

INDIAN STATISTICAL INSTITUTE

STUDENTS' BROCHURE

MASTER OF SCIENCE IN QUANTITATIVE ECONOMICS (MS(QE))

### 1. ELIGIBILITY FOR ADMISSION:

Three-year Bachelor's degree with Economics and Mathematics as full subjects. Holders of the B.Stat. degree of the Institute are eligible only if they have taken all the four elective papers in Economics in the B.Stat. course. The details of admission

are available in the prospectus.

[Back to the content page](#)

### 2. STIPENDS AND OTHER FINANCIAL SUPPORTS:

The students admitted to this course will be given initially a stipend at par with that of M.Stat. students which is at present

Rs.800/- only per month and an annual contingency grant of Rs.1250/- only. Students should be warned at the end of each semester if the performance is unsatisfactory and in which case his/her stipend may be withdrawn fully or partially. If the stipend of a student is withdrawn fully or partially at the beginning of any particular semester, but his/her academic

performance in that semester turns out to be good then the full amount of the stipend for that semester may be restored with retrospective effect. A student will deserve this provided the requirements for continuation of the programme are satisfied and the course composite score in that semester is at least 60% and no more than one composite score in that semester is less than 45%. Stipend should be given after the end of each month for eleven months in each academic year.

[Back to the content page](#)

### 3. METHOD OF EXAMINATION AND AWARD OF DEGREE:

For each course there should be periodical and semestral examinations; the scores in these would be combined in suitable ratios to be decided by the teachers' committee to obtain a composite score in the course. A student will be allowed to take a semestral examination if he/she attends at least 75% of all classes in the semester and his/her character and conduct are satisfactory. A student would be declared to have passed the first/second year of the course if he/she

- a) does not obtain a composite score of less than 25% in any course,
- b) does not obtain a composite score of less than 45% in more than three courses, and
- c) secures at least 45 in an overall percentage of composite scores in the course.

If the composite score of a student falls short of 45% in a course, the student may take a back paper examination. At most four back paper examinations will be allowed in a year for each student. Maximum possible score in the back paper examination is 45. Only one back paper is allowed in each course. A maximum of 6 back paper examinations will be allowed in two years. If a student fails to appear in periodical/semestral examinations due to illness or extreme family emergency, and this is promptly reported to the Dean of Studies in writing, the teachers' committee, at its discretion, may allow the student to take supplementary examinations.

If the student fails in the first year examinations, even after appearing for supplementary/back paper examinations referred to in the preceding paragraph, then he/she has to discontinue the course. However, if he/she fails in the second year examinations even after supplementary/back paper examinations, then at the discretion of the teachers' committee, he/she may be allowed to repeat the second year of the course without stipend. If a student fails to meet the attendance requirements due to illness or extreme family emergency, which is promptly reported to the Dean of Studies in writing, the teachers' committee, at its discretion, may waive the attendance requirements. A student who successfully completes the first and the second year of the course will be declared to have passed the M.S. in Quantitative Economics degree examination and placed in the

- i) First Class with Distinction if he/she secures an overall average percentage score of at least 75 in the twenty courses,

ii) First Class if the student secures an overall average percentage score of at least 60 but less than 75 in the

twenty courses,

iii) Second Class if the student fails to secure First Class with Distinction or First Class.

A student passing the M.S.(Q.E) degree examination will be given a certificate of M.S.(Q.E) degree and a marks sheet mentioning

i) the twenty courses taken and the composite percentage score in each course, and

ii) the class in which the student is placed.

[Back to the content page](#)

#### 4. COURSE STRUCTURE :

The programme comprises fourteen compulsory courses (including a dissertation) and six optional courses distributed as follows :

(a) five compulsory courses each in semesters I and II (first year), two in semester III and one in semester IV (second year);

(b) six optional courses and the dissertation in semesters III and IV (second year).

The student will have to opt for one of the following three packages in the second year.

- Package (i) : three optional courses in each of semesters III and IV and a dissertation in semester III;
- Package (ii) : three optional courses in each of semesters III and IV and a dissertation in semester IV;
- Package (iii) : two optional courses and a dissertation in semester III and four optional courses in semester IV.

Semester I of the course will be taught in Delhi, semesters II and III will be taught in Kolkata and semester IV will be taught both in Delhi and Bangalore. However, any particular student will have to take the course for semester IV either in Delhi or in Bangalore depending upon his optional subjects. The semesterwise distribution of compulsory courses apart from the

Dissertation is given below :

Semester I :

- (a) Microeconomic Theory I,
- (b) Macroeconomic Theory I,
- (c) Statistics I (for students without statistics background)  
or  
Advanced Mathematics (for students with statistics background),
- (d) Economic Development I,
- (e) Mathematical Methods in Economics  
or  
Optimisation Techniques (for students with mathematical background).

Semester II :

- (a) Microeconomic Theory II,

(b) Macroeconomic Theory II,

(c) Statistics II (for students without statistics background)

or

Advanced Statistics (for students with statistics background),

(d) Statistics III, Computer Programming and Applications (for students without computer programming

background)

or

Advanced Computer Programming (for students with computer programming background),

(e) Econometric Methods I.

Semester III :

(a) Econometric Applications I

(b) Planning Techniques.

Semester IV :

(a) Economic Development II.

The optional courses are to be chosen from the following list :

1. Econometric Methods II
2. Econometric Applications II
3. Time Series Analysis and Forecasting
4. Sample Survey : Theory and Practice

5. Bayesian Econometrics
6. Intertemporal Economics
7. Game Theory and Economic Analysis
8. Theory of Planning
9. Industrial Organization
10. Social Accounting
11. Agricultural Economics
12. Public Economics
13. Regional Planning
14. International Economics I
15. International Economics II
16. Mathematical Programming with Applications to Economics
17. Monetary Economics
18. History of Economic Thought.
19. Macro Dynamics.
20. Social Choice and Political Economy.
21. Incentives and Organization.
22. Privatization and Regulations.
23. Environmental and Resource Economics.
24. Theory of Finance I.
25. Theory of Finance II.
26. Political Economy and Comparative System.

The list of optional courses may be revised from time to time and the courses to be actually offered announced at appropriate time.

[Back to the content page](#)

## 5. DISSERTATION:

A student is required to submit a dissertation paper on a topic assigned/approved by the teachers' committee and prepared under the supervision of a faculty member. The work should be started at the beginning of the third semester by the students taking package (i) of the course and the fourth semester by other students and be completed along with the courses of the respective semesters. The dissertation should be submitted within two weeks of completion of all examination for the courses in the semester. The work for the dissertation should relate to some important problem in an area of Economics, econometrics, Quantitative Economics or related topics and would be graded as one full course in a semester. The dissertation will be evaluated by the supervisor and a copy of it, along with the grade/score awarded by the supervisor, be submitted to the Dean of studies sufficiently prior to the meeting of teachers' committee for finalising the result.

[Back to the content page](#)

## 6. SYLLABI OF THE COURSES:

The Compulsory Courses would be as follows :

1. Microeconomic Theory I
2. Macroeconomic Theory I
- 3(a). Statistics I, or
- 3(b). Advanced Mathematics (for students with a statistics background)
4. Economic Development I
- 5(a). Mathematical Methods in Economics, or
- 5(b). Optimization Techniques

6. Microeconomic Theory II
7. Macroeconomic Theory II
- 8(a). Statistics II, or
- 8(b). Advanced Statistics (for students with a statistics background)
- 9(a). Statistics III, Computer Programming and Applications, or
- 9(b). Advanced Computer Programming (for students with a computerprogramming background)
10. Econometric Methods I
11. Econometric Applications I
12. Planning Techniques and Plan Models
13. Economic Development II
14. Dissertation

The Optional Courses would be as follows:

1. Econometric Methods II
2. Econometric Applications II
3. Time Series Analysis and Forecasting
4. Sample Survey: Theory and Practice
5. Bayesian Econometrics
6. Intertemporal Economics
7. Game Theory and Economic Analysis
8. Theory of Planning
9. Industrial Organization
10. Social Accounting
11. Agricultural Economics



12. Public Economics
13. Regional Planning
14. International Economics I
15. International Economics II
16. Mathematical Programming with Applications to Economics
17. Monetary Economics
18. History of Economic Thought
19. Macrodynamics
20. Social Choice and Political Economy
21. Incentives and Organizations
22. Privatisation and Regulations
23. Environmental and Resource Economics
24. Theory of Finance I
25. Theory of Finance II
26. Political Economy and Comparative Systems

[Back to the content page](#)

(A) SYLLABI FOR COMPULSORY COURSES:

Compulsory Course 1: Microeconomic Theory

1. Theory of consumer Behaviour under Certainty, Preference orderings, utility functions, budget sets, demand

theory, duality theory. Theory of revealed preference. Aggregation of individual demand curves. Applications.

2. Theory of the Firm Production sets, cost minimization, profit maximization, supply curves. Duality theory, Aggregation of

individual supply curves, theory of monopoly, Applications.

3. Demand-Supply Equilibrium in a Single Market Equilibrium in a single market. Stability : Walrasian, Marshallian,

and cobweb models, Methods of comparative statics, Applications to capital and labour markets.

4. Decision-Making under Uncertainty Preference over lotteries. Von Neumann-Morgenstern utility functions. Risk

aversion and measures thereof. Partial orderings of risky projects. Applications.

5. Market Structure with Imperfect Competition Monopolistic Competitions. Oligopoly Theory.

#### Compulsory Course 2: Macroeconomic Theory I

1. Review of National Income and Product Accounts.

2. Keynesian Macroeconomics: effective demand and the multiplier - IS-LM model - aggregate demand and supply curves - simple macroeconomics of the open economy.

3. Structuralist Macroeconomics : Structural rigidities in a less developed economy- demand, supply and credit constraints.

4. The Supply of Money: monetary and financial institutions.

5. Introduction to Growth Theory.

#### Compulsory Course 3(a): Statistics I

1. Type of investigation and collection of data : Complete enumeration, sample survey, controlled experiments,

observational studies, retrospective and prospective studies.

2. Types of observations : Classification and tabulation of univariate data. Summarisation of univariate data-Histogram, mean,

variance, skewness, kurtosis, ogive, percentiles, Interpretation.

3. Notions of statistical inference:

(a) Estimation of population mean - Use of random sampling, simulation study.

(b) Randomized allocation - Valid comparisons-simulation study.

(c) Elementary concepts of design of experiments - Local control, randomization and replication - through examples and

simulation.

4. Probability Theory: Sample space, events. combinatorics. classical and axiomatic definition of probability; simple consequences. Equally likely probability model. Conditional probability and independence. Bayes' formula.

Random variables, distribution function, discrete random variables, Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric - illustration through data, genesis. Poisson approximation to Binomial. Continuous random variables - introduction, illustration by simulation, Uniform, Normal, Exponential, Beta, Gamma, Logistic, Pareto, Lognormal - illustration through data, genesis. Normal approximation to Binomial. Distribution of function of a random variable. Expectation - definition, mean, variance and moments in general. Illustration.

5. Bivariate data : Discrete and continuous type. Scatter diagram. Bivariate frequency distribution-arrays and marginals. Correlation - computation and interpretation. Linear regression - regression effect, least-squares computation, residuals, RMS errors for regression and its use, outliers, (graphically), check on linearity and homoscedasticity (graphically) Curvilinear regression, correlation ratio, intraclass correlation, Rank Correlation. Association of attributes.

6. Bivariate probability distribution : Marginal and conditional. Conditional expectation. Regression, Correlation. Bivariate normal distribution.

Compulsory Course 3(b): Advanced Mathematics : Real Analysis

1. Elements of point-set topology in  $R^n$  : Open sets in  $R^n$ , structure of open sets in  $R^n$ , closed sets,

Accumulation points, Bolzano-Weierstrass Theorem, Cantor intersection theorem, Lindelof covering theorem. Heine-Borel Theorem, Compactness in  $R^n$ . Metric space, point-set topology in metric space, Boundary of a set.

2. Limits and continuity in metric space: Convergent sequences in a metric space. Cauchy sequence. Complete metric spaces, Limit of a function. Continuous function, Continuity and inverse images of

open and closed sets, Functions continuous on compact sets, Topological mappings. Bolzano's theorem, connectedness.

3. Discontinuities of real-valued functions: Monotonic functions. Functions of bounded variation. Total variation.

#### Compulsory Course 4: Economic Development I

1. Introduction
2. Technological Dualism
3. Financial Dualism
4. Contractual Relations in Agriculture:
5. Industrial Development
6. Growth. Distribution and Employment
7. Inequality and Poverty
8. International Economy and Economic Development

#### Compulsory Course 5(a): Mathematical Methods in Economics

##### A. Linear Algebra

Vector in  $R^n$ . Simple operations. Vector spaces in  $R^n$ . Spanning set. Linear dependence and independence. Basis and finite-dimensional vector space, Dimension of finite-dimensional vector space. Extension of a linear independent set to a basis, subspace and its dimension. Norm and inner product. Orthogonality. GramSchmidt process. Orthogonal basis. Projection of a vector on a sub-space. Matrix. Row-space and column-space. Nullity. Rank. Singular and nonsingular matrices. Inversion of a matrix. Idempotent Matrix. Orthogonal Projection. Numerical solution. Linear equations: homogeneous and non-homogeneous.

##### B. Advanced Calculus: Functions of Several Variables

1. Sequences and convergence. Closed and open sets. Limit points.
2. Functions of several independent variables. Geometry.
3. Continuity
4. Partial derivatives; change in the order of differentiation.
5. Differential and its geometric meaning.
6. Mean-Value Theorem and Taylor's Theorem.
7. Integrals of a function depending on a parameter continuity and differentiability. Interchange of Integrals.

#### C. OPTIMIZATION

Lagrange method of multipliers. Maxima and Minima of several variables. Elements of linear programming.

Compulsory Course 5(b): Optimization Techniques.

1. Convex sets; Separation theorems for convex sets.
2. Lagrange method of multipliers. Maxima and minima of functions of several variables.
3. Elements of linear programming. Convex programming. Dynamic programming. Applications.
4. Partial derivatives; change in the order of differentiation.
5. Differential and its geometric meaning.
6. Mean-value theorem and Taylor's Theorem.
7. Integrals of a function depending on a parameter- continuity and differentiability. Interchange of integrals.

## Compulsory Course 6: Microeconomic Theory II

1. Equilibrium with Many Commodities and Agents Equilibrium of exchange : the working of the model; relatedness of

goods; complementarity and substitutability-stability on comparative statics vs dynamic stability and the correspondence

principle.

Equilibrium with production : relatedness of goods and factors; stability and comparative statistics with production.

Process of factors and goods in general equilibrium under constant returns to scale : the non-substitution theorem and the factor price equalization theorem: the production frontier.

2. Existence of a General Equilibrium Pure exchange model. The model with production.

3. General Equilibrium and Welfare. Welfare functions. Social choice and aggregation of individual objectives. The Pareto ranking and the fundamental theorem of welfare economics. Theory of the core of an economy. Market failures.

4. General Equilibrium with Public Goods External effects. Collective consumption. Lindahl equilibrium.

5. Introduction to non-Walrasian Equilibrium Dreze equilibrium. Benassy equilibrium. Malinvaud-Yonnes

equilibrium. Equivalences between the different types of non-Walrasian equilibria. Efficiency of non-Walrasian equilibrium.

## Compulsory Course 7: Macroeconomic Theory II

1. Microeconomic foundations of Macroeconomics - contributions of the disequilibrium theorists :

The Hicks Patinkin theory: full employment and involuntary unemployment in Patinkin's model. Clower's critique of the Hicks- Patinkin theory: notional demand, effective demand and non-Walrasian equilibrium - Classical and Keynesian unemployment in a non-Walrasian framework. Asymmetric price flexibility and effectiveness of employment policies. Role of money in the disequilibrium framework.

2. Microeconomic foundations of macroeconomics - contributions of the non classical school. The basic market clearing model, Money, inflation and interest rates in the market clearing model. The labour market, investment and economic growth. Government behaviour - taxes, transfers and the public debt, Money and business fluctuations - the market clearing model with incomplete information. rational expectation and the new approach to stabilization policy.

3. Special Topics Overlapping generations model and money, contract theory of price rigidity and unemployment, theory of government policy, recent developments in the analysis of the problem of balance of payments, inflation and unemployment.

#### Compulsory Course 8(a): Statistics II

1. Multivariate data: Covariance matrix. Multiple linear regression. partial correlation. Multiple correlation.

2. Multivariate distributions : Continuous and discrete conditional and marginal. Independence, Expectation and conditional expectation, Moments, Regressions. Partial and multiple correlations. Multivariate normal distribution - description and properties. Joint probability distribution of random variables. Order Statistics. Chebyshev's inequality, WLLN, CLT.

3. Random sampling : Techniques of drawing random sampling; Theory and methods of stratified sampling, systematic sampling, varying probability sampling, multistage sampling and ratio estimation methods; related sampling distribution by simulation.

4. Point Estimation Finite population : Estimation of mean and proportion. Standard error. Estimation of parameters in standard univariate distribution. Statistic, estimator, MSE, unbiasedness, consistency, Sufficiency. Method of moments, LSE, MLE, Computations. Illustrations, Comparison of estimators, Cramer-Rao inequality.

5. Interval Estimation : Introduction. Illustrations with standard distribution. Criteria for goodness - Simulation. Confidence interval for median. Large-sample approximation.

#### Compulsory Course 8(b): Advanced Statistics

Time-series Analysis: Discrete-parameter stochastic processes; strong and weak stationarity; autocovariance and

autocorrelation. Moving average (MA), autoregressive (AR), autoregressive moving average (ARMA) and autoregressive

integrated moving average (ARIMA) processes. Box-Jenkins models. Estimation of the parameters in ARIMA models;

forecasting. Residuals and diagnostic checking. Use of computer packages. Spectral analysis of weakly stationary

processes. Periodogram and correlogram analysis; fast Fourier transforms

### Compulsory Course 9(a): Statistics III, Computer Programming and Applications

#### Computer Programming - (First half of the semester)

1. Computer Organisation : Hardware : Memory; control unit; arithmetic logic unit; input and output devices; number system; internal representation of numbers and characters; machine language. Software : Higher level language: compiler; assembler; operating system; editor.

2. Programming in a high level language (FORTRAN/C etc.) : Flow charts: constants and variables; arithmetic operators; string

operators; logical operators; relational operators; arithmetic and logical expressions,; input and output statements, type

specification and storage location allocation control statements;

subprogramme, files.

3. Numerical/Statistical applications, random number generation

4. Numerical/Econometric/Statistical packages :

#### Statistics III (second half of the semester)

1. Tests of Statistical Hypotheses: Statistical Hypotheses, Type I and Type II errors, level and size, p-value, randomized test, power. Illustration with binomial distribution. Sign test.

Normal distribution - one-population and two-population problems. One way classified data. F-Test. Unbiasedness. Computation of Power. Distribution of  $\bar{X}$  and  $S^2$ . Tests for correlation. Tests for regression coefficients. Tests for parameters in  $N_2$ .



2. Large-sample tests for means, proportions etc. Chi-Square test of goodness of fit. Test of homogeneity. Test for independence.

#### Compulsory Course 9(b): Advanced Computer Programming

1. Programming in PASCAL/C Concept of data, program heading, label declaration, constant definition, type definition, variable declaration, procedure and function declaration. Assignment statement, compound statement, repetitive statement,

conditional statement, unconditional jump statement, Data types - scalar and subrange, structured types - array, record, set file. pointer.

2. Procedures and function : Input and Output Statements.

3. Data structures : (The course will consist of 5 hours on the terminal per week and 50 lecture hours)

#### Compulsory Course 10: Econometric Theory I

1. Estimation of parameters of multivariate normal distribution and principal components analysis.

2(a) The Nature of Econometrics.

2(b) Review of classical Least Squares Regression Analysis: point and interval estimation and tests of hypotheses involving regression coefficients;  $R^2$  and adjusted  $R^2$  ; prediction : non-linear relationships; Use of dummy variables; multicollinearity - consequences and use of extraneous information; specification errors : ML estimation and asymptotic results.

2(c) Generalized LS Theory: Detection and handling of heteroscedasticity (Glesjer test and Goldfeld-Quandt test) and autocorrelation of disturbances (AR(1), error process only): DW statistic and Von Neuman ratio (BLUS and recursive residuals ) ; properties of OLS estimators under non-spherical disturbances; prediction.

2(d) Stochastic Regressors; (i) case where X and epsilon are fully independent; (ii) case where X and epsilon are contemporaneously uncorrelated; uses of lagged independent variables; distributed lags; use of lagged dependent variables with/without autocorrelated disturbances; time series methods; (iii) case where X and epsilon are contemporaneously correlated: (a) The errors in variables problems, IV estimation and grouping methods; (b) The problem of simultaneous equation systems - structural and reduced forms. Least squares bias, the problem of identification, rank and

order conditions for identifiability, use of restrictions on variances and covariances of disturbances; indirect least squares,

recursive systems and OLS, two-stage LS, K-class estimators. IV estimation, LIML/Least Variance Ratio estimation. Three-stage LS and FIML methods. Comparative merits of different estimators - asymptotic results, Monte Carlo studies. Prediction from estimated structural models.

### Compulsory Course 11: Econometric Applications I

1. Analysis of Income and Allied Size Distributions Pareto distribution, graphical test and fitting, universality of Pareto's

Law. Lognormal distribution-properties, graphical test and fitting, law of proportionate effect. Income inequality - notion

of economic inequality, Lorenz curve, Lorenz ratio and their properties, other common measures of inequality; poverty - concept and measurement.

2. Demand Analysis Demand function and elasticities of demand; Engel curve specification and estimation from budget data, treatment of demographic factors in Engel curve analysis. Demand function - specification and estimation from time-series data, methodological problems in estimation, dynamic factors in the analysis of demand for a single commodity.

3. Production Analysis: Production function - theoretical properties, elasticity of substitution: problems of estimation of a production function; Cobb-Douglas production function - methods and problems of estimation.

### Compulsory Course 12: Planning Techniques and Plan models

1. Introduction Concept of economic planning, planning techniques and plan models.

2. Linear Programming (LP) (i) Examples of LP problems; dual problems; some duality theorems. (ii) A review of relevant results in linear algebra, Simplex method and related theoretical results. Exercises, (iii) Use of LP model to solve resource allocation problem-decentralized planning, an outline of the Dantzig Wolfe algorithm as a decentralized planning technique.

3. Input-Output (IO) Analysis :(i) The Structure, (ii) The problem of viability, (iii) Uses of I/O model, (iv) Extensions of I/O

models - (a) Introduction of primary factors and feasibility approach, (b) Leontief model, (c) Introduction of joint products in an activity and also alternative activities for producing a given good.

4. Cost-Benefit Analysis(CBA) (i) Objectives of CBA : (ii) Identification and measurement of costs and benefits , (iii) Rate of interest for CBA; time preference for individual and for society: methods of discounting. Exercises on CBA.

5. Plan Models (i) Methodology of plan models. (ii) Macroeconomic growth models and their uses in planning: (a) the Harrod-Domar model -investment and growth; (b) investment capacity "the Feldman - Mahalanobis model.(iii) Multi-sector models: (a) general structure of such models, (b) selected multisector planning models.

Compulsory Course 13: Economic Development II (Indian Economics)

#### A. MACROISSUES

1. Development of the Indian Economy - an Overview
2. Unemployment, Urbanisation and Industrialization
3. Constraints on Growth
4. Level of Living and Poverty
5. Planning in a Mixed Economy
6. Economic Policies
7. Resource Mobilization
8. Balance of Payments
9. Monetary Policy

#### B. MICROISSUES

1. Agricultural Development
2. Industrial Development

### 3. Regional Disparities and Urbanization

Compulsory Course 14: Dissertation

[Back to the content page](#)

#### (B) SYLLABI FOR OPTIONAL COURSES:

##### Optional Course 1: Econometric Methods II

1. Inference in Linear Regression Model with Non-spherical Disturbances; Detection of Presence of heteroscedasticity in disturbances - Breusch Pagan - test. Ramsey's test, Szroeter's class of tests, White's test; estimation under alternatives specifications of heteroscedasticity: detection of presence of serial correlation in disturbances - Breush - Godfrey test and generalization of the Durbin-Watson test: estimation of models with MA(1) and ARMA(1,1) error processes.
2. Qualitative and Limited Dependent Variable Models; Linear probability model; probit and logit analysis; censored and truncated models; Heckman's and Amemiya's approaches to estimation of such models.
3. Specification Analysis: Types of misspecification and their consequences: Criteria for selection of a set of regressors  $R^2$  and adjusted  $R^2$ , Mallow's  $C_p$  Criterion, Amemiya's prediction criterion, Akaike's information criterion and Sawa's information criterion; non-linearity, transformation of variables and related econometric problems, estimation of models with Box-Cox transformation of variables, Hausman's general test of misspecification; tests for non-nested models.
4. Analysis of Panel Data: Alternative model specifications - models with varying intercepts and constant slope coefficient, dummy variable model and the error components model, the SUR models; and Swamy's random coefficient model; estimation of these models; Hildreth-Houck random coefficient models switching regression model and adaptive regression model.
5. Decision Theoretic and Other Types of Inferences in Linear Models: Alternative approaches to inference; decision-theoretic estimators; models with prior information - pretest estimator, James-Stein estimation ridge and adaptive ridge estimators; Boot-strap and Jackknife - resampling procedures and their applications in regression analysis.

6. Inferences in Nonlinear Statistical Models Introduction: estimation methods. computational methods - gradient methods, method of steepest descent; Newton-Raphson methods etc.

7. Introduction to Bayesian Econometrics Bayes' Theorem, prior probability density functions. point estimates of parameters, Bayesian intervals for parameters, point prediction, some large sample properties of Bayesian posterior

probability density functions.

#### Optional Course 2: Econometric Applications II

1. Income and Allied Size Distributions Stochastic models of income distribution- forms of income distribution and their properties. Measurement of economic inequality- positive and normative measures of relative inequality, Aitkinson-Kohm-Sen measure, significance of Lorenz curve in inequality comparison; problems of measurement and comparison of income inequality; Indian studies on income distribution, inequality and absolute poverty.

2. Demand Analysis Theoretical frame for demand analysis based on complete demand systems: alternative approaches to specification of complete static demand system: models of complete static demand systems and their properties - linear expenditure system. Rotterdam models. models based on generalized Gorman Polar form cost functions; method and problems of estimation of complete static demand system; dynamic demand models - sources of dynamism in consumer

behaviour; alternative approaches to specification of dynamic functions - Chow's model, Stone Rowe model, state adjustment model, properties and estimation methods for these models.

3. Production Analysis Review of production theory with special reference to the alternative approaches to representation of production technology and the properties of a production function including the elasticity of substitution: Cobb-Douglas production function - properties, specification, problem of identification and alternative estimation techniques; constant elasticity of substitution (CES) production function - properties and estimation techniques; treatment of technical progress in production analysis; aggregate production functions: general problems of production analysis with particular reference to the problems of choice of form, choice of variables, problem of aggregation and measurement of variables and interpretation.

4. Application of Econometrics to Macro-economic Problems Macro econometric models - econometric issues in the specification and estimation: illustrative application; uses in forecasting and policy evaluation.

#### Optional Course 3: Time Series Analysis and Forecasting

Time series as a realization of stochastic process. Stationarity and strict stationarity. White noise, test of randomness.

Estimation and elimination of trend and seasonal components. Autocovariance function and their estimation. AR, MA and ARMA processes their properties, conditions for stationarity, invertibility, Autocovariance function and partial

autocovariance function, ARIMA processes. Identification, estimation and diagnostic checks; order selection; Seasonal ARIMA processes. Prediction -Minimum MSE forecasts, including standard errors. stepwise autoregression. Exponential smoothing and its variants. Optimality of exponential smoothing. Combination of forecasts. Comparative merits of different techniques. Transfer function models - construction and use. Asymptotic properties of maximum likelihood and least squares estimators. confidence intervals. Multivariate time series models. Threshold models, Elements of spectral analysis - estimation and use. Use of computer packages for time series analysis.

#### Optional Course 4: Sample Survey: Theory and Practice

1. Introductions: Need of sample surveys. Sampling versus complete enumeration. Merit of random sampling. Random sampling number. and their uses for random sampling. pps selection by Lahiri's method and using map frames.

2. Sampling Techniques Simple random sampling with/without replacement estimation with s.e.'s of population/domain totals/means, proportions etc. stratified srs allocation of sample size, gain due to stratification, construction of strata. linear and circular systematic sampling. pps and pps systematic sampling. Cluster sampling. Multi-stage sampling two-stage simple random sampling, choice of sample sizes. Composite sampling designs; self-weighting designs:

interpenetrating sub-samples. Ratio estimators-bias. use etc. Regression estimators, Double sampling: sampling on successive occasions.

3. Planning and Conduct of Sample Surveys Statement of objectives: choice of method of data collection; questionnaire designing: choice of reference period and handling of seasonality; choice of sampling frame and sampling design:

pilot surveys: cost and variance functions; field work and supervision; data editing and processing.

4. Non-sampling Errors: Measurement and control: coverage errors; nonresponse and response errors: Post-enumeration surveys and reinterviews: external (record) checks; consistency checks; use of interpenetrating samples etc.

## 5. Experience of Indian Surveys on Selected Topics

### Optional Course 5: Bayesian Econometrics

1. Principles of Bayesian Analysis
2. The Simple Univariate Normal Linear Regression Model
3. Analysis of Single Equation Nonlinear Models
4. Multivariate Regression Models
5. Comparison and Testing of Hypothesis
6. Simultaneous Equations Econometric Models

### Optional Course 6: Intertemporal Economics

1. A Model of Intertemporal Accumulation The General multisector growth model, drawn from Von-Neumann-Malinvaud, Feasible programmes, Properties of the set of feasible programmes.
2. Efficient Consumption Programs Characterizations of efficiency in aggregative and multisectoral models, efficiency and present value maximization.
3. Optimal Consumption Programs Optimality criteria in discounted and undiscounted models, Existence of optimal programs.
4. Selected Topics Exhaust resources, Consistent planning and dynamic games, Irreversible investment, Overlapping generations models, Temporary equilibria.

### Optional Course 7: Game Theory and Applications

1. Noncooperative Games Games in normal form. Nash equilibrium and standard concepts, Applications of static games to economics, Games in extensive form. A refinement of Nash equilibrium: subgame perfection. Applications of extensive games. Other refinements. Applications to economic situations with incomplete information. Repeated games

and applications.

2. Cooperative Games Games in characteristic function form. Various solution concepts: core, bargaining set, Shapley value, etc. Application to economics.

#### Optional Course 8: Theory of Planning

1. Political Economy of the State, Alternative Viewpoints

2. Modelling Government Behaviour Rational choice models, median voter model, legislatures and special interest groups; bureaucracy models.

3. Planning Models Centralized planning: informationally decentralized planning processes: Lange-Lerner, MDP procedures: Team Theory.

4. Incentives within the Public Sector Performance Incentives for managers, decentralized organisation of production, multidivisional firms, cost centres and profit centres, cost allocation transfer pricing, labour policies: Soviet and East European firms.

5. Cost-Benefit Analysis

6. Pricing Public Sector Outputs Marginal cost and average cost pricing, peak load pricing, priority pricing.

#### Optional Course 9: Industrial Organisation

1. Structure-Conduct Performance Paradigm

2. Static Oligopoly Models Homogeneous goods-Cournot and Bertrand models: differentiated products - horizontal and vertical differentiation: models with free entry contestable markets. Cournot and price setting models with free entry.

3. Dynamic Oligopoly models Entry deterrence, limit pricing, attrition and reputation models, collusion and cartels.

4. R & D and Adaption of Technology Private vs. social incentives for R & D models of adoption. diffusion and transfer of technology.

5. Mergers and Takeovers Firm size and vertical integration, corporate finance.



6. Regulation of Monopolies Rate of return regulation, regulation of firms with unknown costs/demands.

7. Multinational Firms

#### Optional Course 10: Social Accounting

1. The Economic Process and Various Concepts
2. System of Social/National Accounts
3. National Accounts and Various Estimates
4. 'Real' Gross Domestic Product/'real' National Income
5. Estimation of National Income in India
6. Preparation of an Input-output (IO) Table,

#### Optional Course 11: Agricultural Economics

##### Part I : Theory

1. Price and income elasticities of demand for agricultural commodities, factors affecting demand for agricultural

commodities with particular reference to developing economies.

2. Characteristics of the supply function for agricultural commodities - output response in periods of rising prices - lags

in adjustment and the cobweb model -price responsiveness of market supply.

3. Agricultural price policies: aims of price policy - types of price policy - theoretical analysis of price support and its

applicability.

## Part II Issues in Indian Agriculture

1. Growth & fluctuations in Indian agriculture since independence.
2. Farm efficiency.
3. The New Agricultural Technology.
4. Behaviour of marketed/marketable surplus of foodgrains.
5. Rural employment.
6. Relations of production.

## Optional Course 12: Public Economics

1. Welfare Objectives of the State : Interpersonal utility comparisons; incentives and mechanism design; Gibbard

Satterthwaite theorem. Groves scheme for public goods.

2. Consumer Surplus & Deadweight Loss, Tax incidence. (Harberger)
3. Optimal Taxation and Public Production
4. Dynamics : incidence and efficiency analysis of taxes.
5. Tax Evasion
6. Imperfect Competition and Optimal Fiscal Policies.
7. Controlling Externalities: second-best theory and optimal taxes.
8. Procurement Policies : incentive contracts and auction theory.

## Optional Course 13: Regional Economics

1. Introduction to Regional Planning
2. Review of the Indian Situation

3. Concepts and Techniques Used in Regional Planning
4. Regional Decisionmaking and Regional Balances
5. Functional Spatial Configuration and Regional Synthesis

#### Optional Course 14: International Economics I

1. The Basic Exchange Model: Stability and comparative statics - immiserizing growth, transfer problem.
2. Ricardian Trade Theory - comparative advantage with many goods and many countries - neo-Ricardian trade theory.
3. Neo-classical Models of Trade - The Heckscher - Ohlin - Samuelson model and the specific factor model.
4. Theory of Commercial Policy - tariffs, taxes and quantitative restrictions.
5. Imperfect Competition and International Trade
6. International Trade and Economic Development

#### Optional Course 15: International Economics II

1. Introduction to balance of payments
2. Different approaches to the problem of balance of payments adjustments.
3. Exchange Rate Regimes - fixed exchange rate. flexible exchange rate.
4. Forward Markets. spot markets and the efficient market hypothesis of exchange rate determination.
5. Selected Topics - The Quershooting hypothesis, components of the current account and the exchange rate. international transmission of economic disturbances.

#### Optional Course 16: Mathematical Programming with Applications to Economics

1. Static Problems Quadratic Programming - Wolfe's algorithm, optimization problems with large variance in returns.

Nonlinear Programming Methods - Frank-Wolfe method, gradient method, resource allocation problems. Stochastic Linear programming

2. Dynamic Problems Calculus of Variations - Euler Equation, first and second order conditions for fixed and end point problems, free horizon and transversity condition. Optimal Control Theory-The Pontryagin Maximal Principle,

applications to production planning, growth and investment. Dynamic Programming- Principle of optimality, application of optimal growth problems, Stochastic Dynamic Programming - Application to asset price, investment under uncertainty.

#### Optional Course 17: Monetary Economics

Transaction, Precautionary and speculative demands for money, Money in a overlapping generation model, General equilibrium Baumol-Tobin Model, Cash-in-advance model, Currency and Credit with long lived agents in overlapping generations, Monetary policy (non-)neutrality, Money, inflation and stability, Money vs. interest rate targetting.

#### Optional Course 18: History of Economic Thought

Part I. Overview of the Subject and Time-frame of Reference "Beginning" of the subject in the concept of "circular flow" -

idea of "social accounting"; the mercantilist background - common and distinct analytical features of the "reaction" against

mercantilism in Adam Smith and Quesnay ; theoretical structure of classical economics - division of labour and exchange, wage, rent and profit, the Ricardian system; Marx- the wider perspective, surplus value; abandonment of classical framework of the "turning point" in the history of economic thought - common and distinct analytical features of the "reaction" against classical economics in Jevons, Menger and Walras, the second generation marginalists, birth of "welfare economics", "perfect" and "imperfect competition", "effective demand"; review of the theoretical structure of contemporary economics - micro and macroeconomics; short vs long run; economic theory and econometrics.

Part II. Major Thematic Developments Social Accounting: Physiocracy - breaking through the "circular flow", the concept of "product net", the physiocratic system as a whole; classical economics - departures from physiocracy, distinguishing the "physical" and the "value" approaches to the problem, developments in each approach, the problem of "services" - contribution of Mill and Senior; neoclassical economics - subjectivist redefinition of the concept of production, national

income accounting and related systems. Price formation: Classical (Smith) - natural vs market price, the problem of "rent"; neoclassical (Marshall) - "firm theory", market morphology and the benchmark of "perfect competition", short vs long run and fixed vs variable costs, further developments - doctrines of imperfect competition; modern (Kalecki and others) - theories of producer pricing. Macro Modelling : Quesnay : Tableau Economique; Ricardo : Distribution through time; Marx : Theories of crises; Keynes, Kalecki and genesis and morphology of macro-models of business cycles/ growth/ distribution/ development. Welfare Economics : Origin and evolution of the concept of "utility"; Marshall and the Cambridge tradition; Paretian welfare economics; Social welfare function. General equilibrium : Walras; the problem of "existence" and the development of mathematical economics; tatonnement, non-tatonnement and the problem of "stability"; feedback from "general equilibrium" to "macro modelling" - multisector models of von Neuman, Leontief and Sraffa. Developments in Money- Banking, Public Finance and International Trade.

#### Optional Course 19: Macrodynamics

Traditional Growth Models : Bounds on long term growth rates, technological progress and unbounded growth, predictive contents of the models. The Convergence Question and The Need for an Endogenous Theory of Growth : Early results on endogenous growth - market failures, new growth theory models and alternative channels for endogenizing growth - technology (physical capital, product innovation, human capital), population growth (fertility), government policy.

Growth in an Open Economy.

#### Optional Course 20: Social Choice and Political Economy

1. Classical Aggregation Theory: Arrow's theorem, Harsanyi's theorem, aggregation with rich informational structures.

2. Classical Voting Theory : The Gibbard - Satterthwaite theorem, results on restricted domains, the median voter result, stochastic outcome functions. The Theory of Implementation in Complete and Incomplete Information Settings.

The Theory of Elections, Legislatures and Agenda Control.

3. The Theory of Interest Groups : Lobbying, bureaucracies, endogenous coalition formation. Models of Corruption.

Optional Course 21: Incentives and Organizations

1. Theory of Incentives : Adverse selection, moral hazard, multiple agents, contract dynamics.

2. Organization Theory : Team theory, message space size, costly information processing models.

3. Incentive-based Approaches : Supervision, managerial slack, limited commitment.

4. Applications to the Theory of the Firm : Decentralisation, hierarchies, transfer pricing, managerial compensation, cost allocation.

Optional Course 22: Privatization and Regulation

Regulation of competition; externalities and natural monopolies; vertical integration; mergers and takeovers; bureaucracies and corruption. Public Sector Performance in India and Other Developing Countries. Privatisation : Theory and experiences.

Optional Course 23: Environmental and Resource Economics

Externalities; model of resource depletion; exhaustible and renewable resources; irreversibility and uncertainty; common property; the charges and standard approach in environment regulation; direct control and taxes; contingent valuation and other approaches to non-market valuation.

Optional Course 24: Theory of Finance I

Preference Representation Under Uncertainty. Stochastic Dominance. Measures of Risk. Portfolio Frontier. Value aximisation and the Separation Theorem. CAPM. Valuation of Security. Asymmetric Information and Efficiency.

## Optional Course 25: Theory of Finance II

Modigliani-Miller Theorem. Agency Costs and Management. Debt vs Equity. Corporate Law and Governance. Takeovers, Mergers, Acquisitions and Their Disciplinary Impact on Opportunistic Behaviour. Value of Large vs Small Share Holders. Financial Institutions and the Market for Corporate Control.

## Optional Course 26: Political Economy and Comparative System

1. Classical Political Economy : Crystallisation of the concept of "social structure" in the concept of "class"- class division and boundary of production ("productive" vs "unproductive" class/labour) in Quesnay and Smith, the systems of social accounting, policy aspects - reaction against "mercantilism"; theoretical structure of classical

political economy- value, distribution and accumulations, the Ricardian system, the post Ricardian scene : emergence of "socialist" doctrines.

2. Marxian Political Economy : The broader perspectives and view of history - "modes of production" (feudalism, capitalism and socialism); the political economy of capitalism - surplus value, theories of crises.

3. Further Developments in the Political Economy of Capitalism :

Developments within a "class" framework - Kalecki's theory of effective demand and business cycles; abandoning the "class" framework or the turning point in the history of economic thought - birth of "welfare economics", "competition" and "monopoly", Keynes' theory of effective demand and its link up with the theory of growth.

4. Political Economy of Socialism : Doctrines and experiences.

5. Political Economy of LDCs : The intrinsic heterogeneity and amorphousness of LDCs, the "goal" of development and role of "governments" - the "mixed" economy, economic development in a historical perspective - the concept of "dual economy", global perspectives.

[Back to the content page](#)