

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU INDIA

## SCHOOL OF SCIENCE AND HUMANITIES DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

**Table 1: Course Structure (Number of Credits)**

Semester	CC [E & DS]	AECC	SEC	EAA	Electives [E & DS]	Major Project/ Dissertation	Total Credits
I	16	4	1	1	-		22
II	16	3	3	1	-		23
III	16	-	4	-	4		24
IV	12	-	2		8		22
V	12		4		8		24
VI	-		-		12	6	18
<b>Total Credits</b>	<b>72</b>	<b>7</b>	<b>14</b>	<b>2</b>	<b>32</b>	<b>6</b>	<b>133</b>

NOTE:CC includes both Economics and Data Science

AECC: Ability Enhancement Compulsory Course

CC: Core Course

DS: Data Science

SEC: Skill Enhancement Course

DSC: Discipline Specific Course

E: Economics

EAA: Extra Academic Activity

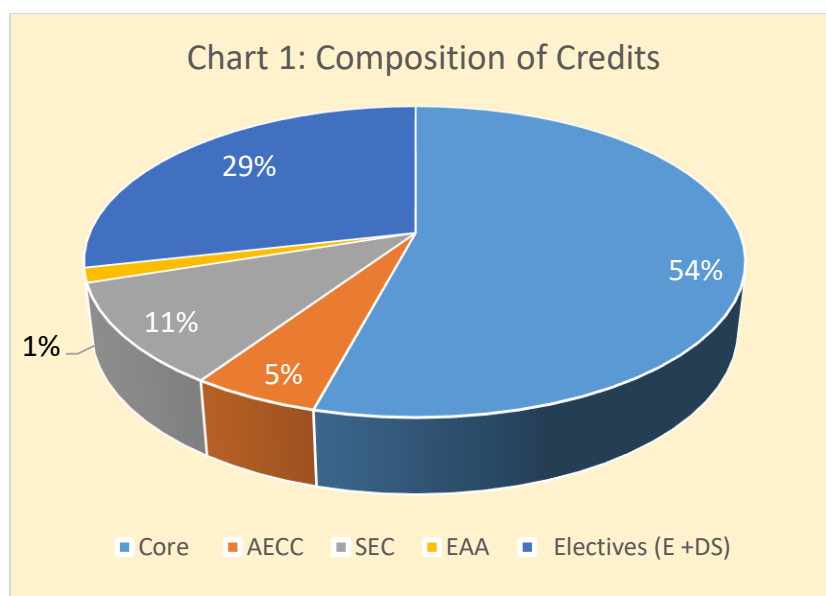
**Table 2: Number of Courses and Credit Distribution**

Semester	CC [E & DS]	AECC	SEC	EAA	Electives [E & DS]	Major Project/ Dissertation	No. of Courses (Total Credits)
I	4	1	1	1	-	-	7 (22)
II	4	1	2	1	-	-	8 (23)
III	4	-	2	-	1	-	7 (24)
IV	3	-	1	-	2	-	6 (22)
V	3	-	2	-	2	-	7 (24)
VI	-	-	-	-	3	1	4 (18)
<b>No. of Courses (Total Credits)</b>	<b>18 (72)</b>	<b>2 (7)</b>	<b>8 (14)</b>	<b>2 (2)</b>	<b>8 (32)</b>	<b>1 (6)</b>	<b>39 (133)</b>

Table 3: Course Structure for B.Sc. in Economics (Data Science)

Year	Sem	CORE COURSE	AECC	SEC	DSE	
1	I	Microeconomics I (3-1-0-4)	Communication Skills in English (3-1-0-4)	MS Excel: Basics (0-0-2-1)		
		Macroeconomics I (3-1-0-4)				
		Mathematics- 1 (3-1-0-4)				
		Statistics I (3-1-0-4)				
	II	Microeconomics II (3-1-0-4)	Environmental Studies (3-0-0-3)	Programming in Python (0-0-4-2)		
		Macroeconomics II (3-1-0-4)		MS Excel: Advanced (0-0-2-1)		
		Mathematics- II (3-1-0-4)				
		Statistics II (3-1-0-4)				
2	III	Money and Banking (3-1-0-4)		SQL Programming (0-0-2-1)	DSE1 (3-1-0-4)	
		Basics Econometrics (3-1-0-4)		Econometrics Lab- (0-2-2-3)		
		Introduction to Data Science (3-1-0-4)				
		Public Economics and Policy (4-0-0-4)				
	IV	Indian Economy (4-0-0-4)		Academic Writing (0-2-0-2)	DSE 1 (3-1-0-4)	
		Introduction to Artificial Intelligence (4-0-0-4)				DSE 2 (3-1-0-4)
		Data : Sources, Issue and Socio-Economic Analysis (2-2-0-4)				
3	V	Development Economics (4-0-0-4)		Internship/Mini Project (0-0-4-2)	DSE 1 (3-1-0-4)	
		Basics of Finance (3-1-0-4)				
		International Economics (3-1-0-4)		R Programming (0-0-4-2)	DSE 2 (3-1-0-4)	
	VI				DSE 2 (3-1-0-4)	
					TS1 or TS2 (3-1-0-4)	
					TS1 or TS2 (3-1-0-4)	
					Project (0-0-12-6)#	
Numer of Credits		72	7	14	38	
Total Credits =131+2@= 133						

Note: @ 1 Credit courses on Extra Academic Activities (NSS/ NSO/YRS) in Semester 1 and Semester 2 are mandatory as per SNU rules and regulations



Note: Credits for the major project/dissertation have been included in the Electives in the chart.

### Courses in Semester I

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Microeconomics I	CC	3	1	0	4
2		Macroeconomics I	CC	3	1	0	4
3		Mathematics- 1	CC	3	1	0	4
4		Statistics I	CC	3	1	0	4
4		Communication Skills in English	AECC	3	1	0	4
5		MS Excel: Basics	SEC	0	0	2	1
6		YRC/NSS/NSO	EAA	-	-	-	1
<b>Total</b>				<b>15</b>	<b>6</b>	<b>2</b>	<b>22</b>

### Courses in Semester II

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Microeconomics II	CC	3	1	0	4
2		Macroeconomics II	CC	3	1	0	4
3		Mathematics- II	CC	3	1	0	4
4		Statistics II	CC	3	1	0	4
5		Programming in Python	SEC	0	0	4	2
6		MS Excel: Advanced	SEC	0	0	2	1
7		Environmental Studies	AECC	3	0	0	3
8		YRC/NSS/NSO	EAA	-	-	-	1
<b>Total</b>				<b>15</b>	<b>4</b>	<b>6</b>	<b>23</b>

### Courses in Semester III

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Money and Banking	CC	3	1	0	4
2		Basics Econometrics	CC	3	1	0	4
3		Introduction to Data Science	CC	3	1	0	4
4		Public Economics and Policy	CC	4	0	0	4
5		Discipline Specific Elective	DSE1	3	1	0	4
6		SQL Programming	SEC	0	0	2	1
7		Econometrics Lab	SEC	1	0	4	3
<b>Total</b>				<b>17</b>	<b>4</b>	<b>6</b>	<b>24</b>

**Note: Annexure Table 1 A provides the list of DSE1. DSE1 are Economics Electives.**

### Courses in Semester IV

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Indian Economy	CC	4	0	0	4
2		Introduction to Artificial Intelligence	CC	4	0	0	4
4		Data : Sources, Issue and Socio-Economic Analysis	CC	2	2	0	4
5		Discipline Specific Elective	DSE 1	3	1	0	4
6		Discipline Specific Elective	DSE 2	3	1	0	4
7		Academic Writing	SEC	0	2	0	2
<b>Total</b>				<b>16</b>	<b>6</b>	<b>0</b>	<b>22</b>

**Note: Annexure Table 1 A provides the list of DSE1 and DSE2. DSE 2 are Data Science Electives.**

### Courses in Semester V

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Development Economics	CC	4	0	0	4
2		Basics of Finance	CC	3	1	0	4
3		International Economics	CC	3	1	0	4
4		Discipline Specific Elective	DSE 1	3	1	0	4
5		Discipline Specific Elective	DSE 2	3	1	0	4
6		Summer Internship/Mini Project	SEC	0	0	4	2
7		R Programming	SEC	0	0	4	2
<b>Total</b>				<b>16</b>	<b>4</b>	<b>8</b>	<b>24</b>

**Note: Annexure Table 1 A provides the list of DSE1 and DSE2.**

### Courses in Semester VI

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Track Specific Elective	TS1/TS2	3	1	0	4
2		Track Specific Elective	TS1/TS2	3	1	0	4
3		Discipline Specific Elective	DSE 2	3	1	0	4
4		Project	Project	0	0	12	6
<b>Total Credits</b>				<b>9</b>	<b>3</b>	<b>12</b>	<b>18</b>

Note: Discipline Specific Electives (DSE) include both Economics and Data Science Electives given in Annexure Table 1A.

Annexure Table 2A gives the list of courses for Track Specializations (TS), Development Studies (TS1) and Finance (TS2). Students have to choose either TS1 or TS2.

Following is the list of electives from which the student will have to choose one elective in each of the semesters, viz., Sem 3, 4 and 5. A student will have to take **3 Electives from DSE1 and 3 electives from DSE2**. The syllabus of these courses is given at the end of this document. Offering of these electives will depend on the availability of faculty and the number of students opting for a course.

**Annexure Table 1A: Discipline Specific Electives in Economics (DSE1) and in Data Science (DSE2)**

Economics Electives (DSE1)	Data Science Electives (DSE 2)
1. Advanced Econometrics	1. Big Data Analytics
2. Agricultural Economics	2. Data Mining
3. Game Theory	3. Data Processing
4. Behavioural Economics	4. Data Science for Business
5. Industrial Economics	5. Machine Learning Techniques
6. Operations Research	6. Social Media Mining

**Annexure Table 2A: Two Electives to be chosen from Any ONE Track Specialization**

Track Specialization 1 (TS1)	Track Specialization 2 (TS2)
Development Studies	Finance
1. Environmental Economics	1. Financial Economics
2. Gender Economics	2. Financial Markets
3. Health Economics	3. Auditing
4. Urban Economics	4. Investment Management
5. Global Political Economy	5. Agricultural Finance
6. Law and Economics	
7. Labour Economics	
8. Demography and Social Statistics	

### Extensions and Choices:

#### **B.Sc. Economics (Data Science) Honours program**

Students, who have maintained a CGPA of 8.0 and above and have completed all curricular requirements up to Semester 3, may register for the B.Sc. Economics (Data Science) Honours program at the commencement of Semester 4. The total credits of the B.Sc, Economics (Data Science) Honours Program would be **149** over 6 semesters.

The **B.Sc. Economics (Data Science) Honours program** requires 2 additional Core courses of 4 credits each, in 4<sup>th</sup> and 5<sup>th</sup> Semester (total of 8 credits). In addition to this, one Research Paper/Project/Dissertation of 8 credits will have to be completed in the 6<sup>th</sup> Semester.

The two courses that are mandatory for the **B.Sc. Economics (Data Science) Honours program** are: International Trade [3-1-0-4 (L-T-P-C)] in the 4<sup>th</sup> Semester and History of Economic Thought [3-1-0-4 (L-T-P-C)] in the 5<sup>th</sup> Semester.

**B.Sc. Economics (Data Science) Honours students need to maintain a CGPA of 8.0 and above throughout the program.**

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

#### Semester I

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Microeconomics I	CC	3	1	0	4
2		Macroeconomics I	CC	3	1	0	4
3		Mathematics- 1	CC	3	1	0	4
4		Statistics I	CC	3	1	0	4
4		Communication Skills in English	AECC	3	1	0	4
5		MS Excel: Basics	SEC	0	0	2	1
6		YRC/NSS/NSO	EAA	-	-	-	1
		<b>Total</b>		<b>15</b>	<b>6</b>	<b>2</b>	<b>22</b>

CC is Discipline Specific Core, which includes both Economics and Data Science

#### Semester I

### Microeconomics I

Course Category	L	T	P	C
CC	3	1	0	4

## Detailed Contents of Syllabus

### Unit I: Microeconomics: Introduction (5 Hours)

The Scope and method of economics; the economic problem: scarcity and choice; problems of economic organization; opportunity costs; economic systems; State vs Markets

### Unit II: Consumer behaviour: Cardinal Approach (10 Hours)

Utility analysis: Assumptions of Utility Analysis; Total Utility vs. Marginal Utility; The Law of Diminishing Marginal Utility; The Law of Equi-Marginal Utility. Demand and Law of Demand: factors Influencing Demand; an Individual's Demand Schedule and Curve; The Market Demand Curve and Schedule; Elasticity of demand: Price Elasticity of Demand; Cross Elasticity of Demand;

Income Elasticity of Demand; Factors Affecting Price Elasticity of Demand; Importance of the Concept of Price Elasticity; Applications.

### **Unit III: Consumer's Behaviour: Ordinal Approach (15 Hours)**

The Indifference Curve Theory: Assumptions of Indifference Curve Analysis; Properties of Indifference Curves; Marginal Rate of Substitution; Price-Income Line; Consumer's Equilibrium; Income Effect; Substitution Effect; Price Effect; The Separation of Substitution and Income Effect, To Derive Demand Curve from Price Consumption Curve; Compensated Demand Curve;

### **Unit IV: Theory of Producers' Behaviour (15 Hours)**

Technology, Production Functions and Isoquants, short run and long run, production with one and two variable inputs, total average and marginal products, law of diminishing return, marginal rate of technical substitution, elasticity of substitution, economics of scale. Types of production functions- Cobb-Douglas, fixed-coefficient and CES functions

Cost: Types of cost, Determinants of Short run cost, Cost Curves, cost minimization and expansion path, Short run versus long run cost curves, economies of scope. concepts of total revenue, average revenue and marginal revenue - relationship between AR, MR, TR and price elasticity of demand-behavioural principles - Revenue: Total Revenue, Average revenue, Marginal Revenue - Relation between Average Revenue, Marginal Revenue and Price Elasticity of Demand, Profit maximization.

### **Unit IV: Market Structure (15 Hours)**

Market Structure: Types of markets – classification of market – types of market structures – distinguishing features -Price Output Determination under Different Market Forms: Perfect Competition, Monopolistic, Monopoly and Oligopoly -Imperfect competition – features and price determination – equilibrium of the industry - equilibrium of the firm - Short-Run Profit Maximization by a Competitive Firm - Short run supply curve of the firm in a competitive market – super normal profits – normal profits - Long Run Equilibrium of a Competitive Firm – Monopoly: meaning – features - causes - Monopolist's Revenue Curves - Equilibrium of the a Monopoly Firm - Short run Equilibrium - Price Discrimination – meaning, conditions and objectives – equilibrium under price discrimination – economic effects of monopoly -

Imperfect competition-monopolistic competition – features – price and output determination - Conditions for the Equilibrium of an individual firm – Oligopoly: meaning – types – characteristics – price and output decisions – price leadership – kinked demand curve – other important market forms

**Total: 60 hours including Tutorials**

### **Books**

1. H R. Varian. 2010. Intermediate Microeconomics, a Modern Approach, Springer (India) Pvt. Ltd. India, 2010.
2. H. Gravelle and R Rees. Microeconomics. Addison Wesley Longman Limited.
3. A. Koutsoyiannis, Modern Microeconomics
4. R S. Pindyck and D.L. Rubinfeld, (2000), Microeconomics, 3rd edition, Prentice Hall, India.
5. G.S. Maddala and E. Miller. 1989. Microeconomics. McGraw-Hill International Editions. (or later edition)
6. Lipsey and Chrystal. 2007. Economics. Oxford University Press.



## Macroeconomics-I

Course Category	L	T	P	C
CC	3	1	0	4

### Detailed Contents of Syllabus

#### Unit I: Introduction to Macroeconomics and National Income Accounting

Basic issues in macroeconomics; Macroeconomic goals and policy instruments, measurement of national income and the circular flow; approaches to measure national income, national income identities; real versus nominal GDP; price indices; national income accounting for an open economy; balance of payments: current and capital accounts, trends and business cycles

**(15 Hours)**

#### Unit II. Money and Inflation

Properties and functions of money; demand for money and supply of money, measures of money stock and high powered money, money multiplier, Inflation: definition and measurement, Demand pull and cost-push inflation, inflation categories by intensities, expected vs unexpected inflation, hyperinflation, social costs of inflation; Anti-inflationary policy

**(15 Hours)**

#### Unit III: Classical Macroeconomics

Say's Law, The Classical full employment model, Wage-Price Flexibility and The Classical Labor Market, Effect of Change in Money Supply, Shift of Labour Supply Function, Shift of Production Function, the Classical Dichotomy, The Classical theory of Saving, Investment and the Interest rate, Critique of Classical economics

**(15 Hours)**

#### Unit V: Simple Keynesian Model (15 Hours)

Components of Aggregate Demand, Consumption function and Savings functions, Concepts of propensities to consume, save and import; Simple Keynesian model of income determination, AD-AS model: Goods, money and labor markets, Multipliers- Investment, government expenditure multiplier and the tax rate multiplier; the balanced budget multiplier; Tax multiplier, Investment Multiplier, Critique of Keynesian model

**Unit IV: Keynesian Models versus Classical Models** IS-LM model for a closed economy, Synthesis between classical models and Keynesian models, interpretation and policy analysis

**(15 Hours)**

**Total: 60 hours including Tutorials**

### Textbooks

1. N. Gregory Mankiw. *Macroeconomics*, Worth Publishers, 7<sup>th</sup> edition, 2010.
2. Richard T. Froyen, *Macroeconomics*, Pearson Education Asia, 2<sup>nd</sup> edition, 2005.

## Mathematics- 1

Course Category	L	T	P	C
-----------------	---	---	---	---

CC	3	1	0	4
----	---	---	---	---

## Detailed Contents of Syllabus

### UNIT I: Functions, limits, derivatives

Product Sets - Relations and Functions - Domain and Range of a Function - polynomial, exponential, logarithmic, limits of functions, continuity, derivatives of standard functions (polynomials, rational functions, trigonometric and inverse trigonometric functions), differentiation of inverse functions

**12 Hours**

### UNIT II: Higher Order Differentiation

Derivative of a Function of Function - Implicit Functions - Parametric Equation - Logarithmic Differentiation – Higher-Order Differentiation -Taylor series - L'Hopital's rule, limits involving infinity-applications in economics and finance

**12 Hours**

### UNIT III: Single Variable Optimization

Maxima and Minima of functions of one variable – First Derivative Test, Rolle's Theorem, Mean Value Theorem, concavity, Second Derivative Test, curve sketching-Applications in economics and finance

### UNIT IV: Partial Differentiation

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Taylor's expansion (up to 3<sup>rd</sup> derivative) - Maxima and Minima functions of two variables - Lagrangean method of undetermined multipliers - Applications to Economics.

**12 Hours**

### UNIT V: Ordinary Differential Equations

Ordinary Differential Equations: 1st order and separable, logistic growth, 1st order and linear-applications in economics and finance

**12 Hours**

**Total: 60 hours including Tutorials**

## Textbooks:

1. T. K. Manicavachagam Pillay, T. Natarajan, K. S. Ganapathy, Algebra, Volume I, Viswanathan Publication 2007.
2. B. S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.

## Suggested Readings

1. Anthony, M., and Biggs, N. Mathematics for Economics and Finance. Cambridge University Press
2. Sydsaeter and P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia, Delhi
3. Dowling, E.T. Mathematics for Economics, Schaum's Outlines Series. McGraw Hill Publishing
4. Narayan, Shanti and Mittal P.K. Differential Calculus - S Chand
5. Narayan, Shanti and Mittal P.K. Integral Calculus - S Chand
6. Soni, R.S. Business Mathematics. Pitambar Publishing House

7. A.C Chiang, *Fundamental Methods of Mathematical Economics*, McGraw-Hill, 3rd Edition, 1984.

**Total: 60 hours including Tutorials**

# Statistics I

Course Category	L	T	P	C
CC	3	1	0	4

## Detailed Contents of Syllabus

<b>UNIT I</b>	<b>Organization and Presentation of Data</b>	<b>12 Hours</b>
---------------	--	-----------------

Statistical Representation of Data, Diagrammatic Representation of Data, Frequency Distribution, Graphical Representation of Frequency Distribution - Histogram, Frequency Polygon, Ogive, Pie-chart- Implementation in Excel

<b>UNIT II</b>	<b>Measures of Central Tendency and Dispersion</b>	<b>12 Hours</b>
----------------	--	-----------------

## Measures of Central Tendency and Dispersion: Mean, Median, Mode, Mean Deviation, Quartiles and Quartile Deviation, Standard Deviation, Coefficient of Variation, Coefficient of Quartile Deviation- Implementation in Excel

<b>UNIT III</b>	<b>Correlation Analysis</b>	<b>12 Hours</b>
-----------------	-----------------------------	-----------------

Introduction - Bivariate Data - Correlation Analysis - Measures of Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation

<b>UNIT IV</b>	<b>Regression Analysis</b>	<b>12 Hours</b>
----------------	----------------------------	-----------------

## Regression Analysis - Linear Regression - Relation between Correlation and Regression- method of least squares - Implementation in Excel

<b>UNIT IV</b>	<b>Probability</b>	<b>12 Hours</b>
----------------	--------------------	-----------------

Probability, Axiom, Laws of Probability - Conditional Probabilities, Independent and Dependent Events - Mutually Exclusive Events - Total Probability - Bayes Theorem

**Total: 60 hours including Tutorials**

### SUGGESTED READINGS:

1. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning
2. Levin, Richard, David S. Rubin, Sanjay Rastogi, and HM Siddiqui. Statistics for Management, Pearson Education
3. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), McGraw Hill Education.
4. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.

5. Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Mathematical Statistics, 11th Edn. (Reprint), Sultan Chand and Sons

## COMMUNICATION SKILLS IN ENGLISH

Course Category	L	T	P	C
AECC	3	1	0	4

### Detailed Contents of Syllabus

- Unit 1: 12 Hours**  
 Reading: Short comprehension passages; Practice in skimming, scanning, and predicting Writing: Understanding text structure (Use of reference words and discourse markers, coherence markers, reordering jumbled sentences)  
 Speaking: Introducing oneself; Exchanging personal information  
 Listening: Comprehending formal and informal conversations  
 Language Development: Asking and answering - Wh- and Yes/No questions; Prepositions; Conjunctions; Pronouns; Clauses  
 Vocabulary Development: Prefixes and Suffixes
- Unit 2: 12 Hours**  
 Reading: Short narratives and descriptions from newspapers  
 Writing: Instructions, recommendations; Paragraph writing (including compare and contrast)  
 Listening: Telephonic conversations; short presentations and news  
 Speaking: About oneself and others; Routine actions  
 Language development: Tenses; Modal verbs  
 Vocabulary development: Guessing meanings of words/expressions from the context
- Unit 3: 12 Hours**  
 Reading: Short texts and longer passages (Intensive reading)  
 Writing: Letters (informal and formal); E-mails (personal and professional)  
 Listening: Short dialogues and longer conversations  
 Speaking: Expressing opinions; Making short presentations  
 Language development: Degrees of comparison; subject-verb agreement  
 Vocabulary development: Idioms and phrases; Single word substitutes; Adverbs
- Unit 4: 12 Hours**  
 Reading: Longer texts of different types (journalistic, literary); note-taking, note-making  
 Writing: Essays (including analytical and issue-based)  
 Listening: TED talks  
 Speaking: Role-plays  
 Language development: Passive voice  
 Vocabulary development: Synonyms and Antonyms; Phrasal verbs
- Unit 5: 12 Hours**  
 Reading: Longer academic texts  
 Writing: Interpreting charts and graphs; Reports  
 Listening: Listening to technical talks and academic lectures  
 Speaking: Interviews and short group discussions  
 Language development: Reported speech  
 Vocabulary development: Collocations

**Total: 60 hours including Tutorials**

## REFERENCE BOOKS

1. Richards, C. Jack. Interchange Students' Book-2 New Delhi, Cambridge University Press, 2015.
2. Bailey, Stephen. Academic Writing: A practical guide for students, New York: Routledge, 2011.
3. Means, L. Thomas, and Elaine Langlois. English & Communication for Colleges. Cengage Learning, USA, 2007.
4. Redston, Chris & Gillies Cunningham. Face2Face (Pre-intermediate Student's Book & Workbook) Cambridge University Press, New Delhi, 2005.
5. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge: Reprint 2011.
6. Board of Editors. Using English: A Course Book for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad, 2015.
7. Dutt P, Kiranmai and Rajeevan Geeta. Basic Communication Skills. Foundation Books, 2013

## MS Excel: Basic

Course Category	L	T	P	C
SEC	0	0	2	1

## Detailed Contents of Syllabus

### Unit 1: Introduction to Excel

**Basic Excel functions:** Structure of an excel function, functions such as SUM (), MIN (), MAX (), AVERAGE (), COUNT (), AUTOSUM, AUTOFILL. **Working with an Excel List:** Understanding Excel List Structure, Sorting a List Using Single Level Sort, Sorting a List Using Multi-Level Sorts, Using Custom Sorts in an Excel List, Filter an Excel List Using the AutoFilter, Creating Subtotals in a List, Format a List as a Table, Using Conditional Formatting to Find Duplicates, Removing Duplicates. **Excel Data Validation:** Understanding the Need for Data Validation, Creating a Validation List, Adding a Custom Validation Error, Dynamic Formulas by Using Validation Techniques

**6 Hours**

### Unit 2: Conditional Functions and Working with Large Excel Data Sets

**Conditional Functions:** Working with Excel Name Ranges, Using Excel's IF () Function, Nesting Functions, Using Excel's COUNTIF () Function, Using Excel's SUMIF () Function, Using Excel's IFERROR () Function.

**Working with Large Sets of Excel Data:** Using the Freeze Panes Tool, Grouping Data (Columns and/or Rows), Consolidating Data from Multiple Worksheets.

**6 Hours**

### Unit 3: Look Up and Text Based Function

**Excel's Lookup Functions:** Using Excel's VLOOKUP() Function, Using Excel's HLOOKUP() Function, Using Excel's INDEX() and MATCH() Functions.

**3 Hours**

## **Reference Books**

1. Alexander, Kusleika, & Walkerbach ; Excel 2019 Bible; Wiley, 2018
2. John Walkenbach; Excel Charts, Wiley, 2016
3. Lokesh Lalwani, BPB publication, 'Excel All-in One: MASTER the new features of Excel, 2019

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

### Semester II

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Microeconomics II	CC	3	1	0	4
2		Macroeconomics II	CC	3	1	0	4
3		Mathematics- II	CC	3	1	0	4
4		Statistics II	CC	3	1	0	4
5		Programming in Python	SEC	0	0	4	2
6		MS Excel: Advanced	SEC	0	0	2	1
7		Environmental Studies	AECC	3	0	0	3
8		YRC/NSS/NSO	EAA	-	-	-	1
		<b>Total</b>		<b>15</b>	<b>4</b>	<b>6</b>	<b>22</b>

### Microeconomics-II

Course Category	L	T	P	C
CC	3	1	0	4

### Detailed Syllabus

#### Unit 1: Monopolistic Competition and Modern Theories of Firm (15 Hours)

Product Differentiation and the Demand Curve-The Concepts of the 'Industry' and the 'Group' Equilibrium of The Firm -Comparison with Pure Competition, Average-Cost Pricing, Limit-Pricing, Bromol's Sales Revenue Maximisation

#### Unit 2: General Equilibrium and Welfare Economics (20 Hours)

General Equilibrium and Economic Efficiency- Exchange, production and welfare, Pareto Optimality, Edgeworth box and contract curve, Pareto efficiency and perfect competition, Reasons

for Market failure, Pareto efficiency, contract curve; efficiency and welfare economics: fundamental theorems of welfare economics.

### **Unit 3: Choice under Uncertainty (15 Hours)**

Choice under Uncertainty and Intertemporal Choice -Choice under uncertainty – utility function and expected utility, risk aversion and risk preference; intertemporal choice: savings and borrowing, asymmetric information and moral hazard: principal agent problem, theory of lemon, credit market,

### **Unit 4: Input Markets (10 Hours)**

Labour and land markets: Basic concepts (derived demand, productivity of an input, marginal productivity of labour, marginal revenue product); demand for labour; input demand curves; shifts in input demand curves; competitive labour markets; labour markets and public policy

**Total: 60 hours including Tutorials**

## **Textbooks**

1. Hal R. Varian: Intermediate Microeconomics: A Modern Approach, 8th edition, W.W. Norton and Company/Affiliated East-West Press (India), 2010.
2. C. Snyder and W. Nicholson: Fundamentals of Microeconomics, Cengage Learning (India), 2010, Indian edition.
3. M. J. Osborne [O]: An introduction to Game Theory, Indian Edition

## **Macroeconomics II**

Course Category	L	T	P	C
CC	3	1	0	4

### **Unit 1: Aggregate Demand (AD) and Aggregate Supply (AS) Curves**

Interaction of aggregate demand and supply, 'Full employment' and 'Underemployment' equilibrium in the AD-AS model and adjustment process.

**(10 Hours)**

**Unit 2. Inflation, Unemployment and Expectations:** Phillips curve; Expectation Augmented Phillips curve, short-run trade-off and long-run relation between inflation and unemployment, adaptive and rational expectations; policy ineffectiveness debate.

**(10 Hours)**

**Unit 3. Microeconomic Foundations of macroeconomics: Consumption Functions-**Keynesian consumption function, life-cycle and permanent income hypotheses; rational expectations and random-walk of consumption expenditure; Fisher's theory of optimal intertemporal choice, Determinants of investment. Savings Paradox

**(10 Hours)**

### **Unit 4. Open Economy Macroeconomic Models**



Short-run open economy models; Mundell-Fleming model; Efficacy of monetary and fiscal policies with fixed and flexible exchange rates/capital im(mobility)

(10 Hours)

**Unit 5. Economic Growth and Fluctuations:** Harrod-Domar model; Solow model; golden rule; technological progress and elements of endogenous growth, Real Business Cycles

(10 Hours)

**Unit 6: Money Supply and Monetary Frameworks:** Monetary policy rules-Monetary targeting, inflation targeting and interest rate targeting, Public Debt and Deficit: Traditional View of Government Debt

(10 Hours)

**Total: 60 hours including Tutorials**

**Readings:**

1. Dornbusch, Fischer and Startz, *Macroeconomics*, McGraw Hill, 11<sup>th</sup> edition, 2010.
2. N. Gregory Mankiw. *Macroeconomics*, Worth Publishers, 7<sup>th</sup> edition, 2010.
3. Richard T. Froyen, T. Richard: *Macroeconomics: Theories and Policies*, 9<sup>th</sup> ed. (Prentice Hall), (2009)
4. Soumyen Sikdar, *Principles of Macroeconomics*, Oxford University Press, 2<sup>nd</sup> Ed, 2011

## Mathematics II

Course Category	L	T	P	C
CC	3	1	0	4

## Detailed Contents of Syllabus

**UNIT I** **Indefinite Integrals** **12 hours**

Basic Formulas – Integration by Substitution (change of variable), Integration by Parts Bernoulli formula, Method of partial fractions

**UNIT II** **Definite Integrals** **12 hours**

Definite integrals, properties, Application-Area under the curve-Applications in economics

**UNIT III** **Matrices** **12 hours**

Algebra of matrices-determinants-inverse of a matrix – solution of system of linear equations-Cramer's rule- method of cross multiplication-applications to business and economics

**UNIT IV** **Input-Output Analysis** **12 hours**

Leontief's input-output model-closed model- open model- applications in business and economics-determination of output-equilibrium prices-primary input requirement-consumer demand-value added

**UNIT V****Eigen values****12 hours**

Matrices-Eigenvalues and Eigenvectors - Characteristic Equation - Properties of Eigenvalues and Eigenvectors

**Total: 60 hours including Tutorials****TEXTBOOKS:**

1. B. S. Grewal, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers, 2017.
2. S. K. Sharma and Gurmeet Kaur, Business Mathematics, 1<sup>st</sup> Edition, Sultan Chand, 2015.

**SUGGESTED READINGS:**

3. Anthony, M., and Biggs, N. Mathematics for Economics and Finance. Cambridge University Press.
4. Carl P. Simon and Lawrence Blume, Mathematics for Economists, N.W Norton & Company, Inc.
5. Sydsaeter and P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia, Delhi
6. Dowling, E.T. Mathematics for Economics, Schaum's Outlines Series. McGraw Hill Publishing
7. Narayan, Shanti and Mittal P.K. Differential Calculus - S Chand
8. Narayan, Shanti and Mittal P.K. Integral Calculus - S Chand
9. Soni, R.S. Business Mathematics. Pitambar Publishing House
10. A.C Chiang, Fundamental Methods of Mathematical Economics, McGraw-Hill, 3rd Edition, 1984.

**Statistics II**

Course Category	L	T	P	C
CC	3	1	0	4

**Detailed Contents of Syllabus****UNIT I****RANDOM VARIABLES****12 hours**

Random Variables: Discrete and Continuous Random Variables, Probability Mass and Density Functions - Cumulative Distributive Functions- Mean, Variance, Moments-skewness and kurtosis

**UNIT II****THEORETICAL DISTRIBUTIONS****12 hours**

Binomial - Poisson – Geometric- Uniform-normal distributions

**UNIT III****TESTING OF HYPOTHESIS OF LARGE SAMPLES 12 hours**

Sampling distributions – Estimation of parameters – interval estimation -Statistical hypothesis – Large sample tests based on Normal distribution for proportion, mean

**UNIT IV****TESTING OF HYPOTHESIS OF SMALL SAMPLES****12 hours**

Tests based on t distribution, confidence interval -Chi-square and F distributions for mean, variance– Contingency table (test for independent) – Goodness of fit- Implementation in Excel

**UNIT V****DESIGN OF EXPERIMENTS****12 hours**

One way and Two-way classifications – Completely randomized design – Randomized block design – Latin square design

**TOTAL: 60 hours including tutorials****SUGGESTED READINGS:**

1. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning
2. Levin, Richard, David S. Rubin, Sanjay Rastogi, and HM Siddiqui. Statistics for Management, Pearson Education
3. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), McGraw Hill Education.
4. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.
5. Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons

**PROGRAMMING IN PYTHON**

Course Category	L	T	P	C
SEC	0	0	4	2

**Detailed Contents of Syllabus****DATA, EXPRESSION, STATEMENT, CONDITIONAL****Hours:10**

Data and types: int, float, boolean, string, list; variables, expressions, statements, simultaneous assignment, precedence of operators; comments; in-built modules and functions; Conditional: boolean values and operators, conditional (if), alternative (if-else), case analysis (if-elif-else).

**ITERATION, FUNCTION, STRINGS****Hours:10**

Iteration: while, for, break, continue, pass; Functions: function definition, function call, flow of execution, parameters and arguments, return values, local and global scope, recursion; Strings: string slices, immutability, string functions and methods, string module.

**LISTS, TUPLES, DICTIONARIES****Hours:10**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, nested lists, list comprehension; Tuples: tuple assignment, tuple as return value, tuple

operations. Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists

## TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, <http://greenteapress.com/>

## REFERENCES

1. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and expanded Edition, MIT Press, 2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
5. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus”, Wiley India Edition, 2013.
6. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3”, Second edition, Pragmatic Programmers, LLC, 2013.

## MS Excel: Advanced

Course Category	L	T	P	C
SEC	0	0	2	1

## Detailed Contents of Syllabus

**Unit 1: Data organization and management:** Creating Simple and classic pivot tables, Choosing Field, Filtering Pivot Tables, Modifying PivotTable Data, Grouping based on numbers and Dates

**5 Hours**

**Unit 2:** Using basic formulae and basic functions, using advanced formulae Using Data Analysis tools for ANOVA, Correlation, Covariance, Descriptive Statistics, Exponential Smoothing, F-Test: Two Sample for Variances, Histogram, Random Number Generation Rank and Percentile, Regression, Sampling, t-Test, etc.

**5 Hours**

**Unit 3:** Preparation of various types of charts-line graphs, pie charts, hierarchical charts, stock and waterfall charts, radar charts, Combo Charts, scatter plots, etc.

**5 Hours**

## Reference Books

1. Alexander, Kusleika, & Walkerbach ; Excel 2019 Bible; Wiley, 2018
2. John Walkenbach; Excel Charts, Wiley, 2016
3. Lokesh Lalwani, BPB publication, 'Excel All-in One: Master the new features of Excel, 2019

## Environmental Studies

Course Category	L	T	P	C
AECC	3	0	0	3

## Detailed Contents of Syllabus

**Unit 1: Introduction and Natural Resources:** Multidisciplinary nature of environmental studies  
**Renewable and non-renewable resources:** Natural resources and associated problems. Forest, water mineral, food, Energy, land resources overutilization, Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

**Unit 2: Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: - Forest ecosystem Grassland Ecosystem Desert Ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Biodiversity and its conservation Definition: genetic, species and ecosystem diversity. Biogeographical classification of India Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values Biodiversity at global, National and local levels. India as a mega-diversity nation Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**Unit 3: Environmental Pollution:** Definition - Cause, effects and control measures - Air pollution - Water Pollution Soil Pollution Marine Pollution Noise Pollution Thermal Pollution Nuclear Hazards Solid Waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

**Unit 4: Social Issues and the Environment:** From Unsustainable to Sustainable Development  
Urban problems related to energy Water conservation, rain water harvesting, watershed management Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act Wildlife Protection Act Forest Conservation Act Issues involved in enforcement of environmental legislation - Public awareness

**Unit 5 Human Population and the Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

## Suggested Readings

Agarwal, K.C, Environmental Biology, Nidi Publ. Ltd. Bikaner.  
Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, India,  
Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)  
Compliances and Standards, Vol I and II, Enviro Media (R)  
Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T, Environmental Encyclopedia, Jaico Publishing House, Mumabai,  
Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay  
Jadhav, H & Bhosale, V.M, Environmental Protection and Laws. Himalaya Pub. House, Delhi  
Kanagasabai, C.S, Environmental Studies. Rasee publishers. Madurai  
Mckinney, M.L. & School, R.M, Environmental Science systems & Solutions, Web enhanced edition  
Odum, E.P, Fundamentals of Ecology. W.B. Saunders Co. USA  
Sapru R.K, Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.  
Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)  
Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines,  
Yogendra, N. and Srivastava, N, Environmental Pollution, Ashish Publishing House. New Delhi

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

### Semester III

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Money and Banking	CC	3	1	0	4
2		Basics Econometrics	CC	3	1	0	4
3		Introduction to Data Science	CC	3	1	0	4
4		Public Economics and Policy	CC	4	0	0	4
5		Discipline Specific Economics Elective	DSE1	3	1	0	4
6		SQL Programming	SEC	0	0	2	1
7		Econometrics Lab	SEC	0	2	2	3
		<b>Total</b>		<b>16</b>	<b>6</b>	<b>4</b>	<b>24</b>

## Money and Banking

Course Category	L	T	P	C
CC	3	1	0	4

### Detailed Syllabus

1. Introduction: Evolution of money, Institutions and Policy: Metallic standards and their breakdown, Innovations in the forms of money  
[5 hours]
  2. Demand and Supply of Money: Money and the Financial System, Supply of money, Determinants of the Supply of Money, Demand for Money: Quantity Theory framework, Keynesian Model, Restatement of Quantity Theory of Money, Tobin Model, Baumol Model, Money Supply-Measures and components of money stock, determinants of money supply and money-multiplier, credit creation and commercial banks  
[15 hours]
  3. Central Banks and Objectives of Monetary Policy- money supply in a closed and open economy, Tools of Money Supply Control, Direct and indirect instruments of monetary policy, Open market operations, Currency-Deposit-Ratio, Cash Reserve Ratio, Statutory Liquidity Ratio, interest rates - Repo Rate, Bank Rate, Reverse Repo rate, Term Structure of Interest Rates; Monetary Policy Rules-Inflation, interest rate and monetary targeting  
[15 hours]
  4. Interlinkages between Monetary and Fiscal Sectors: Monetization of the fiscal deficits, Public debt and monetary policy.  
[15 hours]
  5. Overview of the Indian Financial System. Banking Industry: Structure, Competition, and Regulation (with special reference to the Indian context). Banking Sector: The Role of Development. Banking Sector Reforms in India. Financial Crises and the Subprime Meltdown. Banking and the Management of Financial Institutions. Basel Norms and their implications.  
[10 hours]
- 60 hours including tutorials**

### Textbook

Partha Ray (2013). Monetary Policy, Oxford India Short Introductions, Paperback

### References:

1. J.G. Gurley and E.S. Shaw. (1960). Money in Theory of Finance,
2. F.S. Mishkin. (2007). The Economics of Money, Banking and Financial Markets,
3. Tyrone Black and D. L. Daniel. (1985). Money and banking: contemporary practices, policies, and issues.
4. Ministry of Finance, GoI; Report of the Committee on Banking Sector Reforms, (1998).
5. L.S. Ritter and W.L. Silber. (1974) Principles of Money, Banking and Financial Markets,
6. Gupta, S B (2018). Monetary Economics: Institutions, Theory and Policy, S Chand



## Basic Econometrics

Course Category	L	T	P	C
CC	3	1	0	4

### Detailed Syllabus

#### Unit 1: Introduction (10 Hours)

Review of Statistics: Sampling Distribution, Estimation of Parameters, Hypothesis Testing

#### Unit 2: Classical Linear Regression Model (20 Hours)

Classical Linear Regression Model: Assumptions, Two variable & Multiple Variable Regressions analysis, Properties of Least Squares estimates; tests of hypotheses and confidence intervals

#### Unit 3: Violations of Classical Assumptions (20 Hours)

Violations of classical assumptions: Multi-collinearity; Heteroscedasticity; Auto-correlation; measurement error, omitted variables

#### Unit 4: Discrete Response Models (10 Hours)

Introduction to binary variables, Linear probability models and their limitations, Normal and Logistic curve, Probit and Logit models

**Total: 60 hours including tutorials**

### Textbook

1. Gujarati and Porter, Basic Econometrics, Fifth Edition, McGraw Hill/Irwin, 2009.

### Reference Books

1. Greene, William H. Econometric Analysis. 6th Edition, Prentice Hall. 2008
2. Johnston J. and DiNardo, J. Econometric Methods. 4th Ed. McGraw-Hill 1997.

## Introduction to Data Science

Course Category	L	T	P	C
CC	3	1	0	4

### Detailed Syllabus

#### Introduction to Data Science

#### Unit1: Introduction to Data Science 12 Hours

Introduction: Need for data science – Benefits and uses – Facets of data – Big data ecosystem – The data science process: Retrieving data – Cleansing, integrating and transforming data – Data analysis – Build the models – Presenting findings and building applications.

**Unit 2: Toolboxes for Data Scientists****12 Hours**

Introduction to Python; Fundamental Python Libraries for Data Scientists : Numpy – Scipy – ScikitLearn – Pandas – Matplotlib; IDE; Data Manipulation with Python

**Unit 3: Descriptive Statistics****12 Hours**

Introduction – Data Preparation – Exploratory Data Analysis: Data summarization – Data distribution – Outlier Treatment – Measuring asymmetry – Continuous distribution; Estimation: Mean – Variance – Sampling – Covariance – Correlation.

**Unit 4: Statistical Inference****12 Hours**

Introduction – Frequentist Approach – Measuring the Variability in Estimates: Point estimates – Confidence intervals; Hypothesis Testing: Using confidence intervals – Using p-values.

**Unit5: Machine Learning****12 Hours**

Supervised Learning: Introduction – kNN classifier; Regression analysis: Linear regression – Logistic regression; Unsupervised Learning: Introduction – Clustering; Evaluation metrics.

**Total Hours: 60****TEXT BOOKS**

1. Davy Cielen, Arno D B Meysman, Mohamed Ali, “Introducing Data Science – Big data, Machine Learning, and more using Python tools”, Manning Publications Co, 2016.

**Public Economics and Policy**

<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
CC	4	0	0	4

**Detailed Syllabus****Unit 1: Normative Approach to Public Finance (15 Hours)**

Welfare Economics-Pure Exchange Economy and Economy with Production- The Fundamental Theorem of Welfare Economics; Choosing among Pareto Efficient Points

**Unit 2: Market Failure and Public Goods (13 Hours)**

Types of market failure- Public Goods-Samuelson’s theory-Lindahl Model of Pareto Optimality- Free rider problem- Efficient provision of Public Goods-Externalities- Introduction to Public Choice

**Unit 3: Principles of Taxation and Grant Theory (12 Hours)**

Benefit approach, Ability to Pay Principle-Progressive Taxation-Excess Burden-Direct vs. Indirect Taxes-Theory of Tax Incidence-Theory of Grant

**Unit 4: Deficit Financing and Public Debt (10 Hours)**

Deficit financing-measures of deficit and their relation with public debt-causes and sources of public debt-consequences of high level debt-debt sustainability-solvency conditions-debt dynamics- relation between debt and growth-Ricardian view, Keynesian view and neo-classical view.

## Unit 5: Indian Fiscal System (10 Hours)

Constitutional Assignment of Tax powers and Expenditure Responsibilities to Union and States- Transfers Mechanism-Composition and Trends in Central and States Receipts and Expenditures- Fiscal issues in India and Tax Reforms-Deficits and Public Debt- FRBM Act

**Total Hours: 60**

## Textbooks

1. Hillman A.L.: Public Finance and Public Policy, Cambridge University Press (2003)
2. Jha, R: Modern Theory of Public Finance, Wiley Eastern Ltd., (1987)
3. Musgrave, R .A, and P.B.Musgrave: Public Finance in Theory and Practice, McGraw-Hill, New York, (1976)
4. J. Hindriks, G. Myles: Intermediate Public Economics, MIT Press, 2006.
5. H. Rosen, T. Gayer: Public Finance, 9th ed., McGraw-Hill/Irwin, 2009.
6. .Joseph E. Stiglitz, Economics of the Public Sector, W.W. Norton & Company, 3rd edition, 2000.

## SQL Programming

Course Category	L	T	P	C
SEC	0	0	2	1

Structured English Query Language (SQL)- Introduction- Storing, Retrieving, and Manipulating Data in Databases, Looping, Logic Directives, Variables, Markup, Concept of Tables

SQL Language Elements: Keywords- Add, Join, View, **I**dentifiers, Expressions, Search Conditions, Data Types, Nulls, Comments, etc

List of SQL Commands: **C**reation of Database Tables, Finding/Extraction of Data, Data Adjustments, Data Deletion, Removing Tables from Database, insertion of New Data into the Database, etc

## Learning Resources:

<https://online.stanford.edu/lagunita-learning-platform>

[https://sqlzoo.net/wiki/SQL\\_Tutorial](https://sqlzoo.net/wiki/SQL_Tutorial)

## Econometrics Lab

Course Category	L	T	P	C
SEC	0	2	2	3

## Detailed Syllabus

**Linear Regression Model:** Estimation of correlation coefficients, statistical significance, Testing of hypotheses with Two variable & Multiple Variable Regressions analysis

(15 Hours)

**Unit 3: Violations of Classical Assumptions:** Examples on Multi-collinearity, Heteroscedasticity; Auto-correlation; measurement errors, omitted variables

(15 Hours)

### Unit 3: Discrete Response Models

Estimation of models with binary variables, Linear probability models and demonstration of their limitations, Examples and exercises on Probit and Logit models

(15 Hours)

**Total Hours: 45**

## Textbooks

1. Gujarati and Porter, Basic Econometrics, Fifth Edition, McGraw Hill/Irwin, 2009.

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

## Semester IV

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Indian Economy	CC	4	0	0	4

2		Introduction to Artificial Intelligence	CC	4	0	0	4
4		Data : Sources, Issue and Socio-Economic Analysis	CC	2	2	0	4
5		Discipline Specific Elective	DSE 1	3	1	0	4
6		Discipline Specific Elective	DSE 2	3	1	0	4
7		Academic Report Writing	SEC	0	2	0	2
		<b>Total</b>		<b>16</b>	<b>6</b>	<b>0</b>	<b>22</b>

## Indian Economy

Course Category	L	T	P	C
CC	3	1	0	4

## Detailed Syllabus

### Unit1:

A Brief overview of the Indian Economy on the Eve of Independence, An overview of planning in India, India's development strategy.

[5 hours]

### Unit 2:

Overall Growth and Sectoral Performance of the Indian Economy: structural change and productivity, Issues pertaining to agricultural growth; Agricultural Commodity Markets, Contract Farming, WTO and Agriculture; manufacturing growth and issues relating to productivity; services-led growth in India. Savings and Investment in the Indian Economy.

[10 hours]

**Unit 3.** Trade and Balance of Payments in India: Merchandise trade performance and determinants, Dimensions of Services Trade, Exchange rate arrangements, Capital Flows and their impact, Balance of Payments and issues related to Accumulation of Foreign Exchange Reserves, Capital Account Convertibility, external sector reforms in India, India and WTO

[10 hours]

### Unit 4.

Fiscal Policy in India: Tax and non-Tax Revenue trends in India, issues pertaining to fiscal deficits, Public debt sustainability, fiscal reforms and State finances, FRBM Act, GST-Concept and issues. [10 hours]

#### **Unit 5.**

India's Financial Sector- An overview, Financial Sector Reforms in India – Issues relating to reforms in banking, insurance, pensions, capital market. [10 hours]

#### **Unit 6.**

Employment, Poverty and Inequality in India – Measurement issues, Regional and sectoral dimensions of employment, poverty and inequality, Recent debates on poverty and employment during reforms, Issues relating to rural employment, livelihood security and NREGA.

[10 hours]

#### **Unit 7:**

Issues relating to Infrastructure in the Indian economy: Financing-private vs state, case studies on selected provision of infrastructure, e.g., roads, energy, railways, ports, irrigation, sanitation and water supply and their impact on development.

[5 hours]

**Total Hours: 60**

### **Textbooks**

1. Joshi, V. and I. M. D. Little 1994. India: Macroeconomics and Political Economy, 1964-1991. New Delhi: OUP
2. Uma Kapila, Indian Economy Since Independence (33rd Edition), Academic Foundation, New Delhi, 2022.
3. Uma Kapila, Indian Economy Performance and Policies, (23rd Edition), Academic Foundation, New Delhi, 2022.

### **Suggested Readings**

1. Ahluwalia I. J. and I. M. D. Little (eds.). 1998. India's Economic Reforms and Development: Essays for Manmohan Singh. New Delhi: OUP.
2. Ahluwalia, M. S., S.S. Tarapore and Y. V. Reddy. (eds.). 2004. Macroeconomics and Monetary Policy. New Delhi: OUP.
3. Balakrishnan, P. 2010. Economic Growth in India. New Delhi: OUP.
4. Joshi, V. and I. M. D. Little. 1996. India's Economic Reforms (1991- 2001). New Delhi: OUP.
5. Mohan, R. (ed). 2002. Facets of the India Economy. New Delhi: OUP
6. Reddy, Y.V. 2004. Lectures on Economic and Financial Sector Reforms in India. New Delhi: OUP.
7. Panagariya, A. 2008. India: The Emerging Giant. USA: OUP

## **Introduction to Artificial Intelligence**

<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
CC	4	0	0	4

#### Unit 1 Problem Solving by Searching (12 Hours)

Introduction to AI - Intelligent agents, Searching - Uninformed, Informed, Stochastic search strategies.

#### Unit 2 CSPs and Gaming (12 Hours)

Constraints satisfaction problems, Gaming: minimax algorithm, alpha-beta pruning.

#### Unit 3 Logic and Inference (12 Hours)

Knowledge based agents, Knowledge representation using Propositional and First-Order logic, Resolution, Unification, Inference - Backward chaining, forward chaining.

#### Unit 4 Reasoning with Uncertainty (12 Hours)

Quantifying uncertainty - Semantics and Inference of Bayesian Networks, Inference in Temporal Models - Hidden Markov Models, Markov Decision Processes.

#### Unit 5 Decision Making and Learning (12 Hours)

Decision networks, Markov Decision Processes, Learning from examples, Reinforcement learning, Case study - Natural Language Processing.

Total Periods: 60

## Text Book

1. Stuart Russell and Peter Norvig AI – A Modern Approach, 3rd Edition, Pearson Education 2010

## References:

1. Dan W. Patterson, Introduction to AI and ES”, Pearson Education, 2007. (Unit-III)
2. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE), McGraw Hill- 2008. (Unit- I,II, IV, & V).
3. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006
4. Deepak Khemani Artificial Intelligence, Tata Mc Graw Hill Education 2013.
5. WEB RESOURCES: <http://nptel.ac.in/>

## Data: Sources, Issue and Socio-Economic Analysis

Course Category	L	T	P	C
CC	2	2	0	4

## Detailed Syllabus

### Unit 1: Importance of data

Assessment of policy outcomes vis-a-vis Policy objectives, Data sources: Government, Social Media, Private, etc. Data as a public good; personal data and the right to privacy; Awareness about sharing the data [10 hours]

### Unit 2: Data collection agencies:

Government and private sources, Levels of data: (i) Micro, meso and macro data; (ii) Global, Regional and Country specific data; Methodologies of data collection: Surveys, official records, etc. [20 hours]

Data collection, Compilation and Dissemination for the Indian Economy

Sr. No.	Description of Data	Data Compilation and Released by Ministries and Departments of Govt of India
1	Demographic Data, standard of living data	Census Data Office, Registrar General & Census Commissioner, India, Ministry of (Mo)Home Affairs
	National Income, Savings, Investment, Sectoral Incomes, State Domestic Product,	Mo Statistics and Programme Implementation
2	Health and family welfare indicators	National Family Health Survey reports, -NFHS-Series, Mo Health & Family Welfare
3	Education	Mo Education DISE data
4	Periodic Labour Force Survey (PLFS) data	Ministry of Statistics and Programme Implementation
5	Industrial Production	Official Industrial Data from Ministry -CMIE data bases, Ministry of Statistics and Programme Implementation
6	Agricultural, food availability data	Directorate of Economics & Statistics, Department of Agriculture and Farmers Welfare.
7	Financial Markets Data	SEBI, NSE, BSE
8	Monetary and Banking	RBI
9	Fiscal Sector	Mo Finance
10	Prices and Inflation	Labour Bureau and MoSPI
11	Industrial Sector	Annual Survey of Industries, NSSO
12	Poverty data	Niti Aayog, ARIS/REDS Data NCAER, EPW Research Foundation Data Bases

Note: 'Ministry of' abbreviated as 'Mo'

**Unit 3:** Global data sources: International Monetary Fund, World Economic Outlook, Food and Agricultural Organization, World Bank, World Trade Organization, United Nations, etc. [15 hours]



## Web Resources

Government of India Website, RBI website, BSE and NSE Websites, SEBI Websites, etc.

Websites for Global Data: IMF, WTO, Worldbank, FAO, etc

## Academic Writing

Course Category	L	T	P	C
SEC	0	2	0	2

## Detailed Syllabus

Unit 1: Identification of important Issue/problem/situation and Organization of academic material

Unit 2: Literature review, focussing on the issue to be dealt with, void in the literature

Unit 3: Data details-temporal, spatial and geographical coverage

Unit 4: Data collection: Methods and reliability check

Unit 5: Description of Data Analysis Methodology: qualitative, quantitative, mixed methods, analytical, exploratory, etc. Introduction to NVIVO

Unit 6: Reporting Data Analysis: Use of charts, Tables, text etc. Statistical analysis, Qualitative data analysis reporting

Unit 7: Presentation of Summary and Conclusions: Some precautions

**Total Hours: 30 hours**

## Textbook

1. John M. Swales and Christine B. Feak (2012). Academic Writing for Graduate Students: Essential Tasks and Skills, (Michigan Series in English for Academic & Professional Purposes), The University of Michigan Press

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)

RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES

## DEPARTMENT OF ECONOMICS

### B Sc Economics (Data Science) Degree Program

### Semester V

SL. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Development Economics	CC	4	0	0	4
2		Basics of Finance	CC	3	1	0	4
3		International Economics	CC	3	1	0	4
4		Discipline Specific Elective	DSE 1	3	1	0	4
5		Discipline Specific Elective	DSE 2	3	1	0	4
6		Summer Internship/Mini Project	SEC	0	0	4	2
7		R Programming	SEC	0	0	4	2
		<b>Total</b>		<b>16</b>	<b>4</b>	<b>8</b>	<b>24</b>

### Development Economics

Course Category	L	T	P	C
CC	4	0	0	4

### Detailed Syllabus

#### Unit I: Development and Underdevelopment (15 Hours)

Development Economics: Introduction, Alternative Measures and Indicators of Development: Economic Growth, Economic Development and Structural Changes, PQLI, HDI and its extensions, Development and growth- income as a measure of growth - Human development-Sens capability approach, development as freedom, Structural features of underdeveloped economies- International variations – development gap Underdevelopment as a low level equilibrium in a multiple equilibrium situation – low level equilibrium trap

**(15 Hours)**

### **Unit 2: Models of Growth and Development:**

Endogenous growth models, Productivity and Growth Linkages, Determinants of growth; Big Push, Balanced and Unbalanced Growth, Dual Economy Models- Lewis Model, Harris-Todaro Migration Model.

**(20 Hours)**

### **Unit 3: Poverty and Inequality (12 Hours)**

Poverty and inequalities: Conceptual Underpinnings, Indicators of poverty, measurement of poverty and inequalities, ; characteristics of the poor; mechanisms that generate poverty traps, and path dependence of growth processes-Vicious circle of poverty, Kuznets curve

**(15 Hours)**

### **Unit 4: MDGs and SDGs (9 Hours)**

Cross Country Differences in Development Paths and New Development Challenges- Millennium Development Goals Sustainable Development Goals

**(10 Hours)**

Total Hours: 60

## **Text Books:**

Kaushik Basu: Analytical Development Economics, OUP

Debraj Ray: Development Economics, Princeton University Press (1998)

## **Basics of Finance**

Course Category	L	T	P	C
CC	3	1	0	4

## **Detailed Syllabus**

**Unit 1: Introduction to Finance [10 hours]**

Basic forms of business organizations and financing of business. Objectives of a business organization – Profit Maximization vs Sales Maximization; Evaluation of financial decisions; Agency problems and its mitigation

**Unit 2: Financial Accounting [10 hours]**

Meaning, Accounting Concepts, Recording of Business Transactions, Double Entry System, Journal, Ledger, Preparation of Final accounts

**Unit 3: Financial Statements and Cash Flow [10 hours]**

Basics of financial statements; Balance sheet-assets, liabilities, and stockholders' equity; Income statement-profit and loss; the link between financial statements; Derivation of cash flows from financial statements; the sources and uses of cash flows.

**Unit 4: Financial Statements Analysis [10 hours]**

Application of financial statements: standardized statements; ratio analysis and the financial health of a firm; Financial ratios as proxies for the liquidity, leverage, profitability, financial ratios and the asset management

**Unit 5: Time Value of Money [10 hours]**

The basic concepts of time value of money: the present value, the future value, and the net present value; Various concepts of interest rates: quoted interest rate and effective annual rate; Patterns of cash flow-annuity and perpetuity. Applications of time value of money and business valuation, e.g., mortgage plan selection, insurance plans, pension plan choice, and investment decisions, etc.

**Unit 6: Costing and Pricing: [10 hours]**

Marginal cost vs Average Cost Pricing, Marginal Costing, Break even analysis, Cost, Volume, Profit analysis, Standard Costing and Variance analysis, Variance analysis and its usefulness: Variance analysis of Material and Labour Cost

**Total Hours: 60**

**Textbooks:**

1. Maheswari S.N. Management Accounting and Financial Control, Sultan Chand & Sons, New Delhi.
2. Shukla M.C and Grewal T.S Advanced Accounts, Volume I S. Chand & Co. New Delhi.

## International Economics

Course Category	L	T	P	C
CC	3	1	0	4

## Detailed Syllabus

**1. Introduction:** Difference between internal and international trade, An overview of global trade, Trend and composition of global trade in goods and services, Capital inflows and their importance in global finance

[15 hours]

**2. International Trade and Competitiveness**

Trade Theories and Comparative Advantage, New Trade Theories; Competitiveness, Outsourcing and Multinational Enterprises, WTO and International Trade.

[15 hours]

**3. Trade Policy**

Instruments of trade policy, regional integration-free trade area and customs unions; political economy of trade policy; controversies in trade policy, Trade policy and WTO, WTO and Trade Disputes.

[15 hours]

**4. International Finance**

International Monetary Systems, Exchange Rate Systems and arrangements, Fixed, flexible and hybrid systems exchange rates; adjustment and financing of deficits in fixed and flexible exchange rate regimes, financial globalization and financial crises. IMF and the World Bank

[15 hours]

## Textbook

Dominick Salvatore, *International Economics: Trade and Finance*, John Wiley, International Student Edition, 10<sup>th</sup> edition, 2011.

## Readings:

1. Paul Krugman, Maurice Obstfeld, and Marc Melitz, *International Economics: Theory and Policy*, Addison-Wesley (Pearson Education Indian Edition), 9<sup>th</sup> edition, 2012.

## Web resources:

[www.imf.org](http://www.imf.org), [www.worldbank.org](http://www.worldbank.org), [www.wto.org](http://www.wto.org), [www.rbi.org.in](http://www.rbi.org.in)

**Total Hours: 60**

## Summer Internship or Mini-Project

Course Category	L	T	P	C
SEC	0	0	4	2

Students are encouraged to do summer internships with industry/other institutions including academic institutions. They can also opt for doing a mini-project under the supervision of a faculty at SNUC with the approval of the appropriate authorities.

## R Programming

Course Category	L	T	P	C
SEC	0	0	4	2

## Detailed Syllabus

**Unit 1** Introduction to R Programming – vectors – control statements – functions in R – matrices – Strings – Lists – Arrays in R – R factors – Data Frames in R – Data exploration and data cleaning - Data visualization with R – StringR, dplyR libraries, Practice Exercises and Assignments.

**(15 Hours)**

**Unit 2:** Application of Regression analysis- Principal Component Analysis- and Case Studies.

**(15 Hours)**

**Total Hours: 30**

# SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)

RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU

## SCHOOL OF SCIENCE AND HUMANITIES

### DEPARTMENT OF ECONOMICS

#### B Sc Economics (Data Science) Degree Program

#### Semester VI

Sl. No.	COURSE CODE	Course Title	Category	L	T	P	C
1		Track Specific Elective	TS1/TS2	3	1	0	4
2		Track Specific Elective	TS1/TS2	3	1	0	4
3		Discipline Specific Elective	DSE 2	3	1	0	4
4		Major Project/Dissertation	Project	0	0	12	6
	Total Credits			9	3	12	18

#### Major Project/Dissertation

Course Category	L	T	P	C
Major Project/Dissertation	0	0	12	6

## SHIV NADAR UNIVERSITY CHENNAI

(State Private University established under the Shiv Nadar University Act, 2018)  
RAJIV GANDHI SALAI (OMR), KALAVAKKAM - 603 110 TAMIL NADU INDIA

### SCHOOL OF SCIENCE AND HUMANITIES

#### DEPARTMENT OF ECONOMICS

#### B Sc Economics (Data Science) Degree Program

## List of Economics Electives (DSE1)

### Advanced

1. Advanced Econometrics
2. Agricultural Economics
3. Game Theory
4. Behavioural Economics
5. Industrial Economics
6. Operations Research

### Econometrics

Course Category	L	T	P	C
DSE1	3	1	0	4

### Detailed Syllabus

#### Unit 1: Introduction of Time Series (10 Hours)

Introduction: Examples, simple descriptive techniques, trend, seasonality, the correlogram. Stochastic Process: Introduction and Stationary Process. Introduction to time series data, application of time series from various fields. Modelling time series as deterministic function plus IID Errors- Characteristics of Time Series Data Model identification/estimation/linear operators. Practice sessions

#### Unit 2: AR, MA ARMA Models and Forecasting (20 Hours)

Basic models of Time Series Data -Probability models for time series: stationarity. Detrending and De-seasonalizing-Box-Jenkins modelling: Moving-average (MA) process and Autoregressive (AR) process of orders one and two.ACF and its graphical use in guessing the order of MA processes. Estimation of the parameters of AR (1) and AR (2) using least square and Yule-Walker equations. Basics of ARIMA models  
ACF and PACF- Estimation & Forecasting - Estimating the autocorrelation function and fitting ARIMA models. Forecasting: Exponential smoothing, Forecasting from ARIMA models. Practice sessions

#### Unit 3: Panel Data Estimation (20 Hours)

Definition of panel data- representation of balanced-panel and unbalanced panel models- Pooled OLS Model-Panel data and pooled OLS model -The fixed effects model -The random-effects model - Further topics in the analysis of linear panel data models  
Practice sessions

#### Unit 4: First Difference Estimator (10 Hours)



First difference estimator, random effects model, time fixed effects, Tests of hypothesis for pooled or fixed effects model, pooled and or random effects models (Breusch-Pagan Lagrange Multiplier Test) and fixed or random effects (Hausman test- Practice sessions

**Total Hours: 60**

## Reference:

1. Wooldridge, Jeffrey M. (2002) Econometric Analysis of Cross Section and Panel Data. MIT Press.
2. Cameron, A. Colin and Trivedi, Pravin K. (2005). Microeconometrics: Methods and Applications. Cambridge University Press.
3. Cameron, A. Colin and Trivedi, Pravin K. (2009) Microeconometrics Using Stata, Stata Press.
4. Kohler, Ulrich and Kreuter, Frauke (2012) Data Analysis Using Stata. Stata Press.
5. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.
6. Kendall M.G. (1976): Time Series, Charles Griffin.
7. Brockwell and Davis (2010): Introduction to Time Series and Forecasting (Springer Texts in Statistics) ,2nd Edition.
8. Shumway & Stoffer (2000), Time Series Analysis and Its Applications With R Examples, 4th Edition, Springer.

## Agricultural Economics

Course Category	L	T	P	C
DSE1	3	1	0	4

## Detailed Syllabus

### Unit I: Agriculture and Economic Growth (5 Hours)

Role of Agriculture in Economic Development, sectoral changes and agriculture, agriculture in rural development, farm and non-farm employment issues, inter-linkages between agriculture and other sectors; Schultz's hypothesis on traditional agriculture and its critique Mechanization of Indian Agriculture; Green revolution and its impacts

### Unit II: Agricultural Marketing (20 Hours)

Agricultural price policy for a developing economy – objectives and effectiveness of agricultural price policy, elements of agricultural price policy, features of an ideal agricultural price policy, agricultural price policy in India and public distribution system Agricultural marketing – need and criteria for assessing efficiency, agricultural marketing system in India, development of a national agricultural marketing platform-Role of Capital in Agriculture, Meaning, scope and significance – Factors determining demand for credit; Classification and sources of Agricultural Credit - Role of NABARD – Cooperation - Micro finance and SHGs – Capital formation in Agriculture - Crop Insurance

### Unit III: Risk and Uncertainty in Agriculture (15 Hours)

Difference between risk and uncertainty, types of uncertainty in agriculture, measures for mitigating risk and uncertainty in agriculture, new agricultural insurance scheme of India Rural credit in India, importance and estimates, agencies for rural credit, review of progress of institutional finance in rural India since independence

## Unit V: Agriculture in Indian Planning (20 Hours)

Agriculture in Indian Planning, Globalization and Indian agriculture, Case for and against privatization of agriculture, WTO and India's trade in agricultural commodities – Agriculture price and food policy-Agriculture Prices Functions and Fluctuations; Cobb-Web Model; Need for Government intervention; Objectives of Price policy; Types of Agriculture Prices: Minimum Support Prices and Statutory Minimum Support Price, Procurement Prices; Fixation of Minimum Support Price; Terms of Trade and Agriculture; Food Security and Food Subsidy; Food Corporation of India and Buffer stock; Public Distribution System (PDS) in India: Procurement and Distribution; Critics of PDS - National Food Security Act-Contemporary issues of primary sector in India.

**Total Hours: 60**

### Textbook

1. Sony, R. N. (2006), Leading Issues in Agricultural Economics, Vishal Publishing, Jalandhar.

### Reference Book:

2. Sadhu, A N and A Singh (2008), Fundamentals of Agricultural Economics, Himalaya Publishing House, Mumbai.
3. Acharya and Agarwal (2016). Agricultural marketing. Oxford & IBH Publishing Co. Pvt. Ltd. (or latest edition available)

## Game Theory

Course Category	L	T	P	C
DSE1	3	1	0	4

## Detailed Syllabus

### Unit 1: Simultaneous Move Games with Complete Information (25 Hours)

Introduction- Definition, types of game -representation of a game, the normal form; basic concepts; Dominated strategies Iterated dominance; Best responses; Rationality; Knowledge, common knowledge-solution concept: Iterated deletion of strictly and weakly dominated strategies; Best Response Functions and Nash equilibrium, mixed and pure strategies; applications –Finding pure strategy Nash equilibria in finite games; Applications.

### Unit 2: Extensive Form Games with Perfect Information (20 Hours)

The game tree; strategies; subgame perfection; backward induction; commitment; bargaining; other Applications-Oligopoly model-applications

### Unit 3: Simultaneous Move Games with Incomplete Information (15 hours)

Incomplete information game structure- types, representation- Strategies; Bayesian Nash equilibrium; applications-Cournot duopoly with private information; Perfect Bayesian Nash equilibrium and sequential equilibrium

**Total Hours -60**

### Textbooks

1. Osborne, M. (2004). An introduction to game theory. Oxford University Press.

2. Gibbons, R., A Primer in Game Theory, Harvester-Wheatsheaf, 1992.
3. Fudenberg, D and J. Tirole, Game Theory, MIT Press, 1991.
4. Osborne, M. J. and A. Rubinstein, A Course in Game Theory, MIT Press, 1994.

## Behavioural Economics

Course Category	L	T	P	C
DSE1	3	1	0	4

## Detailed Contents of Syllabus

Introduction: Behavioural Economics-Using this multidisciplinary approach- Integrating Economics with psychology, sociology, neuroscience, and evolutionary biology, limits to rational decision-making-concepts of bounded, ecological, and selective rationality; Behavioural economists in search of relevant and reliable data experimental and neuroscientific data through natural experiments and randomized controlled trials

10 hours

Motivation and incentives: Incentives as the fundamental drivers in economic analysis; Money is often the main incentive, but a complex range of Incentives: socio-economic and psychological factors as drivers of decision-making; Other incentives and motivations- intrinsic and extrinsic; Pro-social choices and image motivation; Efficiency wage theory as a motivation to work.

8 hours

Social lives: social influences and behaviour, aversion to unequal outcomes, trust and reciprocity, social learning, and peer pressure; the interplay between trust and reciprocity in cooperative and collaborative activities; Inequity aversion; Social norms as drivers of behaviour.

8 hours

Quick Decision Making: Risky Choice and Time factor: Information and choice overload and decision-making; 'Quick thinking', Heuristics and the associated behavioural biases: availability, representativeness, and anchoring and adjustment; Habitual behaviours. Anchoring/adjustment

8 hours

Risk, Uncertainty and Prospect Theory: Possibility of anomalous behaviour Paradoxes. certainty, reflection, and isolation Effects. Alternatives to prospect theory; mental accounting model and the regret theory

Present bias: disproportionate preference for smaller, immediate rewards vs delayed, larger rewards-underlying time inconsistency; the intertemporal tussle between patient and impatient selves, pre-commitment strategies, and self-control; The behavioural life cycle models of choice bracketing, framing, and mental accounting

8 hours

Personalities, moods, and emotions: psychological factors in economic and financial decision-making; measuring personality through OCEAN tests and the five dimensions: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism; Somatic market hypothesis, dual-system models, and Neuroeconomics.

Behavioural microeconomic public policy, behaviour change— nudging for efficient and productive decision-making; Complementing conventional economic policy instruments with nudging. Behaviour and Macroeconomics: The role of social and psychological factors, optimism and pessimism in explaining macroeconomic fluctuations; the impact of confidence and social mood on macroeconomic outcomes; happiness and well-being.

10 hours

Total Hours: 60

**Text Books:**

1. Michelle Baddeley, Behavioural Economics: A Very Short Introduction, 2017
2. N. Wilkinson and M. Klaes (2012), An Introduction to Behavioral Economics, Palgrave Macmillan.
3. Animal Spirits, G. Akerlof and R. Shiller (2009), Princeton University Press.
4. Loewenstein (1987) "Anticipation and the Valuation of Delayed Consumption". Economic Journal, 97(387): 666-684.
5. Oster, Emily, Ira Shoulson, and E. Ray Dorsey. 2013. "Optimal Expectations and Limited Medical Testing: Evidence from Huntington Disease." American Economic Review, 103(2): 804-30.
- Brunnermeier, Markus, K., and Jonathan A. Parker (2005). "Optimal Expectations." American Economic Review, 95(4): 1092-1118.

**Industrial Economics**

Course Category	L	T	P	C
DSE1	3	1	0	4

**Detailed Syllabus****Unit 1: Industrial Economics – Introduction: (8 Hrs)**

Nature and Role of Industrial Economics. Theories of Firm- Behavioural Theory of the Firm, Managerial Theory of the Firm, Contestable Market theory of the Firm. 2.

**Unit 2: Structural Analysis of Industry (18 Hrs)**

Oligopoly – collusive and non-collusive models; Concentration –measurements of concentration and interpretation, trends in concentration and location of industry; systematic determinants of seller concentration – horizontal and vertical mergers, random growth hypothesis; barriers to entry – classification, structural barriers, entry deterring strategies, potential entry & contestability, entry and industry evolution; market structure, firm strategy and performance: empirical tests of the SCP paradigm, strategic groups, concept of profitability and measurement, sources of variation in profitability- industry, corporate and business unit effect, New Empirical Industrial Organisation (NEIO).

**Unit 3: Industrial Efficiency and Productivity -Concepts & Measurement (4 Hrs)**

Meaning, determinants, measurement of efficiency levels, efficiency conditions, efficiency and decision making process.

**Unit 4: Analysis of Firm Strategy (30 Hrs)**

Pricing – cost plus pricing, price discrimination, peak-load pricing, transfer pricing; product differentiation-types, monopolistic competition-socially optimal amount of product differentiation, Lancaster's product characteristics model, Hotelling's & Salop's location model, advertising – determinants of advertising expenditure, advertising & product characteristics, advertising & profit maximization, advertising & barriers to entry, advertising, information search & quality signaling; R & D: Market structure, firm size and the pace of technological change, Investment in research and development; Investment in research and development: Motives for vertical integration: enhancement of market power, motives for vertical integration, agency & vertical relationships, motives for and types of vertical restraints; diversification: types, motives, corporate coherence, corporate focus and deconglomeration.

**Total Hours: 60**

## Books Recommended:

1. John Lipczynski, John Wilson and John Goddard: Industrial Organization Competition, Strategy, Policy, second edition, Prentice Hall.
2. Barthwal, R.R: Industrial Economics – An Introductory Textbook, New Age International Publishers.
3. Church J, Ware, R: Industrial Organization: A Strategic Approach.
4. Clarke R: Industrial Economics, Blackwell Publishing

## Operations Research

Course Category	L	T	P	C
DSE1	3	1	0	4

### **UNIT I                      OPERATIONS RESEARCH                      12 Hours**

Introduction of Operations Research - Operations Research Techniques and Tools - General Mathematical Formulation of LPP - Graphical Methods to Solve LPP - Some Exceptional Cases.

### **UNIT II                      LINEAR PROGRAMMING PROBLEMS                      12 Hours**

Simplex Method - The Simplex Algorithm - Big M Method - Variants of Simplex Method.

### **UNIT III                      TRANSPORTATION & ASSIGNMENT PROBLEM                      12 Hours**

Transportation problems – Initial solution by North West Corner Rule, Least Cost Method, Vogel's Approximation Method, Modified Distribution Method - Assignment Problems - Travelling Salesman Problem

### **UNIT IV                      NETWORK SCHEDULING                      12 Hours**

Project Network - Diagram Representation - Floats - Critical Path Method (CPM) - PERT - Cost Considerations in PERT and CPM

### **UNIT V                      STATISTICAL QUALITY CONTROL                      12 Hours**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling- Implementation in Excel

**TOTAL PERIODS: 60**

**Textbook**

1. Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, 9<sup>th</sup> Edition, Third Indian Reprint 2010

**References**

1. Kanti Swarup, P.K. Gupta, Man Mohan, Operations Research, Sultan Chand Sons, New Delhi, 2004.
2. J. K. Sharma, Operations Research Theory and applications, Macmillan, 5<sup>th</sup> Edition, 2013.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 9th Edition Mc Graw Hill Inc. 2009.
4. Jit. S. Chandran, Mahendran P. Kawatra, Ki Ho Kim, Essentials of Linear Programming, Vikas Publishing House Pvt. Ltd. New Delhi, 1994.
5. Philip D.T. and Ravindran A., Operations Research, John Wiley, 1992.

## Data Science Electives (DSE 2)

1. Big Data Analytics
2. Data Mining
3. Data Processing
4. Data Science for Business
5. Machine Learning Techniques
6. Social Media Mining

## Big Data Analytics

Course Category	L	T	P	C
DSE 2	3	1	0	4

### UNIT I INTRODUCTION

**12**

Introduction to Intelligent data analysis: Nature of data - Modern Data analytics tools, Statistical concepts: Probability – Sampling – Statistical inference – Prediction & Prediction errors – Resampling.

### UNIT II STATISTICAL AND MACHINE LEARNING METHODS

**12**

Statistical Methods: Regression modelling – Classical Multi-Variant analysis, Bayesian Methods: Bayesian Inference – Modelling – Bayesian Network, SVM & Kernel Method:

Overfitting & generalized bounds – SVM , Neural Network: Multi-layer feedforward – Learning & Generalization – Radial basic functions.

### **UNIT III MINING DATA STREAMS**

**12**

Introduction, Stream data model, Sampling data in a stream, Filtering streams, Counting distinct elements in a stream, Estimating moments, Counting oneness in a window, Decaying window.

### **UNIT IV BIG DATA MINING**

**12**

Frequent Item Sets: Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream, Clustering Techniques: Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and parallelism.

### **UNIT V FRAMEWORKS & VISUALIZATION**

**12**

Frameworks: MapReduce – Hadoop Distributed file systems - NoSQL Databases, Visualization: Introduction - Classification of visual data analysis techniques - Data types to be visualized - Visualization techniques.

## **TEXT BOOKS**

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007. (Unit I & II).
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012 (Unit III, IV & V).

## **REFERENCES**

1. Jawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
2. Holmes, Dawn E., "Big data: A Very Short Introduction", Oxford University Press, 2017.
3. Hastie, Trevor, et al., "The Elements of Statistical Learning", Vol. 2. No. 1. New York: Springer, 2009.
4. Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015.

## **Data Mining**

<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
DSE 2	3	1	0	4

## **MODULE1: DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING**

12

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

## **MODULE 2: DATA MINING – INTRODUCTION**

12

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Pre-processing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

## **MODULE 3: DATA MINING - FREQUENT PATTERN ANALYSIS**

12

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns - Mining associations in real time data sets using WEKA / R.

## **MODULE 4: CLASSIFICATION**

12

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy - Classification of real time data sets using WEKA / R.

## **MODULE 5: CLUSTERING**

12

Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods -



## TEXTBOOKS

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

## REFERENCES

2. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 35<sup>th</sup> Reprint 2016.

3. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

4. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

## Machine Learning Techniques

Course Category	L	T	P	C
DSE 2	3	1	0	4

### MACHINE LEARNING BASICS

12

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

### MACHINE LEARNING METHODS

12

Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

### MACHINE LEARNING IN PRACTICE

12

Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon’s Machine Learning Tool Kit: Sagemaker

## **MACHINE LEARNING AND DATA ANALYTICS**

**12**

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

## **APPLICATIONS OF MACHINE LEARNING**

**12**

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

**TOTAL HOURS: 60**

## **TEXTBOOKS**

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020
2. John D. Kelleher, Brain Mac Namee, Aoife D’ Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press, 2015

## **REFERENCES**

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020
3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

## **Data Processing**

<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
DSE 2	3	1	0	4

## **TOOLBOXES FOR DATA SCIENTISTS**

**12**

Introduction to Python; Fundamental Python Libraries for Data Scientists: Numpy – Scipy – ScikitLearn – Pandas – Matplotlib; IDE; Data Manipulation with Python - Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing

## **BASICS OF DATA VISUALIZATION**

**12**

The Seven Stages of Visualizing Data – Different types of charts – Intro to tableau – Connections and Correlations - Scatterplot Maps - Trees, Hierarchies- Acquiring Data – Parsing Data – Calculated fields in tableau.

## **ADVANCE DATA VISUALIZATION**

**12**

Visualizing Geographic Data – Creating dashboards, Story boards and Animations – Level of Detail (LoD) calculations – Dual Axis charts in tableau – time series visualization.

## **MACHINE LEARNING**

**12**

Supervised Learning: Introduction – kNN classifier; Regression analysis: Linear regression –

Logistic regression; Unsupervised Learning : Introduction – Clustering; Evaluation metrics.

## **TIME SERIES, TEXT AND IMAGE EXPLORATION**

**12**

Introduction to Time series –Algorithms for handling time series– Introduction to text processing – Regular Expressions – Basic text processing – Introduction to Image data exploration.

Total Hours: 60

## **Social Media Mining**

<b>Course Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
DSE 2	3	1	0	4

### **MODULE 1 INTRODUCTION 12**

Introduction, Statistical properties of social networks: Static and dynamic properties, Random walk and their applications: Random walk on graphs - Algorithms for Computing Personalized Pagerank and Simrank – Text analysis

### **MODULE 2 COMMUNITY DISCOVERY AND NODE CLASSIFICATION 12**

Introduction, Communities in context, Core methods: KL algorithm– Agglomerative & divisive algorithm – Markov clustering, Node classification: Introduction- Node classification problem – Random walk based methods

### **MODULE 3 EVOLUTION AND LINK PREDICTION IN SOCIAL NETWORKS 12**

Evolution: Introduction – Modeling a network actor across time frame – Challenges – Laws of evolution – Incremental mining, Link prediction: Introduction – Feature based linked prediction – Bayesian and Probabilistic relational models

#### **MODULE 4      PRIVACY IN SOCIAL NETWORKS      12**

Introduction, Privacy breaches: Disclosure of identity, social links and attribute, Privacy definition for publishing data: k-anonymity, l-diversity & t-closeness – Differential privacy, Privacy preserving mechanisms for social networks

#### **MODULE 5      VISUALIZING SOCIAL NETWORKS      12**

Introduction, Taxonomy of visualization: structural- semantic – temporal, Visualization and analytics: Centrality-based Visual Discovery and Exploration

TOTAL PERIODS: 60

### **TEXT BOOK**

1. Aggarwal, Charu C. Social network data analytics, Springer, Boston, MA, 2011.

### **REFERENCES**

1. Stanley Wasserman, Katherine Faust Social Network Analysis: Methods and Applications Volume 8 of Structural Analysis in the Social Sciences, ISSN 0954- 366X, Cambridge University Press, 1994
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.
3. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
4. Guandong Xu ,Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition Springer, 2011.
5. John G. Breslin, Alexandre Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

<b><i>Approval of Board of Studies for the Curriculum of B.Sc. Economics (Data Science)</i></b>			
<b>Srl No.</b>	<b>Name</b>	<b>Signature</b>	<b>Approved/Not-Approved</b>
1	Prof. Malathy D (External Member)		
2	Dr. Rupa Rege Nitsure (External Member)		
3	Prof. T Nagrajan		

4	Dr. P. Venugopal		
5	Dr. Sujatha		
6	Dr. Deepesh Chandrasekharan		
8	Dr. Shrabani Mukherjee		
9	Prof. Pushpa Trivedi [Convenor]		