D. W., & Mäki, U. (1998). The handbook of economic methodology.
- Hausman, D. M. (Ed.). (1994). The philosophy of economics: An anthology. Cambridge University Press.
- Daniel Hausman, "Appendix: An Introduction to Philosophy of Science," The Inexact and Separate Science of Economics. Cambridge: Cambridge University Press, 1992, pp. 281-329
- Hausman, D. M. (1989). Economic methodology in a nutshell. Journal of Economic Perspectives, 3(2), 115-127.
- Boumans, M., & Davis, J. B. (2015). Economic methodology: Understanding economics as a science. Macmillan International Higher Education.
- Godfrey-Smith, P. (2009). Theory and reality: An introduction to the philosophy of science. University of Chicago Press.
- Lakatos, I. (1968, January). Criticism and the methodology of scientific research programmes. In Proceedings of the Aristotelian society (Vol. 69, pp. 149-186). Aristotelian Society, Wiley.
- Popper, K. (2014). Conjectures and refutations: The growth of scientific knowledge. routledge.
- Popper, K. R. (1982). Science: conjectures and refutations. Philosophy of science and the occult, 104-111.
- Karl Popper, "Science: Conjectures and Refutations," in Conjectures and Refutations. London: Routledge and Kegan Paul, 1963,
- Popper, K. (2005). The logic of scientific discovery. Routledge.
- Boumans, M., & Davis, J. B. (2015). Economic methodology: Understanding economics as a science. Macmillan International Higher Education.
- Blaug, M. (1975). Kuhn versus Lakatos, or paradigms versus research programmes in the history of economics. History of Political Economy, 7(4), 399-433.
- Kuhn, T. S. (2012). The structure of scientific revolutions. University of Chicago press.
- Reiss, J. (2013). Philosophy of economics: a contemporary introduction. Routledge.

## **Programming with Python**

**Course Objective:** This course aims to introduce students to Python programming. The Python programming language is one of the most popular programming languages worldwide and this course will be of great interest to all learners who would like to understand the basics of programming using the Python language and its applications in several domains.

### **Learning Outcome:**

- To apply Python fundamentals to manipulate and analyze data
- To master data visualization techniques
- To implement various regression algorithms
- To build and evaluate classification models
- To apply machine learning in practice:

### **Module 1: Basic Operations**

Installing Python and choosing an IDE (e.g., Jupyter Notebook, PyCharm);

Basic Data Types and Operations: Numbers, strings, booleans, and lists, Operators and expressions, Variables and data assignment, Basic input and output (using print); Control Flow: Conditional statements (if-else), Loops (for, while), Nested control flow; Functions: Defining and calling functions, Arguments and return values, Local and global variables;

Data Structures: Lists, tuples, dictionaries, Indexing and slicing; List comprehensions and dictionary methods;

Data Transformation and Manipulation: String formatting and methods, Date and time handling, File handling (reading and writing); Introduction to NumPy and Pandas: Creating and accessing NumPy arrays, Basic operations on arrays, Introduction to Pandas Data Frames Indexing, selecting, and filtering data

Packages: numpy, pandas

### **Module 2: Data Visualization**

Common types of charts and graphs; Choosing the right visualization for data;

Matplotlib Basics: Creating basic plots (scatter, line, bar), Customizing plots (labels, titles, legends), Subplots and figure layout

Seaborn for Statistical Visualization: Statistical plots (boxplots, violin plots, histograms), Categorical data visualization, Creating publication-quality graphs

Interactive Visualization with Plotly/Bokeh: Creating interactive charts and dashboards. Adding hover tools and custom interactions, Building interactive web applications with Plotly/Bokeh

Packages: matplotlib, seaborn, plotly, bokeh

### **Module 3: Regression Techniques in Machine Learning**

Introduction to Machine Learning: Supervised learning and tasks: Regression and Classification; Common regression algorithms (Linear, Polynomial, Ridge, Lasso, Support Vector Regression, Decision Tree regression); Implementing Regression in Python: Preprocessing data for regression analysis, Training and evaluating regression models using Scikit-learn; Visualizing model predictions and residuals; Model Selection and Feature Engineering: Choosing the right regression model for your data, Feature engineering techniques to improve model performance

Packages: scikitlearn

### **Module 4: Classification Techniques in Machine Learning**

Introduction to Classification: Binary and multi-class classification problems, Performance metrics for classification (accuracy, precision, recall), Common classification algorithms (Logistic Regression, Decision Trees, k-nearest neighbours); Implementing Classification in Python: Data preparation for classification tasks, Training and evaluating classification models using Scikit-learn, Visualizing model predictions and decision boundaries; Model Optimization and Hyperparameter Tuning: Cross-validation for robust model evaluation; Tuning hyperparameters to improve model accuracy,

Case Studies and Project

#### **Core texts:**

Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.

VanderPlas, J. (2016). Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc."

Downey, A. (2012). Think Python. " O'Reilly Media, Inc."

## **Semester III**

### **International Trade and Finance**

**Course Objective:** The course aims to familiarize students on two aspects in a global economy- trade and finance. While the first three modules discuss the currency, exchange rate systems and currency derivatives, the last three modules focus on trade. This subject is meant to be a blend of theoretical models and recent advances.

#### **1. Balance of Payments and Exchange Rates**

Balance of Payments (BOP) Accounts; Exchange Rate systems; Disequilibrium in BOP; Elasticity approach to BOP, absorption approach, monetary approach to BOP; International monetary system – gold standard, the Bretton Woods system, post-Bretton Woods monetary arrangements; Purchasing Power Parity Theory; Balassa – Samuelson model; Flexible price monetary model; Dornbusch sticky price monetary model; Real interest rate differential model of Frankel; Portfolio balance model; Empirical evidence on exchange rates; Exchange market efficiency; News approach to modelling exchange rates; Modelling exchange rate expectations.

#### **2. Foreign Exchange Risks and Currency Derivatives**

Types of foreign exchange exposures and their management- translation, transaction, operating, contingent, tax, exposures; Exposure Netting; Growth of currency derivative markets; Hedging; Foreign currency forwards, futures, options, swaps– The pricing of currency derivatives; Over the counter markets.

#### **3. International Investments and Financing**

Short-term and long-term capital movements; Gains from international capital markets; Foreign Direct investment (FDI) and Foreign Institutional Investments (FII) – FDI and economic growth; Multi-National Companies (MNCs); Multi-National Banking; Capital flow episodes; Capital flows and Financial Crisis; Banking crisis; Balance of Payment crisis; Currency crisis.

#### **4. Trade Theories**

Comparative advantage; HO theory; Factor price equalisation; Intra industry trade; New trade theory- Economies of Scale; Imperfect competition - Rybczynski theorem; Linder's preference similarity; Product life cycle theory; Gravity model of trade; Recent advances in trade theory

#### **5. Inter-temporal Approach to Current Account**

Two-period endowment theory; Role of investment; Two region world economy; Taxation of foreign borrowing and lending; International labour movements; Small economy with many

periods; Dynamics of current account; Stochastic current account model; Consumer durables and current account; Firms, labour markets and investments.

## **6. Overlapping Generations model of Current Account**

Government budget policy in the absence of Overlapping Generations model; Government budget deficit in an Overlapping Generations model; Output fluctuations; Demographics and life cycle- investment and growth; Application of Feldstein and Horioka's saving-investment puzzle; Aggregate and international gains from trade; Public debt and world interest rate; Integrating Overlapping Generation and Representative Consumer model.

### **References:**

Pilbeam, Keith. International finance. London: Macmillan, 1998.

Levi, Maurice D. International finance. Psychology Press, 2005.

Obstfeld, Maurice and Kenneth S. Rogoff. Foundations of international macroeconomics. The MIT press, 1996.

Terra, Cristina. Principles of International Finance and Open Economy Macroeconomics: Theories, Applications, and Policies. Academic Press, 2015.

Sarno, Lucio, and Mark P. Taylor. The economics of exchange rates. Cambridge University Press, 2003.

## **Indian Economy**

**Course objective:** This main objective of this program is to provide a detailed analysis on the various aspects of the Indian economy. Apart from giving an understanding on the Economy, this paper also aims at preparing students for competitive exams. Therefore the course focuses on the recent advancements and events in the Indian economy. The course is meant to be taught using relevant and recent journal articles.

### **1. Introduction to Indian Economy**

Feature of Indian Economy; Nature of the economy; Demographic features; Development indices; Inequality; Poverty, Unemployment; Inflation; Healthcare system; Education

### **2. Sectoral comparison of Indian Economy**

Agriculture- Growth and issues; Land reforms; Green revolution; Subsidies; Recent developments in agricultural sector; Growth and efficiency in agricultural sector; employment generation; food security; storage management; Policy interventions, regulations and reforms;

Industry: Performance, problems and prospects; Capital formation; industrial infrastructure; Regional imbalances; MSME's; Output and employment; employment and labour reforms; Development strategies and policies; Industrial growth; technology and innovation;

Service: Overview; Market size; Service sector led growth story; Employment; labour productivity; Policy intervention; ICT and economic growth; FDI inflows; Sub sector wise performance

Public sector vs. Private sector in India

### **3. Economic Policies**

Economic Planning in India; Five Year Plans; Planning commission v/s NITI Ayog; Monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission;

### **4. External Sector**

India's foreign trade value composition and direction; Balance of payment since 1991; Foreign capital flow; Impact of Globalization on Indian Economy; WTO and India; Trade agreements; Free trade agreements; Trade in service sector

## **5. Government intervention and financial inclusion**

Social security measures in organized and unorganized sector; Pension; Health and medical insurance; disability benefits; Maternity benefits; Gratuity; Poverty alleviation schemes; public distribution system; Indian banking sector; priority sector lending; JAM; LPG policy

## **6. Recent developments**

Impact of Global financial crisis; NPA issues in the banking sector; Insolvency and Bankruptcy code; The new Companies act; Power sector reforms; Digital India; Atmanirbhar Bharat; Covid crisis and policy response; fiscal- monetary policy coordination- Indian experience

## **Reference**

Basu, K. (2004). The Indian economy: Up to 1991 and since. India's Emerging Economy– Performance and Prospects in the 1990s and Beyond, 3-31.

Financial Stability Report, Reserve Bank of India, (various editions)

Ghate, C. (Ed.). (2012). The oxford handbook of the indian economy. Oxford University Press.

Handbook of Statistics on Indian Economy. Reserve Bank of India. (various editions)

Jalan, B. (2004). Indian Economy. Penguin UK.

Krishna, K. L., Pandit, V., Sundaram, K., & Dua, P. (Eds.). (2016). Perspectives on Economic Development and Policy in India: In Honour of Suresh D. Tendulkar. Springer.

Monetary Policy report, Reserve Bank of India, (various editions)

Reports by various ministries, NITI Ayog;

Recent journal articles

## **Semester III (Elective courses)**

### **Monetary Economics**

**Course Objective:** The course provides an introduction to monetary theory, to the effects of monetary variables on the macroeconomic system, the role of the Central Bank, and the conduct of monetary policy. This course will enable students of economics to understand theory, practice, and analyze the interconnection between the monetary forces and real forces, their developmental role, and limitations in shaping and influencing the monetary and related policies both at the national and international levels.

#### **1. Classical building blocks**

Real Business Cycle Models and General Equilibrium Monetary Models Models with nominal rigidities, Rational expectations, representative agents, Real business cycles; Lucas Model, Money in the Utility Function (MIU), Cash-in-advance models, welfare cost of inflation ; Nominal Price and Wage Rigidities Sticky prices and wages; Imperfect competition; Frictions in the timing of price adjustments or in the adjustments of prices?;; Forward-looking Phillips curve; Output gaps; Short and long-run effects of technology and money shocks

#### **2. The basic new Keynesian model**

The basic model, a linearized new Keynesian model, Efficient allocations; Sources of distortions; Equilibrium uniqueness and stability; Taylor rules and the Taylor principle; Volatility trade-offs; Evaluating simple policy rules; Optimal monetary policy

#### **3. Monetary policy in the new Keynesian model**

Efficient allocations; Sources of distortions; Equilibrium uniqueness and stability; Taylor rules and the Taylor principle; Volatility trade-offs; Evaluating simple policy rules; Optimal monetary policy

#### **4. Monetary/fiscal interactions**

Fiscal policy and multipliers; Liquidity traps and zero lower bounds; Limits of monetary policy; New Keynesian model in continuous time; Managing a liquidity trap

#### **5. Labour market frictions and Unemployment fluctuations in the new Keynesian model**

Real wage rigidities and steady-state un-employment; Sticky nominal wages and unemployment fluctuations; Unemployment and inflation

#### **6. Modern Monetary Theory**

#### **7. Bank runs, old and new**

Liquidity mismatch; The multiple equilibria problem; The run on repo

## **8. Agency costs**

Costly state verification models; Static amplification and propagation of shocks; Dynamic amplification; Debt deflation; Continuous-time approach; Nonlinear dynamics and asymmetric responses to shocks; Endogenous risk; Volatility; Systemic risk and macro prudential policies

### **Reference**

Pierce, D. G., & Tysome, P. J. (2014). Monetary economics: theories, evidence and policy. Butterworth-Heinemann.

Gupta, Suraj B. (2016): Monetary Economics: Institutions, Theory and Policy, S. Chand and Company Private Limited, New Delhi.

Jagdish Handa, (2009): Monetary Economics, 2nd Edition, Routledge, London

Walsh, Carl E (2010): Monetary Theory and Policy, Third Edition, The MIT Press Cambridge Massachusetts

Wray, L. R. (2015). Modern money theory: A primer on macroeconomics for sovereign monetary systems. Springer.

Mitchell, W.F., Wray, L. R., Watts M.J., Modern Monetary Theory and Practice: An Introductory Text (2016)

Nachene, Dilip, and Bhalchandra Mungekar (2003): Indian Economy in the New Millennium, Himalaya Publication, Mumbai. Journal of Monetary Economics [www.rbi.org.in](http://www.rbi.org.in)

Lewis, M.K., and P.D. Mizen Monetary Economics. Oxford; New York: Oxford University Press.

Gopinath, Gita, Elhanan Helpman, and Kenneth Rogoff, eds. Handbook of International Economics. Vol. 4. Elsevier, 2014.

Vegh, Carlos. Open-Economy Macroeconomics in Developing Countries. MIT Press, 2013.

Friedman, B. M., & Woodford, M. (Eds.). (2010). Handbook of monetary economics. Elsevier.

## **Behavioural Economics**

### **1. Introduction:**

Human Choice under Risk and Uncertainty; Behavioral Models of Decision Making; Applications of Behavioral Decision Theory; Human Behavior under Ambiguity – Neoclassical and Behavioral models

### **2. Preferences:**

Risk preference, reference dependence and prospect theory; Human Sociality- Models of Social preferences; Human morality and social identity

### **3. Behavioural time discounting**

Temporal Human Choice- The discounted utility model; Behavioral Models of Time Discounting; Present-Biased Preferences

### **4. Behavioural Game Theory**

Strategic Human Choice; Models of Behavioral Game Theory; Evolutionary Game Theory; Models of Learning

### **5. Bounded rationality:**

Judgment Heuristics; Limited attention, salience; Mental accounting; Markets, Beliefs, learning

### **6. Neuroeconomics:**

Brain models of decision-making- The neuroeconomics of risky decisions; social preferences; time preferences; strategic interaction

### **7. Development:**

Behavioural development and poverty; Behavioural health; Happiness and utility; fairness, altruism, vengeance

### **8. Policy:**

Behavioural economics and policy; media bias and politics, policy and paternalism

### **References:**

Dhami, S. (2016). The foundations of behavioral economic analysis. Oxford University Press.

Cartwright, E. (2018). Behavioral economics. Routledge.

Wilkinson, N., & Klaes, M. (2017). An introduction to behavioral economics. Macmillan International Higher Education.

Thaler, R. H., & Sunstein, C. R. (2009). Nudge: Improving decisions about health, wealth, and happiness. Penguin.

Kahneman, D. (2011). Thinking, fast and slow. Macmillan.

Kahneman, Daniel, Paul Slovic, and Amos Tversky (eds.). 1982. *Judgment Under Uncertainty: Heuristics and Biases*, Cambridge University Press.

Kahneman, Daniel and Amos Tversky (eds.). 2000. *Choices, Values and Frames*, New York: Russell Sage Foundation: Cambridge University Press.

## **Development Economics**

### **1. Paradigms of Development**

Development equilibrium and disequilibrium; Influences of culture, geography and other factors on development; trickle-down theory; Myrdal's backwash effect

### **2. Theories of Growth and Development**

Neoclassical economic theory: Slow-Swan growth model; Ramsey growth model; Empirics of neoclassical theory: Conditional and unconditional convergence; Endogenous growth theory: AK model; Romer model with knowledge spill overs and increasing returns to scale; Uzawa-Lucas model with human capital

### **3. Poverty and Inequality**

Concepts of poverty; multidimensional aspects of poverty; axioms; Sen's approach to poverty measurement, FGT class of poverty measures; Indian controversies; poverty traps - theory and evidence; anti-poverty measures in India; Food subsidies and Poverty alleviation in India; Universal basic income vs. Targeted transfers; concept of inequality; inequality of income and wealth; inequality and income growth; Kuznets' inverted U hypothesis; Sen's Capabilities approach and its operationalization

### **4. Rural Development**

Land (tenancy, shareholding, and property rights); Labour (labour markets, shadow wages, wage determination); Migration (equilibrium models, causes and consequences, risks), Harris and Todaro model; Credit market – features of rural credit market, alternative credit policies; micro-finance (credit rationing, household credit, lending to the poor)

### **5. Financial flows, Aid and Developing countries**

The financial flows to developed and developing countries; various forms of financial flows (Direct investment, portfolio investments and bank flows), its determinants and impacts and the institutional and policy issues arising from their impact on macroeconomic stability and growth; Aid and economic growth; the positive and normative economics of aid; the relationships between these two sorts of financial flows; Financial flows and developing countries; Aid and African nations.

### **6. Industrial Policy and Technological Change**

Industrialization, economic growth and the industrial policy debate; The experience of the East Asian NICs: lessons and debates; Transfer of technology and role of multinational companies; Industrialisation and catch-up in the emerging economies: the BRICS and beyond; Opportunities and constraints for industrial policy in the 21<sup>st</sup> century: internal and external dimensions

## **7. Culture, Institutions, Education and Development**

Culture and economic outcomes; Role of institutions in economic development; Corruption and economic growth; Monitoring corruption; estimating the value of political connections; Returns to education and demand for schooling; Schooling and labour markets; Evaluation of schooling in developing countries; rural indebtedness, role of micro-finance, skilling and deskilling. Migration and development; migration beyond gravity; economic consequences of migration; Causes, consequences and risk associated with illiteracy, migration; Broad perspective evaluation of Indian development process.

### **References**

Michael Todaro, Economic Development, Addison-Wesley, New York & London, Seventh Edition (2000)

Debraj Ray, Development Economics, Oxford University Press, New Delhi (1999)

Yotopoulos, P. A., & Nugent, J. B. (1976). Economics of Development: Empirical Investigations. HarperCollins.

Gerald Mayer, Leading Issues in Economic Development, OUP (1995).

Jones, C. I., Introduction to Economic Growth (Second Edition). W.W.Norton & Company, New York, (2001)

Banerjee, A., R. Benabou, and D. Mookherjee (2006) Understanding Poverty. Oxford University Press.

Barro, R. and X. Sala-i-Martin (2004) Economic Growth. Second edition. MIT Press. BSM]

Rodrik, D. editor (2003) In Search of Prosperity: Analytic Narratives on Economic Growth. Princeton University Press

D. Mookherjee and D. Ray (2001) Readings in the Theory of Economic Development. Blackwell Readings for Contemporary Economics, Blackwell Publishers

J. Behrman and T. N. Srinivasan (Eds)- Handbook of Development Economics Elsevier 1995

Bardhan, Pranab and Christopher Udry, Development Micro-Economics. Oxford University press. 2000. New York

Nafziger, Economics of Developing countries. Prentice Hall 1997

David Colman, Frederick Nixon, Economics of Change in Less Developed Countries, Harvester Wheatsheaf, London, Third Edition (1994).

Banerjee, Gopinath, Rajan, Sharma, (2019) What the Economy Needs Now, Juggernaut

## **Financial Econometrics**

**Course Objective:** Financial econometrics is the intersection of statistical techniques and finance. It provides a set of empirical tools to analyze historical financial data, model underlying economic mechanisms, and predict future price trends. This course covers both cross-sectional and time-series data. Multivariate regression analysis is developed to study the cross-sectional differences in stock returns of individual firms and associated portfolio models. Applications of these techniques to evaluate the performance of new trading strategies and hedge fund managers are also discussed. Furthermore, time-series models are introduced to model and forecast both time-varying aggregate stock returns and volatility. The course prepares students to conduct empirical research in an academic or business setting. Stata will be used for the class.

### **Modules:**

#### **1. Financial Returns**

Simple returns; Log (Continuous) Returns;; Adjustment for Dividends; E Constant Expected Returns (CER) Model; Characteristics of Financial Returns, Geometric Random Walk, Clustered Volatility

#### **2. Portfolio Theory**

Portfolio Mean and Variance; Minimum Variance Portfolio; Efficient Frontier; Tangency Portfolio; Capital Market Line (CML); Quadratic Utility; Optimal Portfolio Choice; Fragility of Optimal Portfolio Weights; CAPM; Security Market Line (SML) ; Security Characteristic Line (SCL); Portfolio and Security Performance Measures, Jensen's alpha, Appraisal Ratio, Information Ratio, Sharpe's Ratio, Treynor's Ratio; Factor Models of Returns, Fama-French 3-Factor Model; Carhart, Other Factor Models, Fragility of Coefficients of Return Model

#### **3. Event Study Analysis**

Typical Event Study Time Line, Market Model with Pulse Dummies, Joint Test of Significance of Pulse Dummies, Case Study

#### **4. Efficient Market Hypothesis**

Definition; Types; Evidence For; Evidence Against – Behavioral Economics, The Over-reaction Hypothesis, The Momentum Effect – Carhart model, Smart Beta Portfolios

#### **5. Term Structure of Interest Rates**

Definition of Term Structure; Deriving Forward Rates from the Term Structure; The Expectations Hypothesis of the Term Structure of Interest Rates; Testing the Expectations Hypothesis

#### **6. Cointegration of Time Series**

Definition of Cointegration; Engle-Granger Residual – based tests of Cointegration; The Error Correction Model; Applications, Expectations Hypothesis of the Term Structure, Spot and Futures prices, Paired Investments

## **7. Modeling Volatility of Returns**

ARCH and GARCH models; Forecasting Volatility; Multivariate GARCH models; Applications-Black-Scholes Model; Simulating the Price of a Financial Option, RiskMetrics, Value at Risk computations, Conditional Betas and Dynamic Hedge Ratios

## **References**

Analysis of Financial Time Series by Ruey S. Tsay. Wiley India, 3<sup>rd</sup> edition

Basic Econometrics (4e) by Damodar N. Gujarati & Sangeetha. Mc-Graw Hill.

Applied Econometric Time Series by Walter Enders. Wiley India Edition.

Chris Brooks, “Introductory Econometrics for Finance”, Cambridge University Press

Econometrics: Theoretical Foundations and Empirical Perspectives by Dilip M. Nachne. Oxford University Press.

Introduction to Econometrics (3e) by G.S. Maddala. Wiley India Edition.

Campbell, J. Y., Champbell, J. J., Campbell, J. W., Lo, A. W., Lo, A. W., & MacKinlay, A. C. (1997). The econometrics of financial markets. Princeton University press.

## **Global Financial Markets**

**Course Objective:** The course, as the name suggests, gives students an overview of the securities markets and the various products that are available in the markets. It is a course that will cover almost all aspects of the financial markets but will not go too much into the details of each of the topics. This may work out to be an informative course for those who want to have a broad macro perspective about financial markets and products.

### **1. Financial Institutions, Instruments, and Markets I:**

Why financial markets?; Categories of economic units; Types of securities; Concept of return or yield; Concept of risk; Concept of liquidity; Classification of markets; Market Intermediaries; Concept of the bid and ask prices; Concept of the underwriting of public issues

### **2. Financial Institutions, Instruments and Markets II:**

Stock Exchanges; Listing of securities; Bond markets; Derivative markets; The concept of long and short positions; Sell-side traders vs. Buy-side traders; The concept of a specialist; Clearing and settlement; Depositories and custodians; The principle of arbitrage; The Eurocurrency market; Floating rate loans; Eurobonds and Foreign bonds; Globalization of equity markets; ADRs and GDRs; International Banking Facilities

### **3. Types of Orders and Market Structures:**

Introduction to orders; Continuous markets with electronic rule-based order matching; Block trades; Time conditions; Spread Orders; Markets structures; Trading sessions; Trading hours; Execution systems; Types of order-driven systems; Market Information Systems; Ticker symbols; The concept of transparency; Order routing systems; Order presentation systems

### **4. Introduction to Money market:**

Concepts, features, and objectives; Structure of money markets; Money market Instruments; Certificate of Deposits; Treasury Bills; Commercial Bills; Bankers' Acceptance; Call Money; Repurchase Agreements; Inter-Corporate Deposits

### **5. Introduction to Equity market:**

Nature of common stock; Voting rights; Preferred shares; Margin trading & Short selling; Stock indices; Types of indices; Forming mimicking portfolios; Portfolio rebalancing

### **6. Introduction to the Bond market:**

Plain Vanilla Debt; Valuation on a coupon date; Price versus yield; Par, discount and premium bonds; Zero-coupon bonds; Floating rate bonds; LIBOR; Callable and puttable bonds; Convertible bonds; Valuation of bonds in between coupon dates; The procedure for Treasury bonds; The procedure for corporate bonds

### **7. Fundamentals of Foreign Exchange:**

The spot market; Direct quotes; Indirect quotes; European versus American terms; Arbitrage; The forward market; Merchant rates and exchange margins; Covered Interest Arbitrage; Inter-bank swap deals; Option forwards; Covered Interest Arbitrage

## **8. Derivatives Overview – Futures & Options:**

Forward versus Futures contracts; Types of assets underlying futures contracts; Derivative exchanges; Types of assets underlying options contracts; Call and Put options; European versus American options; Hedgers, Speculators, and Arbitrageurs; The role of futures and options markets; Standardization of futures contracts; Margins and marking to market; Liquidating a futures position; Role of the clearinghouse; Trading volume versus Open Interest; Exercising call and put option; Cash settlement versus delivery settlement; Payoffs and profits; Exchange-traded versus OTC options

## **Reference**

Geert Bekaert and Robert Hodrick, International Financial Management, Pearson Prentice Hall, 2nd Edition, 2012.

Buckley, Adrian, Multinational Finance, Prentice Hall of India, New Delhi

Henning, C.N., Piggot, W. and Scott, W.H, International Financial Management, Mc Graw Hill, Int. Ed., New York.

Maurice, Levi, International Finance, McGraw Hill, Int. Ed., New York.

Rodriquefe, R.M and E.E Carter, International Financial Management, Prentice Hall of India, Delhi.

Shaprio, A.C., Multinational Financial Management, Prentice Hall of India, New Delhi.

## **Economics of Banking and Finance**

### **Course Objective:**

The students should be able to:

- a) Comprehend the need, definition, functions, and economic significance of financial institutions and markets.
- b) Understand the interdependence between financial markets and interest rates.
- c) Comprehend the behavioral analysis of interest rates: risk, liquidity, and term structure.
- d) Identify the role played by the Central Bank and instruments of credit control.
- e) Grasp the conduct of monetary policy and its effect on the interest rate, credit availability, prices, and inflation rate.

### **1. An Overview of the Financial System**

Saving and Investment; Money, Inflation, and Interest; Banking and Non-Banking Financial Intermediaries

### **2. Financial Markets and Instruments**

Money market and Capital Markets; Financial Instruments: REPO, TBs, Equities, Bonds, Derivatives, etc; Characteristics of Financial Instruments: Liquidity, Maturity, Safety, and Yield

### **3. Principles of Financial Markets and Interest Rates**

Understanding Interest Rates; Risk and Term Structure of Interest Rates; Interdependence of Markets and Interest Rates; Rational Expectations and Efficient Markets

### **4. Economics of Banking (Depository) Institutions**

Banking Institutions: Revenues, Costs, and Profits; Basic Issues and Performance of Depository Institutions; Asymmetric Information and Banking Regulation

### **5. Central Banking, Monetary Policy, and Regulation**

The RBI as a Central Bank: Structure, Functions, and Working; Reforms; The Current Regulatory Structure

### **6. Conduct of Monetary Policy and Interlinkages**

Objectives and Targets of Monetary Policy; Policy Lags and Intermediate Targets; Rules Vs. Discretion in Monetary Policy; Interlinkages

### **Reference**

Indian Institute of Banking and Finance, Principles & Practices of Banking, Macmillan Publication.

Indian Institute of Banking and Finance, International Banking, Mumbai

Uppal R, Indian Banking in the globalized world, New Century Publications, New Delhi

Khan M Y., Indian Financial System, Tata Mc Graw Hill, Delhi

Srinivasan NP and Saravanavel, P., Development banking in India and Abroad, Kalyani Publications.

## **World Economic History**

**Course objective:** This course will permit students to appreciate the several and overlapping ways in which pre-history and history exert an influence on present relations and practices. It discusses the escape of the human race from the Malthusian trap, industrialisation and the increasingly complex and volatile financial world, and so providing a well-rounded perspective for other courses.

### **1. Introduction:**

Uses of studying economic history; ways of studying economic history; the emerging world of cliometrics; long shadows of pre-history; path dependence

### **2. Malthusian trap:**

The trap through pre-history; escape

### **3. Evolution of economic systems**

Feudalism; capitalism; birth of economics; path of evolution of economic systems; some country studies; experiments

### **4. Industrialisation:**

British industrial revolution, third world industrialisation; the global dynamics of industrialisation; the Great Depression

### **5. Money:**

A history of money; the bullion system; the gold standard; financial crises through history; some country experiences

### **References:**

Diamond, J. M. (1998). *Guns, germs, and steel: A short history of everybody for the last 13,000 years*. Random House.

Clark, G. (2008). *A farewell to alms: a brief economic history of the world*. Princeton University Press.

Landes, D. S. (2000). *Revolution in time: Clocks and the making of the modern world*.

Huberman, L. (1968). *Man's Worldly Goods* (Vol. 70). NYU Press.

Hobsbawm, E. J. (1975). *Age of Capital: 1848-1875*. Abacus.

Mokyr, J. (2009). *The Enlightened Economy: An Economic History of Britain 1700-1850*. Yale University Press.

Eichengreen, B. J., & Flandreau, M. (1997). *The Gold Standard in Theory and History*. Psychology Press.

## **Labour Economics**

**Course Objective:** This course aims at providing an overview of the labour market. The course discusses the factors driving the demand and supply of labour, wages and unemployment and trade union. Discussion on the need for human capital investments are also a part of the curriculum

### **1. Introduction**

Employment; Earnings; Labour markets; Unorganized and Organized labour; Supply and Demand of labour; Facts and recent trends in the labour market in India.

### **2. The Demand for Labour**

Employment decision in the short run and long run Demand for labour in competitive markets, Labour demand when the product market is not competitive; Monopsony in the labour market; Labour demand elasticities; Own-wage elasticity of demand; Cross-wage elasticity of demand; Quasi-fixed labour costs and effects on demand

### **3. Supply of Labour**

Theory of the decision to work; Analysis of the labour/ leisure choice; Theory of household production; Labour supply decisions within the household; Labour supply in recessions: Income effects on labour supply; Estimates of the labour supply elasticity; Competitive equilibrium across labour markets

### **4. Human Capital Investments;**

The basic theory of human capital; Human capital investments and the separation theorem; Education and earnings; Labour market signaling; externalities and peer effects

### **5. Wages**

Compensating wage differentials and labour markets; Earnings distribution; Hedonic wage function- risk of injury, employee benefits: Efficiency wage models

### **6. Inequality in Earnings and worker mobility**

Measured and unmeasured sources of earnings differences; Market discrimination- Race and Gender; Measuring inequality in the distribution of earnings; International comparisons of changing inequality; Worker mobility- migration, immigration- recent trends

### **7. Trade Unions and bargaining**

Union relative wage effects; International comparisons of unionism; Constraints on the achievement of union objectives

## **2. Social Security in India**

Need of Social Security; Social insurance and social assistance; Various labour laws on workmen compensation, insurance, maternity benefits, women and child labour.

### **References**

McConnell, C., Brue, S., & Macpherson, D. (2016). Contemporary labor economics. McGraw-Hill Education.

Ehrenberg, R. G., & Smith, R. S. (2016). Modern labor economics: Theory and public policy. Routledge.

Borjas, G. J., & Van Ours, J. C. (2010). Labor economics (pp. 346-382). Boston: McGraw-Hill/Irwin.

Cahuc, P., Carcillo, S., & Zylberberg, A. (2014). Labor economics. MIT press.

Acemoglu, D., & Autor, D. (2011). Lectures in labor economics. Manuscript. <http://economics.mit.edu/files/4689>, 22.

McConnell, Brue & MacPherson, Contemporary Labor Economics, 8th edition, McGraw-Hill, 2009.

## **Introduction to Big Data Analytics**

### **1. Big Data**

Characteristics; Evolution; Definition; Classification digital data; Big data Analytics; Hype, Challenges; Importance of Data science; Terminology

### **2. Hadoop**

Features; Advantages; Overview of Hadoop Ecosystems; RDBMS versus Hadoop; Hadoop Distributions; Processing Data with Hadoop; Managing resources; Hadoop Ecosystems

### **3. HDFS (Hadoop Distributed File System)**

Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

### **4. Map Reduce**

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

### **5. Hadoop Eco System**

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL

### **Reference**

White, T. (2012). Hadoop: The definitive guide. " O'Reilly Media, Inc."

Smolan, R. (2013). The human face of big data.

Mayer-Schönberger, V., & Cukier, K. (2013). Big data: A revolution that will transform how we live, work, and think. Houghton Mifflin Harcourt.

Holmes, A. (2012). Hadoop in practice. Manning Publications Co..

Simon, P. (2013). Too big to ignore: the business case for big data (Vol. 72). John Wiley & Sons.

## **Data Analytics**

### **(using Excel and Power BI)**

Course Objective: This course aims to equip learners with the skills and knowledge to effectively analyze data using Microsoft Excel and Power BI. Participants will learn how to leverage advanced Excel functions, create interactive dashboards, and gain insights from complex datasets.

#### **Learning Outcomes:**

1. Proficiently use advanced Excel functions for data analysis, manipulation, and reporting.
2. Understand the Power BI platform and its capabilities for data visualization and dashboard creation.
3. Develop skills in connecting to various data sources, cleaning and transforming data, and creating interactive dashboards.
4. Gain insights from complex datasets and make data-driven decisions using Excel and Power BI.

#### **1. Advanced Excel Functions**

Exploring and applying Excel functions for data analysis

Conditional functions: SUMIF, SUMIFS, COUNTIFS

Lookup functions: VLOOKUP, INDEX, MATCH

Text functions: LEFT, RIGHT, MID, SUBSTITUTE

Date and time functions: TODAY, NOW, YEAR, MONTH, DAY, HOUR, MINUTE, SECOND

Unique and frequency functions: UNIQUE, FREQUENCY

Correlation Regression; Moving Average; F-test, t-test, ANOVA, exponential smoothing, Fourier analysis

Excel solver for optimization techniques

#### **2. Data Manipulation and Visualization in Excel**

Cleaning and transforming data using Excel functions

Creating dynamic charts and graphs for data visualization

Applying conditional formatting for better data representation

#### **3. Introduction to Power BI**

Understanding the Power BI ecosystem and its components

Connecting to data sources and importing data into Power BI

Transforming and cleaning data using Power Query

#### **4. Building Interactive Dashboards in Power BI**

Creating visually appealing and informative dashboards

Applying advanced visualizations and custom formatting

Sharing and publishing dashboards for collaboration and insights

#### **4. Practical applications**

## **Semester IV (Electives)**

### **Political Economy**

**Course objective:** This course will assist students to see the old economics models in other angles. Political economy is an older discipline than the modern economics, and so is a suitable lens through which to see the discipline as it is today. Finally, it must permit a student to be more discerning, more critical in their reading of other courses, old and new research, and understanding of policy, and world economic events.

#### **1. Introduction:**

Why political economy; Rational choice and collective action; Classical, Marxian, Feminist, environmental and other schools of thought

#### **2. The PE perspective:**

The political economy of the Classical economists' market, political economy deconstruction of select micro and macroeconomic models

#### **3. Institutions:**

Anarchy; institutions; Political authority-market anarchy; Economic institutions; The state

#### **4. Justice:**

Conceptions of efficiency and justice and the (im)balance; The welfare state

#### **5. Democracy and development:**

Democracy and dictatorship; State corruption; Development across systems of governance

#### **6. Political economy of globalisation:**

Inequality in a globalised world; Role of the state; Hegemonic (in)stability

#### **7. Indian thoughts**

Kautalya, Deen Dayal Upadhyaya; M.K. Gandhi; Dr. B. R. Ambedkar and others.

#### **References:**

Bardhan, P. (2015). Globalisation, democracy and corruption: An Indian perspective. Frontpage.

Basu, K. (2000). *Prelude to political economy: A study of the social and political foundations of economics*. OUP Oxford.

Chang, H. J. (2010). *Bad Samaritans: The myth of free trade and the secret history of capitalism*. Bloomsbury Publishing USA.

Easterly, W. (2002). *The elusive quest for growth: economists' adventures and misadventures in the tropics*. MIT press.

Friedman, M. (2009). *Capitalism and freedom*. University of Chicago press.

Hahnel, R. (2015). *The ABCs of political economy*. University of Chicago Press Economics Books.

Miller, D. (2003). *Political philosophy: A very short introduction*. OUP Oxford.

Polanyi, K., & MacIver, R. M. (1944). *The great transformation*. Boston: Beacon press.

Rodrik, D. (2008). *One economics, many recipes: globalization, institutions, and economic growth*. Princeton University Press.

Sowell, T. (2007). *A conflict of visions: Ideological origins of political struggles*. Basic Books.

Stiglitz, J. E. (2012). *The price of inequality: How today's divided society endangers our future*. WW Norton & Company.

## **Economics of Climate Change**

### **1. Introduction to Economics of climate change:**

The science of climate change: energy balance model with GHGs, Green House Effect and Global Warming, characteristics of environmental goods: Uniqueness, Uncertainty and irreversibility, Climate Change and economy, Economics of climate change: Global Commons: Market failure, Externalities and Public Goods, Risks, Costs and Discounting, Low carbon economy; IPCC

### **2. Economics of Climate Change Impacts:**

Projecting the growth of greenhouse gas emissions; Impacts, adaptation, and vulnerability; Dynamic General Equilibrium Model; The challenge of stabilization; Costs of climate change; Impact of Climate Change on different sectors; Food, Water, Health, settlements, ecosystems (agriculture, forests, coastal zones); Approach to Valuing Climate Change Damages.

### **3. Economics of Mitigation:**

Environmental Policy Instruments; Harnessing markets to reduce emissions; Emissions Trading, Carbon Tax, Carbon pricing and emission markets in practice; Clean Development Mechanism; Carbon Credits (CER), carbon markets and technology; Energy and transport policy.

### **4. Economics of Adaptation:**

Understanding the economics of adaptation; Human resources, economic capacity, and environmental capacity; Adaptation in the developed and underdeveloped world; Cost benefit analysis; multicriteria analysis; cost effective analysis

### **5. Economics of Financing climate change and International Agreements:**

Negotiations and Equity; Kyoto protocol, Hedging, international financing and domestic financing; public and private finance; Financing for mitigation and adaptation programmes in energy, transport, afforestation programmes and technology transfer; Paris agreement;

### **References:**

Intergovernmental Panel on Climate Change – Fourth Assessment Report, 2007

Stern, N., The economics of climate change – The Stern Review, Cambridge University Press, 2006.

Nordhaus, W.D., Managing the Global Commons: The Economics of Climate Change, MIT Press, 1994.

Nordhaus, W. and J. Boyer, Warming the World: Economic Models of Global Warming, MIT Press, 2003.

Toman, M.A., U. Chakravorty, and S. Gupta, India and Global Climate Change: Perspectives on Economics and Policy from a Developing Country, RFF Press, 2003.

Nordhaus, W. (2008), A Question of Balance: Weighing the Options on Global Warming Policies, Yale University Press, New Haven.

Stavins , Robert, N. (Eds) Economics of the Environment, WW Norton, 2012. Sixth Edition

Mann, Michael E. and Kump, Lee. R., Dire Predictions: Understanding Global Warming: The illustrated guide to the findings of the IPPC, Pearson Books, USA, 2009

Stern, Nicolas, The Economics of Climate Change: The Stern Review, 2006.

Akhurst, M., et al. (2003). Greenhouse gas emissions trading in BP. Energy Policy, Vol. 31, pp. 657-663

Dasgupta, P. (2014). Pricing climate change. Politics, Philosophy & Economics, 13(4), 394-416.

## **Corporate Finance**

The course is designed to give an overview of the theoretical framework for understanding and analyzing major financial problems and decisions associated with modern firms in the market environment. This course introduces a business corporation, their functions and the role of capital market. Valuation of the firms is given importance so is the capital structure decisions of firms. The course also delves into Mergers and Acquisition and Corporate Governance practices of the firms. Understanding of Financial Economics is a prerequisite to this course.

### **1. Introduction**

Why corporate Finance? Types of corporations; Control and ownership, Role of capital markets; Value creation and corporate management

### **2. Financial decision making**

Valuing decisions; Analyzing costs and benefits, Interest rates and time value of money; Present value and Net present value; Arbitrage and law of one price; No arbitrage and Security prices

### **3. Advanced Valuation**

Recap of Risk-returns, portfolio mean-variance, CAPM and APT; Estimating cost of capital, Market portfolio, Debt cost of capital and Project's cost of capital; Weighted Average Cost of Capital for valuation, Valuing equity cash flows- Free cash flow to Equity and firm;

### **4. Financing of firms**

Long term equity financing- Initial Public Offers- advantages and disadvantages of going public, seasonal equity offerings; Long term debt financing- private debt and public debt; Short term debt financing- Overview of Working Capital, Trade Credit receivables, payables, inventory, cash holdings; Matching principle in short term financing- financing with bank loans and commercial papers, secured financing

### **5. Capital Structure**

Value of the firm- Modigliani-Miller model of capital structure irrelevance; Modigliani- Miller in real world; Debt and Taxes; Cost of Bankrupts, Financial Distress and firm value; Optimal capital structure-Trade-off theory; Asymmetric information and Capital structure- Pecking order theory; Market timing theory of capital structure; Determinants of capital structure

### **6. Mergers and Acquisitions**

Reasons to Acquire; Takeover Process; Takeover Defenses; Value addition from take over; Market reaction to a take over- free rider problem, leveraged buyouts M&A in India case studies

### **7. Corporate Governance**

Governance in financial and non-financial corporates; Corporate Governance and agency costs, Board composition and firm performance; Monitoring by the Board of Directors and Others;

Compensation Policies; Managing agency conflict; Corporate governance norms in India; Uday Kotak Committee report

## **References**

Berk, J., & DeMarzo, P. (2016). Corporate Finance, GE. Pearson Australia Pty Limited.

Vernimmen, P., Quiry, P., Dallochio, M., Le Fur, Y., & Salvi, A. (2014). Corporate finance: theory and practice. John Wiley & Sons.

Brealey, R. and S. Myers, Principles of Corporate Finance, fifth edition, New York, McGraw Hill, 1997

Copeland, T. E. and J. F. Weston, Financial Theory and Corporate Policy, Addison Wesley, 1992

Ross, S. A., Westerfield, R., & Jordan, B. D. (2008). Fundamentals of corporate finance. Tata McGraw-Hill Education.

Asquith, P., & Weiss, L. A. (2019). Lessons in corporate finance: A case studies approach to financial tools, financial policies, and valuation. John Wiley & Sons.

Parrino, R., Kidwell, D. S., & Bates, T. (2011). Fundamentals of corporate finance. John Wiley & Sons.

## **Indian Economic Thought**

**Course Objective:** This course makes a broad sweep across Indian history and is intended to acquaint students with the works of prominent political economy and economics scholars. The Classic tradition does not incorporate most of these scholars, but their relevance remains unchallenged in the context of India's political and developmental history, present and future.

### **1. Introduction:**

Indology, ancient Indian economic thought in the Vedas, in the Arthashastra, Charvak

### **2. Mughal economic thought:**

Capitalism and technological development; taxation policy, welfare state

### **3. Colonial Indian scholars:**

Ram Mohun Roy and modernisation; GV Joshi and intersectoral imbalances; Ranade and economic nationalism; Dadabhai Naoroji and the drain theory; R C Dutt on imperialism, taxes and famines; Gokhale on development; Gandhi and swadeshi, selects works of B R Ambedkar; imperialist versus nationalist thinkers

### **4. Independent India's policymakers:**

Nehru's Fabian socialist ambitions; Mahalanobis model of development for India; Brahmananda, Vakil and the Bombay School; architects of the 1991 reforms

### **5. Some economics researchers:**

VKRV Rao' national income accounts; KN Raj's development economics; Krishna Bharadwaj's methodology; research centres and their policy influence

### **References:**

Dasgupta, A. K. (2002). A history of Indian economic thought. Routledge.

Dutt, R. C. (1901). The Economic History of. Vols. I and II, Kegan Paul, Trench, Great Britain.

Gokhale, G. K. (1920). Speeches of Gopal Krishna Gokhale. GA Nateson.

Habib, I. (1963). The agrarian system of Mughal India (1556-1707). The agrarian system of Mughal India (1556-1707).

Habib, I. (Ed.). (2017). Indian Nationalism: The Essential Writings. Aleph Book Company.

Naoroji, D. Poverty and UnBritish Rule in India (London, 1901); RC Dutt. Economic History of India, 2.

## **New Institutional Economics**

**Course objective:** This course will challenge the student to rethink fundamental economic theories in the light of institutional boundaries and transaction costs, which are both absent in core economic theory. The student will be able to see the role of institutions in daily events at any level – individual, community, national, or international, and so be in a position to apply this knowledge to work with them.

### **1. Introduction:**

Old and new institutional economics; evolution of habits, customs, legal institutions; types of interaction situations, corresponding norms and enforcement mechanisms

### **2. Transaction costs:**

Introduction; types; means of minimization; modelling; measurement

### **3. Property rights:**

Externalities; commons and the tragedy; rent-seeking

### **4. Theory of contracts:**

Types of contracts; pre and post contractual opportunistic behaviour; adverse selection and moral hazard; asset specificity; principle-agent problem and agency costs; private ordering; transactions and contracts; types of trust

### **5. New institutional theory of the firm:**

Market, coordination, ownership; corporate governance

### **6. Institutional evolution:**

Williamson's levels of social analysis and change; path dependence

## **References:**

Acemoglu, D., & Robinson, J. A. (2012). *Why nations fail: The origins of power, prosperity, and poverty*. London, Profile.

David, P. A. (2001). Path dependence, its critics and the quest for 'historical economics'. *Evolution and path dependence in economic ideas: Past and present*, 15, 40.

Dixit, A. K. (1998). *The making of economic policy: A transaction-cost politics perspective*. MIT press.

Furubotn, E. G., & Richter, R. (2010). *Institutions and economic theory: The contribution of the new institutional economics*. University of Michigan Press.

Greif, A. (1993). Contract enforceability and economic institutions in early trade: The Maghribi traders' coalition. *The American economic review*, 525-548.

- Michaels, R. J. (2010). *Transactions and Strategies: Economics for Management*. Cengage Learning.
- North, D. C. (1991). Institutions. *Journal of economic perspectives*, 5(1), 97-112.
- Olson, M. (1993). Dictatorship, democracy, and development. *American political science review*.
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.
- Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of economic growth*, 9(2), 131-165.
- Santhakumar, V. (2011). *Economic Analysis of Institutions: A Practical Guide*. SAGE Publishing India.
- Schofield, N., & Caballero, G. (Eds.). (2011). *Political economy of institutions, democracy and voting*. Springer Science & Business Media.
- Shleifer, A., & Vishny, R. W. (1993). Corruption. *The quarterly journal of economics*, 108(3), 599-617.
- van den Berg, A., Spithoven, A. H. G. M., & Groenewegen, J. (2009). *Institutional economics: An introduction*. Palgrave Macmillan.
- Williamson, O. E. (2000). The new institutional economics: taking stock, looking ahead. *Journal of economic literature*, 38(3), 595-613.

## **Gender and Economics**

The main objective of this course is to highlight the role of gender in economic activity. Specifically it looks at the gender differences in the economy in terms of labour force participation and earnings.

### **1. Introduction**

Importance of economics of gender- Women and economy; Why and how men and women are different; Gender differences in the economy; Difference in the work load, work location and environment, wage differences, time allocation

### **2. Labour force participation**

Rationale for women and men to work; The household as economic unit; Factors determining the division of labour; Power distribution in households; Labour force participation- trends in India; Explanations of the rise in women's labour force participation; Changes in the labour market; Consequences for family structure..

### **3. Earnings:**

Gender segregation in the workplace; Theories of why segregation occurs and persists; Relationship between segregation and earnings; Causes of earnings differences- human capital, compensating differentials, discrimination; Gender differences in education

### **4. Cross-Societal Comparisons**

Gender differences in industrialized capitalist societies; Socialist and cooperative societies; Non-industrialized traditional societies; Effects of the development process on gender differences; gender differences over time, race, ethnicity and class consideration

### **5. Gender and Economics Policy**

Policy approaches to gender issues in developing countries; Precepts for policy formulation; Legislations on work place equality and safety in India

### **6. Gender Issues in developing countries**

Marriage and fertility in developing countries; Women's work and earnings in developing countries

## **References**

Jacobsen, J. P. (2007). *The Economics of Gender*, Wiley.

Hoffman, S. D., & Averett, S. L. (2015). *Women and the economy: family, work and pay*. Macmillan International Higher Education.

Benería, L., Berik, G., & Floro, M. (2015). *Gender, development and globalization: economics as if all people mattered*. Routledge.

## **Advanced Operations Research**

**Course Description:** This course is about optimization techniques using mathematical, computational and communication skills. Students are introduced to fundamental issues in production and inventory planning and control and at the same time, develop the students' modeling and analytical skills on the various types of scheduling problems and techniques that can be employed to solve concerned problems.

### **1. Transportation problem (TP)**

Formulation, finding basic feasible solution of TP using North-West Corner Rule, Least Cost and Vogel's Approximation Method, MODI method for finding optimal solution for TP, Assignment problem and its formulation, Hungarian method for solving Assignment problem, Transshipment and Travelling salesmen problem.

### **2. Inventory Systems:**

Introduction to inventory systems, inventory classification and its use in controlling inventory. Deterministic inventory models: Economic order quantity (EOQ) model, EOQ with finite supply, EOQ with backorders, EOQ with constraints, All-units quantity discounts model.

### **3. Project Scheduling:**

PERT and CPM with known activity times. Critical Path Analysis, Various types of floats. Probability considerations in PERT. Updating of PERT charts. Project crashing. Formulation of CPM as a linear programming problem. Resource leveling and resource scheduling.

### **4. Sequencing problem:**

Introduction to Sequencing problem. Flow shop problem: Processing jobs through 2, 3 and m machines. General n/m job-shop problem

### **Case study**

### **Reference**

J. D. Weist, F. K. Levy: A Management Guide to PERT/ CPM. 2nd Edition, PHI, 1967 (Reprint 2007).

M. S. Bazara, J. J. Jarvis, H. D. Sherali: Linear Programming and Network Flows, Wiley, 3rd Edition, 2004.

Donald Waters: Inventory Control and Management, John Wiley, 2010.

Buffa, Elwood S. and Sarin Rakesh K.: Modern Production/Operations Management, 8th Edition, Wiley India, 2009.

Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.

A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.

## **Health Economics**

### **1. Introduction**

Importance of health Economics; Growth and factors affecting growth of health economics; Rising health care costs; Externalities and government intervention

### **2. Microeconomics tools for health economics**

Scarcity and PPF; Supply and demand; Consumer theory and demand curve; Individual and market demands; Elasticities

### **3. Demand for Health care**

Rationality; Health production functions; Demand for health- health as a capital stock; Measuring health capital; Uncertainty; Consumer choices about health behaviours; Demand for health care services- Demand for health insurance coverage; Time price; Welfare analysis

### **4. Demand for private health insurance**

Diminishing marginal utility of wealth and demand for insurance; Models for demand insurance, Determinants for demand for insurance; Tax benefits and demand for insurance; Adverse selection in insurance markets

### **5. Supply of health care**

Market of medical practitioners and hospitals; Hospital ownership and performance; Quality health care and malpractices; Adverse events and negligent injuries; Pharmaceutical manufactures- Investments and pricing; Entry of generic drugs and consequences

### **6. Supply of health insurance**

Functions of insurers- risk bearing, marketing, under writing, claim processing; Financial strength of insurers; Public and private health insurance coverage; Employer based insurance coverage; Government regulation on health insurance in India

### **7. Government intervention in health care markets**

Economic rationale; Forms of government intervention; Social insurance; Health care system in India; Health care reforms in India; Swatch Bharat Abhiyan

### **References**

Folland, S., Goodman, A. C., & Stano, M. (2016). The Economics of Health and Health Care: Pearson New International Edition. Routledge.

Sloan, F. A., & Hsieh, C. R. (2017). Health economics. MIT Press.

Phelps, C. E. (2016). Health economics. Routledge.

Morris, S., Devlin, N., & Parkin, D. (2007). Economic analysis in health care. John Wiley & Sons.

## **Agricultural Economics**

### **Agriculture and Economic Development:**

Nature and scope of agricultural economic; Role of agricultural economists at micro level and macro level; Role of agriculture in development; Role of agriculture in economic development; Interdependence between agriculture and industry;

### **Agricultural Productivity**

Agricultural production Function; Profit Maximizing - input; Demand for Input; Determining Cost; Profit Maximizing - output; Loss Minimization; Factor combination and resource substitution; Agricultural Farm size and productivity: relationship laws of returns; Theories of agriculture in economic development; MGNREGA

### **Agricultural Credit**

Institutional and Non-institutional agro credit; Supply of credit to rural areas; Priority sector lending; Interest subvention schemes; Subsidies; Role of Indirect Finance; Microfinance; Recent trends in agricultural credit flow; credit limits; Kisan credit cards; Disconnect between credit and investment; Non-performing assets due to agricultural loans; Farm loan waivers and impact

### **Agricultural marketing and Pricing**

Marketing and state policy; Agricultural markets; Regulated markets; Marketed and marketable surplus; Marketing channels, Supply chain; E-distributor; e-Nam; Contract farming Storage facilities; E-marketplaces; Price spread, Behaviour of agricultural prices; Real time agricultural prices; Digitisation of Land Records; Land Leasing Framework

### **Impact of technology in Agriculture**

Modern farming methods and productivity; Incentives for farmers; Information dissemination to farmers; Mechanization; Mobile applications; Remote sensing, geo tagging; Crop Sensors; Precision farming; Soil and water sensors; Smart irrigation methods; Weather forecasting; GIS mapping; Aquaponics; Hydroponics; Financing investments in technology;

### **Agricultural trade**

Growth and instability in agricultural trade; Comparison of Agricultural trade; Protectionism in agriculture; Agriculture trade policy making, Preferential trading agreement, regional trade agreements; Impact of trade agreements

### **References**

Penson, J. B., Capps, O., Rosson III, C. P., & Woodward, R. T. (2015). Introduction to agricultural economics (No. 338.1 I-61i). Pearson,.

Reddy S. S, Ram P. R, Sastry, T.V.K., Devi, I. B. Agricultural Economics (2015)

Evanson R. E, Pingali P., Hand book of Agricultural Economics, all volumes , North Holland

## **Analysis of the Informal Economy**

### **1. Nature and Significance of Informal:**

Concept and Definition: Difference between Informal and Formal and between Informal and Un-organised sectors – The Legislative definition of Informal Sector. Indicators of informal sector – Some Examples. Importance of Informal Sector in the Developing Economies with particular reference to India

### **2. Macro Level Features of Informal Sector**

Size and Pattern of Employment in informal sector – Size and pattern of informal sector output, trends in the growth of informal sector

### **3. Micro-Level Pattern of Informal Sector**

Types of Informal Sector Undertakings: Manufacturing Units - Service providing units - itinerant sales units, domestic units and old material collecting units. Some examples Artisanary units, field-worker owned units, units in traditional rural industries and units in modern urban industries some examples.

### **4. Informal Sector Labour Market**

Unorganised nature of Informal Labour Market with no state regulation – free entry and exit – Workers' characteristics – unskilled nature, impermanence, child labour, old age labour, low earnings and wages, absence of social security and job security.

### **5. Women in informal sector**

Women in rural informal sector – Women in urban informal sector - Problems faced by Women in the informal sector units.

### **6. Problems of and Policies for informal sector development**

Low productivity of informal sector – need for technological input use, lower capital availability –institutional credit – unskilled nature of labour employed - need for skilling the workers and training them in skill formation - marketing problem of informal sector, need for creating link between informal sector producer and consumer, linking informal sector units with formal sector units both in respect of raw material supply and finished goods, transport facilities to market places and sheds on streets. Impact of demonetization and GST implementation on informal sector.

### **References**

Sethuraman, S V (ed.), (1981), The Urban Informal Sector in Developing Countries: Employment, Poverty and Environment International Labour Organisation, Geneva.

Papola, T S (1981) ,Urban Informal Sector in a Developing Economy, Vikas Publishing House, New Delhi.

- Jhabvala, R (1998), "Social Security for Unorganised Sector", Economic and Political Weekly, Vol.33 No22, pp.1-7 to L-10.
- Lubell, H (1991), The Informal Sector in the 1980s and 1990s, Development Centre of the Organisation for Economic Cooperation and Development, Paris.
- Shah, Amita (1990), "Linkages between Small and Large Scale Industries: Some Evidences from Gujarat", ArthaVijnana, Vol.32, No.2.
- Harris, John (1982), "Character of an Urban Economy, Small Scale Production and Labour Markets in Coimbatore", Economic and Political Weekly, Vol.17, Nos.23-24.
- Samal, Kishore C. (1990), Urban Informal Sector, Minerva Publications, New Delhi.
- Sinclair, M. Thea (1998), "Tourism and Economic Development: A Survey", Journal of Development Studies, Vol.34, No.5.
- Breman, Jan (1996), Footloose Labour: Working in India's Informal Economy, Cambridge University Press.
- Deshpande, Sudha and L K Deshpande (1999), "Gender-based Discrimination in the Urban Labour Market", in Papola and Sharma (eds).
- Papola, T S and Alakh N Sharma (eds.), (1999), Gender and Employment in India, Indian Society of Labour Economics and Vikas Publishing House, New Delhi.
- Standing, Guy (1987), Vulnerable Groups in Urban Labour Processes, WEP Working Paper No.13, ILO, Geneva.
- Ghate, Prabhu et al. (1992), Informal Finance: Some Findings from Asia, Oxford University Press, Hong Hong.
- Papola, T S (1980), "Informal Sector: Concept and Policy", Economic and Political Weekly, Vol.15, No.18.
- Kundu, Amitabh and Sharma, Alak N (Eds.) (2001). Informal Sector in India, Manohar Publications, New Delhi.
- Sengupta, A. K. (2007). National Commission for enterprises in the unorganized sector. Govt of India.

## **Introduction to Machine Learning and Artificial Intelligence**

**Course Objective:** The main objective of this course is to gain a fundamental understanding of machine learning and artificial intelligence concepts. It provides practical skills for building machine learning models using Python libraries like scikit-learn. The students will get introduced to deep learning concepts like artificial neural networks and convolutional neural networks.

### **Learning Outcomes:**

1. Explain the core concepts of machine learning and artificial intelligence.
2. Preprocess and prepare data for machine learning tasks.
3. Build and evaluate different machine learning models using scikit-learn.
4. Implement basic deep learning architectures using TensorFlow.

### **Modules**

#### **1. Introduction to Machine Learning**

ML Fundamentals; Scikit-Learn Introduction data loading, preprocessing, and model building. Importance of model evaluation and validation; Techniques for cross-validation: train-test split, k-fold cross-validation; Evaluating model performance: accuracy, precision, recall, F1-score; Hyperparameter tuning and model optimization

#### **2. ML & Dimensionality Reduction**

Performing Principal Component Analysis (PCA); Applying PCA for dimensionality reduction and feature extraction

#### **3. Clustering using Python**

K-means clustering: intuition, algorithm, implementation, and evaluation; Hierarchical clustering and DBSCAN

#### **Naïve Bayes:**

Fundamentals; Implementing Naïve Bayes models using Scikit-Learn; Applications of Naïve Bayes in text classification and spam detection

#### **k Nearest Neighbors (KNN):**

Intuition behind the k-Nearest Neighbors (kNN) algorithm; Implementing kNN for classification and regression tasks; Selecting the optimal value of k and handling class imbalance

#### **Support Vector Machines (SVM):**

Introduction to Support Vector Machines (SVMs); Implementing SVMs for linear and non-linear classification; Kernel tricks and parameter tuning

**Boosting Algorithms:**

Ensemble learning and the concept of boosting; Implementing AdaBoost and Gradient Boosting algorithms; Comparing boosting techniques and their applications

**Introduction to Artificial Intelligence:**

Definition and history of Artificial Intelligence (AI); AI applications in various domains: healthcare, finance, transportation, and more; Ethical considerations and societal impact of AI

**Artificial Neural Networks Basics and Intuition**

Activation functions and the concept of neural network layers; Forward and backward propagation in neural networks

Convolution Neural Networks; Convolutional Neural Networks (CNNs) for image recognition; Convolutional and pooling layers, and their role in feature extraction

**Implementing CNNs using TensorFlow and Keras****TensorFlow: Sentiment Analysis with Recurrent Neural Networks**

Recurrent Neural Networks (RNNs) and their application in text processing

Building a sentiment analysis model using TensorFlow and RNNs

**Introduction to Deep Learning**

Overview of deep learning and its advancements; Deep learning architectures: feedforward, convolutional, and recurrent networks; Applications of deep learning in computer vision, natural language processing, and more

## **Economics of Impact Evaluation**

### **Course Description**

This course is an introduction to the methods of social program evaluation. Program evaluation stems from the idea that social programs should have discernable effects compensating for the costs of the program. The current course gives a detailed overview of the cutting edge evaluation techniques that are currently adopted in the domain of public policy evaluation research. This course would cover some of the applied econometrics techniques with fair amount of emphasis on econometrics and real life situations. The course is supplemented by books as well as journal articles. The course is designed for students who have successfully completed their Econometrics I and II courses.

### **Learning outcome**

The impact evaluation course would target students who aim to understand how best to design an effective intervention. It seeks to provide a generalized overview of technical as well as nontechnical methods of impact evaluation. The technical portion of the course will use statistical and econometric analysis that are essential to understand the required steps for a policy evaluation exercise. The module would be taught through a combination of lecture driven classroom deliberations, problem-based learning, practical sessions and student presentations.

### **Modules**

#### **1. Introduction**

Topic introduction and course overview; What is program evaluation? The importance of program evaluation; Appropriate questions and measures; Design of experiments; Ethical considerations in program evaluation, Cost effectiveness

#### **2. Understanding Causality**

Linear models and the problems in policy evaluation; The ideal policy experiment setting; Selection bias; Counterfactual; Random assignment, Regression analysis and causality, Instrumental variables and 2SLS

#### **3. Randomized field experiments**

The experiment setting – assigning treatment and control groups; Baseline and Endline, The intervention, Balance, Identification, Treatment effects, ITT estimates, LATE, External validity, Heterogeneous treatment effects, Spillovers, Limitations

#### **4. Difference-in-differences**

Overview of the method and its applications; Non-random assignment and DID; Establishing parallel trends assumption, some advantages and limitations

#### **5. Matching**

Overview of the PSM method; Artificial control groups, Applications, Limitations

## **5. Regression Discontinuity Design**

Overview of the method, applications, combining matching with other methods, limitations

### **References:**

- Banerjee, A. V., & Duflo, E. (2009). The experimental approach to development economics. *Annu. Rev. Econ.*, 1(1), 151-178.
- Deaton, A., & Cartwright, N. (2018). Understanding and misunderstanding randomized controlled trials. *Social Science & Medicine*, 210, 2-21.
- Khandker, S. R., Koolwal, G. B., & Samad, H. A. (2009). Handbook on impact evaluation: quantitative methods and practices. World Bank Publications.
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- Dynarski, S. (2017). Laptops are great. But not during a lecture or a meeting. *New York Times*.
- Angrist, Joshua and Jorn-Steffen Pischke. 2009. Mostly Harmless Econometrics – An Empiricist’s companion, Chapter 2 and Chapter 3 (Section 3.2), Chapter 5 and Chapter 6.
- Ravallion, Martin. “Evaluating Anti-Poverty Programs.” Handbook of Development Economics Volume 4, edited by Robert E. Evenson and T. Paul Schultz, Amsterdam, North-Holland.
- Jalan, Jyotsana and Martin Ravallion. 2003. “Estimating Benefit Incidence for an Anti-poverty Program using Propensity Score Matching.” *Journal of Business and Economic Statistics*, 21(1): 19-30.
- Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan. 2004. “How Much Should We Trust Difference-in-Differences Estimates?” *Quarterly Journal of Economics*, 119 (1): 249 – 275.

### **General reading**

- Duflo, E., & Banerjee, A. (2011). Poor economics (Vol. 619). Public Affairs.
- Ravallion, M. (2012). Fighting Poverty One Experiment at a Time: A Review of Abhijit Banerjee and Esther Duflo's "Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty". *Journal of Economic Literature*, 103-114.
- Cunningham, S. (2021). Causal Inference. Yale University Press.

## **Natural Resource Analytics**

### **Course Description:**

This course equips students with the foundational knowledge and practical skills of Geographic Information Systems (GIS). You'll gain expertise in working with various spatial data formats, interpreting maps and projections, and utilizing advanced image processing techniques. Through hands-on exercises, you'll learn to create thematic maps, analyze flood risk using Digital Elevation Models (DEMs), and explore the application of geospatial econometrics for economic analysis in specific contexts.

### **Course Outcomes:**

- i. To prepare the students in identifying, analysing and solving geospatial problems.
- ii. Ability to disseminate both theoretical and hands-on expertise across academia, research, and industry settings.
- iii. Demonstrate proficiency in GIS software tools through projects, assignments, and case studies.
- iv. Equip students with a robust foundation of knowledge adaptable to both private sector R&D using GIS and teaching roles, ensuring their suitability across diverse professional landscapes.

Pre- requisite(s): Basic Statistics, Applied Econometrics, Basic Understanding of Satellite images.

Co- requisite (s): Computer Knowledge with Basic R Programming

Software: QGIS, ArcGIS, ArcGIS Pro and R

### **1: Introduction to Geographic Information Systems (GIS), Digital Image**

Satellite: Early history of space imaging; geostationary satellites; Polar Sun-synchronous satellites; LANDSAT satellite program overview; Remote Sensing {Stages, Active& Passive, Orbits, Platform, Application, Resolution type, Significance of Resolutions, Sensor}

### **2: Spatial Analysis and Visualisation**

Raster and Vector Data, Data Structure and File Format {ISRO (Bhuvan) and NASA Database}, Vector Data Analysis- Distance Measurement, Quantifying Change, and Resource Map creation; Measurement {Conversion: DN to Radiance& Radian to Reflectance, Errors & Correction}; Geo-visualization {Chart, Report, Layout}; Coordinate System

### **3: Image Processing**

Introduction to Digital Image Processing, Image Pre-processing, Image Enhancement, Image Classification (Random Forest, Support Vector Machine, K-Nearest Neighbour) using machine learning models and Maximum Likelihood Classification.

### **4: Application of Image Processing**

Basic concept and criteria of Land Use/ Land Cover classification, Supervised and Unsupervised classification, Vegetation Mapping, Snow cover Mapping, Methodology; Introduction to DEM data and analysis, 3D Flood Simulation, Nightlight Data.

### **5: Spatial Pattern, Process and Geospatial Econometrics**

Kriging and Spatial Autocorrelation, Point and Pattern Analysis, Introduction to Geospatial Econometrics (OLS) and application using R.

Reference:

George Joseph & C. Jeganathan (2018). Fundamentals of Remote Sensing 3rd edition, Universities Press, India

Jensen, J.R. (1996). Introductory Digital Image Processing A remote sensing perspective. Prentice Hall Series in GIS , USA

Burrough, Peter A. and Rachael McDonnell (1998). „Principles of Geographical Information Systems“ Oxford University Press, New York.

Yue-hong Chou (1997). Exploring Spatial Analysis in Geographical Information System. Onword Press. Thomson Learning

Anselin, L. (1988). Spatial econometrics: methods and models (Vol. 4). Springer Science & Business Media.

Bhatta, D. B. (2008). Remote sensing and GIS. 1. publ. New Delhi [ua]: Oxford University Press (India), 14

\*Syllabus for the following courses are to be prepared after wider consultation.

Law and Economics

Experimental Economics

Introduction to Artificial Intelligence and Machine Learning