

St. Joseph's College of Commerce

(Autonomous)

163, Brigade Road, Bengaluru - 560 025

Accredited with 'A++' Grade (4th Cycle) by the National
Assessment and Accreditation Council (NAAC)

Recognized by the UGC as
"COLLEGE WITH POTENTIAL FOR EXCELLENCE"



B.Sc. (Economics, Mathematics, and Data Analytics)

Semester I and II

*Syllabus as per State Education Policy 2024
Curriculum Framework w.e.f., 2024-2025*

**Academic Year 2024 - 2025
Batch 2024**

SEP CREDIT MATRIX – Academic Year 2024-25

BSc (ECONOMICS, MATHEMATICS AND DATA ANALYTICS)							
Category/Semester	I	II	III	IV	V	VI	Total Credits
PART A: LANGUAGES							
Languages 4 Hrs - 3 Crs	Lang I	Lang I	Lang I	Lang I	-	-	
	Lang II	Lang II	Lang II	Lang II	-	-	
Part A Credits	6	6	6	6			24
PART B: DISCIPLINE-SPECIFIC CORE & ELECTIVE COURSES							
Major Core ECONOMICS (5 Crs)	Micro economics 5 Crs	Macro economics 5 Crs	Basic Econometric s5 Crs	Financial economic s 5 Crs	1. International Economics 2. Economics of Growth and Development	1. Environmental Economics 2. Behavioural Economics	
Major Core MATHEMATICS (5 Crs)	Fundamentals of Applied Maths 5 Crs	Linear Algebra 5 Crs	Advances applied mathematics 5 Crs	Numerical Methods 5 Crs			
Major Core 3 DATA ANALYTICS (3Crs)	Descriptive Statistics and MS Excel 3 Crs	Advanced Statistics 3 Crs	Advanced-Data Analytics 3 Crs	Introduction to Machine Learning 3 Crs			
Major Core Practical 3 DATA ANALYTICS PRACTICAL (2Crs)	MS Excel 2 cr	Advanced Statistics using R Programming 2 cr	Advanced-Data Analytics using R programming 2 Crs	Machine Learning Using Python 2 cr			

Major Electives					Electives	Electives	
Part B Credits	15	15	15	15	20	20	80
PART C: SKILL ENHANCEMENT COURSES/ACTIVITIES							
Skill Based Courses	Indian Economy (2 Crs)	Applied Mathematics I Economics (2Crs)	Field Project (2Crs)	SEC (2Crs)	SEC (2Crs)	SEC (2Crs)	
					Research Methodology (3Crs)	Internship (2 Crs)	
						Research Project (2Crs)	
Value-Based Activities		Extra-Curricular Activities 1 Cr	-	Extra-Curricular Activities 1 Cr	-	Extension Activities 1 Cr	
Part C Credits	2	3	2	3	4	7	21
PART D: COMPULSORY COURSES							
Foundation Courses	Constitutional Values I 2 Crs	Constitutional Values II 2 Crs	-	-	-	-	
	Psychological Wellbeing 1 Cr						
Part D Credits	3	2					5
Total Credits	26	26	23	24	24	27	150

B. Sc. - Economics, Mathematics and Data Analytics Programme

PROGRAMM STRUCTURE CORE SUBJECTS SEMESTER - I

Course Code	Title of the Course	Category	Lecture Hours per week	Credits	CIA	ESE	Marks
S1 24 MC 101	Microeconomics	Major Core	5	5	20	80	100
S1 24 MC 102	Fundamentals of Applied Maths	Major Core	5	5	20	80	100
S1 24 MCT 103 S1 24 MCP 103	Descriptive Statistics	Major Core	3	3	20	80	100
	Descriptive Statistics using Excel	Major Core (Practical)	4	2		50	50
S1 24 SE 101	Indian Economy	Skill Enhancement	2	2	20	30	50
S1 24 GE 101	General English	Language	3	3	20	80	100
	Language 2	Language	3	3	20	80	100
S1 24 KN 101	Kannada						
S1 24 HN 101	Hindi						
S1 24 AE 101	Additional English						
UG 24 CC 101	Psychological wellbeing	Compulsory course	1	1		25	25
UG 24 CC 102	Constitutional Values I	Compulsory course	2	2		50	50
Total credits				26	120	555	675

SEMESTER II

Course Code	Title of the Course	Category	Lecture Hours per week	Credits	CIA	ESE	Marks
S1 24 MC 201	Macro Economics	Major Core	5	5	20	80	100
S1 24 MC 202	Linear Algebra	Major Core	5	5	20	80	100
S1 24 MCT 203	Advanced Statistics	Major Core	3	3	20	80	100
S1 24 MCP 203	Advanced Statistics using R Programming	Major Core Practical	4	2	-	50	50
S1 24 SE 201	Applied Mathematical Economics	Skill Enhancement	2	2	20	30	50
	Language 1						
S1 24 GE 201	General English	Language	3	3	20	80	100
	Language 2		3	3	20	80	
S1 24 KN 201	Kannada	Language					100
S1 24 HN 201	Hindi						
S1 24 AE 201	Additional English						
UG 24 CC 201	Constitutional Values II	Compulsory course	2	2		25	50
UG 24 VB 202	Extra-Curricular activities	Value Added Activity	1	1		50	25
Total credits				26	120	555	675

SEMESTER - I

S1 24 MC 101: MICROECONOMICS

COURSE OBJECTIVES

The course is designed to acquaint the students with the basic concepts of microeconomics which form the base of modern economics. The course help the student understand the functioning of the economy at the individual level.

Module 1 - Introduction to Economics 10 hrs

Introduction to Economics: Nature and scope of economics, Basic Concepts in economics, Importance of study of Economics, Understanding the economy, Mankiw's ten principles of economics.

Module 2 - Approaches to Consumer Behaviour 15 hrs

Cardinal Analysis: Utility: Law of diminishing marginal utility, equi marginal utility, consumer's equilibrium, Consumer surplus and its - application. Ordinal analysis: Meaning of Indifference curves - Indifference Schedule, Indifference Map, properties of Indifference curves Budget line - Equilibrium position, Income, Price, and substitution effects through **Hicks and Slutsky's Method**-inferior goods v/s Giffen goods, Samuelson's revealed preference theory, **Choice under risk and uncertainty.**

Module 3 - Demand Analysis 10 hrs

Meaning and Determinants of Demand, the Demand Schedule, The Law of Demand, Exceptions to the Law of Demand, Elasticity of Demand: Meaning- Types: Price, Income and Cross Elasticity, Measurement of Elasticity of Demand. Supply: Concept of Supply, the Law of Supply, and Determinants of Supply.

Module 4 - Production Analysis 15 hrs

Production Function Production Function - The Law of Variable Proportion - the Law of Returns to Scale -**Isocost- Isoquant Approach**- Least cost combination of Inputs

Module 5 - Cost Analysis 5 hrs

Cost Concepts, Cost output relationship in the short - run and long - run - Relationship between Short run and long run curves, Relationship between Average Cost and Marginal Cost

Module 6 - Market Competition 20 hrs

Concepts of Revenue: Total, Average and Marginal Revenue Curve
- Price and Output determination under different markets: Meaning and features of perfect competitive market, Monopoly, Monopolistic competition and oligopoly, Price, and Output determination under these markets. **(in depth)**

SKILL DEVELOPMENT

(These activities are only indicative, and the faculty member can innovate)

1. Understand how economic concepts are applicable to everyday life by taking live examples.
2. Conduct a small survey to understand how consumer behaviour has evolved during the pandemic.
3. Choose a particular firm or industry and study the demand forecasting techniques.
4. Analyse different companies and identify which market competition they fall into.
5. Study the price fluctuations in the market due to changes in demand and supply.

COURSE OUTCOMES:

After the completion of the course, students will be able to:

1. Analyse the economic behaviour of the consumer and the firm
2. Explain the relationship between various variables such as Input and output, cost and output, price of the product and quantity demand and so on
3. Product and Factor pricing under different market structure

Books for Reference

1. Ahuja H.L, Advanced Economic Theory, S. Chand and Company, New Delhi
2. Koutsoyiannis A, Modern Microeconomics, Macmillan, London
3. Dominick Salvatore, Theory and Problems of Microeconomic Theory, Schaum's Outline Series, McGraw-Hill Book Company, Singapore
4. Ferguson C.E and Maurice S. Charles, Economic Analysis-Theory and Applications, Richard D. Irwin Inc. USA
5. Hubbard R. Glenn and Anthony Patrick O Brien, Microeconomics, Pearson Prentice Hall, New Jersey
6. Pindyck Robert S., and Daniel L. Rubinfeld, Microeconomics, Pearson Prentice Hall, New Jersey
7. Varian, H. R., "Intermediate Microeconomics: A Modern Approach", W. W. Norton and Company

S1 24 MC 102: FUNDAMENTALS OF APPLIED MATHEMATICS

COURSE OBJECTIVES:

This aims to provide students with a firm grasp of key matrix algebra, differential and integral calculus, and mathematical modelling. Through theoretical learning and practical applications, students will develop essential problem-solving skills relevant to mathematical analysis in addressing real-world problems.

Module - 1: Sets and functions 12 hrs

Definition of sets, set notation, types of sets, set operations (union, intersection, and difference), laws of set operations, Venn diagram and applications. Relations and Functions: ordered pairs, definition of a relation and examples, definition of a function, domain, codomain and range of a function, and types of functions (one to one, onto, many to one, and bijective) with examples. Algebraic functions -constant function, polynomial functions, rational functions and non - algebraic functions.

Module 2: Matrices, Determinants and Applications 15 Hrs.

Definition of matrix, order, Types of matrices, Determinant: Value of determinant of order 2×2 and 3×3 , adjoint, row operations, inverse using formula method and row operations (2×2 and 3×3 matrices only). System of linear equations, augmented matrix, row operations, row echelon form, reduced row echelon form, existence and uniqueness of the solution, Gauss -Elimination method, Cramer's and matrix methods (2×2 and 3×3 matrices only).

Applications - Linear systems: Investment Problems, Traffic Flow, and Balancing the Chemical equations, and data encryption and decryption using a matrix and its inverse.

Module - 3: Differential Calculus 15 hrs

Functions, Limits and Continuity, Derivative of a function (concepts only), derivatives of the standard functions (excluding trigonometric functions), Rules of Differentiation: addition/subtraction, scalar multiplication, product, quotient, chain, Partial Derivatives, Maxima and Minima, and Lagrangian Multiplier-Constrained Optimization.

Applications: Cost minimization and Revenue and Profit maximization, Break Even Point, Marginal Cost, Marginal Revenue, and price elasticity of demand.

Module - 4: Integral Calculus 15 hrs

Introduction, Indefinite Integration, Standard Integrals (excluding trigonometric functions), Rules of Integration: addition/subtraction and scalar multiplication, Integration by Substitution, Integration by Parts, Integration by resolving into Partial Fractions.

Applications of Integration in business (finding cost, revenue functions from marginal cost and marginal revenue functions)

Module - 5: Differential Equations 8 Hrs

Definition of differential equation, first and second order linear homogenous ordinary

differential equation with constant coefficients and its solution.

Module -6: Mathematical modelling using differential equations 10 hrs

Definition of Mathematical modelling, Applications: Radioactive Decay, Logistic growth (fishery, rabbits' population, piggery etc.), and Exponential Growth (continuous compounding of an invested amount)

SKILL DEVELOPMENT

1. Visualization of solution or roots of algebraic functions and discussion of nature of the roots
2. To solve and visual system of linear equations with 3 variables on GeoGebra website (Math visualizer platform)
3. Visualization of maxima and minima of single and multivariable functions(optimization) through function plotting software.
4. Visualization of the solution of the differential equations.

COURSE OUTCOMES:

After the completion of the course, students will be able to:

1. Understand the basic concepts of sets, relations, and functions.
2. Perform operations in matrix algebra and solve system of equations of real-world problems.
3. Differentiate and optimize the function of single and multiple independent variables.
4. Integrate functions with single independent variable.
5. Solve first and second order linear ordinary homogenous differential equations.
6. Model and solve differential equations governing real world problems.

Books for Reference

1. P. N. Arora & S. Arora: Mathematics
2. Lay, D. C., Lay, S. R., & McDonald, J. J, Linear algebra, and its applications
3. Pugh, C. C, Real mathematical analysis
4. Fitzpatrick, P. M., Advanced calculus
5. D.R. Agarwal: Comprehensive Mathematics
6. Anand Sharma: Business Mathematics & Analytics
7. Ajay Goel & Alka Goel: Mathematics & Statistics
8. Robert R. Stall: Linear Algebra & Matrix Theory

S1 24 MC 103: DESCRIPTIVE STATISTICS AND EXCEL

COURSE OBJECTIVES

This aims to provide students with a firm grasp of basic statistical concepts. Through theoretical learning and practical applications, students will develop an essential problem-solving skill relevant to statistics and real-world data analysis and interpretation, with a focus on applications in various fields and master excel functions for precise data manipulation. Develop proficiency in data visualization through charts and graphs for clear communication of insights. Gain expertise in dashboard development for representation of dynamic systems.

Module 1: Introduction to Statistics 15 Hrs.

Definition of Statistics, Scope and Limitations, Ethics to be followed by a statistician and role of statistics in sustainable development. Data- Meaning, Collection methods, and sampling techniques, Variables and Attributes - Discrete and Continuous Variables, Classification of data based on the nature of the variable and the source of collection, Formation of Statistical Series, Frequency Distribution (univariate and bivariate) and Tabulation. Diagrams and Graphs: Line, Bar diagrams and Pie chart, Ogives, Histogram, Frequency Curve and Polygon.

Module 2: Measures of Central Tendency and Dispersion 15 Hrs.

Meaning of Central Tendency, Arithmetic Mean (Simple, Weighted and Combined), Median, Mode, Empirical relationship, Quartiles, Deciles, Percentiles (applications, importance, merits, and demerits). Definition of Dispersion, Importance of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation, and their coefficients, (applications, importance, merits, and demerits).

Module 3: Skewness and Kurtosis 10 Hrs.

Definition of Skewness, Measures of Skewness: Karl Pearson's and Bowley's Coefficient of Skewness, Moments (about mean and arbitrary point), Coefficient of Skewness based on Moments. Definition of Kurtosis, Measure of Kurtosis, and Coefficient of Kurtosis based on Moments.

Module 4: Correlation & Simple Linear Regression Analysis 15 Hrs

Correlation: definition, scatter diagram, levels of correlation, Karl Pearson's Coefficient of Correlation (Direct method only), probable error and confidence interval, and Spearman's Correlation Coefficient (unique and repeated ranks) and applications. Meaning of Linear regression, general expression ($y = \beta_0 + \beta_1x + \epsilon$), types of simple linear regression equations, regression equation using method of least squares (direct method only), relationship between regression and correlation coefficients, and applications.

Module 5: Introduction to Excel 10 Hrs

Origin and Importance of Excel in Data Analysis, workbook, sheets: cells, columns, rows, ribbon and its components, table border and style, cell colour, text colour, range, formula bar and status bar, referencing: Relative, Absolute and Mixed, Mathematical operators and relations. Excel Functions - Mathematical Functions: SUM, AVERAGE, COUNT,

COUNTA, MIN/MAX, SQRT, POWER, LCM, COMBIN and PERMUT. String functions: LEN, LEFT, MID, RIGHT, CONCAT, TRIM, UPPER, LOWER, PROPER, Date Functions, Random number generators: RAND and RANDBETWEEN, Conditional functions: IF, NESTED IF, SUMIFS, COUNTIFS, and AVERAGEIFS, Data Handling Functions: VLOOKUP, HLOOKUP. Financial functions: PMT, PV, RATE, NPER.

Module 6 : Statistical Analysis using Excel 10 Hrs

Data Visualization: Bar charts, Column charts, Histogram, pie-chart, Line graphs, Sparklines, Scattered plot: linearity check and curve fitting, Chart elements and Chart designs. Interactive Dashboard Development: Pivot Table, Pivot Chart and Slicers. Measures of Central tendency: mean, median, mode, Dispersion: standard deviation, skewness and kurtosis, coefficient of correlation, simple linear regression, and estimation. What if Analysis: Goal Seek, Scenario manager, and Data table (one way and two way).

Skill Component:

Group Project: Utilizing Excel Tools for Analysis and Presentation of Insights.

The objective of this project is to employ the necessary Excel tools to analyse a given case study and extract valuable insights and presentation the same.

Course Outcomes:

After completion of the course, the students will be able to

1. Illustrate the significance of statistics in analysing business problems.
2. Use the concept of measures of central tendency and dispersion for decision making.
3. Apply the concept of Correlation and Regression to analyse the data.
4. Proficiently utilize Excel functions for precise data manipulation, enhancing analytical capabilities.
5. Demonstrate proficiency in data visualization through charts and graphs, and in statistical analysis, enabling clear communication of findings.

Books for Reference:

1. Gupta S.P., Statistical Methods, New Delhi, Sultan Chand & Sons.
2. J K Sharma - Business Statistics.
3. Akhilesh K. B. and Balasubrahmanyam S, Mathematics and statistics for Management, 1st Edition, Delhi, Vikas Publishing.
4. Winston, W. L., Microsoft Excel: Data Analysis & Business Model.
5. Lalwani, L., Excel All-In-One.
6. McFedries, P. Excel Formulas and Functions.
7. Alexander, M., & Walkenbach, J. Excel Dashboards and Reports.

UG 24 FC 101: PSYCHOLOGICAL WELL-BEING

COURSE OBJECTIVE

This course aims to nurture self-awareness and meaningful relationship skills and to help in the development of emotional quotient and inter-personal skills.

Module 1 - Introduction 3 Hrs.

Meaning of counselling - Myths and Facts related to counselling - Breaking stigmas related to seeking counselling - Normalizing seeking help - Self-reflection through concentric circles.

Module 2 - Intra-personal and Inter-personal Awareness 10 Hrs.

Meaning of self-esteem - Factors that influence self-esteem - Importance of self-esteem - Effects of low self-esteem - Qualities seen in people with high vs. low self-esteem - How to improve self-esteem - Self-awareness activity. Meaning of peer pressure - Different kinds of peer pressure - Resisting peer pressure - Confronting peer pressure - Group sharing activity. Meaning of relationships - Types of relationships - Healthy relationship dynamics - Personal Rights in a relationship - Components of a healthy relationship - Types of abuse in a relationship - Intimacy and understanding our needs - Boundaries

Module 3 - Understanding Emotions 4 Hrs.

Meaning of emotions - Role of emotions in our lives - Beliefs regarding emotions - Harmful effects of suppressing emotions - Signs of emotional suppression - Handling emotions in a healthy manner - Self-assessment activity

Module 4 - Anger management 5 Hrs.

Meaning of anger - Physical and Emotional symptoms of anger - Different ways that people express anger - Expression and experience of anger - What makes us angry and what it means when we're angry - Dealing with anger - Guided visualization and art activity.

Module 5 - Managing Anxiety/Fear 4 Hrs.

Meaning of fear - Types of fear - Physical and Emotional symptoms of fear - Different reactions to fear - Overcoming fear - Artwork followed by group sharing activity.

Module 6 - Dealing with Loss and Grief 4 Hrs.

Understanding loss and grief - Form of loss - Stages of grief - Dangers of not grieving - Dealing with grief - Ways to help others in grief.

COURSE OUTCOMES

After completion of the course, the students should be able to:

1. Develop a better emotional quotient.
2. Formulate a healthier sense of self through self-awareness.
3. Build more meaningful relationships.
4. Display an improvement in inter-personal skills.
5. Modify thought and belief patterns.

S1 24 AR 101: CONTEMPORARY INDIAN ECONOMY

Course objectives

- To familiarise students on the current problems of Indian Economy
- Identify solutions through specific policies.

Module 1: LPG Policies and Economic Reforms 5 hrs

of LPG-Economic reforms under the New economic policy – globalisation, privatisation, and liberalisation -Niti Aayog – functions and its role in India’s economic development

Module 2 NITI AAYOG and Economic Development 10 hrs

NITI Aayog and goals of SDG, programs of the govt- priorities of economic growth and employment, education, health and gender, environmental concerns, clean water, energy security, poverty alleviation and income inequality (overview of different programs). Population and demographic dividend. Human development Index, Hunger Index, Gross Happiness Index,

Module 3 Economic Reforms in Agriculture and Food management 10 hrs

Green revolution- Agricultural Finance-Agriculture price policy, minimum support price- procurement prices and issue price- zero hunger, public distribution system. MGNREGA- Agriculture and WTO (overview)

Module 4. Industry, innovation, infrastructure 10 Hours

New Industrial Policy 1991- public sector reforms, privatisation and disinvestment, entrepreneurship- competition policy. Role of MNCs in industrial development- economic and social infrastructure-roads, railways, airports tele density (overview).

Module 5. Monetary, Fiscal Policy and External Trade 10 Hours

Monetary Policy – RBI- Monetary policy -banking privatisation, role of SEBI. Fiscal Policy - Finance Commission and its role- Fiscal federalism. India’s foreign trade- volume, direction, and composition (latest trends)- FDI –Meaning, trends and patterns- India’s balance of payment since 1991.

Skill Development:

1. Using case study analyse the U N sustainable development goals.
2. Draft a diagrammatic representation of inflation rates for specific products using secondary data from websites
3. Using a chart to show impact of MNREGA works.
4. Using secondary data analyse India’s direction of trade in the last 5 years.
5. Using secondary data analyse India’s volume of trade in the last 5 years.

Course Outcomes

After completion of the course the students will be able to:

1. Understand the current problems of Indian Economy
2. Analyse the sector specific policies adopted for achieving the aspirational goals.
3. Review various economic policies adopted.
4. understand the history of Economic planning in India.
5. understand the sectoral reforms through LPG policy.

BOOKS FOR REFERENCE

1. Ramesh Singh. 2022 The Indian Economy, Tata McGraw Hill
2. Byres Terence J. (ed.), (1998), The State, Development Planning and Liberalisation 'in India, Delhi,
3. Dutt Ruddar and K.P.M Sundaram (2011): Indian Economy, S Chand& Co. Ltd. New Delhi
4. Frankel Francine R., (2004), India's Political Economy, Delhi. Jenkins Rob, 2000, Economic Reform in India, Cambridge,
5. Jalan, B. (1996), India's Economic Policy- Preparing for the Twenty First Century, Viking, New Delhi.
6. Joshi Vijaya and L.M.D. Little, (1998), India's Economic Reform 1991-2001, Delhi,
7. Kapila Uma: Indian Economy: Policies and Performances, Academic Foundation
8. Mishra S.K & V.K Puri (2001) "Indian Economy and -Its development experience", Himalaya Publishing House.
9. Mukharji Rahul (ed.) (2007), India's Economic Transition: The Politics of Reforms, edited by Rahul Mukherji, Oxford University

SEMESTER II

Semester	Course Code	Course Title:	Course Duration	Course Type:	Teaching Hours Per week:	Credits
II	S1 24 MC 201	Macroeconomics	: 75 hrs	MCT	5	5
Course Objectives:	The objective of this course is to explore and understand basic concepts related to National Income. The course will also help familiarize the students with the Keynesian Theory of Income and Employment. Further, the course entails understanding different policies and debates under macroeconomics.					
Course Outcomes	T2	CO 1	Explain the concept of National Income and methods of its estimation.			
	T4	CO 2	Analyse the relationship between Macroeconomic variables			
	T2	CO 3	Describe the determination of income and employment under Classical and Keynesian framework			
	T2	CO 4	Discuss with the students the monetary and fiscal policies and their effectiveness in the regulation of the economy.			
Module 1	Introduction to Macroeconomics Identities				No of Hours:	15
Nature of Macroeconomics and its significance, Indicators of Macro Economic Activity - Key Concepts: Stock and flow variables- Two Sector Model, Three Sector Model and Four Sector Models. Measurement of Macro Variables and Economic Performance: National Income Accounting - Important Concepts: GNP, GDP, NNP, NDP, NI, PI, DPI- Real GDP versus Nominal GDP - GDP deflator - Method of estimating National Income - Expenditure Method- Income method - Value added or Net Product method - Difficulties in National Income Accounting - Trends in GDP in India- GNP and Quality of Life - Net Economic Welfare - Green Income						
Module 2	Building Blocks of Macroeconomic Analysis				No of Hours:	15
Simple Keynesian Theory-Aggregate Demand (AD) curve, Aggregate Supply (AS) curve, Sources of shift in AD and AS, Equilibrium in National Income and Price level, Unemployment and National Income, Inflation and Unemployment, Circular flow of Income, Goods market and Money Market- Phillips Curve-Opel's Law						
Module 3	Classical Theory				No of Hours:	15
Introduction to Classical theory of employment - Basic Assumptions of the Classical School - Say's Law of Market - Determinants of Output, Employment, Savings, Investment, Wages, Prices, Interest Rate - Equilibrium Output and Employment- Implications of Classical Full Employment Model - Critical Evaluation						
Module 4	Keynesian Macroeconomics				No of Hours:	15

Principle of effective demand - Keynesian theory of output, income and employment - Concept of Multiplier and accelerator-IS-LM curve-General Equilibrium of Product and Money Market-Extensions of IS-LM Model													
Module 5	Keynes Psychological law of consumption										No of Hours: 10		
An Overview of Post Keynesian theories of consumption: absolute income, relative income, permanent income & life cycle hypothesis - Multiplier and Accelerator Analysis - Marginal Efficiency of Capital - Relevance and Critique of Keynesian Macroeconomics													
Module 6	Monetary and Fiscal Policy										No of Hours: 5		
Monetary Policy: Objectives and Instruments Fiscal Policy: Objectives and instruments Effectiveness of Monetary and Fiscal Policy													
Skill Development:													
1	Segregate different economic indicators into stock and flow components.												
2	Conduct a study on the inflationary trends during the last ten years.												
3	Calculate the different national income estimates from actual data through the online databases.												
4	Analyze the relevance of Keynesian theory in modern Indian Economy.												
Book for Reference:													
1	Ahuja H L (2013) Macroeconomics: Theory and Policy, S Chand & Company Pvt Ltd. New Delhi												
2	Mankiw N. Gregory, (2012) Macroeconomics, Worth Publishers, New York												
3	Shapiro Edward, (2004) Macroeconomic Analysis, Galgotia Publications Pvt. Ltd, New Delhi												
4	Ackley Gardner, (1978) Macroeconomics: Theory and Policy, Macmillan, New York												
5	Dornbusch, R., Fischer, S. and Startz, R., "Macroeconomics", McGraw-Hill, 11th Ed 2010												
6	D'Souza E., "Macroeconomics", Pearson Education, 2009												
7	Froyen Richard T. (2013) Macroeconomics-Theories and Policies, Macmillan Pub., Company, NY												
8	Hubbard R. Glenn and Anthony Patrick O'Brien, (2012) Macroeconomics, Pearson Prentice, New Jersey, USA												
Mapping of CO and PO													
	CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
	CO1	H	M	L		M	L	L				L	
	CO2	L	H	M	L		M		H				H

	CO3	L	H	M		L		M	H			M	H
	CO4	L	H	M	L	M				H			M
	CO5		H	M	M	L		L	M	H		L	
	CO6		H	M	M	L			H	L		M	

Semester	Course Code	Course Title:	Course Duration :	Course Type:	Teaching Hours Per week:	Credits :
II	S1 24 MCT 203	Advanced Statistics	45	Theory	3	3
Course Objectives:	The course on Advanced Statistics aims to deepen students' understanding of probability theory, statistical distributions, and inferential statistics. It focuses on theoretical and applied aspects of probability functions, distribution models, sampling techniques, and hypothesis testing. By exploring real-world data, students will gain proficiency in using statistical tools to make informed decisions, solve complex problems, and analyse large datasets. The course emphasises the practical implementation of statistical methods, fostering critical thinking, analytical skills, and decision-making capabilities for data-driven environments.					
Course Outcomes with T Levels	CO1	Illustrate the scope of Probability and its application for determination of certainty of possible outcome of event in real world uncertain problems.				T4
	CO2	Apply Binomial and Poisson distributions to model real-life situations involving discrete data.				T3
	CO3	Understand Uniform and Normal distribution models to analyse and interpret large datasets, with a focus on fitting the Normal curve.				T2
	CO4	Differentiate between various sampling methods and distributions, and standard error for population mean estimation.				T4
	CO5	Apply hypothesis tests using t, z, χ^2 , ANOVA to evaluate hypotheses in various research scenarios.				T3
Module 1	Introduction to Probability			No of Hours: 8		
Definition of Probability- Sample Space - Favourable Events - Mutually Exclusive Events - Dependent and Independent Events - Permutations and Combinations (application-based problems) - Addition, and Multiplication Theorem of Probability (statement only) - Conditional Probability and Bayes theorem (statement only), Importance and application-based problems.						
Module 2	Discrete Probability Distributions			No of Hours: 8		
Random Variable- Expectation-Variance, Theoretical probability distributions - Bernoulli Distribution- definition-properties-importance, Binomial distribution- definition- properties -importance-applications - fitting a Binomial distribution, Poisson Distribution- definition- properties -importance-fitting a Poisson distribution- applications.						
Module 3	Continuous Probability Distributions			No of Hours: 6		

Uniform distribution-definition-properties-importance-application, Normal distribution – introduction-definition –properties -Probability Density function- expected value- variance, importance - applications, Standard Normal Distribution, Fitting a Normal distribution.

Module 4	Sampling Distributions	No of Hours: 6
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Population and Sample- parameter and statistic, Sampling Techniques (Probability and Non-Probability), Mean and Variance, Stand Error and properties ,Sampling Distributions - Chi-square, t-distribution, and F distributions. Central Limit Theorem (statement only)

Module 5	Hypothesis Testing	No of Hours:17
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Meaning and Importance of Hypothesis - Formulation of Null and Alternative Hypothesis - Level of Significance -Type I and Type II Errors - Hypothesis Testing- t-test for mean (one sample, two- sample and paired), Confidence interval, z-test for mean (one sample and two- sample), Chi-square test - Importance and applications problems (Goodness of fit -Uniform, Binomial, and Poisson distribution and test for independence of attributes) , ANOVA and F statistic- Meaning- Need- Procedure- Assumptions- One-Way - Post-hoc test -Applications.

Book for Reference: (Strictly APA Format)

1	Hoel, P. G. (2022). Statistics for behavioural sciences. Macmillan.
2	Gupta S.P. (2019), Statistical Methods, Sultan Chand and Sons, New Delhi.
3	J.K.Sharma, (2017), Quantitative Techniques for Management, Macmillan, New Delhi.
4	Croxton, F. E., Cowden, D. J., & Klein, S. (1973). Applied general statistics (3rd ed.). Prentice Hall Inc.
5	Goon, A.M., Gupta, M.K., and Das Gupta, B. (1991). Fundamentals of Statistics, Vol. I, World Press, Calcutta.

Mapping of CO and PO

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	H	M	H	M						M	M
CO2	H	M	M	L	H						M	M
CO3	H	H	H	H	L						M	M
CO4	M	H	H	H	M						L	L
CO5	H	M	M	M	H						M	M

Semester	Course Code	Course Title:	Course Duration :	Course Type:	Teaching Hours Per week:	Credits :
II	S1 24 MCP 203	Advanced statistics using R	60	Practical	4	2
Course Objectives:	Develop proficiency in conducting exploratory data analysis (EDA) and utilizing data visualization techniques in R to extract insights and patterns from diverse datasets, ultimately aiding in informed decision-making processes in data analytics.					
Course Outcomes with T Levels	CO1	Use mathematical operators and logical and conditional statements on R for solving basic mathematical problems.				3
	CO2	Use inbuilt statistical function in R for Descriptive Statistical analysis and interpretation.				3
	CO3	Use data visualisations tools on R to draw insights from the raw data taken from various sectors.				4
	CO4	Use the relevant inbuilt hypothesis testing functions to test the hypothesis and its significance for better decision making in various fields like medicine, commerce, engineering etc.				4
	CO5	Use regression tools and functions available on R for fitting the best curve for the original data with minimal error to make reliable estimations and predictions				4
Module 1	Introduction to R				No of Hours: 12	
Introduction to R Programming Language, R Studio Environment, Basic Data Types: Numeric, Character, Logical, Basic Operations: Arithmetic, Logical, Relational, Introduction to Functions and Control Structures (conditional and looping), User defined function, Hands-on Exercises and Assignments						
Module 2	Descriptive Statistics using R				No of Hours: 12	
Data Structures: Vectors, Matrices, Lists, Data Frames: Creation, Manipulation, and Sub setting, Data Import and Export: CSV, Excel, Text files, Introduction to R Packages and Libraries, Descriptive Statistics: measures of central tendency (mean, median, mode), and measures of dispersion (standard deviation, variance, range)-Analysis and Interpretation: Application of descriptive statistics in data analysis.						
Module 3	Data Visualisation and Exploratory Data Analysis				No of Hours: 11	
Data Visualization: Scatter plot, Bar plot, pie chart, histogram, boxplot, Line graphs, multiple bar diagram, and ggplot library, missing values and outliers' analysis, Hands-on Exercises and Assignments and Exploratory Data Analysis (EDA)						
Module 4	Hypothesis Testing using R				No of Hours: 15	
Hypothesis Testing- t-test for mean (one sample, two- sample and paired), z-test for mean (one sample and two- sample), Chi-square test -applications problems (Goodness of fit -Uniform, Binomial, and						

Semester: II	Course Code: S1 24 MC 202	Course Title: Linear Algebra	Course Duration : 75 hrs	Course Type: Theory	Teaching Hours Per week: 5	Credits: 5
Course Objectives:	This aims to provide students a firm grasp of key linear algebra concepts, including matrices, vectors, systems of equations, and eigenvalues and eigenvectors. Through theoretical learning and practical applications, students will develop essential problem-solving skills relevant to mathematical analysis and real-world data interpretation, with a focus on applications in machine learning (Linear model fit) and data analysis.					
Course Outcomes with T levels	CO1	Understand the fundamental concepts of vectors in R^2 and R^3 , including vector operations, geometric properties, and applications in physics (force analysis) and Image Processing				T2
	CO2	Apply the concepts of matrix rank, solutions to systems of linear equations, and their applications to real-world problems such as network flow, traffic flow, and chemical equation balancing, using Gauss-Jordan elimination.				T3
	CO3	Understand vector spaces, subspaces, bases, and dimensions to explore their properties and solve related problems.				T2
	CO4	Solve problems involving linear transformations by understanding their definitions, properties, and applications in computer graphics.				T3
	CO5	Solve problems involving eigenvalues and eigenvectors, including characteristic equations and applications to Markov Chains and the Cayley-Hamilton theorem.				T3
	CO6	Apply techniques for solving inconsistent systems of linear equations, focusing on solution approximation using least squares, normal matrix equations, and linear regression models.				T3
Module 1	Vectors				No of Hours: 12	
Vectors in R^n , position vectors, Length of a vector, unit vector, parallelogram law of vector addition, algebra of vectors (addition, subtraction and scalar multiplication), Dot product, Cross product of vectors, Scalar triple product, Colinear, Coplanar and orthogonal vectors, properties, area of a parallelogram and volume of a parallelepiped, graphical representation in R^2 and R^3 , and Applications - Force, Resultant force and displacement problems, Mean shift theory in Image processing(overview)						
Module 2	System of Linear Equations				No of Hours:15	

Recapitulation (Matrices, Algebra of matrices, Elementary Row operations and Echelon form), Rank of a matrix by reducing to row reduced echelon form, System of Linear Equations with real coefficients, Matrix form of System of Linear Equations, Augmented Matrix, Solution through Gauss Jordan method, Criteria for Existence and Uniqueness of the solution, linear combinations of vectors, linear span of vectors, vector equation of system of linear equations, parametric vector form of the solution set, linear independence and dependence of vectors, Applications of linear systems: Network flow->Traffic Flow

Semester	Course Code	Course Title:	Course Duration:	Course Type:	Teaching Hours Per week:	Credits:
II	S124SE201	Applied Mathematical Economics	30 hrs	SE	2	2
Course Objectives:	The Mathematical Economics course provides essential mathematical tools for economic analysis, covering functions (linear, non-linear, logarithmic, and exponential) and their applications to demand, supply, and market equilibrium. Students will learn matrix algebra, differential calculus, optimization techniques, and integration for calculating consumer and producer surplus. By the end, students will be adept at applying these mathematical methods in economic contexts.					
Course Outcomes	T2	CO 1	Describe the Role of Mathematics: Students will explain the role of mathematics in economic analysis, identifying its uses and limitations			
	T3	CO 2	Apply Matrix in Economic Analysis: Students will solve economic problems using elementary matrix algebra, including determinants and simultaneous equations through Cramer's rule and matrix inversion			
	T3	CO 3	Apply differential calculus to analyze elasticity, consumer behavior, production functions, and cost analysis, including problems related to market equilibrium and monopolies			
	T2	CO 4	Demonstrate proficiency in integral calculus, applying it to calculate consumer and producer surplus and solving linear programming problems			
Module 1	Introduction to Mathematical Economics					No of Hours: 10
Introduction -Role of Mathematics in Economic Analysis-Uses and limitations. Applications of mathematical functions- Demand and supply-market equilibrium-taxation and subsidy, P.T. Curve, national income analysis.						
Module	Application of Matrix in Economic Analysis					No of

2		Hours: 5
Application of Cramer's rule and matrix inversion- input-output analysis- input-output table- matrix of technical coefficients.		
Module 3	Application of Differential Calculus in Economic Analysis	No of Hours: 10
Limits and Derivatives -ordinary and partial differentiation- elasticity, consumer behaviour, production functions, revenue and cost analysis market structure problems- monopoly, discriminating monopoly, duopoly, and Oligopoly.		
Module 4	Optimization and Integration	No of Hours: 5
Constrained Optimisation(maxima-minima). Application of integral calculus- definite and indefinite integration - consumer's surplus-producer's surplus.		
<p>Lists of tools can be used for solving the problems in the modules</p> <p>1) Excel 2) https://www.derivative-calculator.net/ 3) https://www.integral-calculator.com/ 4) https://www.wolframalpha.com/calculators/integral-calculator/ 5) https://www.wolframalpha.com/calculators/derivative-calculator/</p>		
	Skill Development:	
1	Create graphs for various economic functions (demand, supply) using Exce	
2	Solve real-world input-output problems using matrix algebra.	
3	Work on case studies that require linear programming to allocate resources efficiently.	
4	Conduct research on the application of mathematics in a specific area of economics, such as econometrics	
5	Use software (R/Python) to simulate economic models and analyze outcomes.	
	Book for Reference: (Strictly APA Format)	
1	Mas-Colell, A., Whinston, M. D., & Green, J. R. (2021). Microeconomic theory (3rd ed.). Oxford University Press.	

