Mahatma Education Society's

Pillai College of Arts, Commerce & Science (Autonomous)

Affiliated to University of Mumbai

'NAAC Accredited 'A' grade (3 cycles)'
'Best College Award' by University of Mumbai
ISO 9001:2015 Certified

SYLLABUS

Program: B.Sc. Economics

S.Y. B.Sc. Economics

PCACS/BSE/SYL/2024-25/SY

As per National Education Policy
Choice Based Credit & Grading System

Academic Year 2024-25

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pcacs

S.N.	Name	Designation	Signature
1	Dr. Rinkoo Shantnu	HOD / Chairperson	
2	Dr. Aarti Sukheja	Member	
3	Ms. Praniti Rajapure	Member	
4	Dr. B. S. Patil	Vice Chancellor Nominee	
5	Mr. Sunil Ghadge	Subject Expert	
6	Ms. Saleha	Subject Expert	
7	CA Mr. Abhilash Tewari	Industry Representative	
8	Ms. Priti Mishra	Alumni Representative	

Dr. Rinkoo Shantnu
Co-ordinator B.Sc. Economics

1. Introduction to the Program

B.Sc. Economics programme of Pillai College of Arts, Commerce and Science (Autonomous) will equip you with a nuanced understanding of economic models and the ability to devise policy interventions to economic problems. Our carefully designed degree combines compulsory units in core economics, econometrics, applied mathematics and other Courses which will be able to develop deep insights into the dynamics of global and national economies.

Employers look for candidates who can produce reports that make use of advanced quantitative skills in analysis and modelling. The analytical reasoning and quantitative techniques provided by the said course will give the best employment prospects to the students.

This degree will open up myriad career options. Students will not only enjoy a substantial edge when applying for prestigious postgraduate programmes in Economics around the world, but will also become a highly competitive applicant for working in areas such as policy-making, data science, consulting, finance and economic research.

2. Programme Outcomes (POs) for B.Sc. Programme

Sr. No.	PO Brief
PO1	Develop a strong foundation in the core principles and theories of their chosen field of study to pursue a profession of choice by understanding fundamental concepts, methodologies, and key terminologies.
PO2	Trigger the research aptitude by developing basic research skills, including the ability to conduct literature reviews, design experiments, collect and analyze data, and draw meaningful conclusions.
PO3	Communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing and also ability to present their work through written, oral, and visual presentations, including an original research proposal in a clear and understandable manner to both technical and non-technical audiences.
PO4	Understand and adhere to ethical standards by recognizing the importance of integrity, honesty and ethical responsibility in scientific research and professional practice.
PO5	Ability to work cohesively to achieve common goals, solve problems and contribute to the success of a project or task paving way to individual and collective growth.
PO6	Engage themselves in lifelong learning to keep up with the pace of changing technology.
PO7	Acquisition of specialized technical skills and expertise relevant to the specific field of study i.e advanced laboratory techniques, computational skills, or other specialized methodologies.
PO8	Equipped with the ability to analyze information critically, think logically, and solve complex problems by applying scientific methods, mathematical reasoning, and logical approaches to real-world situations.

3. Programme Specific Outcomes (PSOs) for B.Sc Economics Programme

PSO-1	Apply quantitative skills and its application in economic analysis and modelling.
PSO-2	Exhibit in-depth practical skills for working in areas such as policy-making, data science, consulting, finance and economic research.
PSO-3	Develop understanding of economic models and the ability to devise policy interventions to economic problems.
PSO-4	Develop a research mindset by aiding deep insights into the dynamics of global and national economies.

Course Structure

		S.Y.B.Sc. Economics Semester III				
Course Code	**Course Type**	**Course Title**	**Theory/ Practical**	**Marks**	**Credits**	**Lectures / Week**
PUSEC301	**Major**	Econometric Techniques I	Theory	100	4	4
PUSEC302	**Major**	Advanced Mathematics for Economics	Theory	100	4	4
PUSEC303	**Major**	Introduction to Database	Theory	100	2	3
PUSEC304	**Minor**	Public Finance	Theory	100	3	4
PUSEC305	**SEC**	Mini Project	Theory	100	2	2
PUSEC306P	**Major P**	Introduction to Database Practical	Practical	50	2	2
PUAEC30	**AEC**	Indian Languages from the pool	Theory	100	2	3
PUIDC30	**IDC**	To be taken from the Pool	Theory	100	3	4
Total				800	22	26

Abbreviations:
Abbreviations:
SEC: Skill Enhancement Course
AEC: Ability Enhancement Course
IDC: Interdisciplinary Course

SEC – Mini Project

IDC – Public Policy (Department is offering)

Semester IV						
Course Code	Course Type	Course Title	Theory/ Practical	Marks	Credits	Lectures / Week
PUSEC401	**Major**	Environmental Economics	Theory	100	4	4
PUSEC402	**Major**	Advanced Statistics for Economics	Theory	100	2	4
PUSEC403	**Major**	Business Intelligence	Theory	100	2	3
PUSEC404	**Minor**	Indian Economy	Theory	100	3	4
PUSEC405	**SEC (SWAYAM)**	To be taken from the Pool	Theory	100	2	-
PUSEC406P	**Major P**	Advance Statistical Methods using R tool Practical	Practical	50	2	2
PUSEC407P	**MajorP**	Business Intelligence Practical	Practical	50	2	2
PUAEC20	**AEC**	To be taken from the Pool	Theory	100	2	3
PUIDC20	**IDC**	To be taken from the Pool	Theory	100	3	4
Total				**800**	**22**	**26**

Abbreviations:
SEC: Skill Enhancement Course
AEC: Ability Enhancement Course
IDC: Interdisciplinary Course

SEC – (SWAYAM)

1. Economics Of IPR
2. Business And Sustainable Development
3. Decision-Making Under Uncertainty
4. Business Analytics & Data Mining Modeling Using R Part II

IDC – Indian Economy since 1991 (Department is offering)

AEC – Emotional Intelligence

Evaluation Pattern

Marking Code	Marking Scheme
A	60 Marks Final Exam, 20 Marks Internal Exam, 20 Marks Field Project.
B	60 Marks Final Exam, 40 Marks Internal Exam.
C	100 marks distributed within report /case study/ project/ presentation etc.
D	50 Marks Practical Examination.

SEMESTER III

Course Code	Course Type	Course Title	Evaluation Pattern
PUSEC301	Major	Econometric Techniques I	A
PUSEC302	Major	Advanced Mathematics for Economics	A
PUSEC303	Major	Introduction to Database	A
PUSEC306P	Major	Introduction to Database Practical	D
PUSEC304	Minor	Public Finance	A
PUSEC305	SEC	Mini Project	C
	IDC	To be taken from the Pool	C
	AEC	Advanced Indian Languages from the pool	C

SEMESTER IV

Course Code	Course Type	Course Title	Evaluation Pattern
PUSEC401	Major	Introduction to Database	A
PUSEC402	Major	Advanced Statistics for Economics	A
PUSBT406P	Major	Advance Statistical Methods using R tool Practical	D
PUSEC403	Major	Business Intelligence	A
PUSEC407P	Major	Business Intelligence Practical	D
PUSEC404	Minor	Public Finance	A
PUSEC405	SEC (SWAYAM)	To be taken from the Pool	C
PUSEC40-	IDC	To be taken from the Pool	C
	AEC	To be taken from the Pool	C

SEMESTER III

BOS	B.Sc. Economics
Class	F.Y. B.Sc. Economics
Semester	II
Course Name	Econometric Techniques I
Course Code	PUSEC301
Course Type	Major
Level of the Course	Basic
Credits	4

Course Objectives:

1. To aid students' thought process by developing a way of thinking in quantitative terms.
2. To introduce students to the various econometric techniques/tools for research.

Unit No.	Name of Unit	Topic No.	Name of the Topic	Hours
1	Introduction	1.1	Meaning, Methodology: Statement, Specification of the mathematical model, Specification of the statistical, or econometric model.	15
		1.2	Obtaining the data, Estimation of the parameters, Hypothesis testing, Forecasting, Using the model.	
		1.3	Types of Econometrics: Theoretical econometrics and Applied econometrics (Classical and Bayesian)	
2	Single-equation and Two-Variable Regression Analysis	2.1	Nature of Regression analysis, Historical Origin of the Term Regression, Modern Interpretation of Regression, Regression versus Causation & Correlation.	15
		2.2	Sources of Data for Economic Analysis: Time-Series, Cross-Section & Pooled Data.	
		2.3	Multiple Regression Analysis: Concept of Population Regression Function (PRF), Stochastic Disturbance Term, Sample Regression Function.	
3	Two-Variable Regression Model and Classical Normal Linear	3.1	Method of Ordinary Least Squares, Properties of Least-Squares Estimators: The Gauss–Markov Theorem.	15

Course Outcomes
1. Explain the meaning and purpose of Econometrics.
2. Discuss the nature of Regression Analysis.
3. Examine the sources of Data for Economics Analysis.
4. Evaluate the methods and properties of the OLS estimator.
5. Analyze the Coefficient of Determination r2.
6. Create a quantitative model in the light of Regression model and Hypothesis Testing.

References:
1. Econometrics A Modern Approach, 2020 7th Edition by Jeffrey M. Wooldridge
2. Basic Econometrics,6th Edition, By Damodar N. Gujarati, Dawn C. Porter, Manoranjan Pal,© 2021 | Published: August 10, 2020
3. Goldberger, Arthur S. *A Course in Econometrics*. Cambridge, MA: Harvard University Press, 1991. ISBN: 9780674175440.
4. DeGroot, Morris H., and Mark J. Schervish. *Probability and Statistics*. 3rd ed. Boston, MA: Addison-Wesley, 2001. ISBN: 9780201524888.
5. Econometric Methods" by J. Johnston and J. DiNardo (Adapted for Indian Markets by Kishore G. Kulkarni)

Case Studies	1	Most people who fall sick with COVID-19 will experience mild to moderate symptoms and recover without special treatment. However, some will become seriously ill and require medical attention. You decide to get tested for COVID-19 based on mild symptoms. There are two errors that could potentially occur: a) The test result says you have coronavirus, but you actually don't. b) The test result says you don't have coronavirus, but you actually do.
	2	As of April 1, 2022, there were 2,414 death row inmates in the United States. The number of death row inmates changes frequently with new convictions, appellate decisions overturning conviction or sentence alone, commutations, or deaths (through execution or otherwise). A random survey of 75 death row inmates revealed that the mean length of time on death row is 17.4 years with a standard deviation of 6.3 years. If you were conducting a hypothesis test to determine if the population mean time on death row could likely be 15 years, what would the null and alternative hypotheses be?

BOS	Mathematics and Statistics
Programme	S. Y. B.Sc. Economics
Semester	III
Course Name	Advanced Mathematics in Economics
Course Code	PUSEC302
Course Type	Major
Level of the Course	Medium
Credits	3

Course Objectives:
1. To provide fundamental mathematical logic and tools for formal economic analysis.
2. To extend the knowledge of mathematics needed to pursue economic analysis at a more advanced level.

Unit No.	Name of the Unit	Topic No.	Name of Topic	Hours
1	Differential Calculus	1.1	Introduction, Formulae of differentiation	15
		1.2	Rules of differentiation	
		1.3	Partial differentiation, chain rule	
2	Higher order differential equations	2.1	2nd order derivatives	15
		2.2	Applications of derivatives:- Extreme values	
3	Integral Calculus	3.1	Introduction, Rules of integration	15
		3.2	Single & double integration	
		3.3	Definite Integrals, Lagrange's integration	
		3.4	Application of Integration:- Area & Volume	
4	Matrices	4.1	Cramer's rule	15
		4.2	Row Echelon form	
		4.3	Rank of a matrix	
		4.4	Eigen values & Eigen vectors	
			Total number of lectures	60

Course Outcome: By the end of the course the student will be able to:

1. Apply the rules of differentiation to mathematically solve economic problems that they come across in the study.
2. Understand how changes in one independent variable's value affect the dependent variable's value.
3. To aid performance comparisons and assist future corporate management strategies.
4. Apply the rules of integration to mathematically solve economic problems that they come across in the study.
5. Understand and apply the basics of optimization and constrained optimization.
6. To improve the methods at which increase in production out-put can be achieved.

Reference Books:
1. Calculus and analytical geometry –George B Thomas , Ross L Finney
2. Calculus , early transcendental – James Stewart , Brooks Cole

3. Differential Calculus by Shanti Narayan, Publication date 1962, Publisher S. Chand And Company https://archive.org/details/differentialcalc031624mbp/page/n5/mode/2up
4. Calculus, Gilbert Strang
   https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf
5. Matrices , A.R Vasishtha
   https://examflame.com/matrices-a-r-vasishtha-krishna-series-pdf-download/

Case studies	1. A carpenter has 25 units of wood and 17 units of board to prepare chairs and tables . A chair requires 4 units of wood and 2 units of board whereas a table requires 1 unit of wood and 5 units of board .Assume that there is no wastage of material .The carpenter is paid Rs.300 per chair and Rs.200 per table How many chairs and tables he can prepare from available Material What is the total amount paid to the carpenter 2. A rectangular sheet has area of 24 square meters.The margin at the top and bottom is 75 centimeters and at the sides is 50 centimeters each. The remaining part of the paper is printed . Find the area of the printed part Find the intervals in which the area is decreasing

BOS	B.Sc. Computer Science
Programme	S. Y. B.Sc. Economics
Semester	III
Course Name	Introduction to Database
Course Code	PUSEC303
Course Type	Major
Level of the Course	Medium
Credits	2

Course objectives:
1. To introduce the concept of the DBMS with respect to the relational model.
2. To specify the functional and data requirements for a typical database application.

Unit No.	Name of the Unit	Topic No.	Name of Topic	Hours
1	Introduction to Data	1.1	Define Data, Database Management System, DBMS vs file processing system.	11
		1.2	Limitations of file processing systems.	
		1.3	Applications of DBMS, DBMS Architecture.	
2	Introduction to data Models	2.1	Data Model, Types of data model.	11
		2.2	**Entity Relationship Model** – ER diagram Symbols, Entities, attributes.	
		2.3	Relational Model-What is relation, attribute, types of attribute, Data types, Integrity Constraints.	
3	Introduction to Database Languages	3.1	**DDL Statements:** Creating Databases, Using Databases, data types, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables, Backing Up and Restoring databases.	12
		3.2	**DML Statements:** insert, update, delete, unique records, conditional select, where clause search condition, in **clause**, between clause, aggregate functions (count, min, max, avg, sum), group by clause, having clause.	
4	Introduction to Database languages	4.1	**DCL Statements** (creating/dropping users, privileges introduction, granting/revoking privileges, viewing privileges)	11
		4.2	**Functions:** String Functions, Date Functions.	
		4.3	**Joining Tables:** Inner Join ,Outer Join ,Sub Queries	

	Total number of Lectures	**45**

Expected Outcome: By the end of the course the student will be able to:
1. Describe the basic concept of DBMS and the DBMS Architecture.
2. Develop the skills of using ER diagrams to organize the entities and attributes
3. Apply Data Definition language for designing the database
4. Use Data Manipulation and Control language for management of data.
5. Choose Database Control language rules according to situations
6. Design and create database using Data base functions

Reference Books:
1. Ramez Elmasri & Shamkant B.Navathe, Fundamentals of Database Systems,
2. Pearson Education, Sixth Edition, 2010
3. Ramakrishnam, Gehrke, Database Management Systems, McGraw‑Hill, 2007 Joel Murach, Murach's MySQL, Murach, 2012
4.Fundamentals of Database Systems" by Ramez Elmasri and Shamkant B. Navathe
5.Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke

Case studies	1	Consider the below two tables for reference while trying to solve the SQL queries.

Table: Employee

EmpID	FullName	ManagerID	DateOfJoining	City
121	John Snow	321	2019-09-09	Toronto
321	Walter White	986	2020-05-12	California
421	Ned Stark	876	2023-09-09	New Delhi

Table: Salary

Empid	Project	Salary	Variable
121	P1	8000	500
321	P2	10000	1000
421	P1	12000	0

		A. Write an SQL query to create the above 2 tables and insert the respective data in the tables.
	2	Consider the below two tables for reference while trying to solve the SQL queries.

Tabel: Faculty

FacultyID	FirstName	LastName	Department	City	Gender
1	Sanjay	Mishra	BCom	Thane	Male
2	Ananya	Pandey	BSc	Mumbai	Female
3	Hritik	Roshan	BMS	Navi Mumbai	Male

Table:Salary

FacultyID	Position	DateOfJoining	Salary
1	Assistant Professor	2020-08-10	50000
2	HoD	2015-09-09	100000
3	Associate Professor	2022-05-10	60000

A. Write an SQL query to create the above 2 tables and insert the respective data in them.

BOS	B.Sc. Economics
Programme	S. Y. B.Sc. Economics
Semester	III
Course Name	Public Finance
Course Code	PUSEC304
Course Type	Minor
Level of the Course	Medium
Credits	4

Course Objectives:
1. To develop an understanding among the students about public finance.
2. To introduce the students to the public finance issues.

Unit No.	Name of the Unit	Topic No.	Name of Topic	Hours
1	Introduction to Public Finance	1.1	Public Finance: Meaning & Scope, Public Finance versus Private Finance	15
		1.2	Market Failures and Role of the Government, Principles of Sound and Functional Finance	
		1.3	Dalton's Principle of Maximum Social Advantage	
2	Public Revenue	2.1	Sources of Public Revenue: Tax and non-tax revenue	15
		2.2	Canons of taxation, Rates of taxation: Proportional, progressive and regressive taxation.	
		2.3	Impact, incidence and shifting of taxation, Economic effects of taxation	
3	Public Expenditure & Public Debt	3.1	Public Expenditure: Classification.	15
		3.2	Causes & Effects of Public Expenditure	
		3.3	Public Debt: Classification, Burden of debt, Methods of debt redemption.	
4	Fiscal Management & Financial Administration	4.1	Fiscal Policy: Meaning, objectives, Understanding the budget process.	15
		4.2	Deficit concepts, Fiscal Responsibility and Budget Management Act.	
		4.3	Fiscal federalism and fiscal decentralization, 15th Finance Commission Recommendations	
			Total number of Lectures	**60**

Expected Outcome:
1. Describe the scope of public finance.

2. Discuss market failures and the role of the government in the economy.
3. Examine the various sources and effects of public revenue.
4. Explain the various aspects of public expenditure and public debt.
5. Assess fiscal management and budgetary measures.
6. Create a thought process towards fiscal federalism and fiscal decentralization.

Reference Books:
1. Mithani, D. M. (1998), Modern Public Finance, Himalaya Publishing House, Mumbai.
2. Jha, R. (1998), Modern Public Economics, Route Ledge, London.
3. Hajela T.N., Public Finance – Ane Books Pvt. Ltd.
4. Bhatia H.L., (2012), Public Finance, Vikas Publications.
5. Ahuja H.L., Modern Economics, 19th edition, 2015, S. Chand & Co. Pvt Ltd, New Delhi.
6. Report of the 15th Finance Commission, Government of India.

Case studies	1	Pakistan's total debt and liabilities skyrocketed to Rs 59.7 trillion as the nation added Rs 12 trillion. The increase in public debt alone, which is the direct responsibility of the government, was Rs 9.3 trillion in the past one fiscal year as it swelled to a record Rs 49.2 trillion by end of June 2022, according to the State Bank of Pakistan (SBP). The debt burden increased both in absolute terms and in terms of the size of national economy, indicating that Pakistan is fast burying under the unbearable debt burden. In terms of the size of economy, Pakistan's total debt and liabilities were equal to 76.4% in 2018 that jumped to 89.2% by June 2022. Pakistan's debt from the IMF increased by 21% within one year to Rs 1.4 trillion by the end of last fiscal year, according to the SBP. The external debt of the federal government increased at an alarming pace of 35% to Rs16.7 trillion within one year.
	2	In India, the borrowing levels were very high in the 1990s and 2000s. Indian Economy was weak as it had high Fiscal Deficit, high Revenue Deficit, and high Debt-to-GDP ratio.
		By 2003, the continuous government borrowing and the resultant debt had severely impacted the health of the Indian economy. Much of the borrowing was utilized for interest payments of previous borrowings, but not for productive-purposes. This resulted in interest payments becoming the largest expenditure item of the government.
		Many economists then warned the government that this condition is not sustainable. They advised legal steps to prevent India to fall into a debt-trap. Parliamentarians of India too felt that there should be control on the government of India not to resort to a high level of borrowing to fund its expenditure. Hence in 2000, they introduced a bill to bring responsibility and discipline in matters of expenditure and debt.

BOS	B.Sc. Economics
Class	S.Y. B.Sc. Economics
Semester	III
Course Name	Mini Project
Course Code	PUSEC305
Course Type	Skill Enhancement Course (SEC)
Level of the Course	Medium
Credits	2

Course Objectives:
1. This course is designed to introduce the students about research in economics.
2. The broad view of research will be helpful for the students at UG level.

Course layout:

The students are expected to make a mini project based on primary data and analyse it through econometric techniques, statistical methods or data analysis.

BOS	B.Sc. Computer Science
Programme	S. Y. B.Sc. Economics
Semester	III
Course Name	Introduction to Database Practical
Course Code	PUSEC306P
Course Type	Major
Level of the Course	Medium
Credits	2

S.N.	Topic	CO
1	For given scenario. Draw E-R diagram and convert entities and relationships to table	CO2
2	Perform Following: Create table with integrity constraints and data type char, varchar, date. Create table without integrity constraints and data type char, varchar, date.	CO3
3	Perform Following: Inserting/Updating/Deleting Records in a Table· Saving (Commit) and Undoing (rollback)	CO4
4	Perform the following: Altering a Table· Dropping/Truncating/Renaming Tables· Backing up / Restoring a Database·	CO4
5	Perform the following: Simple Queries· Simple Queries with Aggregate functions· Queries with Aggregate functions (group by and having clause)	CO6
6	Queries involving Date Functions· String Functions· Math Functions	CO6
7	Join Queries : Inner Join· Outer Join	CO3
8	Subqueries with IN clause·	CO3
9	DCL statements Granting and revoking permissions.	CO5
10	DCL Statements: Grant With grant option	CO5
	Total number of Lectures	**15**

SEMESTER IV

BOS	B.Sc. Economics
Class	S.Y. B.Sc. Economics
Semester	IV
Course Name	Environmental Economics
Course Code	PUSEC401
Course Type	Major
Level of the Course	Medium
Credits	4

Course objectives:
1. To provide some insights into the application of economic theory in the design and implementation of public policy related to the management of environment issues & problems.
2. To make students aware about various measures initiated in India and across the globe to conserve the environment.

Unit No.	Name of Unit	Topic No.	Name of the Topic	Hours
1	Environmental Economics & concepts	1.1	Environmental Economics: meaning, concepts, Conflict between environment and development	15
		1.2	Green growth, Urbanization & environment, Women & environment.	
		1.3	Environmental pollution: Causes & effects	
		1.4	Climate change in India	
2	Environmental issues	2.1	Transboundary environmental problems: Global warming	15
		2.2	Acid rain, Desertification	
		2.3	Disaster: concept & management	
		2.4	Ecological footprint	
3	Theory of externality	3.1	Theory of externalities: Positive & negative externalities	15
		3.2	Pareto optimality criterion	
		3.3	Course theorem, Pigouvian taxes	
		3.4	Polluter pay principle, Environmental Kuznets Hypothesis	
4	Environmental Policy	4.1	Environmental Acts in India	15
		4.2	International environmental agreements	

		4.3	Environmental impact assessment & environmental audit	
		4.4	Geospatial technology: types & application	
			Total number of Lectures	**60**

Course Outcomes: By the end of the course the student will be able to:
1. Describe environmental economics, environmental management and green growth.
2. Discuss theory of externalities.
3. Examine the causes and effects of acid rain, desertification and global warming.
4. Explain the Pareto optimality criterion, Course theorem and Polluter pay principle.
5. Assess Environmental impact assessment & environmental audit.
6. Create a disaster management plan.

Reference Books:
1. Muthukrishnan S. (2015): Economics of Environment, PHI Publication.
2. Mani, N. (2020): Environmental Economics, New Century Publications, New Delhi.
3. Zhingan, M. L. (2020): Environmental Economics, Vrinda Publication
4. Bhattacharya, R.N. ed. (2001): Environmental Economics, An Indian Perspective, Oxford University Press, New Delhi.
5. Kalpagram, (1998): Environmental Economics, Sterling Press.
6. Kolstrad, C.D. (1999): Environmental Economics, Oxford University Press, New Delhi

Case Studies	1	A gasoline tax is imposed by the United States which raises the driver's cost to cover the negative externalities created by driving automobiles. The federal gas tax was $0.183 per gallon in 2019. The average state gas tax is $0.2868 per gallon. The revenue goes into the federal Highway Trust Fund to pay for roadway maintenance. France levies a noise tax on airplanes at its nine busiest airports. It ranges from 2 euros to 35 euros depending on the airport and the weight of the aircraft. The government uses the revenue to soundproof houses that are exposed to noise levels beyond 70 decibels.
	2	In 1997 in Kyoto, Japan, United Nations Framework Convention on Climate Change (UNFCCC) was held. Here, the world's nations agreed carbon credits were a good way of reducing the emission of CO2 and other greenhouse gases. Later, in 2001 in Germany, 191 countries ratified the protocol, including Japan, Australia, Canada & France. Among other issues, the protocol mandated that 37 industrialized nations cut down their emissions. For the first time, the idea of a cap-and-trade system and a carbon credits market were brought to the table. Later, in 2015 at the Paris Agreement, a new set of policies to be implemented from 2020 onwards started being discussed. One of the differences is that developing countries are also setting reduction targets, and not only developed nations. One of the goals is to extend the reach and deepen the integration of carbon markets.

BOS	Mathematics and Statistics
Programme	S. Y. B.Sc. Economics
Semester	IV
Course Name	Advanced Statistics for Economics
Course Code	PUSEC402
Course Type	Major
Level of the Course	Advanced
Credits	2

Course objectives:
1. The purpose of this course is to familiarize students with the basics of Statistics.
2. This will be essential for prospective researchers and professionals to know these basics.

Unit No.	Name of the Unit	Topic No.	Name of Topic	Hours
1	Sampling Distributions	1.1	Binomial Distribution- Properties and problems based on Binomial distribution	15
		1.2	Poisson Distribution- Properties and problems based on Poisson distribution	
		1.3	Normal distribution-properties and problems based on Normal distribution central limit theorem	
		1.4	central limit theorem (Statement only)	
2	Testing of Hypothesis (Parametric test)	2.1	Hypothesis- Null and Alternative, Types of error in hypothesis testing, level of significance	15
		2.2	One tailed and two tailed test, critical region, p-value, Confidence interval for mean and proportion	
		2.3	Large sample test (z test)-single mean, two means, single proportion, two proportions	
		2.4	Small sample test(t test) one sample mean, paired t test, unpaired t test	
3	Non parametric test	3.1	Need of non-parametric tests, difference between parametric and non-parametric test	15
		3.2	Sign test, Mann-Whitney test	
		3.3	Run test	
		3.4	Kruskal-Wallis test	
4	ANOVA and Chi-Square test	4.1	Application and importance of ANOVA	15
		4.2	One Way ANOVA	
		4.3	Chi-square test of goodness of fit	

		4.4	Chi-square test of association	
			Total number of Lectures	**60**

Expected Outcome:
1. Identify when to use a parametric method. Different parametric methods in estimation, testing, model fitting, and in analyses.
2. Identify when to use a nonparametric method. Different nonparametric methods in estimation, testing, model fitting, and in analyses.
3. Develops the ability to analyse a problem and understand the appropriate statistical technique to analyse it.
4. Develops the use of the inferential statistical tools to analyse a problem.
5. Apply Parametric and non-parametric statistical hypothesis testing to make a decision.
6. Explain the results obtained using statistical tools based on a problem scenario. and introduces ANOVA for analysing a problem in higher level

Reference Books:
1. Ross, S.M. (2006): A First course in probability. 6th Ed^n Pearson
2. Kulkarni, M.B., Ghatpande, S.B. and Gore, S.D. (1999): Common statistical tests. Satyajeet Prakashan, Pune
3. Gupta, S.C. and Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi
4. Gupta, S.C. and Kapoor, V.K. (4th Edition): Applied Statistics, S. Chand and Sons, New Delhi
5. Trivedi, K.S.(2009) : Probability, Statistics, Design of Experiments and Queuing theory, with applications of Computer Science, Prentice Hall of India, New Delhi

Case Studies	1	A random sample of 600 students from 12th,FY,SY,TY classes were asked the opinion about whether they like Autonomous college or oppose Autonomous college on the basis of the following data can we say that class of student and opinion are independent

Class	FAVOURED	OPPOSED
XII	120	80
FY	130	70
SY	70	30
TY	80	20

(i)set H0and H1(2)(ii) Calculate χ^2 [(4)] (iii)Conclusion(1.5)

2	The following are the kilometers per gallon which a test driver got for ten thankful each of two kinds of gasoline:

A	30	41	34	43	33	34	38	26	29	36
B	39	28	39	29	30	31	44	43	40	33

Use Mann-Whitney test at 5% los to test the null hypothesis that there is no difference in the average kilometer yield of the two types of gasoline.

(i)Set H 0 and H1   (1)
(ii) Calculate U   (3)

(iv) Calculate Z   (2.5)

(v) conclusion   (1)

BOS	Mathematics and Statistics
Programme	S. Y. B.Sc. Economics
Semester	IV
Course Name	Advanced Statistical Methods using R tool Practical
Course Code	PUSEC406P
Course Type	Major
Level of the Course	Advanced
Credits	2

S.N.	Topic	CO
1	Basic inbuilt commands in R	CO1
2	R program on Binomial distribution	CO1
3	R program on Poisson distribution	CO2
4	R program on Normal distribution	CO2
5	R program on t test	CO3
6	R program on Z test	CO3
7	R program on Sign test, Mann-Whitney test	CO3
8	R program on Kruskal-Wallis test	CO4
9	R program on Chi square test	CO5
10	R program on ANOVA	CO6
	Total number of Lectures	**15**

BOS	B.Sc. Computer Science
Class	S.Y.B. Sc. Economics
Semester	IV
Course Name	Business Intelligence
Course Code	PUSEC403
Course Type	Major
Level of Course	Medium
Credits	2

Course Objectives:
1. This course focuses on how to design and build a Business Intelligence solution.
2. Students will also learn how to design and build a data warehouse within the context of student BI projects.

Unit No.	Name of Unit	Topic No.	Name of the Topic	Hours
1	IMPORTANT CONCEPTS	1.1	Introduction to Data, Information, and Knowledge, BI Definitions & Concepts, Business Models, Applications of BI, BI system components, Data mode: Physical data model, logical data model, difference between data warehouse and a database.	15
		1.2	Design and implementation aspect of OLAP/Data Warehouse, Components of Data Warehouse Architectures, Role of DW in BI	
2	ETL	2.1	Data Quality, Data profiling, Data enrichment, data duplication, what is ETL, ETL Architecture, Difference between ETL(Data warehouse),ELT approach(Data Lake)	15
		2.2	Data Extraction concept and Change data capture, Transformation concept, What is Staging, Data marts, Cubes, Scheduling and dependency matrix,	
		2.3	Performance tuning during data load, reconciliation process after data load. Surrogate keys importance in data warehouses.	
3	REPORTING	3.1	Metadata Layer, Presentation Layer, Data Layer, Use of different layers, Various report elements such as Charts, Tables, prompts Data aggregation: Table based, Materialized views, Query rewrite, OLAP, MOLAP,	15
		3.2	Dashboards, Ad-hoc reports, interactivity in analysis (drill down, drill up), Security: report level, data level (row, column), Scheduling. Dashboard design	

			using a reporting tool. Automated report from Dashboard.	
4	ANALYTICS	4.1	Analytics concepts and use in Business Intelligence, Exploratory and statistical techniques:- Cluster analysis, Data visualization, Predictive analysis :- Regression, Time series,	15
		4.2	Data Mining :- Hierarchical clustering, Decision tree Text analytics :- Text mining, In-Memory Analytics and In-DB Analytics,	
		4.3	Case study: Google Analytics. Difference between descriptive, prescriptive and predictive analytics supervised and unsupervised learning.	
Total number of Lectures				**60**

Course Outcomes: By the end of the course the student will be able to:
1. Design and implement OLTP, OLAP and Warehouse concepts.
2. Design and develop Data Warehouse using Various Schemas & Dimensional modelling.
3. Use the ETL concepts, tools and techniques to perform Extraction, Transformation, and Loading of data.
4. Report the usable data by using various reporting concepts, techniques/tools, and use charts, tables for reporting in BI.
5. Use Analytics concepts like data mining, Exploratory and statistical techniques for predictive analysis in Business Intelligence.
6. Demonstrate application of concepts in BI.

Text Books
1. Reema Thareja, "Data Warehouse", Publisher: Oxford University Press.
2. Jiawei Han, Micheline Kamber,Jian Pei "Data Mining: concepts and techniques", 2nd Edition, Publisher: Elsevier/Morgan Kaufmann.
3. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit", 3rd edition, Publisher: Wiley 4. Descriptive analytics (IBM ICE Publication)
4. Rajiv Sabherwal and Irma Becerra-Fernandez, Business Intelligence, Wiley Publications (2010).
5. Swain Scheps, Business Intelligence For Dummies, Wiley Publications (2011)
6. Arshad Khan, Business Intelligence & Data Warehousing Simplified, Mercury learning & information LLC (2012).

Case Studies	1	Suppose you want to build an AI model that can automatically classify emails of different senders into different categories such as spam or legitimate. You would start by gathering a large dataset containing examples of both spam and legitimate emails. Once trained, the algorithm can use the extracted features to predict the label of new, unseen emails. If an email is predicted to be spam, it can be automatically filtered into a spam folder, saving the user's inbox space.

		Suggest a Supervised learning model in this scenario for classifying the emails. Give reason for your suggestion.
	2	Assume that we want to predict how capable an applicant is of repaying a loan from the perspective of a bank. Suppose you have a dataset containing information about customers of a bank, such as applicant's age, gender, average monthly income, debt, credit history, and so on. You want to identify groups of customers who exhibit similar characteristics, so the bank can predict how capable an applicant is of repaying a loan. Suggest an unsupervised learning model in this scenario to identify customers of similar characteristics. Give reason for your suggestion.

BOS	B.Sc. Computer Science
Programme	S. Y. B.Sc. Economics
Semester	IV
Course Name	Business Intelligence (Practical)
Course Code	PUSEC407P
Course Type	Major
Level of the Course	Medium
Credits	2

S.N.	Topic	CO
1	Import the legacy data from different sources such as (Excel, Sql Server, Oracle etc.) and load in the target system. (You can download sample database such as Adventure works, Northwind, foodmart etc.)	CO4
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the power BI.	CO3
3	Import the data warehouse data in Microsoft Excel and create the Pivot table and Pivot Chart.	CO4
4	Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.	CO4
5	Create the cube with suitable dimension and fact tables based on OLAP	CO1, CO2
6	Execute the MDX queries to extract the data from the data warehouse.	CO2
7	Perform the data classification using Time Series Analysis	CO5
8	Perform the data classification using classification algorithm (Decision Tree).	CO5
9	Perform the data clustering using clustering algorithm (k-mean).	CO5
10	Perform the Linear regression on the given data warehouse data.	CO5
	Total number of Lectures	**15**

BOS	B.Sc. Economics
Class	S.Y. B.Sc. Economics
Semester	IV
Course Name	Indian Economy
Course Code	PUSEC404
Course Type	Minor
Level of the Course	Medium
Credits	4

Course objectives:
1. To provide a macroeconomic understanding of the Indian economy.
2. To equip the students with knowledge to develop a perspective on the different issues, reforms and policy measures undertaken by the Government of India.

Unit No.	Name of Unit	Topic No.	Name of Topic	Hours
1	Macro-Economic overview of India	1.1	Macro-Economic overview of India, New Economic Policy-1991	15
		1.2	HRD in India: Education, Health and Family Welfare	
		1.3	Sustainable Development Goals, Make in India	
		1.4	Invest in India, Skill India.	
2	Agriculture During Post Reform Period	2.1	National Agricultural Policy 2000: Objectives, Features and Implications, Recent Agriculture Policy for farmers, 2007 (National Commission on Farmers)	15
		2.2	Agricultural Pricing	
		2.3	Agricultural Finance	
		2.4	Agricultural Marketing	
3	The Industry During Post Reform Period	3.1	Policy Measures- Competition Act 2003	15
		3.2	Disinvestment Policy	
		3.3	Micro, Small and Medium Enterprises [MSME sector] since 2007	
		3.4	Industrial Pollution in India: Meaning, Types, Effects and Control.	
4	The Service Sector During Post Reform Period	4.1	Role of service sector	15
		4.2	Recent trends in banking industry and Insurance	
		4.3	Recent trends in Healthcare and Tourism Industry	
		4.4	Trends and growth potential in Healthcare and Tourism sector	
			Total number of lectures	**60**

Course Outcome: By the end of the course the student will be able to:
1. Describe the major policies to aid macro-economic understanding of the Indian Economy.
2. Explain various developments with regards to agriculture pricing, finance and marketing in the context of Indian Economy.
3. Examine industrial development measures in India in the post reform period.
4. Assess the impact of industrial pollution and the role of service sector in the Indian Economy.
5. Examine role and trends in service sector.
6. Create an understanding of the sub sectors in the service sector in India.

Reference Books:

1. Agarwal, K.N. (2009), Indian Economy: Problems of Development of Planning, New Age of International Publishers.
2. Dhingra, I. C. (2013), The Indian Economy: Environment and Policy, Sultan Chand & Sons, New Delhi.
3. Dutt, Ruddar and Sundaram K.P.M (2013), Indian Economy, S. Chand and Co., New Delhi.
4. Ghosh, Alak (2011), Indian Economy, World Press, Calcutta.
5. Kapila, Uma (2013), Indian Economy since Independence, Academic Foundations, New Delhi.
6. Misra S.K and V.K Puri (2013), Indian Economy: Its Development Experience, Himalaya Publishing House, Mumbai.

Case Studies	I	**Navigating the Dynamic Landscape: Trends Reshaping India's Tourism Industry**
		India's tourism industry is experiencing dynamic shifts driven by changing consumer preferences and technological advancements. With the rise of digital platforms and social media, there has been a significant increase in independent travel, as travelers seek authentic experiences and personalized itineraries. This trend has led to a surge in demand for experiential tourism, including homestays, adventure tourism, and eco-tourism.
		Furthermore, wellness tourism has emerged as a key trend, with travelers seeking destinations that offer rejuvenation and holistic experiences. India's rich heritage of yoga, Ayurveda, and spiritual practices positions it as a prime wellness tourism destination.
		The government's focus on infrastructure development, promotion of tourism circuits, and initiatives like Incredible India 2.0 have bolstered

			domestic and international tourism. Additionally, the adoption of sustainable practices and responsible tourism is gaining traction, driven by increasing awareness of environmental issues.

However, challenges such as inadequate infrastructure, safety concerns, and regulatory hurdles remain. Addressing these challenges while capitalizing on emerging trends will be crucial for India to harness the full potential of its tourism industry. |
| | II | | **Shaping the Future: Trends in India's Healthcare Industry**

The healthcare industry in India is undergoing significant transformations driven by technological advancements, changing demographics, and evolving consumer preferences. Telemedicine has emerged as a key trend, offering remote access to healthcare services, especially in rural and underserved areas. The COVID-19 pandemic accelerated the adoption of telemedicine, highlighting its potential to enhance healthcare accessibility and affordability.

Another notable trend is the rise of digital health solutions, including wearable devices, health apps, and electronic health records. These technologies empower individuals to take control of their health and enable healthcare providers to deliver more personalized and efficient care.

Moreover, there is a growing emphasis on preventive healthcare and wellness initiatives, driven by increasing awareness of lifestyle diseases and the importance of holistic well-being. This trend is reflected in the popularity of fitness trackers, healthy eating habits, and preventive health check-ups.

Furthermore, the healthcare industry in India is witnessing a shift towards value-based care and outcomes-driven models. Healthcare providers are increasingly focused on delivering high-quality care while optimizing costs and improving patient outcomes. Despite these positive developments, challenges such as inadequate healthcare infrastructure, healthcare disparities, and regulatory complexities persist. |

BOS	B.Sc. Economics
Class	S.Y. B.Sc. Economics
Semester	IV
Course Name	SWAYAM/ NPTEL
Course Code	PUSEC405
Course Type	Skill Enhancement Course (SEC)
Level of the Course	Medium
Credits	2

Students have to select any one course:

1. Economics Of IPR
2. Business And Sustainable Development
3. Decision-Making Under Uncertainty
4. Business Analytics & Data Mining Modeling Using R Part II