ఆంధ్రప్రదేశ్ కేంద్రీయ విశ్వవిద్యాలయం आंध्रप्रदेश केंद्रीय विश्वविद्यालय

CENTRAL UNIVERSITY OF ANDHRA PRADESH

Jnana Seema, Ananthapuramu, India - 515701

DEPARTMENT OF COMPUTATIONAL SOCIAL SCIENCE
SCHOOL OF INTERDISCIPLINARY
AND
APPLIED SCIENCES

Masters Programme
(as per the National Credit Framework 2023)

Vidya Dadati Vinayam
(Education Gives Humility)

M.Sc. Computational Social Science

Programme Structure
(Effect from Academic Year 2026 - 27)

M.Sc. Computational Social Science

Department of Computational Social Science

School of Interdisciplinary and Applied Sciences

CONTENTS

M.Sc. Computational Social Science
Department of Computational Social Science
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1. Introduction to the Programme

The Master of Science in Computational Social Science (CSS) programme is one of the new post-graduate programs offered at the Central University of Andhra Pradesh from the academic year 2024-25. CSS is an exciting new field that combines the methods and tools from computer science and data science with fundamentals of social science disciplines. It draws inspiration from the experimental, social, and behavioral sciences, merging their exploratory focus with the predictive capabilities of large-scale data. This integrative approach is designed to equip students with the in-demand skills required to succeed in today's competitive job market. The programme aims to produce competent postgraduates who can make meaningful contributions to academia, industry, and policy, armed with both theoretical knowledge and practical expertise. Emphasizing critical thinking and problem-solving, the curriculum develops advanced analytical skills essential for navigating the evolving global business and economic landscape. It integrates insights from fundamentals of computational social science, Artificial Intelligence and Data Science, Economics, Public Policy with modern data analytics techniques. A strong foundation in these disciplines are provided through core courses, while electives in Geography and Geoinformatics allow students to specialise further.

Technical competencies form the heart of the programme. Students gain hands-on experience with leading software packages such as STATA, R, and Python ensuring they are proficient in handling complex large-scale datasets. Beyond classroom learning, the programme offers opportunities to apply knowledge through industry talks, internships, dissertations, and field surveys. This multidisciplinary approach ensures that students not only refine their technical and analytical skills but also develop professional competencies. By combining theory with practice, the programme prepares postgraduates to tap computational techniques in order to meet real-world challenges and thrive in diverse professional settings.

2. Programme Vision

The vision of the Master of Science in Computational Social Science (CSS) programme is to become a globally recognised leader in advanced education that integrates interdisciplinary knowledge with statistical applications using the latest analytical tools. It seeks to empower students with the knowledge, skills, and ethical framework necessary to excel in a dynamic and interconnected world. Through innovative research, interdisciplinary collaboration, and a commitment to excellence, the programme aims to prepare postgraduates to address complex societal challenges using computational techniques and make meaningful contributions to society. The vision is to foster a vibrant learning community that nurtures future computational social scientists with intellectual curiosity, critical thinking to become experts in social science research.

3. Programme Educational Objectives (PEOs)

PEO1 Foundational Knowledge: Graduates will acquire advanced knowledge in computational techniques, enabling them to understand and address complex societal digital challenges.

PEO2 Analytical and Technical Skills: Graduates will develop proficiency in modern analytical

tools, statistical software, and programming languages (R, Python, STATA) to solve societal and policy problems.

PEO3 Research and Innovation: Graduates will design and conduct independent research projects, dissertations, and field surveys, contributing innovative solutions to academia, industry, and policy-making.

PEO4 Professional and Ethical Competence: Graduates will demonstrate ethical responsibility, critical thinking, and professional readiness to work effectively in diverse teams and multidisciplinary environments.

PEO5 Lifelong Learning and Leadership: Graduates will recognize the need for lifelong learning, adapt to evolving global economic and technological landscapes, and assume leadership roles in academia, industry, and government.

4. Programme Outcomes (POs)

The purpose of this programme is to equip students with advanced knowledge and practical skills in economics and data analytics. After successful completion of the programme, students will be able to:

PO1 Computational Knowledge: Apply computational techniques in interdisciplinary subjects like economics, public policy, and geography to solve complex socio-digital and policy problems.

PO2 Problem Analysis: Identify, formulate, and analyse socio-economic problems using statistical methods, and computational techniques.

PO3 Design and Development of Solutions: Design solutions for societal digital and policy challenges by integrating theoretical knowledge with computational techniques, ensuring relevance to social, and cultural contexts.

PO4 Research and Investigation: Conduct independent research using computational techniques, field surveys, and computational tools to interpret data and derive valid conclusions.

PO5 Modern Tool Usage: Select and apply modern software tools (Python, STATA, R) for modeling, simulating, and solving real world problems.

PO6 Digital technologies and Society: Apply contextual knowledge to assess societal, legal, health, and cultural issues, and evaluate the impact of digital technologies on communities.

PO7 Sustainability and Policy: Understand the implications of digital and data-driven solutions in societal context, demonstrating commitment to sustainable development.

PO8 Ethics: Apply ethical principles and professional standards in computational analysis, data handling, and research practice.

PO9 Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams, demonstrating collaboration in multidisciplinary settings.

PO10 Communication: Communicate effectively on emerging societal issues with peers, academia, industry, and society through reports, documentation, and presentations.

PO11 Project Management: Demonstrate knowledge of interdisciplinary in social sciences, and apply them to project work, internships, and dissertations.

PO12 Lifelong Learning: Recognize the need for, and develop the ability to engage in independent and lifelong learning in social science disciplines, data analytics, and interdisciplinary domains.

5. Programme-Specific Outcomes (PSOs):

The learning outcomes are designed to equip students with the knowledge, skills, and abilities necessary to succeed in careers related to interdisciplinary social science subjects with strong in data analysis, and decision-making:

PSO1: Interdisciplinary Knowledge: Students will demonstrate interdisciplinary understanding of economics, geography, data science and artificial intelligence enabling them to interpret socio-economic behaviour and policy frameworks.

PSO2: Data Analytics Proficiency: Students will acquire hands-on expertise in modern analytical tools and programming languages (R, Python, STATA) to analyse and visualize complex and largescale datasets.

PSO3: Technical and Computational Competence: Students will integrate computational skills with econometric, and GIS modeling, database management, and machine learning techniques to solve emerging social issues.

PSO4: Research and Critical Evaluation: Students will critically analyse emerging societal issues, including due to adoption of digital technologies, while designing independent research projects and dissertations that contribute to academia, industry, and government.

PSO5: Professional Readiness and Ethics: Students will develop professional competencies, teamwork, communication, and leadership skills, while adhering to ethical and professional standards in computational analysis and data-driven decision-making.

6. Pedagogy of the Programme

The pedagogy for the M.Sc. in Computational Social Science is designed in align with the National Education Policy (NEP) 2020, and it is also designed to progress through the six levels of Bloom's Taxonomy, ensuring a structured and engaging learning environment that blends theory with practice. Students begin by recalling and defining fundamental concepts in interdisciplinary domains such as economics, demography, sociology, data science, and geography through interactive lectures and foundational readings. They then move to understanding and interpreting theories from interdisciplinary subjects in strengthening conceptual clarity through group discussions, debates, and problem-solving activities. At the application stage, learners engage in household surveys, field visits, and hands-on projects, using statistical methods, econometric techniques, and programming tools such as STATA, R, and Python to connect theory with real-world practice. This systematic approach ensures that students develop both analytical depth and technical proficiency early in the programme.

As students advance, they are trained to analyze and evaluate socio-economic issues and complex datasets through dissertation work, case studies, and interdisciplinary assignments that integrate computational techniques with demography, computer science, economics, geography, and public policy. They critique empirical research, assess policy implications, and apply ethical and professional standards in collaborative projects and peer learning. Finally, at the creation stage, the programme culminates in a capstone project or thesis, where students design and conduct independent research, innovate solutions to pressing societal challenges, and present findings to academic and industry audiences. Complementary activities such as networking events, career fairs, and mentorship programmes further enhance professional readiness, leadership development, and smooth transition into diverse career pathways. This pedagogy not only equips graduates with interdisciplinary knowledge and technical expertise but also nurtures critical thinking, ethical responsibility, and lifelong learning.

7. Programme Structure

- The Master of Science in Computational Social Science is a two-year postgraduate programme divided into four semesters, comprising a total of 89 credits.
- The curriculum integrates Core Courses, Discipline-Specific Electives, Multidisciplinary Courses, MOOCs, Skill/Internship Components, and Dissertation Work, ensuring a balanced and comprehensive learning journey.
- **Semester-wise Structure:**
  - **Semester I:** Foundational courses in computational social sciences, macroeconomics, quantitative methods, and behavioral theories, supported by one discipline-specific elective and one MOOC. Includes two lab components for practical exposure.
  - **Semester II:** Computational Demography, Qualitative Methods in Social Science Research, Data Harvesting for Social Science Research, Introduction to Econometric Theory, with one elective, one MOOC, and a compulsory core course. Lab work strengthens applied skills.
  - **Semester III:** Courses in causal inferences for social sciences, social and ethical issues of Big Data and AI, Public Policy Analysis, alongside electives, a MOOC, and a skill/internship project. Multiple lab components ensure hands-on training.
  - **Semester IV:** Dedicated to Dissertation Work (12 credits) and one advanced core course enabling students to apply knowledge to significant survey research questions or practical problems.

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Semester and Course-wise Credits Distribution

Semester	Core Course Credits				DSE Credits		IDE Credits		CCC Credits				SIP Credits		Dissertation Credits		Total Credits
	Code	T	L/P	Total	Code	Total	Code	Total	Code	T	L/P	Total	Code	Total	Code	Total	
1	MCS101	4	0	4	MCS111	4	MCS112 MOOC	3	-		-	-	-	-	-	-	23
	MCS102	3	1	4													
	MCS103	4	0	4													
	MCS104	4	0	4													
	Total	**15**	**1**	**16**	**-**	**4**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
II	MCS201	3	1	4	MCS211	4	MCS212 MOOC	3	CCC213	2	2	4	-	-	-	-	27
	MCS202	3	1	4													
	MCS203	3	1	4													
	MCS204	4	0	4													
	Total	**13**	**3**	**16**		**4**	**-**	**3**	**-**	**2**	**2**	**4**	**-**		**-**	**-**	
III	MCS301	3	1	4	MCS311	4	MCS312 MOOC	3	CCC313	2	0	2	MCS314	2	-	-	23
	MCS302	3	1	4													
	MCS303	3	1	4													
	Total	**9**	**3**	**12**		**4**	**-**	**3**	**-**	**2**	**0**	**2**	**-**	**2**	**-**	**-**	
IV	MCS401	3	1	4	-	-	-	-	-	-	-	-	-	-	MCS411	**12**	16
	Total	**3**	**1**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12**	
Total Courses	**12**	**-**	**-**	**-**	**3**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**-**	**22**
Total Credits	**-**	**40**	**8**	**48**	**-**	**12**	**-**	**9**	**-**	4	2	**6**	**-**	**2**	**-**	**12**	**89**
Percentage	**-**	44.94	8.98	**53.93**	**-**	**13.48**	**-**	**10.11**	**-**	4.49	2.24	**6.74**	**-**	**2.24**	**-**	**13.48**	**100**

Note: **T:** Theory **L/P:** Lab/Practicals **DSE:** Discipline Specific Elective
IDE: Inter-disciplinary Electives **CCC:** Common Compulsory Course **SIP:** Summer Internship Project

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Programme Structure

Semester I						
Sl. No.	Course Code	Title of the Course	Credit Points	Credit Distribution		
				L*	T*	P*
1	MCS101	Fundamentals of Computational Social Science	4	3	1	0
2	MCS102	Quantitative Methods in Social Science Research	3	3	0	0
		Lab: Quantitative Methods in Social Science Research	1	0	0	1
3	MCS103	Macroeconomic Theory	4	3	1	0
4	MCS104	Introduction to Social Science Concepts	4	3	1	0
5	**DES Elective-I: Any one of the following**		4	3	0	1
	MCS111	Introduction to Artificial Intelligence				
		Fundamentals of Geographic Information Systems (GIS)				
		Big Data and Public Policy				
6	MCS112	***IDE-I:** MOOCs	3	3	0	0
Total			**23**	**18**	**3**	**2**

Semester II						
Sl. No.	Course Code	Title of the Course	Credit Points	Credit Distribution		
				L*	T*	P*
1	MCS201	Computational Demography	3	3	0	0
		Lab: Computational Demography	1	0	0	1
2	MCS202	Computational Sociology	3	3	0	0
		Lab: Computational Sociology	1	0	0	1
3	MCS203	Qualitative Methods in Social Science Research	3	3	0	0
		Lab: Qualitative Methods in Social Science Research	1	0	0	1
4	MCS204	Data Harvesting for Social Science Research	4	3	1	0
5	**DSE Elective-II: Any one of the following**		4	3	0	1
	MCS211	Introduction to Econometric Theory				
		Big Data analytics				
		Machine Learning				
6	MCS212	***IDE-II:** MOOCs	3	3	0	0
7	CCC213	**CCC-I:** Introduction to R Programming	2	2	0	0
		Lab: Introduction to R Programming	2	0	0	2
Total			**27**	**20**	**1**	**6**

Semester III						
Sl. No.	**Course Code**	**Title of the Course**	**Credit Points**	**Credit Distribution**		
				L*	**T***	**P***
1	MCS301	Causal Inferences for Social Sciences	3	3	0	0
		Lab: Causal Inferences for Social Sciences	1	0	0	1
2	MCS302	Healthcare Data Analytics	3	3	0	0
		Lab: Healthcare Data Analytics	1	0	0	1
3	MCS303	Introduction to LaTex and Academic Writing	3	3	0	0
		Lab: Introduction to LaTex and Academic Writing	1	0	0	1
4	**DSE Elective-II: Any one of the following**		4	3	0	1
	MCS311	Data Analytics with Python				
		Public Policy Analysis				
		Advanced Spatial Statistics and Modelling				
5	MCS312	***IDE-III:** MOOCs	3	3	0	0
6	CCC313	**CCC-II:** Building Mathematical Ability and Financial Literacy	2	1	1	0
7	MCS314	**SIP:** Summer Internship Programme	2	0	0	2
Total			**23**	**16**	**1**	**6**

Semester IV						
Sl. No.	**Course Code**	**Title of the Course**	**Credit Points**	**Credit Distribution**		
				L*	**T***	**P***
1	MCS401	Survey Research Methods	3	3	0	0
		Lab: Survey Research Methods	1	0	0	1
2	MCS411	Dissertation	12	0	0	12
Total			**16**	**3**	**0**	**13**
Grand Total			**89**	**57**	**5**	**27**

Note: **L:** Lectures**; T:** Tutorials; **P:** Practical / Project *As suggested by the department and the university.

Semester-wise Credit Distribution

Semester	Total Credits	Cumulative credit at the end of the semester
1	23	23
II	27	50
III	23	73
IV	16	89

I. Credit Requirement

- The minimum number of credits required to be earned by a student for the award of the degree is **89.**
- Students may earn credits in excess of 89 by opting for additional courses; however, the upper limit shall not exceed **96 credits**.

II. Assessment Pattern

- **Theory Courses**:
  - **Internal (40%)** – Formative evaluation comprising two best out of three tests (each test carrying a maximum of 15 marks, totalling 30 marks), along with seminar/assignments/attendance (10 marks).
  - **External (60%)** – Summative evaluation through the semester-end examination.

III. Laboratory Components:

- **Internal (60%)** – Continuous assessment through lab work and internal examination.
- **External (40%)** – Summative evaluation through the semester-end practical examination.

IV. End-Semester Examination:

- Maximum Marks: **60**
- Duration: **3 Hours**

Important Information to Students

i. Eligibility: A Bachelor's degree in Bachelor's degree with at least 50% marks or Equivalent Grade in Social Sciences or Humanities subjects OR 55% marks in any other subject.

ii. The minimum duration for completion of the programme is four semesters (two academic years) and the maximum duration is eight semesters (four academic years) or as per amendments made by the regulatory bodies from time to time.

iii. A student should attend at least 75% of the classes, seminars, practicals in each course of study.

iv. All theory courses in the programme carry a Continuous Internal Assessment (CIA) component to a maximum of 40 marks and Semester End Examination (SEE) for a maximum of 60 marks. The minimum pass marks for a course is 50%.

v. All lab components carry a Continuous Internal Assessment (CIA) component to a maximum of 60 marks and Semester End Examination (SEE) for maximum of 40 marks. The minimum pass marks for a course in 50%.

vi. A student should pass separately in both CIA and the SEE/, i.e., a student should secure 20 (50%) out of 40 marks in CIA and 30 (50%) out of 60 marks in SEE. Contrary a student should secure 30 (50%) out of 60 marks in CIA and 20 (50%) out of 40 marks in the SEE.

vii. There are 3 CIA tests for each course per semester from which the best 2 performances are considered for the purpose of calculating the marks in CIA. A record of the continuous assessment is maintained by the academic unit.

viii. Each CIA contains 15 marks, out of the best 2 tests scores are considered for 30 marks. Remaining 10 marks awarded for assignments, class presentations and class participation and punctuality of the student.

ix. A student failing to secure the minimum pass marks in the CIA is not allowed to take the semester end examination of that course. S/he has to redo the course by attending special classes for that course and get the pass percentage in the internal tests to become eligible to take the end semester examination.

x. Semester-end examination shall consist of objective type questions, descriptive type questions, short answer questions and case studies or any other recommended by the Board of Studies (BoS).

xi. Students failing a course due to lack of attendance should redo the course.

xii. Re-evaluation is applicable only for SEE papers and shall not be entertained for other components such as lab/practical /thesis/ dissertation/ internship etc.

xiii. An on-campus elective course is offered only if 10 or 50% of the students registered, whichever is higher.

SEMESTER WISE
DETAILED SYLLABUS

SEMESTER-I

Course Code : **MCS101** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Fundamentals of Computational Social Science**

Course Objectives:

- To provide comprehensive understanding on the foundational concepts and some operational definitions in computational social sciences
- To enable students to integrate knowledge from different disciplines, including social sciences

Course Outcomes (COs):

By the end of the course, students can be able to

- **CO1:** Describe the evolution, scope, and major domains of Computational Social Sciences and explain its significance in social science research.
- **CO2:** Apply automated information extraction techniques, including content analysis and data mining, to collect and analyze digital and textual social data.
- **CO3:** Identify social network structures and interpret quantitative measures of social network analysis to examine social relationships and interactions.
- **CO4:** Analyze social complexity using key theoretical approaches, measurement techniques, and power law analysis to understand complex social systems.
- **CO5:** Develop and interpret basic social simulation models, including system dynamics models, for studying social processes and behavioural patterns

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓				✓		✓
CO2	✓	✓	✓	✓	✓	✓		✓				✓
CO3	✓	✓		✓	✓	✓			✓	✓		✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[14 Hours]**

Introduction: Introduction to Computational Social Sciences (CSS); Brief history of CSS; Scope of CSS; Main areas of CSS.

Unit-II: **[10 Hours]**

Automated Information Extraction: Introduction to AIE; Principles of content analysis; Cross-cultural Universality of Meaning; Data mining – Overview, and Methodological Process

Unit-III: **[12 Hours]**

Social Networks: Meaning, and History of Social Networks; Relational types of social networks; Elementary Social Network Structures; Quantitative Measures of Social Network.

Unit-IV: **[12 Hours]**

Social Complexity: What is Social Complexity?; Origins and Evolution of Social Complexity; Features of Social Complexity; Measurement of Social Complexity; Laws of Social Complexity – Serial, Parallel, and Hybrid Complexity; Power Law Analysis, and Theoretical Analysis; Theories of Social Complexity.

Unit-V: **[10 Hours]**

Simulation: Introduction to Simulation; Types of Social Simulation; Methodology of Social Simulation; System Dynamic Models

References:

Claudio Cioffi-Revilla. (2017). Introduction to computational social science.
Uwe Engel, Anabel Quan-Haase, Sunny Liu, Lars E Lyberg. (2022). Handbook of computational social science: Theory, Case studies, and Ethics.
Matti Nelimarkka. (2022). Computational thinking and social science: Combining programming, Methodologies and Fundamental concepts
John H Miller, and Scott. E. Page. (2009). Complex Adaptive Systems: An Introduction to computational models of social life
Simon Herbert, A. (1996). The Sciences of the Artificial.

Course Code : **MCS102** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Quantitative Methods in Social Science Research**

Course Objectives:

The main aim of this course is to:

- To introduce students to the fundamentals of social science research, quantitative data, and statistical reasoning.
- To develop skills in organizing, summarizing, and presenting quantitative data using descriptive statistical techniques and graphical methods.
- To enable students to analyze relationships among variables using correlation and regression techniques for social science research.

Course Learning Outcomes:

By the end of the course, students are expected;

CO1: Explain the fundamentals of social science research, types of data, variables, and the role of quantitative methods in research.

CO2: Organize, summarize, and present quantitative data using frequency distributions, percentages, and graphical techniques.

CO3: Compute and interpret measures of central tendency and dispersion for quantitative data.

CO4: Analyze relationships between variables using correlation techniques and interpret correlation coefficients using STATA.

CO5: Apply linear and logistic regression methods to examine and interpret relationships among variables using STATA.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓				✓		✓
CO2	✓	✓	✓	✓	✓					✓		✓
CO3	✓	✓	✓	✓	✓					✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓				✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Introduction to Social Science Research: Basics of social sciences research; Role of theory and numbers; Types of social research; Types of data – primary data and secondary data; Attributes (categorical variables) and variables, discrete variables, continuous variables

Unit-II: **[10 Hours]**

Organization, and representation of quantitative data: Frequency distributions - what is frequency? Frequency and non-frequency data; Proportions and percentages; Pie chart; Bar graph; Histograms; Line graph.

Unit-III: **[14 Hours]**

Descriptive Statistics: Measures of central tendency – Meaning of central tendency. Mean, median and mode. Calculating mean, median and mode from non-frequency and frequency data; Relation between mean, median and mode. Relative advantages and disadvantages of using mean, median or mode; Measures of dispersion – What is dispersion? Absolute measures of dispersion – range, variance, standard deviation, inter-quartile range; Relative measures of dispersion – coefficient of variation

Unit-IV: **[12 Hours]**

Correlation: Bi-variate data, relationship between two variables, linear and non-linear relationships; Correlation; Scatter diagram; Correlation coefficient; Computing correlation coefficient; Pearson's correlation coefficient; Linear regression; Regression line; Logistic regression

Unit-V: **[12 Hours]**

Introduction to STATA: Creating database structure, data entry, specifying scales, validation of data entry, importing and exporting data; Data visualization: Histogram, boxplots, bar charts, line graphs, heat map, scatterplots, pie charts; customize plot axes, labels, add legends, and add colors; Data manipulation Recoding: creating new variable, sorting, filtering and selection of specific data, merging files, generating simple

frequencies; use of syntax editor; Computation of measures of central tendency and dispersion; computation of correlation coefficient; chi-square test for association between two categorical variables

References:

Chava Frankfort-Nachmias, and Anna Leon-Guerrero. (2018). Social statistics for a diverse society. Eighth edition. Sage publications

Coolidge, F. L (2006), Statistics: A Gentle Introduction, Sage Publications. Los Angeles.

Freedman, David, Pisani, Robert and Purves Roger (2009), Statistics, Fourth edition, Viva Books Private Limited

Lawrence Neuman, W.(2014). Social Reserch Methods: Quantitative and Qualitative approaches. Seventh edition. Pearson publications.

Stephen Gorard (2003), Quantitative Methods in Social Science, Continuum Books

Course Code : **MCS103** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Macroeconomic Theory**

Course Objectives:

The main aim of this course is to:

- To understand how national income is measured using different methods and basic concepts like circular flow of income and input-output tables.
- To learn major theories of consumption, investment, and money and understand how people spend, save, invest, and how money works in the economy.
- To understand basic macroeconomic issues and policies like inflation, unemployment, business cycles, and how fiscal and monetary policies help manage the economy.

Course Learning Outcomes:

By the end of the course, students are expected;

- **CO1:** Understand the structure of national income accounting and apply expenditure, income, and value-added methods for measuring national income, including analysis of circular flow and input-output tables.
- **CO2:** Analyze major theories of consumption such as Absolute Income, Permanent Income, Life Cycle, and Inter-temporal Choice models to explain consumer behavior.
- **CO3:** Evaluate theories of investment and demand for money, including neoclassical investment theory, accelerator theory, Tobin's Q theory, and monetary concepts like money multiplier and high-powered money.
- **CO4:** Examine Keynesian and neoclassical macroeconomic models, and assess the role and effectiveness of fiscal and monetary policy using IS-LM, AD-AS, and open economy frameworks.
- **CO5:** Interpret business cycle phases, inflation, unemployment, and Phillips Curve relationships, and assess macroeconomic policy coordination challenges in developing economies.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	–	✓	✓	–	–	–	–	–	–	✓
CO2	✓	✓	–	✓	–	✓	–	–	–	–	–	✓
CO3	✓	✓	✓	✓	✓			✓	–	–	–	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	–	✓
CO5	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

National Income Accounting: Accounting structure, key concepts in accounting, circular flow of income, computational problems - Expenditure approach, income approach and value added approach for measurement, input-output tables.

Unit-II: **[10 Hours]**

Theories of Consumption: The Psychological Law of Consumption - Kuznets 's Consumption Puzzle - Fisher 's Inter-temporal Choice Model - Permanent Income Hypothesis - Life Cycle Hypothesis.

Unit-III: **[14 Hours]**

Theories of Investment, Demand and Supply of Money: The Neoclassical Theory of Investment - Capital Theory and Theory of the Firm - Finance and the Cost of Capital - The Accelerator Theory of Investment - The Stock Market and Tobin's Q Theory; Baumol Inventory Theory of Money, Quantity Theory of Money, High Powered Money, Money Multiplier.

Unit-IV: **[12 Hours]**

Macroeconomic Models: Fiscal and Monetary Policy in IS-LM Model, Relative Efficacy, Aggregate Supply and Aggregate Demand, Open Economy Models.

Unit-V: **[12 Hours]**

Business Cycles, Inflation, and Macroeconomic Policy Coordination: Phases and theories of business cycles; Inflation – types, causes, and effects Phillips Curve – Expectations-Augmented Phillips Curve; Unemployment – types and measurement; Role of Fiscal and Monetary Policy in stabilization; Policy coordination and challenges in developing economies.

Suggested Readings:

D'Souza, E. (2008). *Macroeconomics.* Pearson Publication.
Romer, D. (2012). *Advanced macroeconomics* (4th ed.). McGraw-Hill Irwin.

References:

Blanchard, O., & Fischer, S. (1989). *Lectures on macroeconomics*. MIT Press.
Snowdon, B., & Vane, H. R. (2005). *Modern macroeconomics: Its origins, development and current state*. Edward Elgar.
Dornbusch, R., Fischer, S., & Startz, R. (2008). *Macroeconomics* (10th ed.). Tata McGraw-Hill.
Mankiw, N. G. (2014). *Principles of macroeconomics* (7th ed.). Cengage Learning.
Obstfeld, M., & Rogoff, K. (1996). *Foundations of international macroeconomics*. MIT Press.
Samuelson, P. A., & Nordhaus, W. D. (2012). *Macroeconomics*. McGraw-Hill.
Scarth, W. (2010). *Macroeconomics: An introduction to advanced methods*. Titles on Demand.

Course Code : **MCS104** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Introduction to Social Science concepts**

Course Objectives:

- To introduce students to key sociological concepts such as family, kinship, marriage, and social stratification and their relevance in understanding society.
- To develop an understanding of major sociological and social psychological theories and their application in explaining social behavior and institutions.
- To enable students to analyze economic and social inequalities using sociological and interdisciplinary perspectives.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Explain basic sociological concepts, institutions, and perspectives in understanding social structure and change.

CO2: Interpret major sociological theories of classical and contemporary thinkers.

CO3: Analyze social psychological processes such as perception, attitudes, conformity, and group behavior using theoretical frameworks.

CO4: Examine economic sociological concepts and perspectives to understand inequality, exchange systems, and gender relations in society.

CO5: Apply sociological and interdisciplinary approaches to analyze contemporary social issues in local and global contexts.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓				✓		✓
CO2	✓	✓		✓		✓				✓		✓
CO3	✓	✓		✓		✓		✓	✓	✓		✓
CO4	✓	✓	✓	✓		✓	✓	✓		✓		✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Introduction to Sociological concepts: Concepts and Perspectives in sociology; The Family: Sociological Significance of the Family, Types and functions of Family, Nuclear and joint families; Marriage: Different forms of marriage, changing patterns of marriage/mate selection in India; Kinship: Features of kinship systems in India, regional variations;

Unit-II: **[12 Hours]**

Social Stratification and Sociological Perspectives: Social stratification: Social Class and Caste, Principles of Class and Caste.; Sociological Perspectives: Functional perspective, Conflict perspective, Symbolic-interactionist perspective, Feminist perspective

Unit-III: **[14 Hours]**

Sociological theories: What is sociological theory and how we navigate sociological theory?; Karl Marx – Alienated labour, Marx's theoretical orientation; Emile Durkheim – Social fact, Mechanical and Organic Solidarity, Division of labour; Max Weber – Spirit of capitalism; Class, Status, Party. Pierre Bourdieu- Social space and symbolic power, Habitus, Forms of Capital, Theory of Practice; Structuration theory - Anthony Giddens; The Network Society - Manuel Castells.

Unit-IV: **[12 Hours]**

Social Psychology - Perspectives and Theories: What is social psychology, evolution of social psychology; Social psychological concepts: Social Cognition: how we think about social world, stages in information processing; Social perception, Attitudes, Prejudice and Discrimination; Social influence changing others behavior: conformity, compliance, obedience and power of the situation; Helping and Altruism, Aggression: social learning theory of aggression, violence against women; Groups and Individuals; Culture and self: Nisbett;

Markus and Kitayama's work; The Milgram Experiments; Zimbardo's Stanford Prison Experiment, Bystander Effect: Seminal Studies in the Bystander Effect

Unit-V: **[10 Hours]**

Basic concepts and perspectives in Economics Sociology: Concepts: Value, property, money, labour, rationality; Forms of exchange: Reciprocity and gift; Exchange and money; Perspectives: Functionalist, Marxist, and feminist; Formalism and Substantivism; Social inequality: Affluence and poverty, Economics of inequality in global society, Economic disparity in India; Gender and economy: emotional labour, gender and exclusion

References:

Neil J. Smelser, and Richard Swedberg (Eds). 2005. The Handbook of Economic Sociology. Princeton University Press.

M.F. Guillen et al. 2002. *The new Economic Sociology*. Russel Sage Foundation.

Frank Dobbin. 2004. *The New Economic Sociology: A Reader.* Princeton University Press.

Hann, Chris. and Keith Hart. 2011. *Economic Anthropology*. Cambridge, UK: Polity Press

Carrier, James G. 2022. *Handbook of Economic Anthropology*. Edward Elgar Publishing.

Barbara Harriss-White. 2005. *India's market Society: Three essays in political economy*. Three Essays Press.

Thomas Piketty. 2015. *Economics of inequality*. Harvard University Press.

Real-Work economic Review- Special issue on Thomas Piketty's *Capital in the Twenty-First Century.*

Abhijit Banerjee and Esther Duflo. 2011. *Poor Economics: Rethinking poverty and the ways to end it*. Penguin.

Course Code : **MCS111** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Introduction to Artificial Intelligence**

Course Objectives:

- To understand basic principles of AI towards problem solving,inference perception, knowledge representation and learning.
- To understand the notions of state space representation, heuristicsearch, time and space complexities.
- To understand the applications of AI namely Intelligent Agents, GamePlay, Expert Systems, Machine Learning and NLP.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Able to demonstrate knowledge of building blocks of AI as presentedin terms of Intelligent Agents.
- **CO2:** Attain the capability to represent various real-life problem domains using logic-based techniques and use this to perform inference and planning.
- **CO3:** Apply various search strategies and problem-solving techniques to design intelligent systems.
- **CO4:** Analyze different machine learning approaches including decision trees, neural networks, and belief networks.
- **CO5:** Understand the fundamentals of Natural Language Processing, image processing, speech recognition, and speech synthesis techniques.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	–	1	–	–	–	2
CO2	3	3	3	2	2	1	–	1	–	–	–	2
CO3	3	3	3	2	2	–	–	–	1	–	1	2
CO4	3	3	3	3	2	1	1	1	–	–	1	2
CO5	3	2	3	2	3	1	1	1	–	1	1	2

Course Outline:

Unit-I: **[12 Hours]**

Introduction: What is AI? Foundations of AI, History of AI, Agents and Environments, the nature of the Environment, Problem Solving Agents, Problem Formulation, Search Strategies.

Unit-II: **[12 Hours]**

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, Inference, Reasoning Patterns in Propositional Logic, forward and Backward Chaining.

Unit-III: **[14 Hours]**

First-order logic: Syntax and Semantics of First-Order Logic, Using First-order Logic, Inference in First-order logic, forward and Backward Chaining, Resolution.

Unit-IV: **[10 Hours]**

Learning: Learning from Observations, Forms of Learning, Inductive Learning, Learning Decision Trees, Why Learning Works, Learning in Neuraland Belief networks.

Unit-V: **[12 Hours]**

Practical Natural Language Processing: Practical applications, Efficient parsing,scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception, Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

Suggested Readings:

Stuart Russell, Peter Norvig, —*Artificial Intelligence: A Modern Approach*‖,2nd Edition, Pearson Education, 2007.

B. Yagna Narayana, —*Artificial Neural Networks*‖, PHI, 2005.

E. Rich and K. Knight, —*Artificial Intelligence*‖, 3rd Edition, TMH, 2017.Dan W. Patterson, —*Artificial Intelligence and Expert Systems*‖, PHI, 2015.

References:

Giarrantana, Riley, —*Expert Systems: Principles and Programming*‖, 4th Edition,Course Technology Inc, 2004.

Ivan Bratka, —*PROLOG Programming for Artificial Intelligence*‖, PearsonEducation, 3rd Edition, 2012.

Course Code : **MCS111** Course Type : **Elective** No. of Credits : **4** No. of Hours : **60**	**Course Title** **Geographic Information System Fundamentals**

Course Objectives:

- To understand the principles, components, data models, and development of Geographic Information System (GIS).
- To examine GIS database management, spatial analysis techniques, and methods of data input, editing, and output generation.
- To analyze GIS applications, project development, and emerging technologies for planning, governance, and resource management.

Course Outcomes (COs):

By the end of the course, students can be able to;

- CO1: Explain the concepts, scope, evolution, components, and applications of Geographic Information System (GIS).
- CO2: Describe geographic data sources, vector and raster models, and methods of data input such as GPS, total station, and remote sensing.
- CO3: Analyze GIS database creation, topology, data editing, updating, and quality assessment procedures.
- CO4: Apply spatial analysis techniques including buffering, overlay, network, and terrain analysis using DEM.
- CO5: Assess GIS applications, project development stages, emerging trends such as Web GIS, Cloud GIS, AI integration, and ethical issues in GIS.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Recall & define	✓				✓							✓
CO2 Explain & interpret	✓	✓		✓	✓							
CO3 Apply Models	✓	✓	✓	✓	✓			✓				
CO4 Analyse & evaluate	✓	✓	✓	✓	✓		✓					
CO5 Research & create	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Introduction to GIS: Meaning, definition, nature and scope of Geographic Information System (GIS). Historical development and evolution of GIS technology. Components of GIS including hardware, software, data, people and methods. Geographic objects, spatial entities and map representation. Applications of GIS in planning, environment and resource management.

Unit-II: **[12 Hours]**

GIS Data Models and Data Input: Nature and sources of geographic data. Spatial and non-spatial data. Primary and secondary data sources. Vector and raster data models, their characteristics, advantages and limitations. Data input devices and methods including digitizer, scanner, GPS, total station and remote sensing data sources. Geo-referencing and data conversion techniques.

Unit-III: **[14 Hours]**

GIS Database Management and Editing: Concept of GIS databases. Database creation, storage, retrieval and management. Attribute data handling and linking spatial with non-spatial data. Topology concepts and topology building. Data editing, updating and map revision. Error detection, correction and data quality assessment.

Unit-IV: **[10 Hours]**

GIS Spatial Analysis and Output: Concept and importance of spatial analysis in GIS. Measurement and query operations. Buffering, proximity analysis, network analysis and interpolation methods. Overlay analysis including union, intersect, clip and dissolve operations. Terrain analysis using DEM including slope, aspect, contour and watershed analysis. Presentation of GIS outputs through maps, charts, tables, reports.

Unit-V: **[12 Hours]**

GIS Applications, Project Development and Future Trends: Stages of GIS project development including problem identification, database design, data collection, analysis and output generation. Applications of GIS in agriculture, forestry, urban planning, disaster management, health, transport and governance. Emerging trends in GIS including Web GIS, Mobile GIS, Cloud GIS, 3D GIS, UAV mapping, Artificial Intelligence and Big Data integration. Ethical and legal issues in GIS including privacy, copyright, data security and policy concerns.

References:

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). Geographic Information Systems and Science (4th ed.). Wiley.
Bolstad, P. (2016). GIS Fundamentals: A First Text on Geographic Information Systems (5th ed.). Eider Press.
DeMers, M. N. (2008). Fundamentals of Geographic Information Systems (4th ed.). Wiley.
Chang, K. (2019). Introduction to Geographic Information Systems (9th ed.). McGraw-Hill.
Heywood, I., Cornelius, S., & Carver, S. (2011). An Introduction to Geographical Information Systems (4th ed.). Pearson.
Jensen, J. R. (2013). Remote Sensing of the Environment: An Earth Resource Perspective (2nd ed.). Pearson.
El-Rabbany, A. (2002). Introduction to GPS: The Global Positioning System. Artech House.
Chaisman, N. (1992). Exploring Geographical Information Systems. John Wiley & Sons, New York.
Chrisman, N. R. (1997). Exploring Geographic Information Systems. John Wiley & Sons.
Jensen, J. R. (1998). Introductory Digital Image Processing: A Remote Sensing Perspective. Prentice Hall.
Lillesand, T. M., & Kiefer, R. W. (1979). Remote Sensing and Image Interpretation (5th ed.). Wiley, New York.
Martin, D. (1991). Geographical Information Systems and their Socioeconomic Applications. Routledge, London.
Schowengerdt, R. A. (1997). Techniques for Image Processing and Classification in Remote Sensing. Academic Press.
Ulaby, F. T., Moore, R. K., & Fung, A. K. (1982). Microwave Remote Sensing Active and Passive (Vol. II). Radar.

Course Code : **MCS111** Course Type : **Elective** No. of Credits : **4** No. of Hours : **60**	**Course Title** **Big Data and Public Policy**

Course Objectives

- To familiarize oneself with big data analysis as a tool for addressing substantive research questions.
- To discuss what the analysis of big data entails, as well as associated technical, conceptual and ethical challenges.
- To provide first-hand experience in handling and analyzing large, complex data structures.

Course Outcomes (COs)

CO1 Develop a critical understanding of contemporary trends and transformations in Indian politics and governance.
CO2 Analyse the impact of social, economic and cultural factors on political participation, representation and policy making in India.
CO3 Evaluate the functioning of political institutions, electoral processes and party systems in the context of changing democratic practices.
CO4 Assess emerging political challenges such as digital politics, identity politics, populism, media influence and governance reforms.
CO5 Apply analytical and research skills to interpret contemporary political developments and public policy issues in India.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Recall & define	✓			✓	✓			✓				✓
CO2 Explain & interpret	✓	✓		✓	✓			✓		✓		✓
CO3 Apply Models	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
CO4 Analyse & evaluate	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5 Research & create	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Introduction
What is Big Data?; Handling and Processing Big Data; Methodological Challenges and Problems; Ethics and Big Data

Unit-II: **[14 Hours]**

Public Policy: Big Data and Public Policy Making; Inter-relationship and Challenges
Data Analysis and Management in Public Policy ; Big Data Application: Case Studies

Unit-III: **[10 Hours]**

Digital Era and Governance
Policy, Politics and Governance in the Digital Era
Digital Government, Development of E- Governance, E-Democracy, Digital Citizenship, E- Parliament, E-Rulemaking, Digital Nation State.

Unit-IV: **[10 Hours]**

Data sets and Analysis
Case Study Analysis
The Analysis of CMIE, Census, NFHS, NSS, Employment Data and other Economic Data Sets like RBI Data, India Public Finance Statistics. Use of GIS and Spatial Analysis for Public Policy

Unit-V: **[14 Hours]**

Contemporary Trends and Emerging Issues in Big Data, Governance and Public Policy

Artificial Intelligence, Machine Learning and Predictive Analytics in Public Policy. Data Privacy, Cyber Security and Digital Ethics: Data Protection and Surveillance Debates. Open Government Data, Smart Governance and Digital Public Infrastructure. Social Media Analytics, Misinformation and Political Communication. Big Data for Sustainable Development: Climate Governance, Health Policy and Urban Planning Emerging Technologies in Governance: Blockchain, Internet of Things (IoT) and Cloud Governance

Suggested Readings

Moody, Rebecca., & Bekkers, Victor. (2024). Big data and public policy: Course, content and outcome. Palgrave Macmillan

Höchtl, J., Parycek, P., & Schöllhammer, R. (2016). Big data in the policy cycle: Policy decision making in the digital era. *Journal of Organizational Computing and Electronic Commerce*, *26*(1-2), 147-169.

Pencheva, I., Esteve, M., & Mikhaylov, S. J. (2020). Big Data and AI–A transformational shift for government: So, what next for research?. *Public Policy and Administration*, *35*(1), 24-44.

References

Giest, S. (2017). Big data for policymaking: fad or fasttrack?. *Policy Sciences*, *50*(3), 367- 382.

Schintler, L. A., & Kulkarni, R. (2014). Big data for policy analysis: The good, the bad, and the ugly. *Review of Policy Research*, *31*(4), 343-348.

Clarke, A., & Margetts, H. (2014). Governments and citizens getting to know each other? Open, closed, and big data in public management reform. *Policy & Internet*, *6*(4), 393-417. Vydra, S., &

Klievink, B. (2019). Techno-optimism and policy-pessimism in the public sector big data debate. *Government Information Quarterly*, *36*(4), 101383.

Hilbert, M. (2016). Big data for development: A review of promises and challenges. *Development Policy Review*, *34*(1), 135-174.

Rogge, N., Agasisti, T., & De Witte, K. (2017). Big data and the measurement of public organizations' performance and efficiency: The state-of-the-art. *Public Policy and Administration*, *32(4), 263-281.*

González-Bailón, S. (2013). Social science in the era of big data. *Policy & internet*, *5*(2), 147- 160.
Al Nuaimi, E., Al Neyadi, H., Mohamed, N., & Al-Jaroodi, J. (2015). Applications of big data to smart cities. *Journal of Internet Services and Applications*, *6*, 1-15.

Janssen, M., Konopnicki, D., Snowdon, J. L., & Ojo, A. (2017). Driving public sector innovation using big and open linked data (BOLD). *Information systems frontiers*, *19*, 189- 195.

SEMESTER-II

Course Code : **MCS201** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Computational Demography**

Course Objectives:

- To provide students with a comprehensive understanding of demographic concepts, processes, and population dynamics.
- To develop skills in measuring and analyzing fertility, mortality, and migration using demographic methods and data sources.
- To enable students to interpret demographic trends and their socio-economic implications using census and survey data.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Explain the basic concepts, theories, and data sources of demography, including age-sex structure and population composition.

CO2: Compute and interpret fertility measures using standard demographic techniques and data sources.

CO3: Analyze mortality patterns and construct life table-based indicators using demographic methods.

CO4: Examine migration concepts, types, and data sources to understand population mobility.

CO5: Apply direct and indirect methods to measure migration and interpret demographic patterns and trends.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓	✓			✓		✓
CO2	✓	✓	✓	✓	✓		✓			✓		✓
CO3	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓
CO4	✓	✓		✓		✓	✓			✓		✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Basics of Demography: Basic concepts of demography, Components of population change, Demography and its linkage with other social science disciplines. Demographic transition theory; Data Sources for Demography: Census of India, Sample Registration System, Surveys; Basic measures: Rate, Ratio, Proportions; Measures of age and sex structure: Defining age and sex, sex ratio, sex ratio at birth, age-sex population pyramid, Median age, dependency ratio and potential support ratio; Importance of age-sex structure in Demography, Factors affecting age and sex structure; Socioeconomic implications of age and sex structure; Computing age-sex pyramid for India and states using Census Data.

Unit-II: **[12 Hours]**

Fertility: Definition and Concepts of fertility: Fecundity and Fertility, Sterility, Family size, Birth order, Parity, Natural fertility; Basic measures of fertility: Crude Birth Rate (CBR), General Fertility Rate (GFR), Age Specific Fertility Rates (ASFR), Total Fertility Rate (TFR), Gross Reproduction Rate (GRR); Sources of Data for computing fertility: Vital registration or Civil Registration System; National Periodic Census, Sample Fertility Surveys; Computing CBR, GFR, ASFR, TFR, GRR, Socio-cultural factors affecting fertility; Computing levels and trends of fertility in India.

Unit-III: **[12 Hours]**

Mortality: Basic concepts of mortality; Measures of mortality – Crude Death Rate (CDR), Age-Specific Death Rates (ASDR), Infant Mortality Rate (IMR), Neonatal Mortality Rate (NMR), Cause-specific death rates, and ratios; Sources of data for computing mortality – Sample Registration System (SRS), National Surveys; Concept of Life table, types, structure and functions; Computing sex and age patterns of mortality for

India and states, and computing rural-urban differentials in mortality;

Unit-IV: **[10 Hours]**

Basics of Migration: Basic concepts: Mobility, Commuting, and Migration; life-time migration, net and gross migration, streams of migration; Sources of data for migration analysis: Census of India, Surveys – National Sample Survey, Kerala Migration Survey, Tamil Nadu Migration Survey, Odisha Migration Survey

Unit-V: **[14 Hours]**

Measures of Migration: Measures of migration: Direct and Indirect; Direct measures: Place of birth, duration of residence, place of last residence, Indirect measures: Vital statistics method, National growth rate method, Survival ratio methods - Census survival ratio method, Life table survival ratio method; Determinants of internal migration: Causes of migration at the place of origin and at the place of destination; Consequences of internal migration; Computing levels of migration, as well as age-sex patterns of migration for India, and States

Reference:

Bhende, A., and Kanitkar, T. (1996). Principles of Population Studies (Seventh Edition), Himalaya Publishing House, Bombay.
Jacob S. Siegel and David A. Swanson. (2004). The Methods and Materials of Demography, Second Edition, Elsevier Science, USA
Rajan, S.I., and Bhagat.R.B. (2023). Researching Internal Migration. Routledge Taylor and Francis Group, London.
Ram, F. and Pathak, K.B. (2017). Techniques of demographic analysis. Himalaya Publishing House, Mumbai.
Srinivasan, K. (2011). Training Manual on Demographic Techniques. UNFPA, and Census of India.
United Nations. (1974). Methods of Measuring Internal Migration, Manual VI, UN, New York.

Course Code : **MCS202** Course Type : **Core** No. of Credits: **4.00** No. of Hours : **60**	**Course Title** **Computational Sociology**

Course Objectives:

- Introduce the concepts, theories, and applications of Computational sociology in understanding the contemporary social phenomenon
- To develop student's ability to use computational tools and social science datasets for analysis of sociological issues
- To enable students to apply computational methods such as network analysis, data visualization, and modelling to study social structures and social change.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Explain the fundamental concepts, approaches of computational sociology
- **CO2:** Analyze contemporary social issues such as family, caste, gender, religion, using sociological and computational perspectives
- **CO3:** Access, manage, and interpret data from major social science datasets such as Census, NFHS, NSS, and other secondary data sources
- **CO4:** Apply computational techniques including data visualization, social network analysis, and computational modelling to investigate social process, and social change
- **CO5:** Design and present a mini research project using computational methods to address a sociological problem and effectively communicate findings

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	–	–	–	✓	–	–	–	–	–	✓
CO2	✓	✓	✓	–	–	✓	✓	✓	–	–	–	–
CO3	✓	✓	–	✓	✓	–	–	✓	–	–	✓	–
CO4	✓	✓	✓	✓	✓	✓	✓	–	–	–	✓	✓
CO5	✓	✓	✓	✓	✓	–	–	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[10 Hours]**

Basic concepts and theories: Sociological imagination and digital society; classical sociological theories; theory of capitalism, class, gender, and caste; Significance of numbers in sociology – positivism, emergence of statistics, role of numbers in sociology research, survey research;

Unit-II: **[12 Hours]**

Evolution of Computational Sociology: Categories of social data: Family issues – Joint, Nuclear, intergenerational networks, Ageing; Marriage and Religion – Hindu Marriage Act, Muslim Marriage systems, Divorces; Caste and Social Change; Gender and Mobility – Free transport services to women, access to health; Education and Gender; Tribal economy; food and culture.

Unit-III: **[12 Hours]**

Social Data Sources: Major social science datasets – National Family Health Survey, National Sample Survey, Kerala Ageing Survey, Census; Data handling – Data extraction, cleaning, pre-processing; data analysis – descriptive statistics, social indicators, cross-tabulation, trend analysis; data visualisation – charts and dashboards, geographic visualisation of social indicators.

Unit-IV: **[10 Hours]**

Social Change, and Computational Modelling: Computational sociology – emergence and scope, digital society and big data; Social media and society; Sociological interpretation of data; How data work for social development, how to interpret census data, sociological importance.

Unit-V: **[16 Hours]**

Computational Sociology Project: Research design – identifying research problem, framing research questions, selection of datasets; Data analysis; Visualisation and communication; Project report writing – structure of mini research report, academic writing and citation; presentations and submission of report;

References:

Stephen, P.B. et al. (2018). Analyzing social networks. Second Edition, Sage Publications

Matthew, J.S. (2017). Social Research in the Digital Age. Princeton University Press.

Luptin, D. (2015). Digital Sociology. London: Routledge

Pentland, A. (2014). Social Physics: How social networks can make us smarter. New York: Penguin Press.

Giddens, A., & Sutton, P. W. (2021). Sociology (9th ed.). Cambridge: Polity Press.

Breiger, R. L., Evans, J. A., & others (Eds.). (2025). *The Oxford Handbook of Computational Social Science*. Oxford: Oxford University Press

Course Code : **MCS203** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Qualitative methods in Social science Research**

Course Objectives:

- To introduce students to the principles, approaches, and processes of qualitative data analysis in social science research.
- To develop skills in coding, categorizing, and interpreting textual and qualitative data using established analytical methods.
- To enable students to use qualitative data analysis software and effectively communicate qualitative research findings.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Explain the concepts, approaches, and processes involved in qualitative data analysis.

CO2: Apply first-cycle and second-cycle coding techniques for organizing and analyzing qualitative data.

CO3: Analyze qualitative data using grounded theory, thematic analysis, discourse analysis, and analytic memo techniques.

CO4: Use computer-assisted qualitative data analysis software (CAQDAS) such as ATLAS.ti, NVivo, and Dedoose for data analysis.

CO5: Write and present qualitative research findings using appropriate analytical and interpretative styles.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	–	✓	–	✓	–	–	–	✓	–	✓
CO2	✓	✓	✓	✓	✓	–	–	✓	–	✓	–	✓
CO3	✓	✓	✓	✓	✓	✓	-	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓		-	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓		✓	–	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[15 Hours]**

Introduction: Introduction to qualitative data analysis; Approaches to textual data analysis; Textual data preparation; Developing codes: definition and purpose of codes; First-cycle coding and second-cycle coding: meaning and examples; Variables versus cases; Within-case and cross-case analysis

Unit-II: **[08 Hours]**

Designing Qualitative Research: First-cycle coding methods: Grammatical coding methods, Elemental coding methods, Affective coding methods, Exploratory coding methods, Second-cycle coding methods, Transition from first-cycle to second-cycle coding, Reflection and refraction in coding

Unit-III: **[15 Hours]**

Qualitative analysis and Interpretation: Grounded Theory Analysis and Coding; Thematic Analysis and Coding; Discourse Analysis; Analytic memos: meaning and significance; Coding and categorizing analytic memos; From codes to patterns; Network display and graphic display techniques

Unit-IV: **[12 Hours]**

Software in Qualitative Research: Introduction to Computer-Assisted Qualitative Data Analysis Software (CAQDAS); Why and how computers are used in qualitative research; Criteria for selecting Qualitative Data Analysis (QDA) software; Overview of ATLAS.ti, NVivo, and Dedoose; Checklist for using QDA software

Unit-V: **[12 Hours]**

Writing and Presenting Qualitative Research: Styles of qualitative research writing: Descriptive, Analytical, Interpretative, Critical; Writing qualitative research reports; Writing theses and dissertations; Presentation of qualitative findings; Hands-on experience with qualitative data analysis using software

References:

Flick, Uwe (2014). An Introduction to Qualitative Research, SAGE, New Delhi.
Hennink, M., Hutter, I. and Baily, A.(2011). Qualitative Research Methods. Sage Publications, London.
Mack, N., Woodsong, C., MacQueen, K.M., Guest, G., and Namey, E. (2005). Qualitative Research Methods: A Data Collector's Field Guide. Family Health International, USA.
Saldana, J. (2011). Fundamentals of Qualitative Research. Oxford University Press, New York.

Course Code : **MCS204** Course Type : **Core** No. of Credits: **4.00** No. of Hours : **60**	**Course Title** **Data harvesting for social science research**

Course Objectives:

- To introduce students to different sources of social science data, including census, surveys, and large-scale datasets in India.
- To develop understanding of data extraction, usage, and interpretation from major national and international survey systems.
- To sensitize students to data privacy, ethical concerns, and legal frameworks related to digital and social media data.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Explain the concepts of data, information, and major sources of social science data.
CO2: Describe the structure and usage of Census of India and National Sample Survey (NSS) data.
CO3: Interpret large-scale survey data such as IHDS, NFHS, and DLHS for social science research.
CO4: Analyze issues related to web scraping, social media data, and privacy concerns in the digital era.
CO5: Evaluate data protection laws and ethical frameworks governing digital data use in India.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	–	✓	–	✓			–	✓	–	✓
CO2	✓	✓	✓	✓	✓	✓			–	✓	–	✓
CO3	✓	✓	✓	✓	✓	✓			–	✓	✓	✓
CO4	✓	✓	✓	✓		✓	✓	✓	–	✓		✓
CO5	✓	✓		✓		✓	✓	✓		✓		✓

Course Outline:

Unit-I: **[12 Hours]**

Introduction to Social Science Data sources: What is Data?; Difference between data and information; Sources of data: primary and secondary; Importance and relevance of data in social science research

Unit-II: **[12 Hours]**

Census of India and National Sample Surveys: Introduction to Census of India; National Sample Survey (NSS); Data structure and data extraction; Major NSS rounds to understand social science research

Unit-III: **[12 Hours]**

Large scale surveys in India: Discussion on large-scale surveys: India Human Development Survey (IHDS), National Family Health Survey (NFHS), District Level Household Survey (DLHS)

Unit-IV: **[15 Hours]**

Understanding Web Scraping and Privacy: Why harvest data?; Advantages and drawbacks of data harvesting Introduction to social media data; Privacy issues with social media: Facebook data-sharing scandal, Pegasus spyware scandal, WhatsApp privacy policy update

Unit-V: **[9 Hours]**

Data Privacy Initiatives: Personal Data Protection Bill; Digital Personal Data Protection Act 2023

References

Freedman, J. (2020). Privacy, Data harvesting and You. Rosen publishing group, New York
González-Bailón, S. (2017). Decoding the Social World: Data Science and the Unintended Consequences of Communication. MIT press.
Salganik, M. J. (2018). Bit by Bit: Social Research in the Digital Age. Princeton University Press.

Course Code : **MCS211** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Introduction to Econometric Theory**

Course Objectives:

- Introduce the basic tools of econometric analysis.
- Understand the methods of econometric analysis and their application in empirical research.
- To develop students' ability to apply econometric methods and diagnostic techniques in empirical research, including handling problems such as multicollinearity, heteroskedasticity, autocorrelation, and specification errors.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Understand and apply the Classical Linear Regression Model (CLRM) and estimate econometric relationships using the Ordinary Least Squares (OLS) method.
- **CO2:** Interpret and evaluate regression results using statistical inference techniques such as hypothesis testing, confidence intervals, goodness of fit, and ANOVA.
- **CO3:** Identify and address violations of CLRM assumptions including multicollinearity, heteroskedasticity, and autocorrelation using appropriate diagnostic and remedial measures.
- **CO4:** Analyze regression models with qualitative (dummy) variables and apply models involving interaction effects, structural stability tests, and piecewise regression analysis
- **CO5:** Apply Maximum Likelihood Estimation (MLE) techniques and estimate binary and limited dependent variable models such as Logit, Probit, and Multinomial models for empirical economic analysis

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	–	–	✓	–	–	–	✓
CO2	✓	✓	–	✓	✓	✓	–	✓	–	✓	–	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	–	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[15 Hours]**

The Linear Regression Analysis: Bi-variate and multivariate linear regression models, CLRM assumptions, Ordinary Least Squares estimation, Properties of OLS and the Gauss- Markov theorem. General and confidence approach to hypothesis testing, goodness of fit, ANOVA and testing of overall significance of sample regression, matrix approach to linear regression models.

Unit-II: **[08 Hours]**

Functional Forms of Regression Models: Choice of functional forms-Log-linear, Double log and Lin-Log models, Reciprocal and polynomial models, Choice of functional form, Interpreting coefficients in different functional forms and applications, Specification error and tests for specification error.

Unit-III: **[15 Hours]**

Relaxation of CLRM Assumptions and Problems in Regression: Violation of CLRM assumptions and its consequences, detection and remedial measures of multicollinearity, heteroskedasticity and autocorrelation.

Unit-IV: **[12 Hours]**

Regression with Dummy Variables: The nature of dummy variables, Regression on dummy variables with two categories, with more than two categories- intercept shifters, dummy variable trap, interaction of two categorical variables, interaction of categorical and continuous (quantitative) variables- slope shifters, piecewise linear regression model, Chow test for cross-section data and for time-series data (test structural stability of regression models).

Unit-V: **[12 Hours]**

Maximum Likelihood Estimation: Introduction to binary and limited dependent variable, Limitation of the linear probability model (LPM), Method of maximum likelihood estimation and its properties (including consistency), Probit and Logit models, Multinomial models

Suggested Readings:

Gujarati, D and Porter, (2009) *Basic Econometrics*. Fifth Edition, McGraw Hill/Irwin.
Greene, William H, (2008) *Econometric Analysis*. 6th Edition, Prentice Hall.

References:

Johnston J. and DiNardo, J, (1997) *Econometric Methods*. 4th Ed. McGraw-Hill.
Ramanathan, Ramu, (2002) *Introductory Econometrics with Applications*. (5th edit), Thomson Asia Pvt Ltd., Singapore.
Stock, James H., and Mark W. Watson, (2006) *Introduction to Econometrics*, Second Edition, (Addison-Wesley Series in Economics).
Wooldridge, J., (2015) *Introductory Econometrics: A Modern Approach*. Nelson Education.
G. S. Maddala, (2009) *Introduction to Econometrics*. Wiley Publishers, 4th Edition, Indian edition.
Christopher Dougherty, (2007) *Introduction to Econometrics*. Oxford University Press (3rd edit), Indian edition.

Course Code : **MCS211** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Big Data Analytics**

Course Objectives:

- Understand big data for business intelligence and learn business casestudies for big data analytics.
- Understand no sql big data management.
- Perform map-reduce analytics using Hadoop and related tools.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Describe big data and use cases from selected business domains.
- **CO2:** Explain NoSQL big data management.
- **CO3:** Perform map-reduce analytics using Hadoop and use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.
- **CO4:** Understand and apply Hadoop ecosystem components such as HDFS, YARN, and MapReduce for distributed data processing.
- **CO5:** Analyze and process large-scale datasets using big data frameworks to solve real-world analytics problems in various domains

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	1	1	–	–	1	1	2
CO2	3	2	2	2	3	–	–	1	–	–	–	2
CO3	3	3	3	2	3	–	–	1	1	–	1	2
CO4	3	3	3	2	3	_	1	1	1	–	1	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2

Course Outline:

Unit-I: **[20 Hours]**

Introduction to big data - convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies –introduction to Hadoop – opensource technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics– inter and trans firewall analytics.

Unit-II: **[20 Hours]**

Introduction to NoSQL – aggregate data models – key-value and document data models–relationships – graph databases – schema less databases – materialized views - Distribution models– master-slave replication – consistency – Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

Unit-III: **[16 Hours]**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop Pipes –design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow –Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures –Cassandra – Hadoop integration.

Unit-IV: **[18 Hours]**

Map Reduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling– shuffle and sort – task execution – MapReduce types – input formats – output formats.

Unit-V: **[16 Hours]**

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive– data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

Suggested Readings:

Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, ―*Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses*‖,1st Edition, Wiley, 2013.

P. J. Sadalage, M. Fowler, ―*NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*‖, Addison-Wesley Professional, 2012.

References:

Tom White, ―*Hadoop: The Definitive Guide*‖, 3rd Edition, O'Reilly, 2012.

Course Code : **MCS211** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Machine Learning**

Course Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IoT nodes.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Extract features that can be used for a particular machine learning approach in various IoT applications.
- **CO2:** Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machinelearning approach.
- **CO3:** Mathematically analyse various machine learning approaches and paradigms.
- **CO4:** Implement supervised and unsupervised learning algorithms such as regression, classification, clustering, and dimensionality reduction for real-world datasets.
- **CO5:** Evaluate and optimize machine learning models using techniques such as cross-validation, ensemble methods, and performance metrics to improve prediction accuracy.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	1	1	–	–	–	2
CO2	3	3	2	2	2	1	–	1	–	–	–	2
CO3	3	3	2	3	2	–	–	–	–	–	–	2
CO4	3	3	3	3	3	1	1	1	1	–	1	2
CO5	3	3	3	3	3	1	1	1	1	1	1	2

Course Outline:

Unit-I: **[12 Hours]**

Introduction – Basic Definitions- Types of Learning: Unsupervised Learning – Reinforcement Learning – Supervised Learning – Learning A Class from Examples. Supervised Learning (Classification): Basic methods: Distance- Based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond BinaryClassification: Multi- class/Structured Outputs, Ranking.

Unit-II: **[12 Hours]**

Supervised Learning (Regression): Basic methods: Linear Models: Linear Regression, Logistic Regression: Bayesian logistic regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods.

Unit-III: **[14 Hours]**

Unsupervised Learning: Clustering: K-means/Kernel K-means, DimensionalityReduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion,Generative Models (mixture models and latent factor models)

Unit-IV: **[10 Hours]**

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, RandomForests)

Unit-V: **[12 Hours]**

Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Suggested Readings:

Kevin Murphy, ―*Machine Learning: A Probabilistic Perspective*‖, MIT Press, 2012.

Trevor Hastie, Robert Tibshirani, Jerome Friedman, ―*The Elements of StatisticalLearning*‖, Springer, 2009.

References:

Christopher Bishop, ―*Pattern Recognition and Machine Learning*‖, Springer, 2007.

Course Code : CCC**213** Course Type : **CCC** No. of Credits : **4.00** No. of Hours : **90**	**Course Title** **Introduction to R programming**

Course Objectives:

- This course introduces R, which is a popular statistical programming language. The course covers data reading and its manipulation using R, which is widely used for data analysis internationally.
- The course also covers different control structures and design of user-defined functions. Loading, installing, and building packages are covered.
- To introduce the fundamentals of R programming for data analysis, including data structures, data manipulation, statistical analysis, visualization, and package development.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Develop an R script and execute it
- **CO2:** Install, load and deploy the required packages, and build new packages forsharing and reusability
- **CO3:** Extract data from different sources using API and use it for data analysis
- **CO4:** Visualize and summarize the data
- **CO5:** Design application with database connectivity for data analysis

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	3	–	–	–	–	–	–	2
CO2	3	2	3	2	3	–	–	–	1	–	1	2
CO3	3	3	3	2	3	–	–	1	1	–	–	2
CO4	3	2	2	2	3	1	–	–	–	2	–	2
CO5	3	3	3	3	3	1	–	1	1	1	1	2

Course Outline:

Unit-I: **[20 Hours]**

Introduction: R interpreter, Introduction to major R data structures like vectors, Matrices, arrays, list and data frames, Operations.

Unit-II: **[15 Hours]**

Control Structures and Functions: if-else statements, switch statements, for loops, while loops, repeat loops, Jumps: break and next statements, functions.

Unit-III: **[25 Hours]**

Installing, loading and using packages: Read/write data from/in files, extracting datafrom web-sites, clean data, transform data by sorting, adding/removing new/existing Columns, centring, scaling and normalizing the data values, converting types of Values, using string in-built functions.

Unit-IV: **[15 Hours]**

Statistical analysis of data for summarizing and understanding data, Visualizing dataUsing scatter plot, line plot, bar chart, histogram, and box plot.

Unit-V: **[15 Hours]**

Designing GUI: Building interactive application and connecting it with database.Building Packages.

Suggested Readings:

Cotton, R., Learning R: a step-by-step function guide to data analysis. 1stedition. O'Reilly Media Inc

References:

Bharti Motwani, Data analytics with R, (1st Edition), Wiley,2019Michael J Crawley, The R Book, (2nd Edition), Wiley, 2018

Gareth James et.al., An Introduction to Statistical Learning: withApplications in R (Springer Texts in Statistics), (7th Edition), Springer, 2017

SEMESTER-III

Course Code : **MCS301** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Causal inferences for Social Sciences**

Course Objectives:

- To provide students with advanced knowledge of multivariate statistical techniques used in social science research.
- To develop skills in applying regression-based models for analyzing complex relationships among variables.
- To enable students to interpret, present, and communicate multivariate analysis results for research and policy applications.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Apply multiple regression techniques to examine relationships among variables and evaluate model fit and statistical significance.

CO2: Perform Multiple Classification Analysis (MCA) and interpret adjusted and unadjusted effects of explanatory variables.

CO3: Construct and interpret path models to analyze direct and indirect relationships among variables.

CO4: Apply logistic and multinomial logistic regression models and interpret coefficients, odds ratios, and model diagnostics.

CO5: Present and communicate multivariate analysis results using appropriate statistical tables, graphical methods, and software tools.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓						✓	✓
CO2	✓	✓	✓	✓	✓	✓				✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓				✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Multiple Regression I

• Multiple regression with two predictor variables, Multiple regression with three or more predictor variables, Dummy variables to represent categorical variables;

• Multicollinearity; interaction, nonlinearities.

Unit-II: **[12 Hours]**

Multiple Regression II

• Goodness of fit: Standard error of the estimate, coefficient of determination, R2, Multiple correlation coefficient, R, Partial correlation coefficient;

• Statistical inference: hypothesis testing, confidence intervals, p values for a single regression coefficient, testing the difference between two regression coefficients.

Unit-III: **[12 Hours]**

Multiple Classification Analysis

• Basic Multiple Classification Analysis (MCA) table: Unadjusted values, and adjusted values;

• MCA with quantitative control variables;

• Expressing results from Ordinary Multiple regression in an MCA format;

• Presenting MCA results graphically.

Unit-IV: [12 Hours]

Path Analysis

• Path diagrams and path coefficients, path models with more than one exogeneous variable; path models with control variables;

• Path models with standardized variables: standardized variables and standardized path coefficients, standardized and unstandardized coefficients.

Unit-V: [12 Hours]

Logit Regression and Multinomial Logit Regression

• Logistic function, Odds and logit of P, Logistic regression coefficients; odds ratios; effect on the odds when the predictor variable is categorical with more than two categories;
• statistical inference, goodness of fit; fitting logit regression model;
• Limitations of logit regression model;
• Basic form of multinomial logit model; Interpretation of coefficients;
• statistical inference, goodness of fit; presentation of results in a Multiple Classification Analysis format; Multinomial models with interactions and nonlinearities.

Suggested Readings:

Andrews, F., J. Morgan, and J. Sonquist (1969), *Multiple Classification Analysis*. Ann Arbor: Survey Research Center, Institute for Social Research, University of Michigan

Kendall, M. G. and C. A. O'Muircheartaigh (1977), *Path Analysis and Model Building*. World Fertility Survey Technical Bulletin No. 2. The Hague: International Statistical Institute

Retherford, R.D. and Minja, K.C. (1993). "Statistical models for causal analysis". John Wiley and sons publications

Course Code : **MCS302** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Healthcare Data Analytics**

Course Objectives:

- To introduce students to the structure of Indian Healthcare system, major healthcare data sources, and digital health initiatives for evidence-based decision making.
- To develop skills in managing, analyzing, and visualizing healthcare data using statistical techniques and healthcare indicators.
- To enable students to apply healthcare data analytic tools to and predictive techniques using statistical software for preparing research-based reports

Course Outcomes (COs):

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

CO1: Explain the structure of the Indian healthcare system, major healthcare datasets, and digital health initiatives such as ABDM, and e-hospital.

CO2: Manage, clean, organize and interpret healthcare datasets from national and international sources such as NFHS, HMIS, IHDS, WHO, Census of India.

CO3: Apply basic statistical measures and data visualisation techniques to analyze healthcare indicators and identify regional variations and trends in health outcomes.

CO4: Use healthcare datasets to perform basic predictive analytics, compute health-related measures, and evaluate model performance using statistical software.

CO5: Conduct a healthcare data analytics project using STATA or RStudio and communicate findings through a structured research report and presentation.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓		✓	✓					✓
CO2	✓	✓		✓	✓	✓						✓
CO3	✓	✓		✓	✓	✓	✓			✓		✓
CO4	✓	✓	✓	✓	✓					✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Foundations of Healthcare data in India: Indian healthcare system overview: public (govt hospitals, PHCs/CHCs) and private sectors; Key Indian Healthcare data sources: NFHS (National Family Health Survey), DHS, Census data, NITI Aayog health index; Digital health initiatives: Ayushman Bharat Digital Mission (ABDM), e-Hospital.

Unit-II: **[10 Hours]**

Data Management and Pre-processing: India Healthcare data challenges; Cleaning organizing survey and coverage data (NFHS, HMIS, IHDS, WHO); Understanding the data across the states and district; Understanding of data storage and basic data concepts.

Unit-III: **[12 Hours]**

Understanding India's Health Data Through Numbers and Charts: Basic statistics applied in health care indictors: maternal mortality, infant mortality, Risk ratio- Relative risk ratio, odds ratio; Visualizing state-wise and

district-wise health differences; Identifying trends of healthcare access in rural and urban areas; Introduction to dashboards: Example of Government health dashboards.

Unit-IV: **[12 Hours]**

Predictive Analytics for Indian Healthcare: Hands on experience on Health data; Computing the basic concepts; Predicting prevalence rate and ratio; Understanding model accuracy in simple terms.

Unit-V: **[14 Hours]**

Applications and Project: Health care data project using Stata and R studio – Ayushman Bharat, PM-JAY claims data; Project report– structure of mini research report; presentations and submission of report;

References

Birkhead GS, Morrow CB, Pirani S. Essentials of Public Health. 5th ed. Jones & Bartlett Learning; 2025.

Park, K. (2025). Park's textbook of preventive and social medicine (28th ed.). Banarsidas Bhanot.

Monga, K. (2025). AI/ML for healthcare: Navigating the AI/ML maze responsibly, securely, and sustainably. CRC Press.

Govt. of India -National Health Policy Ministry of Health and Family Welfare, New Delhi.

Course Code : **MCS303** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **75**	**Course Title** **Introduction to LaTex and Academic Writing**

Course Objectives:

- To develop academic writing skills required for preparing research papers, reports, dissertations while adhering to the principles of citation standards.
- To Apply LaTex tools and techniques to create, format, and manage professional academic documents , including references, tables, figures, and bibliographies.
- To communicate research effectively by preparing scholarly documents, research articles, and thesis reporting.

Course Outcomes (COs):

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

CO1 Demonstrate principles of academic writing, including clarity, arguments, literature review writing, and citation practices.
CO2 Create and format academic documents using LaTex by applying document classes, packages, text formatting, tables, figures, and other essential features.
CO3 Manage citations, bibliographies, cross-references, and research documentation using BibTeX/BibLaTeX and related LaTeX tools
CO4 Prepare research-oriented documents such as journal articles, proposals, conference papers following academic publishing standards.
CO5 Develop a complete scholarly report or mini-project in LaTeX that integrates academic writing conventions, reference management, and research communication practices structured and evidence-based policy recommendations.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓		✓				✓		✓		✓
CO2	✓				✓					✓		✓
CO3	✓			✓	✓			✓		✓		✓
CO4		✓	✓	✓				✓		✓	✓	✓
CO5	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Foundations of Academic Writing: Introduction to academic writing; Characteristics of academic writing: clarity, precision, objectivity, and coherence; Structure of academic texts: essays, reports, research papers, and dissertations; Writing paragraphs, arguments, and literature reviews; Academic integrity: plagiarism, paraphrasing, summarizing, and citation practices; Overview of citation styles (APA, Chicago, MLA, IEEE)

Unit-II: **[12 Hours]**

Introduction to LaTex: What is LaTeX? Advantages over word processors; Installing and using LaTeX systems (TeX Live, MiKTeX, Overleaf); Structure of a LaTeX document; Basic commands, document classes, and packages; Text formatting, sections, lists, tables, and figures; Compiling and troubleshooting LaTeX documents

Unit-III: **[12 Hours]**

Academic documents in LaTex: Creating research papers and reports in LaTeX; Managing references using BibTeX and BibLaTeX; Citations, bibliographies, and reference management; Cross-references, labels, footnotes, and hyperlinks; Formatting tables, charts, and graphical outputs

Unit-IV: **[12 Hours]**

Writing for Research and Publication: Components of a research paper: Title, Abstract, Introduction, Literature Review, Methods, Results, Discussion, and Conclusion; Writing research proposals; Writing conference papers and journal articles; Presenting quantitative and qualitative findings; Data visualization and interpretation in academic writing; Peer review process and responding to reviewer comments

Unit-V: **[12 Hours]**

Advance LaTex Applications and Research communication: Thesis and dissertation preparation using LaTeX; Customizing templates and document layouts; Collaborative writing using Overleaf and version control concepts; Reproducible research workflows; Preparation of a mini-project/report in LaTeX incorporating academic writing standards

References

Kopka, H., & Daly, P. W. (2003). Guide to LaTeX (4th ed.). Addison-Wesley

Mittelbach, F., Fischer, U., Rowley, C., & Schöpf, R. (2023). The LaTeX Companion (3rd ed.). Addison-Wesley

Day, R. A., & Gastel, B. (2022). How to Write and Publish a Scientific Paper (9th ed.). Cambridge University Press

Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & Fitzgerald, W. T. (2016). The Craft of Research (4th ed.). University of Chicago Press.

Ajay Semalty. (2021). Academic Writing. ISBN: 9789390211739, BS Publications, Hyderabad, India; https://bspublications.net/book_detail.php?bid=1574

Oshima, Alice, and Ann Hogue. Introduction to Academic Writing. New York, Longman Writing Series, ISBN 0-13-241028-1

John Sealy. The Oxford Guide to effective writing and Speaking, OUP publications: 9780199652709

Course Code : **MCS311** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **75**	**Course Title** **Public Policy Analysis**

Course Objectives:

- To understand the concepts, approaches, and methods of public policy analysis.
- To examine the role of political, economic, and institutional actors in the policy process.
- To critically evaluate constraints, challenges, and ethical dimensions in policy formulation and implementation.

Course Outcomes (COs):

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

CO1 Explain the theoretical and practical dimensions of public policy analysis.
CO2 Analyse the role of institutions and actors in shaping public policy.
CO3 Evaluate socio-economic and political determinants influencing policy decisions.
CO4 Identify constraints and ethical issues in policy formulation and implementation.
CO5 Develop structured and evidence-based policy recommendations.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓	✓				✓
CO2	✓	✓	✓			✓	✓	✓		✓		✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Foundations of Public Policy Analysis: Policy Analysis: Meaning, Importance and Steps; Empirical and Normative Policy Analysis; Retrospective and Prospective Analysis; Data-Driven Policy Analysis in Governance

Unit-II: **[12 Hours]**

Determinants of Public Policy Analysis in India: Political Culture, Socio-Economic Factors, Political and Governance Factors; Globalization and its Impact on National Policy; Role of Technology and Digital Transformation in Policy Making ; Sustainable Development Goals (SDGs) and Policy Alignment

Unit-III: **[12 Hours]**

Actors in Public Policy Analysis; Government Institutions: Legislature, Executive and Judiciary; International Donor Agencies; Multinational and Transnational Agencies; Political Parties, Media and Civil Society; Think Tanks and Policy Research Organisations

Unit-IV: **[16 Hours]**

Policy Monitoring and Evaluation: Monitoring and Evaluation (M&E) Frameworks; Impact Assessment Methods in Public Policy; AI and Big Data in Policy Evaluation

Unit-V: **[10 Hours]**

Constraints on Public Policy: Economic and Institutional Constraints on Policy; Social and Cultural Factors: Constraining and Enabling Policy Reversals; Political Feasibility: Interests and Power, Administrative Capacity Constraints; Corruption and Transparency Issues in Policy Execution; Ethics and Public Policy

Suggested Readings

Sapru, Radhakrishnan (2023), *Public Policy: A Contemporary Perspective*, Atlantic Publishers.
Dye, T. R. (2017), *Understanding Public Policy* (15th ed.), Pearson.
World Bank (2021), *World Development Report: Data for Better Lives*.
United Nations (2022), *Sustainable Development Goals Report*.
OECD (2020), *Governance and Policy Evaluation Frameworks*.
Government of India (latest), *NITI Aayog Policy Reports*.

References

Anderson, J. E. (2014), *Public Policy Making*, Cengage Learning.

Ayyar, R. V. V. (2009), *Public Policymaking in India*, Pearson.

Bardach, E. (2011), *A Practical Guide for Policy Analysis*, CQ Press.

Birkland, T. A. (2011), *Policy Process: Theories, Concepts, and Models*, Routledge.

DeLeon, P., & DeLeon, L. (2002), *What Ever Happened to Policy Implementation?*, Journal of Public Administration Research and Theory.

Givel, M. (2010), *The Evolution of Punctuated Equilibrium Theory in Public Policy*.

Greenberg, D. G. et al. (1977), *Developing Public Policy Theory*, APSR.

Kingdon, J. (2010), *Agendas, Alternatives, and Public Policies*, Pearson.

Lipsky, M. (2010), *Street-Level Bureaucracy*, Russell Sage Foundation.

Narain, U., & Bell, R. G. (2006), *Who Changed Delhi's Air?*, Economic and Political Weekly.

Stillman, R. (2013), *Public Administration: Concepts and Cases*, Cengage Learning.

Stone, D. (2012), *Policy Paradox: The Art of Political Decision Making*, Norton.

NITI Aayog (2022–2025), *Policy Evaluation and Monitoring Reports*.

World Bank (2022), *Impact Evaluation in Practice*.

OECD (2023), *Government at a Glance: Policy Effectiveness Indicators*.

United Nations DESA (2022), *Public Policy and Governance Innovation Report*.

MeitY, Government of India (2023), *Digital Governance and Policy Integration Reports*.

International Monetary Fund (2021), *Public Policy and Fiscal Governance Frameworks*.

Course Code : **MCS311** Course Type : **Elective** No. of Credits : **4.00** No. of Hours : **90**	**Course Title** **Data Analytics with Python**

Course Objectives:

- Provide a strong foundation in Python programming fundamentals, data preprocessing, and exploratory analysis for economic datasets.
- Train students to apply Python for statistical analysis, econometric modeling, time series forecasting, and machine learning.
- Develop analytical and problem-solving skills through Python-based projects integrating econometrics, visualization, and predictive modeling.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Recall and define Python programming fundamentals, libraries, and data preprocessing techniques.
- **CO2:** Apply Python for data visualization, descriptive statistics, and hypothesis testing.
- **CO3:** Analyze economic data using regression, classification, and statistical models in Python.
- **CO4:** Evaluate machine learning models (trees, forests, logistic regression) using performance metrics and diagnostics.
- **CO5:** Design predictive time series models and case-based projects integrating Python applications for economic decision making.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	–	✓	✓	✓	–	✓	–	✓	–	✓
CO2	✓	✓	✓	✓	✓	–	–	✓	–	✓	–	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[18 Hours]**

A. Introduction to Python Programming: Overview of Python, data analysis libraries (NumPy, pandas, Matplotlib, Seaborn); data preprocessing and cleaning; handling missing data, outliers, anomalies; data transformation, integration, and manipulation.

Unit-II: **[18 Hours]**

Data Visualization and Exploratory Analysis: Descriptive statistics, histograms, box plots, scatter plots; correlation analysis; hypothesis testing (t-tests, χ^2, ANOVA); confidence intervals, p-values, non-parametric tests; interpretation of statistical results.

Unit-III: **[18 Hours]**

Econometric Models in Python: Linear regression (simple, multiple), logistic regression, decision trees, random forests; model evaluation metrics (R^2, MAE, RMSE, accuracy, precision, recall); assumptions, diagnostics, overfitting/underfitting, model selection.

Unit-IV: **[18 Hours]**

Time Series Analysis in Python: Components of time series (trend, seasonality, noise); decomposition techniques; forecasting methods (moving average, exponential smoothing, ARIMA); introduction to ML applications in time series.

Unit-V: **[18 Hours]**

Applied Machine Learning and Case Studies: Introduction to ML libraries (scikit-learn, TensorFlow basics); supervised and unsupervised learning; case studies in economic forecasting; Project work integrating Python models with economic datasets.

Suggested Readings:

McKinney, W. (2012). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. O'Reilly Media.
Swaroop, C. H. (2003). *A Byte of Python*. Python Tutorial.
Stewart, S. (2019). *Python Programming for Beginners*. Platinum Press LLC.

Reference:

Anderson, Sweeney, & Williams. (2011). *Statistics for Business and Economics*. Cengage Learning.
Hosmer, D. W., & Lemeshow, S. (2000). *Applied Logistic Regression*. Wiley.
Montgomery, D. C., & Runger, G. C. (2002). *Applied Statistics & Probability for Engineering*. Wiley.
Devore, J. L. (2011). *Probability and Statistics for Engineering and the Sciences*. Cengage Learning.
Han, J., & Kamber, M. (2006). *Data Mining: Concepts and Techniques*. Morgan Kaufmann.
Kaufman, L., & Rousseeuw, P. J. (1990). *Finding Groups in Data: An Introduction to Cluster Analysis*. Wiley.

Course Code : MCS311 Course Type : Elective No. of Credits : **4** No. of Hours : **60**	**Course Title** **Advanced Spatial Statistics and Modelling**

Course Objectives:

- To understand the principles, concepts, and significance of spatial statistics and geostatistics.
- To examine interpolation, spatial regression, modelling, and simulation techniques for spatial analysis.
- To analyze statistical software applications for geospatial, environmental, and planning studies.

Course Outcomes (COs):

- CO1: Explain the concepts of spatial statistics, spatial data structures, autocorrelation, ESDA, Moran's I, Geary's C, and hotspot analysis.
- CO2: Describe geostatistical principles including variogram, semivariogram modelling, spatial dependence, and anisotropy.
- CO3: Apply kriging methods such as Ordinary Kriging, Universal Kriging, and Indicator Kriging, and compare them with deterministic interpolation methods.
- CO4: Analyze spatial regression, Geographically Weighted Regression, spatial lag/error models, agent-based models, cellular automata, and simulation approaches.
- CO5: Assess the use of R, Python, and SPSS for data analysis in environmental, urban, health, climate, and meteorological applications.

COs/POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Recall & define	✓				✓							✓
CO2 Explain & interpret	✓	✓			✓							✓
CO3 Apply Models	✓	✓	✓	✓	✓							
CO4 Analyse & evaluate	✓	✓	✓	✓	✓		✓					✓
CO5 Research & create	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Spatial Statistics and Exploratory Spatial Data Analysis: Meaning, scope and significance of spatial statistics. Spatial data types and structures. Spatial autocorrelation and pattern analysis. Exploratory Spatial Data Analysis (ESDA). Moran's I and Geary's C statistics. Point pattern analysis and hotspot detection.

Unit-II: **[12 Hours]**

Advanced Spatial Data and Data Preprocessing: Principles of geostatistics. Variogram and covariance functions. Definition and properties of semivariogram. Empirical variogram construction. Modelling the variogram. Spatial dependence and anisotropy. Applications of geostatistics in environmental and resource studies.

Unit-III: **[14 Hours]**

Kriging and Advanced Interpolation Methods: Kriging techniques including Ordinary Kriging, Universal Kriging and Indicator Kriging. Comparison of kriging with deterministic interpolation methods. Accuracy assessment of interpolation surfaces. Applications in rainfall estimation, groundwater studies and pollution mapping.

Unit-IV: **[10 Hours]**

Spatial Regression, Modelling and Simulation: Spatial regression models. Geographically Weighted Regression (GWR). Spatial lag and spatial error models. Types of spatial models including agent-based models and cellular automata. Building and validating spatial models. Monte Carlo simulation and scenario-based modelling. Applications in land use change and environmental impact simulation.

Unit-V: **[12 Hours]**

Statistical Software and Advanced Applications: Introduction to statistical software including R, Python and SPSS. Data manipulation and cleaning. Data analysis using R including descriptive statistics and visualization.

Data analysis using Python using NumPy, Pandas, Matplotlib and SciPy. Case studies in environmental applications, urban and regional planning, public health, climate and meteorology.

References:

Smith, J. K., & Johnson, L. M. (2023). *Advanced Spatial Data Analysis: Techniques and Applications*. Springer.

Jones, R. W., & Brown, S. A. (Eds.). (2022). *Spatial Modeling and Simulation in Geography: Concepts and Methods*. Routledge.

Garcia, M. H., & Wang, Y. (2021). *Advanced Geospatial Technologies: Applications and Innovations*. Wiley.

Williams, P. D., & Davis, E. C. (2020). *Spatial Data Visualization and Decision Support: Principles and Practices*. Pearson.

Miller, A. B., & Smith, C. D. (2019). *Geospatial Analysis in Practice: Case Studies and Applications*. University of Chicago Press.

Course Code :CCC313 Course Type : CCC No. of Credits : 2.00 No. of Hours : 30	Course Title **Building Mathematical Ability and Financial Literacy**

Course Objectives:

The main objectives of this course are:

- Solving skills through mathematical reasoning, quantitative aptitude, and data interpretation, enabling them to apply these concepts in academic, professional, and real-life scenarios.
- Familiarize students with investment options, banking structures, financial institutions, taxation, insurance, and the roles of RBI and SEBI in the financial system.
- Enable students to make informed financial decisions through understanding of investment planning, risk management, digital payments, and awareness of financial frauds.

Course Learning Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Enhance logical thinking and decision-making through structured problem-solving.
- **CO2:** Demonstrate competence in fractions, simple and compound interest ratio and proportion, and percentage-based problems.
- **CO3:** Calculate mean, median, and mode to summarize data effectively. Present data using bar charts, pie charts, and line charts for clear communication.
- **CO4:** Prepare budgets, track expenses, manage savings, and set financial goals using basic money management principles.
- **CO5:** Evaluate financial risks, use digital payment systems securely, and adopt appropriate strategies for financial planning and risk reduction.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1 Recall & define	✓	–	–	–	–	–	–	–	–	–	–	–
CO2 Explain & interpret	✓	✓	–	–	–	–	–	✓	–	–	–	–
CO3 Apply Models	✓	✓	✓	–	✓	–	–	–	–	–	–	–
CO4 Analyse & evaluate	–	✓	–	✓	–	✓	✓	–	–	–	–	✓
CO5 Research & create	–	–	✓	✓	✓	–	✓	✓	–	–	–	–

Course Outline:

Unit-I **[7 Hours]**

Logical Reasoning: Number series, letter series, coding-decoding, problems on ages. **Basic Set Theory**: Operations on sets, Venn diagrams, and cardinality of sets.

Unit-II **[5 Hours]**

Mathematical aptitude: Fractions, time and work, time and distance, ratio and proportion, percentage, profit and loss, discount, simple interest, compound interest, mensuration.

Unit-III **[6 Hours]**

Basic Statistics: Sources and classification of data, data interpretation, quantitative and qualitative data, graphical representation (bar chart, pie chart, line chart), mean, median, and mode for ungrouped data.

Unit-IV **[5 Hours]**

Foundations of Financial Literacy: Introduction to financial literacy and its process and structure, personal finance, income, expenditure, savings, and budgeting, financial goals, financial discipline, money management skills, awareness of financial frauds, basic budgeting and expense tracking activities.

Unit-V **[7 Hours]**

Financial Institutions: Banking system and credit process, recent innovations in the banking system, Reserve Bank of India role and functions, monetary policy tools. **Capital Market;** Primary market, secondary market, financial decision-making,SEBI. **Digital Finance:** Digital payments system and digital currency.

Suggested Readings:

Arihant, (2019). *Teaching and Research Aptitude (General Paper 1)*. Arihant Publication (India) Limited.
Jain, L. & Vashistha, K. C. (2024). *Teaching and Research Aptitude (General Paper 1)*. Upkar Prakashan Agra.
Lewis, M. K. (2000). *Monetary economics*. Oxford University Press, New York.

References:

Aggarwal, R.S. (n.d). *Quantitative Aptitude*. S. Chand.
C Rangarajan. (1991). *Indian economy: Essays in money and finance*. UBS Publishers' Distributors Ltd.
Lewis, M. K. (2000). *Monetary economics*. Oxford University Press.

Course Code : **MCS314** Course Type : **SIP** No. of Credits : **2.00** No. of Hours : **6 Weeks**	**Course Title** **Summer Internship Programme**

Course Objectives:

- Provide students with practical exposure to economic concepts and econometric applications in organizational settings.
- Strengthen analytical and problem-solving skills by applying classroom knowledge to real world economic and business operations.
- Develop professional competencies through report writing, presentation, and viva voce evaluation.

Course Outcomes (COs):

By the end of the course, students can be able to;

- **CO1:** Identify and understand how organizations apply economic concepts and econometric techniques.
- **CO2:** Demonstrate practical knowledge through project/field work in chosen specialization areas.
- **CO3:** Prepare structured internship reports documenting tasks, learning, and organizational practices.
- **CO4:** Present internship findings effectively in departmental seminars.
- **CO5:** Defend applied knowledge and insights during viva voce evaluation.

COs /POs Mapping:

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	–	–	–	–	–	–	–	–	–	–	✓
CO2	–	✓	✓	✓	✓	–	–	–	–	✓	✓	–
CO3	✓	✓	–	–	–	–	–	–	–	✓	✓	–
CO4	–	✓	✓	✓	✓	–	✓	✓	–	✓	✓	–
CO5	✓	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓

Course Outline:

I. **Duration:** 6 weeks during summer vacation (May–June).
II. **Nature of Work:** Internship must align with student's specialization
III. **Report Submission:** Students submit a detailed internship report along with a certificate from the host organization.
IV. **Evaluation**:
    - Internship Report (External Examiner): 60 Marks
    - Viva-Voce (Department): 40 Marks
V. **Supervision**: Each student will work under the guidance of a faculty supervisor.
VI. **Final Submission**: Dissertation must follow university rules and formatting guidelines.

Suggested Readings:

Kothari, C. R. (2014). *Research Methodology: Methods and Techniques*. New Age International.
Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics*. McGraw-Hill.
Wooldridge, J. M. (2016). *Introductory Econometrics: A Modern Approach*. Cengage Learning.
Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.

SEMESTER-IV

Course Code : **MCS401** Course Type : **Core** No. of Credits : **4.00** No. of Hours : **60**	**Course Title** **Survey Research Methods**

Course Objectives:

- To provide students with a comprehensive understanding of sampling concepts, survey designs, and their applications in quantitative research.
- To develop skills in designing questionnaires, conducting large-scale surveys, and utilizing digital data collection tools.
- To equip students with practical knowledge of data management, visualization, and basic statistical analysis using STATA.

Course Outcomes (COs):

By the end of the course, students can be able to;

CO1: Explain the concepts and principles of sampling and survey design.
CO2: Apply probability and non-probability sampling methods in survey research.
CO3: Develop and standardize questionnaires and interview schedules for quantitative surveys.
CO4: Use digital tools such as CAPI and KoboToolbox for survey data collection and management.
CO5: Analyze and visualize survey data using STATA and interpret basic statistical results.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓				✓				✓		✓
CO2	✓	✓	✓	✓		✓	✓					✓
CO3		✓	✓	✓		✓		✓	✓	✓		✓
CO4	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

Unit-I: **[12 Hours]**

Concept of sampling: Concept of population and sample, sample survey verses census; Sampling units, assumptions of sampling from finite population, sampling frame **;** Selection and inclusion probabilities,; Probability and non-probability sampling, and sampling design.

Unit-II: **[12 Hours]**

Probability sampling methods: Probability sampling designs - Simple Random Sampling with and without replacement, Stratified Sampling, Systematic random sampling, Cluster Sampling;

Unit-III: **[12 Hours]**

Non-probability sampling methods, and large-scale survey designs: Nonprobability sampling designs – Quota sampling, Purposive sampling; Sampling design of large-scale surveys National Family Health Survey; Longitudinal Ageing Study in India; Sample registration System; National Sample Survey Organization

Unit-IV: **[15 Hours]**

Questionnaire Development for quantitative surveys

Types of Questionnaire/schedule, Checklist schedules, structure of questionnaire, roster, skipping non applicable questions, checks; Standardization of tools, Principles of constructing a questionnaire/ interview schedule; Types of questions (knowledge, attitudinal, behavioral, practice), framing of questions (simple, delicate, personal matter), sequencing of questions. Updating/developing new questions

Unit-V: **[9 Hours]**

Software for Data Collection in large scale surveys

Computer assisted personal interview (CAPI), process of data transfers, introduction to KoboToolbox. Web-designed questionnaires.

Suggested Readings:

Y. Hayami (2001). *Development Economics: From Poverty to the Wealth of Nations*. OUP.
Alain De Janvry & Elisabeth Sadoulet (2016). *Development Economics: Theory and Practice*. Routledge.
Debraj Ray (1999). *Development Economics*. Oxford University Press.
Sen, A. (2000). *Development as Freedom*. Oxford University Press.
Perkins, Radelet, Lindauer & Block (2012). *Economics of Development* (7th ed.). W.W. Norton.

References:

H.G. Jones. *An Introduction to Modern Theories of Economic Growth*. McGraw-Hill.
K. Basu (1997). *Analytical Development Economics*. MIT Press.
Barro, R. J. & Sala-i-Martin, X. *Economic Growth*. McGraw-Hill.
Jones, C. I. *Introduction to Economic Growth*. W.W. Norton.
Bardhan, P. & Udry, C. *Development Microeconomics*. Oxford University Press.
Agenor, P-R. & Montiel, P. J. (2008). *Development Macroeconomics*. Princeton University Press.
Thirlwall (2006). *Growth and Development with Special Reference to Developing Countries*. Palgrave Macmillan.
Ghatak, S. (2003). *An Introduction to Development Economics*. Routledge.
Krugman, P. (1995). *Development, Geography and Economic Theory*. MIT Press.

Course Code : **MCS411** Course Type : **Dissertation** No. of Credits : **12** No. of Hours : **One Semester**	**Course Title** **Dissertation**

Course Objectives:

- Enable students to undertake independent research in computational social science and data analytics, applying theoretical knowledge to practical problems.
- Strengthen analytical, methodological, and writing skills through supervised dissertation work.
- Encourage students to design case-based projects or field studies that integrate specialization areas with empirical evidence.

Course Outcomes (COs):

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

- **CO1:** Identify and formulate a research problem in their chosen specialization.
- **CO2:** Conduct literature review and develop a coherent theoretical framework.
- **CO3:** Apply appropriate research methodologies, statistical tools, and computational techniques.
- **CO4:** Analyze data, interpret results, and draw evidence-based conclusions.
- **CO5:** Present research findings in a structured dissertation and defend them in viva voce.

COs /POs Mapping:

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Course Outline:

VII. **Synopsis Submission**: Students must submit a synopsis on a selected research topic as per prescribed guidelines.

VIII. **Research Work**: Dissertation must be related to the specialization area chosen (e.g., Computational Demography, Computational Sociology, Economics, Development Studies).

IX. **Evaluation**:
- Dissertation (External Examiner): 60 Marks
- Viva-Voce (Department): 40 Marks

X. **Supervision**: Each student will work under the guidance of a faculty supervisor.

XI. **Final Submission**: Dissertation must follow university rules and formatting guidelines.

Suggested Readings

Kothari, C. R. (2014). *Research Methodology: Methods and Techniques*. New Age International.

Gujarati, D. N., & Porter, D. C. (2009). *Basic Econometrics*. McGraw-Hill.

Wooldridge, J. M. (2016). *Introductory Econometrics: A Modern Approach*. Cengage Learning.

Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications.