Indian Institute of Technology Kanpur

COURSES OF STUDY

2024

Indian Institute of Technology Kanpur
KANPUR-208016

ECONOMICS

17.0 Templates for programs in Economic Sciences (ECO)

17.1 Template for BS program in Economic Sciences

Template for 3rd to 8th semester for BS program in Economic Sciences					
Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
SCHEME-2 HSS-I (9-11)	SCHEME-3 EME (9-11)	ECO371 (11): Game Theory	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)
ECO211 (11): Microeconomics I	ESC201 (14)	ECO351 (11): Econometrics II	ECO311 (11): Microeconomics II	DE-3 (9)	DE-6 (9)
ESO/SO-1: HSO201 (11): Applied Probability and Statistics	ECO231 (11): Macroeconomics I	ECO331 (11): Macroeconomics II	DE-2 (9)	DE-4 (9)	DE-7 (9)
ECO111 (11): Economy, Society and Public Policy	ECO251 (11): Econometrics I	ESO/SO-2: ESO207 (12)	OE-2 (9)	DE-5 (9)	OE-5 (9)
ECO271 (11): Optimization	OE–1 (9)	DE-1 (9)	OE-3 (9)	OE-4 (9)	OE-6 (9)
		UGP-1 (4) (extra credits)	UGP-2 (9) (extra credits)	UGP-3 (9) (extra credits)	UGP-4 (9) (extra credits)
53-55	54-56	54	47	45	45

Note: Students may exchange OEs and DEs across semesters, as long as the total credits for the DEs and OEs remain the same as in the template above.

List of courses		
Course No:	Title	Remarks
ECO101	Economy, Society and Public Policy	New
ECO211	Microeconomics I	New
ECO231	Macroeconomics I	New
ECO251	Econometrics I	New
ECO271	Optimization	New
ECO311	Microeconomics II	New
ECO331	Macroeconomics II	New
ECO351	Econometrics II	New
ECO371	Game Theory	New

Credit table for BS program in Economic Sciences		
Course type	Allowable Credit range	Credits in the department template
Institute Core (IC)	112	112
E/SO	18-45	23
Department requirements	144-179	162 (99 DC + 63 DE)

Open electives (OE)	51-57	54
SCHEME	53-58	53-58
Total for 4-year BT/BS	391-420	404-409

17.2 Template for the BSH program in Economic Sciences

Template for 3rd to 8th semester for BSH program in Economic Sciences					
Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
SCHEME-2 HSS-I (9-11)	SCHEME-3 EME (9-11)	ECO371 (11): Game Theory	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)
ECO211 (11): Microeconomics I	ESC201 (14)	ECO351 (11): Econometrics II	ECO311 (11): Microeconomics II	DE-3 (9)	DE-5 (9)
ESO/SO-1: HSO201 (11): Applied Probability and Statistics	ECO231 (11): Macroeconomics I	ECO331 (11): Macroeconomics II	DE-2 (9)	DE-4 (9)	OE-5 (9)
ECO111 (11): Economy, Society and Public Policy	ECO251 (11): Econometrics I	ESO/SO-2: ESO207 (12)	OE-2 (9)	DEH-2 (9)	OE-6 (9)
ECO271 (11): Optimization	OE–1 (9)	DE-1 (9)	OE-3 (9)	OE-4 (9)	DEH-3 (9)
		UGP-1 (4) (extra credits)	DEH-1 (9)	UGP-2 (9)	UGP-3 (9)
53-55	54-56	54	56	54	54

Note: Students may exchange OEs and DEs across semesters, as long as the total credits for the DEs and OEs remain the same as in the template above.

- For BSH, students have to take 27 credits ECO courses numbered 700 and above as DEH
- **CPI criteria for BSH: 8.5**

17.3 Template for BSM program in Economic Sciences

Template for 3rd to 8th semester for BSM program in Economic Sciences					
Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
SCHEME-2 HSS-I (9-11)	SCHEME-3 EME (9-11)	ECO371 (11): Game Theory	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)	SCHEME* HSS-II (9)
ECO211 (11): Microeconomics I	ESC201 (14)	ECO351 (11): Econometrics II	ECO311 (11): Microeconomics II	DE-3 (9)	DE-4 (9)
ESO/SO-1: HSO201 (11): Applied Probability and Statistics	ECO231 (11): Macroeconomics I	ECO331 (11): Macroeconomics II	DE-2 (9)	MTB-2 (9)	MTB-5 (9)
ECO101 (11): Economy, Society and Public Policy	ECO251 (11): Econometrics I	ESO/SO-2: ESO207 (12)	OE-2 (9)	MTB-3 (9)	OE-3 (9)
ECO271 (11): Optimization	OE–1 (9)	DE-1 (9)	MTB-1 (9)	MTB-4 (9)	MTB-6 (9)
		UGP-1 (4) (extra credits)	UGP-2 (9) (extra credits)	UGP-3 (9) (extra credits)	UGP-4 (9) (extra credits)
53-55	54-56	54	47	45	45

17.4 Template for five-year dual-degree program in Economic Sciences

BS-MS PG (Category A) from same department	
9th Semester	10th Semester
ECO701A (9): Microeconomics	ECO702A (9): Macroeconomics
ECO704A (9): Econometrics	ECO703A (9): Quantitative Methods
DE-PG1 (9)	DE-PG3 (9)
DE-PG2 (9)	DE-PG4 (9)
MS Project (9)	MS Project (9)
45	45

BS-MS PG (Category B) from other departments			
UG Prerequisites			
Odd Semester	Even Semester	9th Semester	10th Semester
ECO211 (11): Microeconomics I	ECO231 (11): Macroeconomics I	ECO701A (9): Microeconomics	ECO702A (9): Macroeconomics
ECO271 (11): Optimization	ECO101 (11): Economy, Society and Public Policy	ECO704A (9): Econometrics	ECO703A (9): Quantitative Methods
ECO351 (11): Econometrics II	ECO251 (11): Econometrics I	DE-PG1 (9)	DE-PG3 (9)
HSO201 (11): Applied Probability and Statistics/MSO201 (11): Probability and Statistics	ECO311 (11): Microeconomics II	DE-PG2 (9)	DE-PG4 (9)
		MS Project (9)	MS Project (9)
44	44	45	45

17.5 Template for double major: second major in Economic Sciences

Double Major	
Odd Semester	Even Semester
ECO271 (11): Optimization	ECO211 (11): Microeconomics I
ECO371 (11): Game Theory	ECO231 (11): Macroeconomics I
ECO351 (11): Econometrics II	ECO251 (11): Econometrics I
ECO331 (11): Macroeconomics II	ECO311 (11): Microeconomics II
HSO201 (11): Applied Probability and Statistics/MSO201 (11): Probability and Statistics	ECO101 (11) – Economy, Society and Public Policy
55	55
Minimum Mandatory Credits for Second Major in Economics: 110 credits.	

17.6 Minors in Economic Sciences

Students pursuing UG programs of other departments/programs will also have option for a minor in Economics. Courses required to obtain a minor would be:

i. Applied Probability and Statistics (HSO201) OR Probability and Statistics (MSO201) OR {Introduction to Probability Theory (MSO205) and Theory of Statistics (MTH211)} ii. ECO211: Microeconomics I

iii. ECO231: Macroeconomics I

iv. ECO251: Econometrics I

Note**:** Students should also have taken ECO101: Economy, Society and Public Policy as part of the SCHEME basket or as an Open Elective.

17.7 Template for MSc in Economics:

Semester 1	Semester 2
ECO701: Microeconomics	ECO713: Advanced Topics in Microeconomics
ECO612: Applied Macroeconomics	ECO702: Macroeconomics
ECO671: Mathematical Methods for Economics	ECO251: Econometrics I
HSO201: Applied Probability and Statistics	ECO611: Computational Methods in Economics (modular)
ECO888: Professional Development & Communication Skills	ECO613: Economic Data Analysis: Methods and Computational Aspects (modular)
	ECO714: Game Theory and Applications
Semester 3	Semester 4
ECO351: Econometrics II	OE-2
OE-1	OE-3/DE-4
DE-1	DE-5
DE-2	DE-6
DE-3/Thesis credits	DE-7/Thesis credits

DEPARTMENT OF ECO			
Courses ID	**Course Title**	**Credits L-T-P-D-[C]**	**Content**
ECO111	ECONOMY, SOCIETY AND PUBLIC POLICY	3-1-0-0-11	National income and economic growth; Social interactions and economic outcomes; Public policy for fairness and efficiency; Work, well-being and scarcity; Institutions, power and inequality; The firm: Employees and owners; Firms and markets for goods and services; The labor market and the product market; The credit market; Banks, money, housing and financial assets; Market success and failures; Governments and markets
ECO211	MICROECONOMICS I	3-1-0-0-11	Consumer Theory; Producer Theory; Markets and Partial Equilibrium; Imperfect Competition (Monopoly, Oligopoly, Price Discrimination, Monopolistic Competition)
ECO231	MACROECONOMICS I	3-1-0-0-11	Classical Theory: Economy in the long Run; Business Cycle Theory: Economy in the short run; Macroeconomic policy debates; Fiscal Policy, government debt and budget deficits.
ECO251	ECONOMETRICS I	3-1-0-0-11	Common families of Distributions; Multiple Random Variables; Properties of Random Sample; Estimation and Hypothesis Testing; Linear Regression Model; Normal Linear Regression Model; Restricted Maximum Likelihood Estimators; General Linear Regression Model
ECO271	OPTIMIZATION	3-1-0-0-11	Examples of Optimization Problems in Economics; Sets, Functions; Basic Mathematical Logic; Proofs, Cardinality. Recap of relevant concepts from basic analysis and linear algebra; Convex Sets, Convex Functions, Quasi-convexity; Existence: Weierstrass Theorem. Unconstrained Optimization; Equality Constraints and Lagrange Theorem; Inequality Constraints and Kuhn-Tucker Theorem; Linear Programming; Duality; Comparative Statics, Envelope Theorems. Cake Eating Problem; Bellman's Principle; Finite and Infinite Horizon Dynamic Programming.
ECO311	MICROECONOMICS II	3-1-0-0-11	General Equilibrium; Social Choice and Welfare Economics; Market Failures; Information Economics; Mechanism Design, Myerson Satterthwaite, Gibbard Satterthwaite, General Equilibrium under Uncertainty.
ECO331	MACROECONOMICS II	3-1-0-0-11	One period model of the macroeconomy; Economic Growth; Savings and Investments; Monetary Economics and Business Cycles; International Macroeconomics
ECO333	MONEY AND BANKING	3-1-0-0-11	Functions of Money and Interest Rates; Money Supply; Money Market; Regulatoryand promotional institutions; Banking institutions; and Term structure of Interest Rates.
ECO351	ECONOMETRIC	3-1-0-0-11	Linear Regression with Variation to Continuous

	S II		Outcomes; Linear Regression and Endogeneity; Treatment Effect Models; Ordinal Models; Models for Unordered Multiple Choices; Panel Data Models; Time Series Models.
ECO371	GAME THEORY	3-1-0-0-11	Static Games of Complete Information; Dynamic Games of Complete Information; Static Games of Incomplete Information; Dynamic Games of Incomplete Information
ECO398	UG PROJECT (UGP-I)		UG PROJECT (UGPI)
ECO399	UG PROJECT -II	0-0-0-2-9	UG PROJECT II
ECO405	CONTRACT ECONOMICS	3-0-0-0-9	Introduction; Economics of contracts (adverse selection and moral hazard); Hidden action, monitoring, and control; Efficient contracts; Transfer prices; Contingent claims; Principal agent models; Incomplete and incentive contracts; Implicit contracts; Auctions and bidding; Regulation of contracts
ECO408	ADVANCED MACRO ECONOMICS	3-0-0-0-9	Introduction; The Solow growth model; Infinitehorizon and overlapping generation models; New growth theory; Real businesscycle theory; Traditional Keynesian theories of fluctuations; Incomplete nominal adjustment; Consumption and investment; Search frictions and unemployment; Inflation and monetary policy; Budget deficits and fiscal policy 18-SEP-14
ECO409	DYNAMIC MACROECONOMICS	3-0-0-0-9	Review of AD-AS, Solow growth model 2. Competitive equilibrium in Consumption-Saving models 3. Introduction to Dynamic Programming a. Neoclassical Growth model – social planner b. Value Function Iteration c. Competitive equilibrium formulation 4. Equilibrium with Complete Markets 5. Self-Insurance and Incomplete Markets a. Non-stochastic endowment model with borrowing constraints b. Precautionary savings and prudence c. Determinacy in income fluctuation problems 6. Continuous Time Growth Theory a. Ramsey-Cass-Koopman Model b. Solow Model, Kaldor Facts
ECO411	INDUSTRIAL ECONOMICS	3-0-0-0-9	Introduction: Structure Conduct Performance (SCP) paradigm, Chicago School view, modem developments and relevance of industrial policy; Monopoly Power and Industrial Concentration; Oligopolistic Industries: competition in quantities and in prices, cartels and collusion; Strategic Behavior: firm entry, accommodation and exit, barriers to entry, predatory pricing and limit pricing; Empirical Studies of SCP Paradigm

ECO412	INTERNATIONAL ECONOMICS AND FINANCE	3-0-0-0-9	World Trade and Empirical Facts of International Trade with its Explanations, Neoclassical Trade Theories, Alternative and New Trade Theories, Trade PolicyInstruments and their
			Impact on Welfare, Trade and Income Distribution, International Factor Movements, Negotiations at the GATT and the WTO, Exchange Rate Movements, Past andPresent Arrangements of the International Monetary System including discussion on theEuropean Monetary System and Optimum Currency Area, Regional Trade Agreements, TradeCreation and Trade Diversion, Theories of Exchange Rate and BOP(Balance of Payments) and Different Approaches to the BOP.
ECO413	INDIAN ECONOMIC PROBLEMS	3-0-0-0-9	India in a Global Perspective (broad comparison with developed, developing and emerging economies), Trends in Aggregate Economic Activities (trends in Indian national income and related variables, primary, secondary and service sector growth etc), Agriculture (Green Revolution, productivity, land reforms, farming methods etc), Industry (industrial policy resolutions, growth, industrial bottlenecks, structural reforms etc), and Infrastructure (education, poverty alleviation programmes, energy, transport etc)
ECO422	ECONOMICS OF REGULATION AND IPR		Introduction; Rationale for regulation and antitrust; Regulatory practices, rules vs. implementation agencies; Regulatory capture; Discriminatory pricing; Controlling franchises; Public enterprise regulation; Restructuring and deregulation of keysectors such as energy, transport etc.; Externalities, environmental concerns,and controls; Product quality, safety, and health issues; Patents; Copyrights;Trademark and Service Mark; Industrial Designs Registration; Protection ofLayout of Designs Integrated Circuit; Protection of New Plant Varieties; AntitrustPolicy and IPR; Agreements and IPR Linkages; Litigation; Continuous Issues inIPR (Such as Biotechnology and IPR, TRIPS and Access to Medicines, etc.).
ECO423	FINANCIAL ECONOMICS	3-0-0-0-9	Basic accounting principles; Basics of financial markets; Return, risk and riskaversion; How securities are traded?; Mutual funds and the institutional environment; Portfolio selection; The capital asset pricing model; Index models and the arbitrage pricing theory; Empirical evidence of market returns; Market efficiency; Bond prices and yields; The term structure of interest rates; Managing bond portfolio; Security analysis; Options and other derivatives; Option valuation;Futures and forward markets; Portfolio management techniques

ECO424	ECONOMIC ANALYSIS OF LAW	3-0-0-0-9	Introduction to economic analysis of law; Economic theory of property law; Contracts and warranties; and Economic theory of tort law in addition, Thecourse focuses on any are of the following madule(s): Economic crimes and penalties; Economic theory of administrative law; Corporations and corporate finance; Economic analysis of labor law; Economic analysis of competition law; Project assignment
ECO425	INTRODUCTORY TIME SERIES ANALYSIS	3-0-0-0-9	Objectives of time series analysis; Time series components; Concept of stationarity and invertibility; Deterministic and stochastic trend, trend stationary and difference stationary process; Random walk model; Testing for unit roots; Autoregressive models, moving average models, mixed
			autoregressive and moving average models; Identification, estimation, diagnostic checking; Exponential Smoothing; Forecast function. Static and Dynamic forecasting. SARIMA, SETAR, STAR, ARCH and GARCH modelling; VAR: Estimation and identification; Impulse response function; Variance decomposition.
ECO434	INTERNATIONAL ECONOMICS	3-0-0-0-9	Global trade in goods and services; Why study international trade and finance;Growth and trade; Basic theory of international trade; Theory of comparative advantage; Implications of HeckserOhlin theory; Alternative theories of trade;Empiricial Tests of Trade Therics; International trade and technical change;Economics of import tariff; Nontariff import barriers; Arguments for and against protection; Regional trading blocks; Trade policies for development; International factor movements; Exchange rate and open economy; Internal and External Balance with Fixed and Flexible Exchange rate; Foreign exchange markets and exchange rates; Balance of payments; International monetary system; Benefits and costs of the Globalication Process.
ECO498	UNDER GRADUATE PROJECT-III		UG PROJECT (UGPIII)
ECO499	UNDER GRADUATE PROJECT-IV		UG PROJECT (UGP IV)
ECO501	ENVIRONMENTAL ECONOMICS AND POLICY	3-0-0-0-9	Price mechanism and its limitations to mitigate externalities, economic instruments to promote sustainable development, missing market methods to set market prices for environmental goods and services, renewable and nonrenewable resources and environmental policy.

ECO502	APPLIED GAME THEORY	3-0-0-09	Introduction: Optimal contracts under uncertainty, hidden information (adverse selection), or hidden action (moral hazard); Bilateral contracting: Hiddeninformation screening and signaling, hidden action moral hazard; Optimal contracting with multilateral asymmetric information: Auctions and trade under multilateral private information; moral hazard in teams, tournaments and organizations; Incomplete contracts: Institution design, implementation theory, bilateral and multilateral contracts
ECO504	ECONOMIC ANALYSIS OF LAW	3-0-0-0-9	The relationship between Law and Economics, Economic Analysis of Property Law, Economic Analysis of Contract Law, Economic Analysis of Tort Law, Economic Analysis of Administrative Law, and Economic Theory of Corporation Law (or) Economic Analysis of Competition Law (or) Economic Analysis of Criminal Law.
ECO506	BEHAVIOURAL AND EXPERIMENTAL ECONOMICS	3-0-0-0-9	A Short history of social life, Circles of power, Greed, Individual Welfare, Internal Psychology: (Neural Science), Application of heuristics to understand dynamic social situations in labour, development and environmental economics.
ECO507	TOPICS IN MANAGERIAL ECONOMICS	3-0-0-0-9	Basic microeconomics (demand, elasticity, production, cost, supply, competitive equilibrium), Financial Analysis for Economic Decision-making (Rate of return, Present-worth analysis, Cost of capital,), Cost Benefit Analysis (Microeconomic foundation; Valuing outcomes (Willingness to pay; Valuing inputs); Linear Programming & Applications)
ECO511	MARKET DESIGN	3-0-0-0-9	Game theory - Dominant strategies, IEDS, Nash equilibrium, Games of incomplete information, Bayesian Nash equilibrium. Auction theory - Basics, first-price sealedbid auction (equilibrium, revenue), second-price sealed-bid auction, reserve-price auction, revenue equivalence, VCG mechanism, keyword auction, multi-unit auction, equilibrium in bilateral trading model, introduction to double auctions, introduction to mechanism design: optimal auctions, revelation principle, auction design, characterization of revenue-maximizing auctions. Matching theory - Basics of two-sided matching model, stable matching, marriage market matching problem, deferred acceptance algorithm, Assignment problem, top trading cycle algorithm.
ECO524	HETEROGENOUS FIRMS AND INTERNATIONAL TRADE	3-0-0-0-9	Static representative agent model, Dynamic representative model, Bellmao equation! Pontryagin's Maximum Principle, Asset pricing, Dynamic endowment economy, Overlapping generations model, Real business cycle models.
ECO535	PUBLIC ECONOMICS	3-0-0-0-9	Scope of public economics; Equity, social welfare and taxation; Taxation, income support and social insurance; Taxation and individuals; Market failure andgovernment intervention; Optimal provision of public goods; Public expenditure and public debt; Modeling government behavior; Organization of public sector

ECO531	ECONOMICS OF UNCERTAINTY AND INFORMATION	3-0-0-0-9	Expected Utility Theory for Decision Making Under Risk and Uncertainty; Critiques of Expected Utility Theory, and Alternative Theories; Belief Updating; Representation of Information Structures; Blackwell's Theorem; Information Transmission and Aggregation; Topics in Behavioural Economics
ECO541	EMPIRICAL METHODS IN APPLIED MICROECONOMICS	3-0-0-0-9	Correlation vs Causality, Omitted Variables, Measurement Error, Randomized Experiments, Introduction to the course; Random Variable, Probability Review. Observational Studies and Regression, Overview of research design, and examples. Measurement Error and Omitted Variables Bias, Applications. Experimental Designs, Applications. Quasi Experimental Designs, Applications. Selection on Observables: Matching and Propensity Scores, Applications. Selection on Observables: Fixed Effects, PrePost Designs and Difference in Differences, Applications. Regression Discontinuity, Applications. Instrumental Variables, Applications. Recent Developments in the field: Discussion of papers on new methods and applications.
ECO542	PANEL DATA PROCEDURES AND ANALYSIS	3-0-3-0-12	1.Panel Data Basics(06) Fixed, Random effect models(one way and two way models),Pooled OLS, Models with unobservable heterogeneity; 2.Model Specification(03) Goodnessoffit measures ,FTest, LMTest, HausmanTest, Model extensions; 3.Dynamic panel data procedures(07) Instrumental Variable Procedure(IV),GIVE(Generalized Instrumental Variable Estimators (2Stage Least Squares) and GMM(Generalized Method of Moments) Estimators, Properties of the GMM estimators, Variances of the IV and 2SLS estimators, Tests for Over identifying Restrictions, Arellano Bond, Arellano Bover , Blundell Bond Procedures, GMM procedure in a simultaneous equation settings; 4.Specification of Dynamic Models(05) SarganHansenTest, Test for autocorrelation, Choice of instruments ,Identification problems; 5.UnitRootTests for Panel Data(04) Levin/Lin, Im/Peseran/Shin, Maddala/Lin ,PANIC Analysis Taking contemporary correlation into account ,Residual tests by Pedroni and Kao TraceTest by LLL (1999); 6.Estimating Cointegration Relationships(04) Fully Modified(FM)OLS (Pedroni, Phillips/Moon), Dynamic Ordinary Least Squares(DOLS)Estimation, Parametric estimation (Pooled Mean Group, 2 Stage Least Squares) ,Estimation of error correction models, Panel VAR(Vector Auto Regression) and Innovation Accounting in a panel framework; 7.Limited Dependent variable models with Panel data(06)Tobit, Logit and Probit Models in a panel settings with applications in Labour economics; 8.Application of Panel data in Trade, Finance, Industrial Economics, Macroeconomics and Microeconomics, among others with hands on experience of doing panel data analysis through standard econometric softwares (07)

ECO545	BAYESIAN ECONOMETRICS	3-0-0-0-9	Basic concepts of probability and inference: Frequentist probabilities, subjective probabilities, prior, likelihood, and posterior. Posterior Distribution and Inference: Properties of posterior distributions (the likelihood function, vector of parameters, Bayesian updating, large samples and identification) and Inference (point estimates, interval estimates, prediction and model comparison).
			Prior Distributions: Normal linear regression model, proper and improper priors, conjugate priors, exchangeability and conditionally conjugate priors. Markov chain Monte Carlo Methods: Basics of Markov chain theory, Gibbs Sampling, Metropolis algorithm, MetropolisHastings algorithm, calculation of marginal likelihood, numerical standard error and convergence. Linear Regression and Extensions: Linear regression with normally distributed errors and student-t distributed errors, limited dependent variable models (Tobit for Censored Data, Binary Probit Model, Binary Logit Model, Ordinal Probit Model) and latent variable models (Item response model and Factor Analysis Models). Semi-parametric Regression: Flexible forms for the conditional mean function and flexible error distributions (Dirichlet Process Mixtures). Multivariate Response Models: SUR Model, Panel Data Model, and Multivariate Probit Model. Time Series Models: Autoregressive Models, Regime Switching Models, Time Varying Parameters, Time series properties of Models for Panel data and Time Varying Variances (ARCH, GARCH, Stochastic Volatility Models). Endogenous covariates and sample selection: Treatment Models, Unobserved covariates and Incidental Truncation.
ECO572	PRODUCTIVITY AND EFFICIENCY ANALYSIS	3-0-0-0-9	This course is designed for students who wish to learn about production economics and benchmarking analysis. Benchmarking is used to measure performance of a producer using a specific indicator (production/ cost/profit) resulting in a metric of performance that is then compared to other producers. Students will learn to estimate production and cost functions and compute measures of absolute and relative economic performance using data envelopment analysis (DEA), deterministic frontier analysis (DFA), and stochastic frontier analysis (SFA) methods. Students analyse different types of datasets using software packages such as DEAP, Excel solver, FRONTIER, and Stata. 01-APR-2015

ECO580	WTO ISSUE AND TRADE FACILITATION	3-0-0-0-9	As a multilateral institution, WTO is engaged in preparing provisions related to various issues which restrict trade. These restrictions are known as tariff and non-tariff barriers (NTBS). Over the years, tariff barriers have come down because of various multilateral and regional trade policy initiatives. However, the level of NTBs has risen. The recent WTO issues talk more about the provisions that mainly cover all NTBS. The efforts of reducing these NTBS are termed as trade facilitation and the provisions to reduce such restrictions are known as trade facilitation measures (TFMS). This course tries to explain the recent WTO issues related to facilitating international trade among countries. This course includes the empirical estimation of impacts of reduction of NTBs on trade and other economy-wide variables. The course would also explain the types of trade facilitation measures (TEMS) at country level to reduce the restrictions on trade. Negotiating positions of various countries would be discussed in this course.
ECO598	PROJECT-I	0-0-4-0-4	PROJECTI
ECO599	PROJECT-II	0-0-4-0-4	PROJECTII
ECO611	Computational Methods in Economics (modular)	3-0-1-0-6	Basics of programming; Numerical analysis; Optimization; Applications
ECO613	Economic Data Analysis: Methods and Computational Aspects (modular)	3-0-1-0-6	Statistical Inference; Multi-variate Statistics; Deep learning; Time-series analysis
ECO612	APPLIED MACROECONOMICS	3-0-0-0-9	Measuring Real and Nominal Variables; Monetary and Fiscal Policy Framework; International Macroeconomics; Monetary Economics
ECO671	Mathematical Methods for Economics	3-0-0-0-9	Linear Algebra; Calculus of Several Variables; Optimization; Dynamics
ECO 672	Dynamic Optimization	3-0-0-0-9	Mathematical Preliminaries; Dynamic Optimization in Continuous Time; Dynamic Optimization in Discrete Time; Stochastic Dynamic Optimization
ECO 673	Introduction to Stochastic Modeling	3-0-0-0-9	Probability and Random Processes; Asset Pricing; Information; Game Theory; O.R.
ECO699	M SC THESIS		Project
ECO701	Microeconomics	3-0-0-0-9	Logic, Set Theory, and Preference Relations 2. Static Games with Complete Information 3. Dynamic Games with Incomplete Information 4. Theory of Producers' Behavior 5.

			Perfect Competition and Monopoly 6. Theory of Consumer Behavior
ECO702	MACROECONOMICS	3-0-0-0-9	A Simple (Static) Representative Agent Model - Elements of Macroeconomic Model: Preference, Endowment and Technology; Optimization; Competitive Equilibrium; Pareto Optima; Welfare Theorems; Comparative Statics Dynamic Optimization - (a) Inter-temporal preferences, (b) Basics of dynamic optimization, (c) Consumption Smoothing, and comparative statics. Search and Unemployment- (a) One-sided search model: separation rate, reservation wage and applications of dynamics programming techniques, (b) Two-sided models: DP model and comparative statics, solutions. Overlapping Generations Model - (a) Life-cycle Consumers and Demographics, (b) Equilibrium, (c) Steady-state and Dynamics, (d) Government budget deficit –Ricardian equivalence, distorting taxes, borrowing restrictions, finite lives, (d) Social Security. Long-run Growth in the economy - (a) Growth accounting, (b) Solow growth model (c) Technological progress in the Solow growth model, (d) Endogenous growth theory Rationale Expectations and economic policy -(a) Adaptive and rational expectations hypotheses, (b) Applications of rational expectation in macroeconomics, (c) Policyineffectiveness proposition (PIP)-Lucas critique, (d) New Keynesian perspectives under one-period and overlapping wage contracts Real Business Cycle Models - (a) The basic stochastic growth model, (b) Linearization, calibration, and simulation, (c) Criticisms and new developments.
ECO703	Quantitative Methods	3-0-0-0-9	Distribution of random Variables; Conditional probability and stochastic independence; Probability distributions; Multivariate analysis; Logic; Basics of Set Theory; Functions of a Single Variable; Functions of Several Variables; Static Optimization
ECO704	Econometrics	3-0-0-0-9	Statistical distribution Theory; Statistical inference; Basic Linear Algebra; Classical Linear Regression Model; Statistical inference in the context of CLRM; Time-series regression; Regression with qualitative information

ECO712	INTERNATIONAL FINANCE AND INVESTMENT	3-0-0-0-9	This PG course is meant for senior undergraduate and postgraduate students, including PhDs, who need to learn about recent developments in international finance. Modernday financial management and investment are international in scope and require the corresponding knowledge and expertise. The finance training should include the field's international aspects, and international training should reflect the current revolutionized environment. This is the main objective of this course. The course is balanced and covers technical and institutional aspects of international finance. The topics that will be covered (not exhaustive) are the structure of the international financial system (international monetary system, international banking, and the Eurocurrency market and foreign exchange market), derivative markets, instruments and techniques, international risk assessment (international portfolio diversification, crisis and contagion risks and assessment of country creditworthiness), foreign exchange risk management (managing foreign exchange risk and hedging techniques), borrowing and lending internationally (international debt markets, interest rate risk and other international markets such as international commodity markets and global equity markets), political risk insurance (expropriation, forced abandonment, trade disruption insurance, contract frustration etc.), the economics of sovereign wealth funds (risk management of SWFs).
ECO713	ADVANCED TOPICS IN MICROECONOMCIS	3-0-0-0-9	This course introduces students to advanced topics in microeconomic analysis, with a particular focus on general equilibrium theory and the theory of Bayesian games. General equilibrium theory studies the interaction of demand, supply and prices across multiple markets, in contrast to partial equilibrium analysis which studies each market in isolation. Bayesian games, or games of incomplete information, are games in which players have private information about their payoffs. This course also introduces the theory of individual decision-making under uncertainty.
ECO714	GAME THEORY AND APPLICATIONS	3-0-0-0-9	Normal Forms, Iterated Elimination of Strictly Dominated Strategies, Nash Equilibrium and refinements; Adverse Selection, Screening, Principal Agent Problem, Moral Hazard, Applications of Markets with Asymmetric Information; Social Choice Theory, Arrow’s Impossibility Theorem; Public Goods, Free Riding, VCG Mechanism; Mechanism Design.
ECO717	Empirical Methods in Health Economics and Public Policy	3-0-0-0-9	Introduction to health and public policy research; Measuring equity and efficiency in health sector; Determinants of health and healthcare; Effectiveness of health and public policies; Causal inference frameworks; Quasi-experimental approaches; Impact of population level policy interventions; Evidence-based policy formulation; Data analysis

ECO718	Agricultural Economics	3-0-0-0-9	Agriculture Household Model; Consumption smoothing; Labor Markets; Trade and Agriculture; Production and Nutrition; Environment effects
ECO721	INFORMATION FRICTIONS IN FINANCIAL ECONOMICS	3-0-0-0-9	This course provides students with an introduction to theories in corporate finance, financial intermediation and information economics. We study the implications of information asymmetry in financial markets and possible remedies. We study both static and dynamic models, as well as models with finite and infinite number of agents. Includes: Corporate Financing, Agency Costs and Capital Structure; Security Design; Information Flows and Learning in Financial Markets; Financial Intermediation.
ECO731	PUBLIC ECONOMICS AND PUBLIC POLICY	3-0-0-0-9	Static Optimal Taxation, Public Goods, Externalities, Dynamic Optimal Taxation, Optimal Transfer Program, Fiscal Federalism, Revenue and Expenditure in India, Public Debt in India, Economics, Politics, and Policy Choice, Dynamic Public Policy.
ECO734	INDUSTRIAL ORGANISATION AND POLICY	3-0-0-0-9	Scope of Industrial organization; Industrial Efficiency; Basic Framework forthe Study of Industrial Organization; Recent Approaches to Industrial Organization; Market Structure and Its Elements; Market Conduct, Internal Structure of theFirm. Critical Appraisal of Industrial Development policies in India; Case Studies from Heavy Industries, Consumer Goods Industries and Public Utilities.
ECO735	DEVELOPMENT ECONOMICS	3-0-0-0-9	The international trends in economic development, various development theoriesand operational strategies towards capital formation, international capital flows, foreign trade, agriculture, industry, HRD, technology transfer and environmentwill constitute the broad contents of this course. Further, focus will be on new economic policies and emerging new international structures. Besides, theshidents will undertake some empirical project as group assign many.
ECO742	EFFICIENCY AND PRODUCTIVITY ANALYSIS	3-0-0-0-9	Course Descriptions: This applied microeconomics course is designed for student who wish to learn about benchmarking analysis. Benchmarking is used to measure performance of decision-making unit (here, a producer or a firm) using a specific economic indicator (productions/cost/profit), resulting in a performance metric (e.g. technical efficiency growth) suitable for comparison across similar units. The course offers an introduction to Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA). In particular, students will learn to use parametric SFA and nonparametric DEA models to estimate production and most frontiers and compute measures of various types of efficiencies and productivity growth. The course is a mixture of advanced theory, quantitative techniques, and computations involving real life productions data.

ECO747	ENVIRONMENTAL ECONOMICS LEGISLATION AND SOCIAL IMPACT	3-0-0-0-9	With a view to establish sustainable development and to overcome the dilemma of development, the course proposes to focus on the broad aspects of environmental economics, environmental legislations and the environmental impact assessment. The consequent changes in the approaches and policies ofvarious Government under the leadership of U.N. and World Bank will be discussed along with a number of case studies. The legel aspects of various environmental projects will be discussed. Besides the students will undertake an empirical excercise through project assignment.
ECO751	LAW AND ECONOMICS	3-0-0-0-9	Introduction; Economic Analysis of Property Law: An Economic Theory of Property, and Intellectual Property Rights; Economic Analysis of Contrat Law: Economic Theory of Contract, and Economics of Remedies for Breach of Contract; Economic Analysis of Tort Law, and Economics of Tort Liability; Public Law and Economics: Legislative and Executive Participation and Discretion: Economic anaylsis of judicial review, and general Applications to Indian Institutes: Economic theoryof Corporation Law: The Theory of the Firm, Corporation and their Interaction,the Economic Reconstruction of Corporation Law, analysis of Specific Problems of Corporation Law, Economic Analysis of Labour Law: Unions and Productivity,Workers Protective Legislation, Issues in Employment discremination on grounds of Race Sex, and Age; and Economic Analysis of Competition Law: Economic Theory of Competition Law, and Competition Policy in India.
ECO752	QUANTITATIVE ANALYSIS OF INTERNATIONAL TRADE	3-0-0-0-9	1. Global Trade and Empirical Facts of International Trade 2. Nature of the Globalization Process and Benefits andCosts associated with the Globalization Process, Globalization and Wages 3. Theory and Empirical Testing of Trade Theories (FromMercantilism to Ricardian, Specific Factor Trade Models and Heckscher-Ohlin trade models), testing of theHeckscher-Ohlin-Vanek model and higher dimensional issues 4. Alternative Trade Theories and their Empirical Tests 5. Trade, Exchange Rate and Balance of Payments,Exchange rate management including hedging, different models of currency and banking crises and empirical assessment of BOP crises, international monetary theories and policies and macroeconomic management of an open economy, Impossible trilemma between fixed exchange rates, monetary policies and perfect capital mobility 6. Trade Policy simulations using software like SMART,GTAP, GTAPE and GAMS, International Trade Data Analysis using Econometric Models, introduction to WITS and TIVA data base. Trade Intelligence network like TINA and RIVA. Gravity analysis with structural modeling through

			R for understanding what explains international trade among countries and firms.
ECO753	LABOUR ECONOMICS	3-0-0-0-9	Static labor supply, Dynamic labor supply, Static labor demand, Dynamic labor demand and equilibrium analysis (supply meets demand).
ECO755	CONTRACT TREORY	3-0-0-0-9	Introduction; Bilateral Contracts (Static Models): Hidden Information – Adverse Selection/Screening Models and Signaling Models, Hidden Action – Moral Hazard Models; Multilateral Contracts: Asymmetric Information – Auctions, Moral Hazard and Collusion; Dynamic Adverse Selection and Moral Hazard; Incomplete Contracts
ECO756	PROGRAMME EVALUATION: METHODS AND APPLICATIONS	3-0-0-0-9	Experimental Design, Measurement Error, Omitted Vairables Bias, Quasi_Experimental Designs, Selection on Observables: Matching and Propensity Scores, Difference in Differences, Instrumental Variables, Regression Discontinuity.
ECO761	APPLIED ECONOMETRICS	3-0-0-0-9	Non Linear Regression Models, Non Parametric Regression Models, Measurement Errors, Stochastic Regressor, Multinomial and Conditional Logit Models, Ordered Logit Models, Nested Logit Models, Random Parameter Models, Truncation, Censoring and Sample Selection Models, Duration and Event Count Models, Dynamic Panel Data Models, Time Series Models including ARCH,GARCH and Multivariate GARCH Models, DEA and Stochastic Frontier Models, Total Factor Productivity Estimation, Levinsohn Petrin Approach of Measurement of Productivity, Single and Multiple Equation GMM Procedures, Spatial Regression Models and its applications, Application of Econometric Models to Trade, Finance, Microeconomics, Development Economics, Growth, Macroeconomics, Industry, Artificial intelligence, Machine Learning, among others.
ECO764	FINANCIAL ECONOMETRICS	3-0-0-0-9	This course is designed for senior undergraduate and postgraduate students. The main purpose is to make students aware of the important concepts and issues in financial econometrics. The balanced course covers theoretical and empirical aspects of financial economics. The snapshot of a broad list of topics included in the syllabus is the basics of data handling tools and techniques, quantitative modeling in market microstructure, asset pricing and dynamic volatility and factor models. In addition, the course covers high-frequency finance and empirical issues in international finance, extreme value theories, and statespace modeling and simulations.

<table>
<tr><td>ECO765</td><td>MACHINE LEARNING FOR ECONOMISTS</td><td>3-0-0-0-9</td><td>Introduction to statistical learning: Introduction to di erent learning methods, supervised/ unsupervised learning, regression, classi cation, differences between statistical models and algorithmic learning, introduction to computational tools: R, python.
Supervised Learning - Linear Models: Linear models for regression: ridge regression, Lasso. Linear models for classification: linear discriminant analysis (LDA), logistic regression.
Supervised Learning - Nonlinear Models: Tree-based methods: regression trees, classi cation trees, random forests, boosting.
Support Vector Machine (SVM): Perceptron algorithm, classifier for separable data, overlapping classes, non-linear classifiers based on kernels, regression.
Deep Learning: Neural networks: Feed-forward, convolutional, recurrent. Regularization and Stochastic Gradient Descent (SGD).
Unsupervised Learning: Principal Component Analysis (PCA), matrix completion, Expectation Maximization (EM) algorithm, K-means clustering, hierarchical clustering.</td></tr>
<tr><td>ECO799</td><td>PHD THESIS</td><td></td><td>Ph. D. Thesis</td></tr>
<tr><td>ECO888</td><td>PROFESSIONAL DEVELOPMENT & COMMUNICATIO N SKILLS</td><td></td><td>Professional Development and Communciation Skills</td></tr>
<tr><td>ECO722</td><td>An Introduction to Derivatives Pricing</td><td>3-0-0-0 [9]</td><td>Course Description: This course introduces the students to the exiting field of pricing financial derivatives under no arbitrage hypothesis. The key idea for pricing these financial instruments is the introduction of the risk-neutral probabilities. To make the course largely self contained we will describe the pricing problem both in discrete time and continuous. The course will culminate in deriving the famous Black-Scholes price for a European call option using the risk-neutral pricing approach. The mathematical tools needed for this course like, conditional expectation, martingales, Brownian motion, geometric Brownian motion, Ito's Integral and Ito calculus will be discussed in detail.

A) Objectives: To equip the students with enough material on quantitative finance so that they can either start doing basic research in mathematical finance or may also join as quants in finance companies and investment firms.

B) Contents
<table>
<tr><th>S No</th><th>Broad Title</th><th>Topics</th><th>No. Lectures</th></tr>
<tr><td>1</td><td>Basics of Financial Derivative</td><td>Options, Futures, Forwards, Arbitrage,</td><td>3</td></tr>
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		Hedging, Complete Market Hypothesis	
2	Derivative Pricing in Discrete time	Pricing European Call option, Basics of Asset Pricing and pricing American Call Options	12
3	Mathematical Tools	Geometric Brownian Motion, Ito's Integral and Ito Calculus	12
4	Derivatives Pricing in Continuous Time	Black-Scholes Formula, Interest Rate Models, Stochastic Volatility	12
5	Monte-Carlo Methods in Finance	Using Monte-Carlo Method to compute the price of a European call Option	2

C) Prerequisites: HSO 201/HSO 201 A, MSO 201/MSO 201 A or any basic probability course.

D) Short summary for including in the Courses of Study Booklet: This course is for the study of pricing financial derivatives under the no arbitrage hypothesis. The topics include, basics of financial derivatives, no arbitrage, binomial pricing model, risk-neutral probabilities, basics of asset pricing, pricing American options in discrete time, Conditional Expectations, Martingales, Brownian Motion, Geometric Brownian Motion, Ito's Integral, Ito's Calculus, Black-Scholes PDE, the Greeks, Girsanov's Theorem, Risk-Neutral Valuation, Interest rate models, stochastic volatility, Monte-Carlo Methods in Finance.

Recommended textbooks:

Steven. S. Shreve, Stochastic Calculus for Finance, Vol -I and Vol-2, Springer 2004.

Y. K. Kwok, Mathematical Models of Financial Derivatives, Second Edition, Springer 2008.

ECO723 | Foundations of Financial Risk | 3-0-0-0 [9]

Objectives: The course aims to provide adequate exposure to the foundational concepts of financial risk in an economy. It also highlights the role of financial markets in financial stability and recent developments in policy thinking.

Course Contents:

No	Broad Title	Topics	No. of Lectures

			1	Nature of Risk	Risk and basic risk management framework, systematic, unsystematic, credit risk, credit risk management framework, operational risk and integrated risk management.	2
			2	Financial Institutions regulations	Central bank regulation, capital market regulations, stock market regulations, Role of SEBI, IRDA and its role in financial markets, management of liquidity and risk; bank safety and prudential regulations, government guarantees, deposit insurance.	3
			3	Market risk measurement	Concept of volatility, portfolio volatility, concept of Value at Risk (VaR), type of VaR measures, methodologies for measurement of VaR, measuring risk using VaR, Stress testing and back-testin VaR, conditional Value at Risk Co-VaR ,	4
			4	Bank balance sheet risk	Risks in Banking Business, Risk identification in Banking Business, Off-Balance Sheet Exposures, Risk Regulations in Banking Industry, Basel I, II and III, Market Risk, Bank balance sheet risk, bank crisis, leverage risk, balance sheet recession.	5
			5	Financial Stability	Defining Financial stability, assets, information problems, role of finance in propagating shocks, bank behaviour,	5

	financial c cles and crises, asset rice bubbles, the financial accelerator, the housing feedback process, bank leverage-centred feedback process.		
6	Financial Instability	Defining financial instability, experience from Global Financial Crisis (GFC), pre-crisis financial system, the upswing of the financial cycle, subprime Crisis, Mortgage-Backed Securities.	4
7	Recent Developments in policy thinking	Post crisis reforms of financial regulation failure, introduction of macroprudential policy (MaPP), need, objectives, instruments of MaPP, how does MaPP assist in maintaining the financial stability , adverse effects of new regulations.	3
Total number of lectures			26

Pre-requisites: Familiarity with macroeconomics (Instructor's consent)

Summary: The critical role of financial institutions in driving economic growth, and development is well documented in the literature. However, rapid financial development can also introduce significant challenges and risks to the system. Therefore, understanding various aspects of financial risk, policy applications, and recent developments is essential. This course explores the following topics: nature of risk, financial institutions and regulations, banking balance sheet risk, market risk measurement, financial stability, financial instability, and recent developments in policy thinking.

Text Books:

Wendy, C., & Soskice, D. (2015). Macroeconomics, Institutions, Instability and the Financial system. Oxford University Press

References Books:

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<td></td>
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<td>Advanced Financial Risk Management: Tools and Techniques for Integrated Credit Risk and
Interest Rate Risk Management (Wiley Finance) by Donald R. Van Deventer, Kenji Imai & Mark Mesler
Chandra, Prasanna: Investment Analysis and Portfolio Management. McGraw Hill Education.
Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk by
Steve L. Allen
Gup, Benton E. Kolari, James W., Commercial Banking: Management of Risk, Wiley; 3 edition (2004)
Machiraju, H. R., Modern Commercial Banking, New Age International, (2008)
Mishkin, Frederic (2007), The Economics of Money, Banking and Financial Markets, 8th ed., Addison Wesley Longman Publishers.
Wendy, C., & Soskice, D. (2006). Macroeconomics: Imperfections, Institutions & Policies. Oxford University Press

<u>Research Articles and Reports</u>
Bank for International Settlement (BIS), Financial Stability Board (FSB), RBI</td>
</tr>
<tr>
<td>ECO725</td>
<td>Environmental Economics: Policy and Trade</td>
<td>3-0-0-0 [9]</td>
<td>A) This course introduces students to environmental economics, environmental policies and regulations, and additionally introduces multilateral agreements and trade patterns in the context of environmental issues. This course is designed to familiarize students with environmental policy instruments, global environmental issues and trading of carbon and waste.

B) Objectives: To equip students with knowledge about environmental issues, the policies and instruments applied to tackle said issues, and an understanding of the global picture in terms of environmental negotiations.

C) Contents
<table>
<tr><th>S. No</th><th>Broad Title</th><th>Topics</th><th>No. Lectures*</th></tr>
<tr><td>1</td><td>Introduction: Environmental Economics</td><td>Economics and environmental policy; externalities; choice of policy instruments</td><td>4</td></tr>
<tr><td>2</td><td>Environmental policy and instruments</td><td>Market-based incentives: taxes and tradable permits; property rights; policy endogeneity in the context of trade and environment</td><td>5</td></tr>
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3	Environmental regulations and trade patterns	Environmental regulations in trade models; pollution offshoring; trade in waste	6
4	Natural resources	Sustainable use; role of natural resources in trade models	5
5	Multilateral trade and environment negotiations	Trade in carbon, border carbon adjustments; emission adjustments; global environmental negotiations	6

*Total 26 lectures, 1 hr and 15 minutes for each lecture.

D) Prerequisites: EC0701/EC0211, EC0704/EC0351

E) Short summary for including in the Courses of Study Booklet: This course introduces the field of environmental economics, with a focus on policy instruments, trade patterns and multilateral agreements. The topics include basics of environmental policy; externalities; marketbased incentives such as taxes and permits; trade and environment policy endogeneity; trade in carbon; pollution offshoring; natural resource management; multilateral trade and environment negotiations.

Recommended textbooks:

1. Baumol William J. and Oats Wallace E. The Theory of Environmental Policy. Second Edition. Cambridge University Press. 1994
2. Kolstad, Charles D. Environmental Economics, selected chapters.

Selected references#.

1. Goulder, L. and Parry, I, (2008), "Instrument Choice in Environmental Policy," Review of Environmental Economics and Policy, 2(2): 152-174

2. Hahn,R. (1989), "Economic Prescriptions for Environmental Problems", Journal of Economic Perspectives, 3 (2): 95-114.

3. Coase, R.H. (1960) "The Problem of Social Cost," Journal of Law and Economics, 3: l 44.

4. Brunel, Claire (2017) "Pollution Offshoring and Emission Reductions in EU and US Manufacturing", Environmental and Resource Economics 68: 621-641

5. Sakai, Marco and John Barrett (2016) "Border carbon adjustments: Addressing emissions embodied in trade", Energy Policy, 92: 102-1 10

			6. Barrows, Geoffrey and Helene Ollivier (2021) "Foreign demand, developing country exports, and C02 emissions: Firm-level evidence from India", Journal of Development Economics, 149 Issue C: 102587. 7. Steinfatt, Karsten (2020) "Trade Policies for a Circular Economy: What Can We Learn From WTO Experience?" WTO Economic Research and Statistics Division, working paper.